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Development of a Mobile Navigation Smartphone Application for Seniors in Urban Areas

Urban Connector

August 2019

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Development of a Mobile Navigation Smartphone Application for Seniors in Urban Areas

Ruey L. Cheu
The University of Texas at El Paso

Natalia Villanueva-Rosales
The University of Texas at El Paso

Guillermina Gina Nunez-Mchiri
The University of Texas at El Paso

Joseph Chow
New York University

Matthew Vechione
The University of Texas at El Paso

Raul Alejandro Vargas Acosta
The University of Texas at El Paso

Corina Marrufo
The University of Texas at El Paso

Okan Gurbuz
The University of Texas at El Paso

Maria Jimenez
The University of Texas at El Paso

Assel Dmitriyeva
New York University

Diana Becerra
The University of Texas at El Paso

Emiliano Ruiz
The University of Texas at El Paso

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Executive Summary

As lifestyle changes seniors start having mobility issues. Switching from driving alone to carpooling, taking a taxi or public transportation are some common examples. Seniors need information about traffic congestion and available alternative means of transportation to keep attending their daily activities. However, there are not enough tools to assist seniors with their specific mobility constraints. Smartphones are potentially useful tools. While there are many navigation apps on the market, very few cater to the specific mobility needs of seniors (such as incorporating information on ADA compliant infrastructure), and the few that exist have limited functions. This study aims to understand the lifestyle and mobility needs of seniors and to develop a prototype smartphone application that caters needs. The main focus is on the development of a mobile smartphone application, named Urban Connector. As a first step, to identify the senior needs, a survey was conducted (in English and Spanish) at various senior centers across El Paso, Texas. Questions were asked to 458 seniors to gain a better understanding of their lifestyle, mobility needs, and technological literacy (especially the use of smartphones). A similar survey of 61 seniors was conducted in New York, New York. It was discovered from the survey that the greatest mobility need of the seniors is avoiding traffic congestion. Although there exist some navigation applications and there is a market for developers (i.e. many seniors own a smartphone), existing tools are not being preferred by seniors to avoid such traffic congestion. Therefore, the primary focus of the Urban Connector was decided as navigation. The survey results provided guidelines on the functions and user interface designs. After the initial version of the Urban Connector had been developed in the Android platform, a pilot survey was conducted in which 65 seniors were asked to comment on the suitability of the functions and ease of use (user interface and menu). Pilot survey findings were used to improve and refine the Urban Connector application. A follow-up usability survey was implemented as the third effort to collect user feedback. In this usability survey, 40 seniors were recruited and they installed the Urban Connector application on their smartphones to field test the application for one month. At the end of one month, 38 participants completed this survey. Most of the questions in this survey asked the participants to state the level of agreement with a given statement related to the ease of use of the application. The survey results revealed that more than half the participants strongly agreed or agreed with statements about the application being easy to use or beneficial. The participants gave the Urban Connector application an average rating of 3.47 out of 5.00. Sixty-eight percent (68%) of the participants said that they would like to recommend the Urban Connector application to their friends.

Table of Contents

List of Figures

List of Tables

SECTION 1. Introduction

1.1. Motivation

As lifestyle changes seniors start having mobility issues. Switching from driving alone to carpooling, taking a taxi or public transportation are some common examples. Seniors need information about traffic congestion and available alternative means of transportation to keep attending their daily activities. However, there are not enough tools to assist seniors with their specific mobility constraints. Smartphones are potentially useful tools. While there are many navigation apps on the market, very few cater to the specific mobility needs of seniors (such as incorporating information on ADA compliant infrastructure), and the few that exist have limited functions. This research covers the initial steps of developing a smartphone application that is customized to the mobility and other needs of seniors.

1.2. Objective

The objectives of this project are: (a) to understand the lifestyle and mobility needs of the seniors; (b) to develop a prototype smartphone smart mobility application that caters to the needs identified; and (c) to conduct a usability survey to obtain feedback on the prototype.

1.3. Outline of Report

This report is outlined as follows. The next section reviews background materials. Section 3 presents the work plan for this research. The fourth section provides information regarding the seniors surveyed in El Paso and New York City and the findings. The fifth section describes the development of the smartphone application. The following sections (Sections 6 and 7) report on the pilot survey and usability survey respectively.

SECTION 2. Review of Background Materials

This section reviews the background materials related to this project. First, the concept of smart mobility, which is the domain problem this project addresses, is introduced. Next, the mobility issues faced by seniors, as found in the literature, are discussed. Then, technologies that enable our solution approach, namely smartphone technology (the hardware) and smartphone applications (the software) are reviewed. The last portion of this section highlights the recommended design features that should be considered when designing smartphone applications for seniors.

2.1. Smart Mobility

Smart Mobility which comes with Smart City concept is a recent topic, however it is spreading fast and being studied by different researchers. There are different definitions for the Smart Mobility and Smart City concepts:

- Bakici et al. (2012) defined Smart city as "a high tech high-tech intensive and advanced city that connects people,information and city elements using new technologies in order to create asustainable, greener city, competitive and innovative commerce, and an increased life quality."
- Nam and Pardo (2011) describe a smart city which "infuses information into its physical infrastructure to improveconveniences, facilitate mobility, add efficiencies, conserve energy, improve the quality of air and water, identify problems and fix them quickly, recover rapidly from disasters, collect data to make betterdecisions, deploy resources effectively, and share data to enable collaboration across entities and domains."
- Faria et al. (2017) describe Smart Mobility as a key concept to transform urban transportation and change the way our cities move. Smart Mobility is, among others, one of the main components of a Smart City; and as such, "Smart Mobility helps cities to reduce gridlocks, lower accident rates, improve air quality, shrink the urban footprint required for parking, and be a tool to achieve sustainable city's development." Faria et al (2017) listed majority of the previous definitions of Smart Mobility and Smart Cities in their study:
    - Albino et al. (2015) describe Smart Mobility as "the use of Information and Communication Technology in modern transport technologies to improve urban traffic."
    - Chun and Lee (2015) state that Smart Mobility "is a concept of comprehensive and smarter future traffic services in combination with smart technology. A Smart Mobility society is realized by means of the current intelligent traffic systems."
    - Vanolo (2014) refers to Smart Mobility as "local and supra-local accessibility, availability of ICTs, modern, sustainable and safe transport systems."
    - Griffinger and Gudrun (2010) describe a Smart City as "a city well performing in a forward-looking way in economy, people, governance, mobility, environment, and living, built on the smart combination of endowments and activities of self-decisive, independent and aware citizens."
    - Harrison et al. (2010) mention that "Smarter Cities are urban areas that exploit operational data, such as that arising from traffic congestion, power consumption

statistics, and public safety events, to optimize the operation of city services. The foundational concepts are instrumented, interconnected, and intelligent. Instrumented refers to sources of near-real-time real-world data from both physical and virtual sensors. Interconnected means the integration of those data into an enterprise-computing platform and the communication of such information among the various city services. Intelligent refers to the inclusion of complex analytics, modeling, optimization, and visualization in the operational business processes to make better operational decisions."

- Bowerman et al. (2000) state that a Smart City is "a city that monitors and integrates conditions of all of its critical infrastructures, including roads, bridges, tunnels, rail/subways, airports, seaports, communications, water, power, even major buildings, so that it can better optimize its resources, plan its preventive maintenance activities, and monitor security aspects while maximizing services to its citizens."

In summary, a smart city is a city that integrates people, technology, and information to create a sustainable and resilient infrastructure that provides high-quality services for residents. Smart mobility refers to the ability of travelers to acquire, share and use information and resources to make transportation systems more accessible, sustainable and resilient.

2.2. Issues Faced by Seniors

The issues faced by seniors depends on what the definition of seniors is. In spite of the fact that seniors' needs may change based on physical wellbeing or mental health, they are legally recognized from the rest by their age. Indeed, different agencies organizations report different age ranges in characterizing seniors. These are some examples of senior definitions:

- The United States Census Bureau (2017) definition for a senior is a person who is older than the age of 65. There were around 47.8 million seniors in 2015 which was around 14.9% of United States population.
- According to the United States Department of Health and Human Services (n.d.), every day more than 10,000 individuals become seniors. In this study, the defined age is 65.
- The United States Department of Labor (2017) Senior Community Service Employment Program was designed to provide work based training for seniors. Minimum age to participate in the program was identified as 55.
- The age defined by social security benefits was 65 after Congress passed legislation in 1983 (National Academy of Social Insurance, n.d.).
- In El Paso, Texas, Sun Metro Bus Service offers a reduced fare program for eligible passengers. Sun Metro's reduced fare program provides discounts off the standard fares for, among others, persons 65 years of age or older (Sun Metro, n.d.).

Based on the findings the age definition for the seniors ranges from 55 to 65. Since the majority of them preferred to use 65, this project considered an individual as a senior with an age of 65 or older.

Seniors' limited access to different transportation alternatives has always been an issue. (BTS, 2016). The American Association of Retired Persons Public Policy Institute estimated that in 2009 seniors took 12% of all trips and 10% of all miles traveled in the United States. According to the same study, from 2001 to 2009, the share of seniors among transit users had increased by 40%. 2009 findings also reported that seniors used public transportation for more than 1 billion trips (BTS, 2016). With the increase in the use of public transit by seniors, transportation agencies efforts to provide senior-friendly services become more important. Being unable to access transportation causes seniors feeling of isolation from the community that does not develop solutions to fix their problems (McDonnal et al., 2016). It is very difficult for older adults to access transportation alternatives due to proximity issues, long waits, crime, uneven or unsafe sidewalks, urban congestion, and mobility issues which are all associated with depression, social isolation, and health problems (Turner et al., 2017).

Individuals' movability and mobility may reduce due to aging. Health in Aging Foundation listed some of the mobility problems of older adults (Health in Aging, 2017). Joint problems, weakness of muscles, pain, disease, and some other neurological disorders cause falls which is the number one issue that older seniors experience.

In addition to falls, many seniors are affected by visual and/or hearing impairments, as well as rheumatism (arthritis) (March et al., 1998). Arthritis greatly affects typing on a keyboard, tablet, or phone in a negative way. These physical impairments not only restrict their mobility options but also limit their ability to use certain tools (e.g., desktop computers, tablets, smartphones).

In addition to the biological and biomechanical issues, many seniors face cognitive decline and dementia (Geerlings et al., 1999). Due to cognitive decline and memory loss, disorientation may subsequently follow (Hanley, 1981). Some seniors can easily become disoriented during a commute and have difficulties understanding where they are as well as how to return home or to their original destination.

However, the majority of older adults prefer driving as their preferred transportation because it symbolizes independence that seniors value deeply (Turner et al., 2017). A smartphone, if used with the right applications, is one solution to the mobility problems faced by the seniors. Smartphones are not only communication devices, but they can also be programmed with applications to help with estimation choices, route planning, navigation, transportation services scheduling, reminding appointments, and some other functions may assist the seniors with mobility and other issues. There should be some focus on dealing with older people who have communication or sensory ailments in order to find a solution.

It is very important for older adults to go out. In fact, going outside has a positive effect on their physical and cognitive health and social activities, whereas older adults who do not go outside frequently have higher mortality, cognitive impairments, and poorer psychological well-being than those who do

(Harada et al., 2018). Dattilo et al. (2005) found in their study that regular interactions with peers improve seniors' self-determination with participating enjoying activities while promoting independence.

Technology is evolving at such a rapid pace, therefore, accessibility to applications for seniors is becoming more important. Applications can help improve care support, safety, social connectivity, and engagement (Czaja, 2019). Having this type of technology can help guide many to new doctor's appointments, senior centers, and engaging activities in the community. In fact, research has demonstrated that technology features that improve one's ability to complete a task are appealing to users (Li & Luximon, 2018), meaning that the user interface and usability are correlated to the usage of technology for older people. This can be achieved with better and more accessible technology for older adults to maintain contact with and travel to their friends and family members and providing support for engagement in social activities. Technology can combat social isolation and increase social participation for older adults (Baker et al., 2018).

2.3. Smartphone Technology

A smartphone may be defined as a handheld device with the computing power of a personal computer, mobile operating system, and mobile broadband cellular network connection for internet data communication (Smith, 2013). The term 'smartphone' refers to "a new class of mobile phones that provided integrated services from communication, computing, and mobile sectors including voice communication, messaging, personal information management (PIM) applications and wireless communication capability." (Sarwar and Soomro, 2013).

In 1999, the Japanese firm NTT DoCoMo released the first smartphones to achieve mass adoption within a country (Rose, 2001). These phones provided data transmission speeds up to 9.6 kbit/s. However, smartphones were rare outside of Japan at that time and began moderately increasing until the release of the Apple iPhone in 2007. Before the introduction of the iPhone to the mass consumer market, many smartphones had a physical keypad or keyboard (Jobs et al., n.d.). Some differences between a smartphone and a traditional cell phone, other than the computing power, are: (i) the ability to run a variety of third-party software components (called "applications" or simply "apps") purchased and downloaded from servers like the Google Play Store or Apple App Store; (ii) the ability to receive bug fixes and gain additional functionality through operating system updates; (iii) have a touchscreen color display; and (iv) high speed wireless communication capabilities.

One of the main characteristics of a smartphone is its screen. Smartphones are almost entirely comprised of a full-color touchscreen, through which the user may enter data, command, and control the phone by touching the screen, as opposed to a numerical keypad. The interface is designed such that the users may input commands or data by the use of their fingers. Smartphones may also have a return button to navigate back to the main screen or when held, restart the smartphone in the event it freezes. In the

past several years, voice/speech has emerged as the secondary source of data entry to smartphones, and to command and control the phone.

In 2014, half of Americans over the age of 65 owned a smartphone or tablet (Medical Alert Advice, 2014). Furthermore, approximately 75% owned some kind of cell phone. Likewise, Rainie and Perrin (2017) from the Pew Research Center affirmed that 77% of U.S. adults said they owned a smartphone. This number was a dramatic increase from 35% in 2011, making the smartphone one of the most quickly adopted consumer technologies by seniors in recent history. In 2017, 42% of those over the age of 65 (i.e. seniors) reported that they owned a smartphone. The recent study showed that within 1 year the rate of smartphone users over the age of 65 increased to 53% (Pew Research Center, 2019).

The two major mobile operating systems used by smartphones are Android and iOS(formerly iPhone OS). The Android operating system is used by many smartphone manufacturers (such as Samsung, LG, Google) while iOS is used only in Apple's iPhones (and other Apple mobile devices). In 2013, Android-operated phone owners represented 28% of the cell phone owning population, while iOS OR iPhone owners represented 25% of the cell phone owning population. Phones that operate with Blackberry and Windows systems only make up 4% and 1% of the cell phone owning population, respectively. The remaining 31% is comprised of traditional flip-phone users Smith (2013).

Some similarities between the two platforms (i.e. Android and iOS) are the simplicity and commands made by the user's fingers. Users typically choose one platform over the other simply due to personal preference more than functionality, as the user interfaces of the two platforms are very similar. The differences are primarily for application developers. In order to have an application available in Apple's App Store, the application developer must pay $99 per year and must update the application accordingly based on Apple's newest operating software requirements. The Google Play Store, on the other hand, charges Android application developers a one-time fee of $25 to have one's application available in the store. For this reason, the Android platform was selected as the initial mobile operating system platform to develop the smartphone application in this research.

2.4. Smartphone Applications

This sub-section focuses on smartphone applications. An application may be defined as a program designed to run on a mobile device such as a smartphone or tablet.

2.4.1. Functional Characteristics

To create an application for the Android operating system, the Android Studio software is required (Android, 2018). To create an application for the iOS operating system, the XCode software is required (Apple, 2019). It should be noted that each software (application development tool) is free to download; however, Apple charges application developers $99 per year to have an application available in the Apple

App Store for iPhone or iPad users to purchase or download, whereas Android charges developers a one-time fee of $25 to have an application available in the Google Play Store.

To best illustrate how an application works, a popular mobility application, Uber (Uber, 2019), is used as an example. Uber is a rideshare service by which a rider may use the Uber application to request a driver (who drives his/her private vehicle to serve the rider), track the progress of the trip, make a payment, etc. The following steps describe how a rider can use the Uber application to improve his/her mobility. First, if the rider does not have the Uber application installed on their smartphone, he/she may access Apple's App Store or Google Play Store, for iPhone and Android users, respectively. Then, the rider searches for Uber and downloads the Uber application. Once the Uber application has been downloaded and installed on the rider's smartphone, the rider accesses or "opens" the Uber application. When the rider uses the Uber application for the first time, the rider is prompted to create a username and password, enter his/her profile as well as payment information. Once an account is created, the rider may request a ride to a specific destination. At this point, the Uber application, on the backend, accesses the global positioning system (GPS) location of the smartphone and subsequently searches for surrounding drivers. The nearest driver who meets the criteria set forth by the rider is then directed to the rider based on the GPS location of the rider's smartphone. While waiting for the ride, the rider is shown the name and photograph of the driver and the vehicle model and license plate. The rider can also see the real-time location of the driver by a map displayed on his/her smartphone screen. The driver then picks up the rider and transports him/her to their desired location. During the trip, the rider can use the Uber application's map to track his/her real-time location. Once the driver confirms that the trip is complete, the Uber application will charge the rider's payment account directly from the application and credit the driver. The above steps are the operations of the application from the rider's perspective. There is another version of the Uber application that is developed for the drivers.

2.4.2. Review of Existing Applications for Mobility

There are currently many smartphone applications available for smart mobility for users of all ages. Some examples of these applications are Google Maps, Waze, and Metropia.

Google Maps may be downloaded for free from Apple's App Store or Google Play Store. Google Maps does not require an account. When the user opens the application, a map is displayed centered at the GPS location of the smartphone (i.e. the user's current location). The user then inputs a destination and mode of travel, based on traffic condition the application decides the best route and provides directions accordingly.

Waze is another navigation software owned by Google that provides turn-by-turn navigation information. Unlike Google Maps, which acquires its real-time traffic condition data from commercial

vendors, Waze relies on the travel time data provided by the user's smartphone and user-submitted incident details.

Metropia (2017) is another application aims to cater to mobility needs. Once the Metropia application has been activated, the user may input a destination, similar to Google Maps. Metropia, however, has a different way of encouraging the app use by providing incentives for the selection of the alternative mode of transportation (i.e. through in-app game points). For example, a user would like to drive to work during the morning peak hour. A certain number of points are awarded for this commute; however, more points are awarded if the user carpools, uses the bus, or travels outside the morning peak hour to work. The application's algorithm determines the number of points for each alternative based on how well the alternative benefits the network's traffic conditions as a whole. The points may be redeemed for prizes such as gift cards.

There are a few popular applications available for senior users. Some of these applications are Pill Boxie, MedCoach, and Medisafe. Some of the most popular applications are described in detail in the next section. In general, most of these applications are very intuitive and user-friendly, but limited functions for the seniors.

Many, if not all, of the existing applications for mobility are not designed specifically for seniors. The tech-savviness of the seniors is not considered with current mobility applications (e.g. large font, use of fingers, etc.). In fact, research shows that older adults would like to use technology more when barriers to use including lack of knowledge, vision, hearing, and fine motor difficulties are handled. (Gitlow, 2014). On the other hand, many of the applications designed specifically for seniors are not related to mobility. The applications are primarily related to the medical needs of the seniors (e.g. medicine reminders, emergency buttons for when falls occur, etc.). Czaja (2019) research findings demonstrated that seniors would like to learn more about the technology related to their needs to live independently. An application that integrates both functions to serve the mobility, social, medical, and other needs of the seniors is potentially very valuable for this segment of the population. This is the objective of this research.

2.4.3. Review of Existing Applications for the Seniors

After researching some of the most popular smartphone application for seniors (as described in the next sections), some of the applications were downloaded by the research team and tested. **Table 1** presents a general description and the authors' remarks about each downloaded application.

Name	Logo/Icon	Description	Remarks
AARP		General news, events, and deals based on your location, specifically for those who are AARP members.	The user interface is intuitive, but the application is designed for those who recently retired.
Mag. Light		Uses the smartphone's camera as a magnifying glass.	The application can use the smartphone's flash for additional light and can even freeze frame.
MedCoach		An application that has a very intuitive user interface (i.e. a 3 x 3 application grid layout) for medicine, doctors, pharmacies, etc.	One key feature is "urgent care" which serves as a panic button while the user is making a trip.
Medisafe		An application that tracks pill usage throughout the day and can track when missing or taken.	Tracks what pills look like to create virtual pillbox, not just the name, which is key to memory loss.
My Pain Diary		Award winning application, which allows users to track the type of pain and location for doctors to better diagnose prior to a patient visiting the doctor.	Very intuitive application and currently used by many seniors.
Koala Phone		Application in which the user interface was designed based on research (large text and keyboard, but very limited features).	This application was designed for seniors who are still relatively independent, and as such, want an easy-to-use smartphone to maintain their social status (e.g. taking pictures while traveling).

Table 1. Downloaded and tested smartphone applications.

Salter (2015) released an article regarding the top six smartphone applications for seniors. The list is summarized below.

1. Magnifying Glass with Light. This application illuminates and magnifies books, magazines, newspapers, and restaurant menus.
2. Skype. This application allows users to "see" each other by video conferencing.

3. Pill Boxie. This application allows the user to set-up reminders with visual pillboxes within the mobile application.
4. MedCoach. This application has quick access to lists of medications, pill reminders with easy set-up, and access to the pharmacy's website to fill prescriptions.
5. Games. These applications (e.g. crosswords, Sudoku, and Lumosity) keep seniors' brains active.
6. Red Panic Button. This application allows the user to input a relative's contact information should an emergency occur. In the event of an emergency or a need for assistance, seniors open the application and hit the red button in the middle of the screen.

Additionally, Belval (2015) also released a list of the top seven smartphone applications for seniors.

1. Lumosity. This application keeps the minds of the seniors engaged to facilitate the prevention of Alzheimer's.
2. Prismatic. This application provides an intuitive user interface for viewing current news.
3. Medisafe. This application provides reminders pertaining to medication.
4. Mint Bills & Money. This application manages bills and finances and can be used by anyone, especially seniors.
5. WebMD. This application allows any user to ask a medical question and receive an answer without visiting a doctor.
6. Kindle. This application may be used by anyone who loves to read; however, there are advantages for senior users such as controls over text size, brightness, and a built-in dictionary.
7. Audible. This application provides audiobooks, which can be helpful for anyone with a visual or literacy impairment, including seniors.

Medical Alert Advice (2014) developed a list of the top smartphone applications for seniors that were related to their medical needs. They are listed below, in no particular order.

- Fade. This application detects falls and can send a text or email to a predefined person.
- iPB Blood Pressure. This application requires a separate monitor but can track blood pressure of the user over time.
- Pill Boxie. This application provides reminders of which medication to take and at what time during the day.
- Viz Wiz. This application aids a visually impaired user in taking pictures and asking a question by which the user will receive an answer through the application.
- Motion Doctor. This application searches for physical therapy videos to help the user when an actual physical therapist is unavailable.

2.4.4. Design Considerations for Senior Users

Campbell (2015) provides recommendations to consider when developing a smartphone application.

- The first recommendation was related to the hearing and visual loss of the seniors (i.e. users). It is recommended that font sizes smaller than 16 pixels should be avoided, or to even allow the user to adjust the text size themselves. With respect to visual impairments, Campbell suggested avoiding the blue color, especially in text.
- The second suggestion was related to motor control. Interface elements that are likely to be used in the sequence should be close to each other, as long as they are at least two millimeters apart. Furthermore, buttons on touch interfaces should be at least 9.6 millimeters apart diagonally and form fields should be at least 11 millimeters apart diagonally.
- Memory is another key factor to consider when designing an application for seniors. Currently, many seniors rely on hard copy materials such as notes in wallets, calendars, and diaries to supplement their memory loss. An application for the seniors should be designed to introduce features gradually over time to prevent cognitive overload, and avoid splitting tasks across multiple screens if the seniors require memory of previous actions.

A slump in tablet sales in recent years has shown that seniors have longer upgrade cycles. In addition, seniors do not rely on text messages to convey important information. In social networking, many seniors connect with a smaller, more important group of people rather than a large, undifferentiated social network as many younger users do.

One important assumption in the application development is the user's familiarity with the device. It is important that smartphone application developers do not assume seniors have any prior knowledge or experience with smartphones. In fact, many seniors are unaware of how to use a scrollbar and some have never used a search field before (Campbell, 2015).

When marketing smartphones to seniors who are not existing owners or users, it may be difficult to persuade them to want a "complicated" phone that is not actually designed for them. One suggestion is to consider an Android phone with a senior-friendly "launcher app" which is only one application but serves as the entire user interface for the senior user (Miller, 2015). This allows the senior to use a smartphone with the common features (e.g. phone, text messaging, contacts, etc.) with no excess clutter. There are "launcher apps" currently available including Necta Launcher, Wiser, Seniors Phone, Fontrillo, and Big Launcher, which are for Android devices only. Once a senior begins to use the "launcher app" and become more familiar with a smartphone, they can be introduced to the actual smartphone user interface.

2.5 Summary

A smart city is a city that integrates people, technology, and information to create a sustainable and resilient infrastructure that provides high-quality services for residents (Villanueva-Rosales et al., 2016). Smart mobility refers to the ability of travelers to acquire, share and use information and resources to make transportation systems more accessible, sustainable and resilient.

Seniors are defined by their ages. The minimum ages of seniors vary from 55 to 65, with a majority of definitions using 65 as the minimum. For this project, an individual with an age of 65 or older is considered as a senior. Seniors are often challenged by mobility issues related to physical, visual and hearing impairments. Such impairments necessitate transportation services to be designed according to their needs. The impairments also require that electronic devices and their software, such as smartphones and mobile applications, be designed for ease of use by the seniors.

Smartphone refers to a new class of mobile phones that integrates services from communication, computing, and mobile sectors including voice communication, messaging, personal information management applications and wireless communication capability. In 2017, 42% of those over the age of 65 (i.e. seniors) reported that they owned a smartphone. Smartphone technology can potentially help the seniors to improve their mobility. However, very few smartphone applications are designed specifically for the seniors and even less so to meet the mobility needs of the seniors.

An application may be defined as a program designed to run on a mobile device such as a smartphone or tablet. Smartphone applications for the seniors need to be designed with the following considerations in mind: large font size, simple navigation menu, strategic placement of large buttons, color-coded for the visually impaired. The applications should also come with memory aids, visual aids, haptic aids, and an emergency help button. They should also be designed to minimize user input errors.

The Android platform was selected as the platform by which to develop this smartphone application.

SECTION 3. Research Work Plan

This section describes the work plan performed to meet the objective and deliver the products of this project. The work plan for this research consisted of the following tasks:

Task 1: Review of existing smartphone applications for mobility and for seniors, and the lifestyle of the seniors. [months 1 to 3]

In this task, issues with seniors' mobility and existing smartphone applications for mobility and for seniors were reviewed.

Task 2: Preliminary design and programming of the prototype application. [months 4 to 7]

In this task, the tools and the devices for the application were determined. The initial prototype of the application was designed and programmed.

Task 3: Conduct the mobility needs survey in El Paso, TX. [months 8 to 10]

After getting approval from IRB, a survey was conducted to understand the lifestyle and mobility needs of seniors in El Paso, TX.

Task 4: Conduct the mobility needs survey in New York, NY. [month 11]

After getting approval from IRB, a survey was conducted to understand the lifestyle and mobility needs of seniors in New York, NY.

Task 5: Analyze the survey data [months 12 to 13]

Data obtained from the surveys in El Paso, TX and New York, NY were analyzed to understand the lifestyle and mobility needs of the seniors.

Task 6: Incorporating the needs of seniors in the prototype application. [months 13 to 14]

The application prototype was programmed to incorporate the needs of seniors.

Task 7: Conduct a pilot survey in El Paso [months 15 to 16]

With approval from IRB, a pilot survey in El Paso was conducted. Participating seniors were given a demonstration of the application and were asked to provide feedback on the user interface and functions.

Task 8: Analyze the pilot survey data. [months 17 to 18]

The data obtained from the pilot survey in Task 7 were analyzed to identify the improvements that were needed for the application.

Task 9: Refine the prototype application. [months 19 to 24]

According to the findings of the pilot survey, the prototype application was refined with improved user interface and functions.

Task 10: Conduct a usability survey in El Paso. [months 25 to 26]

After the prototype application had been refined, a usability survey was performed in which participating seniors were asked to install this application on their smartphones and use it for one month, before providing feedback via interviews.

Task 11: Analyze the usability test data. [months 26-27]

The comments and feedback collected from the usability survey in Task 10 were compiled.

Task 12: Write report. [months 1 to 27]

All the research findings were documented in a final report in this task. The report was written as the tasks were in progress throughout the duration of this project.

SECTION 4. Mobility Needs Surveys

4.1. Background and Purpose

A survey was conducted to better understand the mobility needs and to identify common challenges faced by seniors. The authors met with officials from the City of El Paso Parks and Recreation Department to gather information about the seniors and senior centers in El Paso. Seniors from senior centers were considered as the potential users of the application since they participate in daily events at senior centers. The authors and the El Paso Parks and Recreation Department discussed the details of the surveys and agreed on the instrument, incentives, venues, and the schedule.

4.2. Survey Instrument

It was determined that all seniors at the senior centers are potential survey subjects. A survey instrument was created which incorporated a consent form and questions about the subject's demographics, daily activities, physical limitations, and open-ended questions. The draft version was shared with the El Paso Parks and Recreation Department and was then approved. Survey instrument translated into Spanish to recruit Spanish speaking seniors. English and Spanish versions of the consent form and the questions were reviewed and approved by the UTEP Institutional Review Board (IRB). The final version of the survey instrument consisted of 17 questions and survey duration was estimated as 7 minutes. 17 questions were designed into four different parts: (1) 6 questions asking demographics of the responder; (2) 3 questions about lifestyle of the responder; (3) 5 questions related to responder's mobility needs; (4) 3 questions about smartphones and smartphone applications,

4.3. Survey Implementation

Overall, El Paso has eleven senior centers which are located across the city. City of El Paso Parks and Recreation Department owns and manages all of the senior centers. After approval of the City of El Paso Parks and Recreation Department, the authors organized the surveys with coordination of the staff in each senior center. The survey dates, times, and venues are presented below in **Table 2**. Flyers (such as the one shown in Appendix A) were posted at the senior centers to advertise the survey.

Date	Time	Venue
November 6, 2017	9:00 AM – 12:00 PM	Hilos de Plata Senior Center
November 6, 2017	10:00 – 11:00 AM	East Side Senior Center
November 7, 2017	9:00 AM – 12:00 PM	Hilos de Plata Senior Center
November 8, 2017	9:00 AM – 12:30 PM	Hilos de Plata Senior Center
November 8, 2017	9:00 AM – 12:00 PM	Wellington Senior Center
November 9, 2017	10:00 AM – 12:45 PM	Grandview Senior Center
November 10, 2017	10:00 – 11:00 AM	East Side Senior Center
November 13, 2017	9:00 – 11:00 AM	San Juan Senior Center
November 14, 2017	9:30 AM – 12:30 PM	Pavo Real Senior Center
November 15, 2017	9:30 AM – 12:30 PM	Happiness Senior Center
November 15, 2017	9:00 AM – 12:00 PM	Pavo Real Senior Center
November 15, 2017	9:00 – 11:30 AM	Polly Senior Center
November 16, 2017	9:00 – 11:00 AM	San Juan Senior Center
November 16, 2017	9:00 – 11:30 AM	Polly Senior Center
November 16, 2017	9:00 – 11:30 AM	Polly Senior Center
November 17, 2017	9:00 – 11:30 AM	Polly Senior Center
November 20, 2017	9:30 AM – 12:30 PM	Pavo Real Senior Center
November 27, 2017	11:00 AM – 12:00 PM	South El Paso Senior Center
November 27, 2017	9:00 – 11:30 AM	Memorial Senior Center
November 28, 2017	9:30 – 10:00 AM	Friendly Senior Center
November 29, 2017	9:30 AM – 12:30 PM	Happiness Senior Center
November 29, 2017	11:00 AM – 12:00 PM	South El Paso Senior Center
November 30, 2017	9:30 AM – 12:30 PM	Happiness Senior Center
December 1, 2017	9:00 – 11:30 AM	Grandview Senior Center

Table 2. Survey dates, times, and venues – El Paso.

The authors recruited student volunteers to assist in the implementation of the surveys from the Anthropology Department at The University of Texas at El Paso (UTEP) through a course assignment. Twenty student volunteers received proper training and acquired certifications that met the IRB requirement to conduct the survey.

Hard copies of both the English and Spanish versions of the survey instrument were brought to each senior center at the time of survey implementation. A table was set up with the incentives and UTEP logos to attract potential survey participants. **Figure 1** presents a photo taken at the Grandview Senior Center.

Figure 1. Survey booth at Grandview Senior Center, El Paso.

The seniors at the recreation centers were recruited and guided to complete the surveys as follows. A pollster first asked if a senior would like to participate in the survey, and if so, in English or Spanish. The pollster then asked if this senior participant would like to take the survey independently or if he/she needs help to fill out the survey form. The pollster then provided the participant with the information and consent form, followed by the actual survey instrument. Once the survey was completed, the pollster handed the incentives to the participant. At the end of each survey day, the collected responses were then manually entered into Qualtrics for post-survey analysis.

Concurrent to the survey conducted in El Paso, Texas, an identical survey was conducted in New York, New York. The purpose of this survey was to see the differences and for quality control and quality assurance.

In order to conduct the survey in New York City, New York, two students from New York University (both of whom had the proper IRB certification to survey human subjects) volunteered to conduct the survey at the senior centers. There are several senior centers in New York City, all of which are sponsored by different agencies. They are geographically located throughout all areas of the city. Five senior centers gave permission to the surveyors to conduct the survey at their venues. With the Institutional Review Board (IRB) approval on January 4, 2018 surveys conducted from February 5 to February 16, 2018. The survey dates, times, and venues are presented in **Table 3**.

Date	Time	Venue
February 5, 2018	1:30 PM	PSS King Towers Center
February 8, 2018	1:00 PM	Fort Washington Ave. Rehab
February 9, 2018	3:00 PM	Taft Houses Senior Center
February 12, 2018	10:00 AM	Corsi Senior Center
February 16, 2018	11:00 AM	Lehman Village Senior Center

Table 3. Survey dates, times, and venues – New York City.

The survey instrument was first initially developed in Qualtrics software, at the same time, hard copies were prepared and brought to the senior centers. At the end of each survey day, the completed survey form (hard copies) were brought back and the responses manually transcribed to Qualtrics.

4.4. Survey Results – El Paso

A total of 458 responses were received. Of those, 229 were in the English version of the instrument and 229 were in the Spanish version of the instrument. The number of responses received for individual questions is summarized in **Table 4.**

A full listing of all the responses are compiled and listed in Appendix B.1. The statements listed in Appendix are deliberately not edited (including spelling or grammatical errors) in order to retain their real inputs. For each question, the responses in English and Spanish were analyzed separately.

Question no.	Nature of question	No. of responses in English	No of responses in Spanish	Total no. of responses
1	Age	226	221	447
2	Gender	226	221	447
3	Employment status	219	212	431
4	Ethnicity	223	216	439
5	Language	229	229	458
6	Zip code	223	217	440
7	Type of residence	224	219	443
8	Impairment or disability	229	229	458
9	Electronic device used	229	229	458
10	Mobility assistance	229	229	458
11	Trip frequencies	214	219	433
12	Mode choice	214	219	433
13	Concern when planning a trip	229	229	458
14	Mobility challenge	155	144	299
15	Desired application functions	85	73	158
16	Motivation to use application	119	94	213
17	Data sharing	213	218	431

Table 4. Number of survey responses – El Paso.

4.5. Survey Results – New York City

A total of 61 responses were received in New York City. Different from the El Paso survey, all surveys were conducted in English. The survey results were shared according to total responses in single figures for each. **Table 5** outlines the number of survey responses for New York City.

Appendix B.2 and its subsections share the results obtained for each question. For each question, the responses were analyzed separately under the corresponding sub-sections.

Question no.	Nature of question	Total no. of responses
1	Age	58
2	Gender	61
3	Employment status	61
4	Ethnicity	61
5	Language	61
6	Zipcode	61
7	Type of residence	60
8	Impairment or disability	61
9	Electronic device used	61
10	Mobility assistance	61
11	Trip frequencies	61
12	Mode choice	61
13	Concern when planning a trip	61
14	Mobility challenge	21
15	Desired application functions	15
16	Motivation to use application	13
17	Data sharing	61

Table 5. Number of survey responses – New York City.

4.6. Summary of Findings

The mobility needs surveys were conducted in El Paso, Texas and New York, New York. The survey instruments in El Paso were prepared in English and Spanish. On the other hand, the survey in New York was conducted only in English. El Paso survey results in each language, for each question, were analyzed separately in this report. On the other hand, combined results of El Paso and New York surveys were analyzed and compared by Vechione et al. (2018).

The key findings from this survey are:

- Smartphone applications for seniors should be intuitive, simple, and easy-to-use;
- Smartphone applications should have ADA-compliant alternate transportation modes (e.g. ADA-compliant buses, paved sidewalk, etc.) for senior users;
- Smartphone applications for the seniors should provide adjustable large font option to serve individuals with visual impairments;
- Smartphone applications for the seniors should have speech-to-text and text-to-speech recognition for those with hearing impairments;
- Smartphone applications for the seniors should be inexpensive, or even free;

- Smartphone applications for the seniors should get the users' permission to share their data anonymously with the developers; and
- The greatest mobility challenges faced by the seniors (which applications should help to solve) were traffic congestion (including work zones) and difficulty in finding places to park.

These are the key findings of the first survey which all were taken into account during the development of the prototype version of the Urban Connector application. The next section describes the development of the application, the tools used, functional, non-functional requirements, and user menu.

SECTION 5. Prototype Application Development

The development of the mobile application is based on the results obtained from the survey described in Section 4, using the state-of-the-art tools and techniques in the area. This section describes the main functionality of the application and how to operate it, along with the tools used during the development process.

As described in the Vargas-Acosta et al. (2019), Urban Connector application was developed using Android software tool (Android Studio, 2018). Functional requirements were developed with reference to the findings of the mobility needs survey reported in Section 4. On the other hand, the recommendations that an application designed for seniors should have were listed (Vechione et al., 2018). Users should be allowed to set the preferred language (Spanish or English) , adjust the font size. All main features should be accessed with a minimum number of clicks or text. It was also recommended that user should have chance to input the information using speech to text feature. Similarly text to speech recognition will help seniors who have visual impairments.

Urban Connector allows users to configure his/her settings for the first time. With this one time configuration, users can adjust the perfect font size, select the preferred language, list the impairments, and add the home addresss to be used for navigation purposes. The frequent places menu was designed to make most interaction by the users (see Figure 2) If a home address is provided, the Home icon will become colored and clickable. By clicking the Home button, the Urban Connector application will make use of Google Maps to show the route to get to the address provided in the home address screen. By clicking on the Family & Friends icon, the Urban Connector application will show a list of family and friends. By clicking on a name, the Urban Connector application will make use of Google Maps to show the route to get to the address that has been entered in the record. To add a new record by using a map, Google Maps is used to enter the location by selecting a point on the map with a desired Name for that record. Open resources for El Paso were all collected and listed under the “Transportaion services” and users access to this menu with two clicks form the main menu (three horizontal bars). Till now, research team have succeed to fulfill the six of the 16 recommendations (Vargas-Acosta et al., 2019).

Figure 2. Urban Connector application screenshots

SECTION 6. Pilot Survey

6.1. Background and Purpose

After developing the prototype version of the Urban Connector application, another survey was conducted to collect first-time users' feedback. The authors met with the representatives of the City of El Paso Parks and Recreation Department to demonstrate the prototype application and asked for permission to conduct the second survey. The authors were advised to recruit the majority of the participants from an event called National Fitness Day on May 30th, 2018, which was organized by the Parks and Recreation Department for the entire City. The authors were also given permission to visit senior centers to recruit additional participants.

6.2. Survey Instrument

A survey instrument was created which incorporated a consent form and questions about the subject's demographics and opinion about the prototype application. The consent form and questions were first drafted in English and then translated into Spanish. Both English and Spanish versions of the survey instrument were reviewed by representatives of the City of El Paso Parks and Recreation Department and then approved by UTEP's Institutional Review Board (IRB). Survey final version has four parts with 16 questions: (1) First part has five questions on participant's demographics and the use of mobile devices; (2) Second part has five questions on participant's opinion about the user menus and ease of navigation between and within the menus; (3) Third part consisted of three questions on participant's opinion about the user interface designs (e.g., font size, icons); (4) Last part has three questions on the participant`s overall rating of the prototype Urban Connector application and open-ended feedback.

6.3. Survey Implementation

To advertise this survey and to help recruit participants, posters and videos were created. The posters have English and Spanish versions (see Appendix C). They summarize the results of the first survey. Four two-minute animated videos were prepared. Two of the videos were in English and the other two were in Spanish. For each language, the first video explained viewers the general characteristics and potential function of smartphones, while the second video presented the prototype Urban Connector application. Besides the National Fitness Day on May 30th, 2018, five different senior centers were visited in coordination with the staff at each center. The survey dates, times, and venues are presented in **Table 6.**

Date	Time	Venue
May 29, 2018	10:00 – 11:00 AM	East Side Senior Center
May 30,2018	8:00 AM – 01:30 PM	Pavo Real Senior Center – National Fitness Day
June 4, 2018	10:00 – 12:00 PM	Grandview Senior Center
June 5, 2018	11:00 AM – 12:00 PM	Hilos de Plata Senior Center
June 6, 2018	10:00 AM – 12:00 PM	Polly Senior Center
June 7, 2018	10:30 AM – 12:00 PM	Pavo Real Senior Center

Table 6. Prototype feedback survey dates, times, and venues.

On the day of the pilot survey, a table was set up at the survey site with the UTEP logo. Incentives (water bottles, tote bags) and posters were displayed, and videos were played repeatedly on laptop computers to draw the attention of potential participants. Five student volunteers, trained and certified to follow IRB procedure, assisted in the survey. **Figure 3** presents a photo taken at the site. At the end of each survey day, the hardcopy versions of the survey instruments were brought back to the transportation laboratory on the UTEP campus. The responses were manually transcribed into Qualtrics.

Figure 3. Survey booth at Pavo Real Senior Center on National Fitness Day.

6.4. Survey Results

A total of 65 responses were received in the pilot survey. Of those, 22 were in the English version of the instrument and 43 were in the Spanish version of the instrument. The number of responses received for individual questions are summarized in **Table 7**.

The following sub-sections report the results obtained for each question. Full listing of all the responses are compiled and listed in Appendix D. The statements listed in Appendix D have been left deliberately not edited (including spelling or grammatical errors) in order to retain their original inputs. For each question, the responses in English and Spanish were analyzed separately, and results were combined for demonstration in this report.

Question no.	Nature of question	No. of responses in English	No of responses in Spanish	Total no. of responses
Pre-1	Smart device use	22	43	65
Pre-2	Operating system of the smart device	22	43	65
Pre-3	Ask for assistance	22	43	65
1	Age	22	43	65
2	Gender	22	43	65
3	Electronic device use	22	43	65
4	Device assistance need	22	43	65
5	Smartphone use	22	43	65
6	Home screen menu	22	43	65
7	Frequent places menu	22	43	65
8	Transportation services menu	22	43	65
9	Graphic images	22	43	65
10	Entering preferences	22	43	65
11	Names of menus	22	43	65
12	Size of buttons	22	43	65
13	Colors used	22	43	65
14	Overall Evaluation	22	43	65
15	Recommendation to a friend	22	43	65
16	Suggestions for improvement	9	18	27

Table 7. Number of second survey responses.

6.5. Summary of Findings

The pilot survey on the prototype Urban Connector application was conducted in El Paso on six different days at six different senior centers, from May 29 to June 7, 2018. Sixty-five (65) seniors participated in this survey, with 22 of them answering the English version of the survey form, and 43 of them answering the Spanish version of the survey form.

The survey first asked for the participant's familiarity with mobile devices. Of the 65 participants, 68% of them were already smartphone or tablet users and among them, 68% had Android operating system in their devices. Eighty-eight percent (88%) of the participants asked UTEP student-assistants to demonstrate the Urban Connector application before answering the survey questions.

The last part of the survey asked participants to give overall evaluations for the prototype Urban Connector application:

- Participants gave the application an average score of 4.63 on a scale of 1 to 5.
- 97% of the participants would recommend this application to a friend.

SECTION 7. Usability Survey

7.1 Background and Purpose

After the development of the prototype version of the Urban Connector application and the subsequent modifications based on the pilot survey results, an additional survey was conducted to test the efficacy of the application's features. In collaboration with El Paso Parks and Recreation Department, the authors were advised to attend the 37th annual El Paso Senior Games as this event attracts a suitable conglomeration of seniors. During these events, the individuals demonstrating an interest in the application were recruited and received assistance to download the application on their personal devices. The recruited participants were then asked to engage in a minimum 30-day trial period concluding with the usability survey and bestowal of their participation incentives.

7.2 Survey Instrument

A survey instrument incorporating questions about the participants' demographics, application usability, and overall rating was developed in English and translated into Spanish. Both versions were first reviewed by representatives from the City of El Paso Parks and Recreation Department and later approved based on the guidelines set forth by UTEP's Institutional Review Board (IRB). The final version of the usability survey consisted of 24 questions in four parts:

- Part 1: About Yourself. Five questions on participant's demographics and usage of mobile devices;
- Part 2: About the Urban Connector Application in General. Ten questions on participant's opinion on user menu options, ease of use and usefulness of the functions;
- Part 3: Application Design Features. Three questions on the participant's opinion regarding the user interface design (e.g. font size, icons, colors);
- Part 4: Final Evaluation. Six questions on participant's overall satisfaction and rating of the tested application, as well as open-ended feedback.

7.3 Survey Implementation

A video, as a visual aid tool, was created to recruit seniors. The videos, created in both English and Spanish, feature how to install, personalize according to the user's preferences and apply the resources available to start the application's navigation capabilities. In addition to the mentioned Senior Games, frequently visited places by seniors in El Paso including Cafe Mayapan and El Paso Public Library were visited to meet an adequate recruitment turnout (in geographical spread and sample size). Authors also recruited participants from the Helping Hand Adult Day Care. The survey recruitment dates, times, and venues are summarized in **Table 8** below.

Date	Time	Venue
February 26, 2019	11:00 AM – 12:00 PM	Pavo Real Senior Center
February 27, 2019	11:00 AM – 12:00 PM	Pavo Real Senior Center
February 28, 2019	11:00 AM – 12:00 PM	Pavo Real Senior Center
March 2, 2019	9:00 AM – 12:00 PM	Polly Harris Senior Center
March 8, 2019	9:00 AM – 12:00 PM	Cafe Mayapan
March 9, 2019	9:00 AM -1:00 PM	Noland Richardson Rec. Center
March 15, 2019	10:00 AM – 11:00 AM	El Paso Community College
March 17, 2019	2:00 PM – 5:00 PM	El Paso Library
March 21, 2019	9:00 AM – 1:00 PM	Helping Hand Adult Day Care

Table 8. Usability Survey Recruitment Dates, Times and Venues.

During recruitments, the developed visual tool was repeatedly played on computer monitors. Posters demonstrating the previous survey's findings were displayed, and colorful flyers (as shown in Appendix E) were distributed to the seniors.

Figure 4 presents a photo of the recruitment booth set up at Pavo Real Senior Center. The volunteer students attending these events received proper IRB certification to survey human subjects and special training to prepare for expected frequently asked questions about the application. They aimed to encourage seniors to become participants in the study period.

The recruited seniors engaged in a phone call or personal interview to complete the survey after the 30-day period was over, Participants are first called to see whether they wanted to take the survey on the phone or in person. Many wanted to meet in person to complete the survey and be rewarded with the gift card. Researchers would ask for the time, date, and location that would be most convenient for the participants to meet. Many participants asked to meet at their local senior center or recreational center. Most were available in the morning with the exception of 6 participants that were available in the afternoon. Once the researchers met the participants, they asked the participants to complete the survey. Having submitted the survey, these individuals were rewarded with the promised $10 gift card as an incentive. One participant did not want to receive the gift card. Most seniors wanted to take the survey in person except for five participants who took it over the phone. It took three to five minutes for each participant to answer the survey over the phone and in person.

Figure 4. Urban Connector Recruitment Booth at Pavo Real Senior Center.

7.4 Survey Results

A total of 38 responses were received in this usability survey. Of those, 22 were in the English version of the instrument and 16 were in the Spanish version of the instrument. The number of participants who responded in Spanish was less than the number of participants who responded in English. The number of responses received for individual questions is summarized in **Table 9**.

Question No.	Nature of Question	No. of Responses in English	No. of Responses in Spanish	Total No. of Responses
1	Age	22	16	38
2	Gender	22	16	38
3	Electronic Device Use	22	16	38
4	Device Assistance	22	16	38
5	Smartphone Use	22	16	38
6	Application Use	22	16	38
7	Usage Reason	22	16	38
8	User Preferences	22	16	38
9	Frequent Places Menu	22	16	38
10	Home Screen Menu	22	16	38
11	Graphic Images	22	16	38
12	Entering Addresses	22	16	38
13	Disorientation	22	16	38
14	Avoid Traffic Congestion	22	16	38
15	Fear of Late Arrivals	22	16	38
16	Size of Buttons	22	16	38
17	Menu Options	22	16	38
18	Visual Needs	22	16	38
19	Crash / Freeze	22	16	38
20	Fast Learning	22	16	38
21	Efficiency / Productivity	22	16	38
22	Friend Recommendation	22	16	38
23	Application Rating	22	16	38
24	Features Suggestion	19	10	29

Table 9. Number of Third Survey Responses

The following sub-sections report the results obtained for each question. All the responses are compiled and listed in Appendix F. For each question, the responses in English and Spanish were analyzed separately, and the results were combined.

7.5 Summary of Findings

The usability test for the Urban Connector application was conducted in El Paso by recruiting 40 seniors in March 2019. Thirty-eight (38) seniors used the Urban Connector for one month followed by answering the survey questions in English and Spanish. Twenty-two (22) completed the English version of

the survey form, and 16 answered the Spanish version of the survey form. The usability survey was divided into four parts.

- Part 1 asked the participants about their profiles. Among the 38 participants:
    - 79% were aged 65 or over;
    - 79% were female;
    - 100% used a smartphone, 42% used a tablet, and 42% used a home computer;
    - Smartphones are mainly used for calling, followed by 89% texting, and 84% taking photos. Only 61% of the participants use their smartphone for navigation.
    - More than half of the participants did not need assistance to install the Urban Connector application.
- Part 2 of the survey asked about the participant's usage of the Urban Connector application. Participants were given five answer choices for each question: strongly agree, agree, neutral, disagree or strongly disagree. From the responses of the survey:
    - 92% used the Urban Connector application at least once per week;
    - 98% strongly agreed or agreed that entering their preferences was easy, no participants disagreed or strongly disagreed;
    - 68% strongly agreed or agreed that the Home Screen menu was easy to use and only 16% disagreed or strongly disagreed, and they mainly asked for the font size to be increased;
    - 82% strongly agreed or agreed it was easy to understand the Frequent Places menu. 10% disagreed or strongly disagreed;
    - 82% strongly agreed or agreed that the graphic images were easy to understand. 10% disagreed or strongly disagreed;
    - 53% strongly agreed or agreed that it was easy to enter the addresses of family members and friends. 21% disagreed or strongly disagreed;
    - 53% strongly agreed or agreed that the fear of getting lost was reduced by using the application. 21% disagreed or strongly disagreed;
    - 52% strongly agreed or agreed that the Urban Connector application helped them to avoid traffic congestion, 27% disagreed or strongly disagreed;
    - 53% strongly agreed or agreed that their concerns for arriving late were reduced by using the Urban Connector application; 16% disagreed or strongly disagreed.
- Part 3 of the survey asked the participant's opinions about the application design features.
    - 95% strongly agreed or agreed that the size of the buttons and text met their visual needs. 6% disagreed or strongly disagreed;
    - 100% strongly agreed or agreed that the names of the menus accurately reflected their functions;

    - 94% strongly agreed or agreed that the colors, labels, and images used in the application met their visual needs. No one disagreed or strongly disagreed.

- Part 4 of the survey asked the participant to evaluate the overall impression of the Urban Connector application.
    - Participants gave the application an average score of 3.47 stars out of 5;
    - 68% of the participants would recommend this application to a friend;

SECTION 8. Conclusions

Seniors encounter mobility issues and change in their lifestyle. Smartphone applications are a potentially useful tool to assist seniors in meeting their mobility needs. However, the available applications have not been adequately designed to cater to the needs of the seniors.

The objectives of this project are: (a) to understand the lifestyle and mobility needs of seniors; (b) to develop a prototype smartphone application that caters to the needs identified; and (c) to conduct tests and gather feedback for the prototype application.

Seniors are defined by their ages. The minimum age at which one is considered a senior varies from 55 to 67, with a majority of definitions using 65. Seniors are often challenged by mobility issues related to physical, visual and hearing impairments. Such impairments necessitate transportation services to be designed according to their needs. Electronic devices and their software (such as smartphone applications) should be designed for the ease of use by seniors.

Before and during the development of the application, the research team conducted three surveys with seniors. The first survey was conducted in El Paso, Texas and New York City, New York, with the same questions in English and Spanish, in both locations. The objective of this survey was to better understand the mobility needs of the seniors so that the smartphone application could be developed to better meet those needs. Researchers reached out 458 participants in El Paso and 61 participants in New York City. Based on the key findings of the first survey, the Android platform was selected as the platform by which to develop the Urban Connector smartphone application.

After the development of the prototype of the Urban Connector application, a second survey was carried out in El Paso with 65 participants. The second survey focused on collecting the first time users' feedback. Researchers provided seniors with mobile devices with the application installed. The participants were asked to explore the application for five minutes and then answered questions about the features of the application. Over 70% of the seniors agreed that the features of the application met their needs. The participants gave the application an average score of 4.63 on the scale of 1 to 5, and 97% of the participants said that they would recommend this application to a friend.

The comments received in the second survey included features that seniors would like to see in the Urban Connector application. The research team implemented the requests, improved the functions and user interface. The new prototype was field-tested by 38 seniors in El Paso, followed by a third survey of the pilot test group. The recruited participants were asked to use the Urban Connector application for a 30-day trial period concluding with a usability survey. Most of the questions in this survey asked the participants to state if he/she strongly agreed, agreed, was neutral, disagreed, or strongly disagreed with a given statement. The statements were related to the ease of use or benefits of the Urban Connector applications. Overall, in the third survey, more than half the participants said that they strongly agreed or agreed with the statements given in the questions. The average rating was 3.47 out of 5.00 and 68% of the participants said that they would like to recommend the Urban Connector application to a friend.

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APPENDIX A – Mobility Needs Survey Flyer

MAKE YOUR OPINION COUNT!

Participate in a survey conducted by UTEP to gather information about your mobility needs. The goal is to develop a mobile application (App) named Urban Connector that caters to the transportation needs of senior citizens.

WHEN: November 06
WHERE: Hilos de Plata
TIME: 9:00 AM-12:00 PM

Funded in part by the National Science Foundation Grants HRD-1342038, HRD – 1242122, CNS-1551221 and the Department of Transportation Grant F8741-02.

APPENDIX B – Mobility Needs Survey Results

B.1. El Paso Results

B.1.1. Age

English – What is your age range?

In this question, participants were asked to select the answer choice that included their age. The answer choices given were based on the age ranges in the definitions for seniors (i.e. 55 to 67), as reviewed in Section 2. The number of participants who answered this question (in English) was 226. As shown in **Figure 5,** the highest group was between the age of 65 and 74. This was followed by the age range of 75 and older.

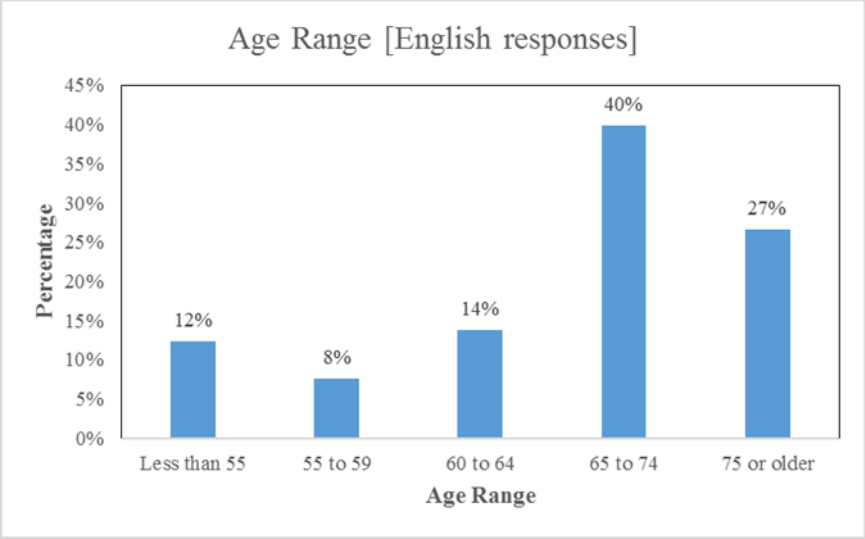


Figure 5. Age range [English responses] El Paso.

Spanish - ¿Qué edad tiene?

The same question was asked in Spanish. As shown in **Figure 6,** of the 221 participants who responded to the Spanish version of the survey, the largest group was 75 years or older, followed by the age range of 65 to 74. It appeared that the participants who answered the Spanish version of the survey were older than those who answered the English version of the survey.

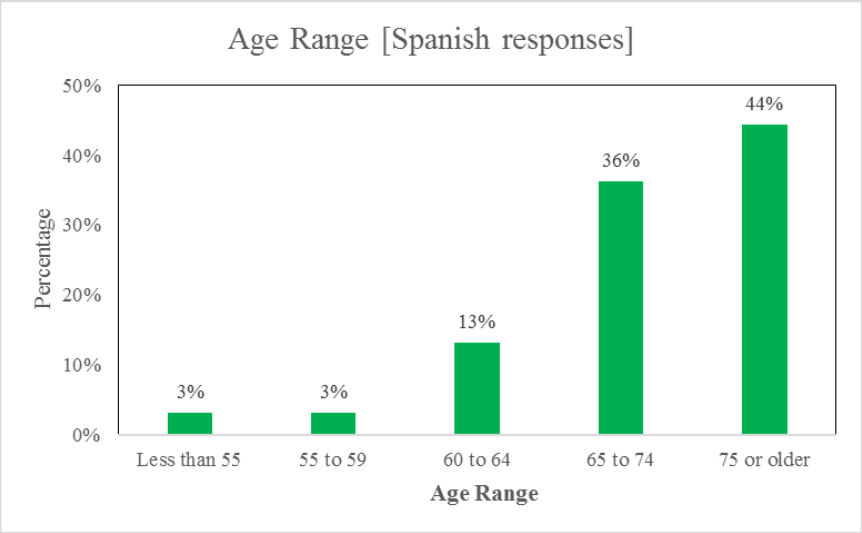


Figure 6. Age range [Spanish responses] El Paso.

B.1.2. Gender

English - What is your gender?

In this question, participants were asked to select the answer choice for their gender. There were only two answer choices: male or female. The results for the 226 responses collected in the English version of the survey for this question are presented in **Figure 7.** There were almost twice as many female participants as males.

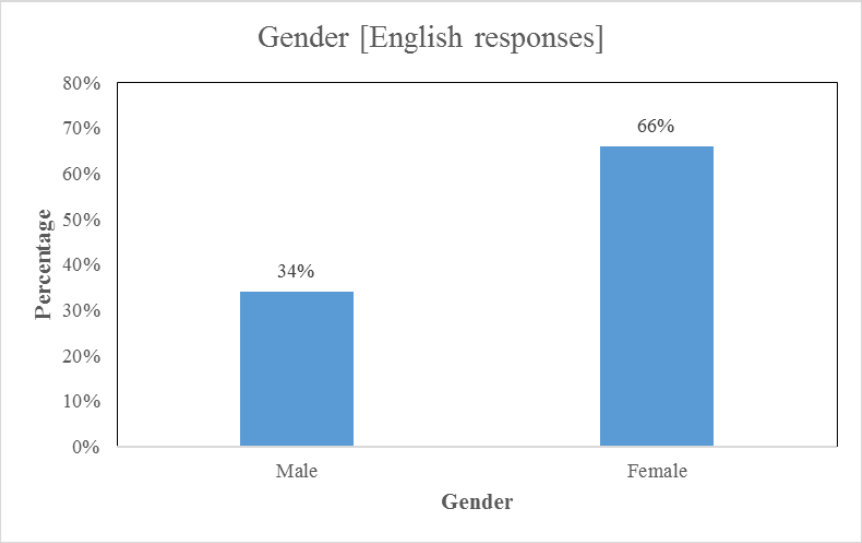


Figure 7. Gender [English responses] El Paso.

Spanish - ¿Cuál es su género?

The same question was asked in Spanish, and 221 responses were collected. As shown in **Figure 8**, there were almost three times as many female participants as males.

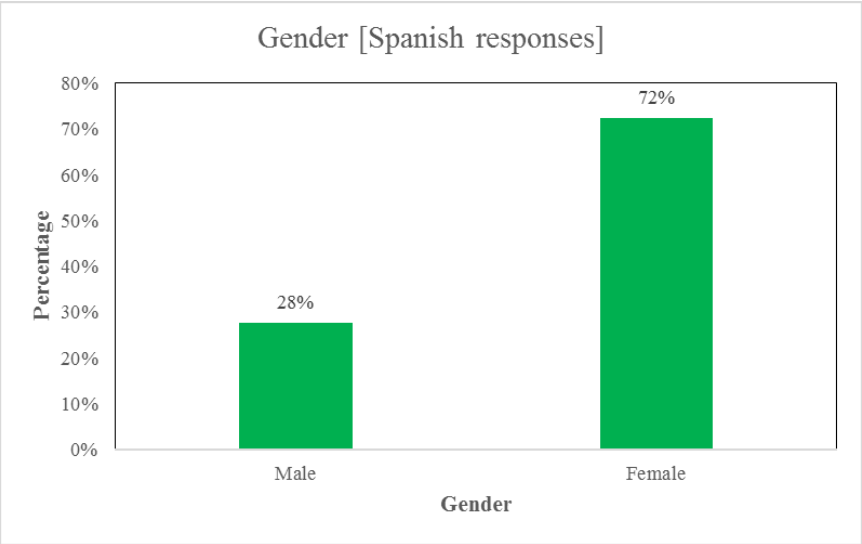


Figure 8. Gender [Spanish responses] El Paso.

B.1.3. Employment Status

English – What is your current employment status (optional)?

In order to reduce the length of the survey, as per the City of El Paso Parks and Recreations Department official's advice, this question was made optional. However, 219 participants still chose to answer this question. For this question, participants were asked to select the answer choice for their employment status. Each answer choice was a range of the number of working hours per week. Choices such as volunteer and retired were also given. The result of the English responses to this question is presented in **Figure 9**. A majority of the participants who answered the English version of the survey were retired, followed by those who have a full-time job (i.e. 40 hours or more per week with salary). These results are expected, as many of the seniors who frequent the senior centers were likely retired.

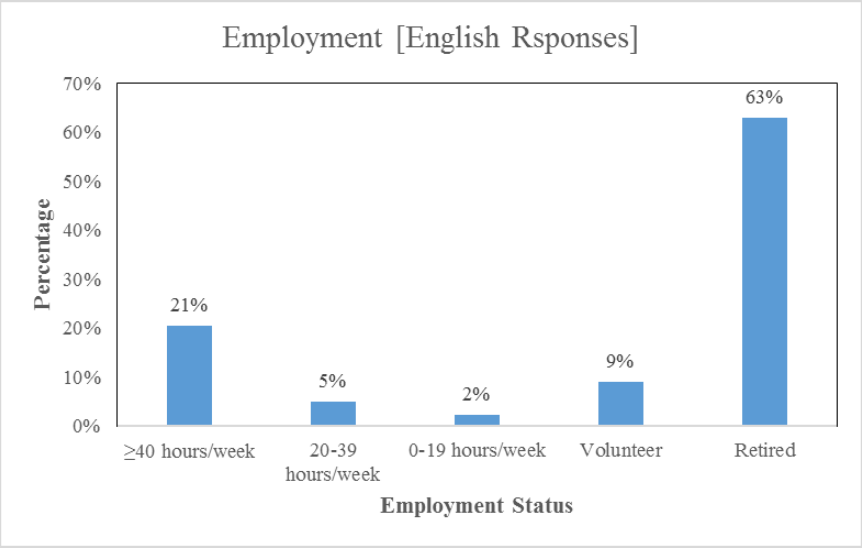


Figure 9. Employment [English responses] El Paso.

Spanish - ¿Cuál es su situación laboral actual (opcional)?

The same question was asked in Spanish, and 212 responses were collected. As shown in **Figure 10**, the majority of participants were retired, followed by those who work full-time with salary.

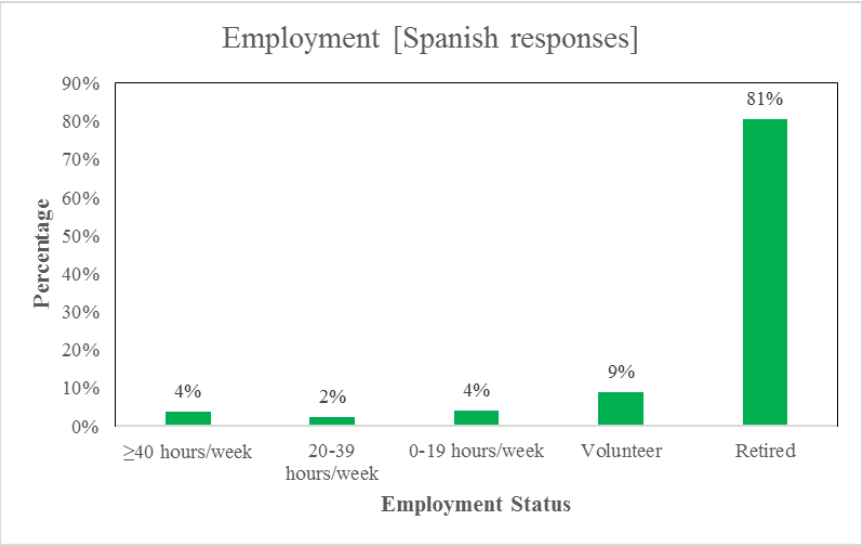


Figure 10. Employment [Spanish responses] El Paso.

B.1.4. Ethnicity

English – What is your ethnicity (optional)?

This question asked the ethnicity of the survey participant and was the second optional question in the survey. There were 223 responses. The results for the participants who answered the English version of the survey are presented in **Figure 11**. The majority of participants reported being Hispanic or Latino, followed by White. This result is expected, given the geographical location of El Paso near the Mexican border.

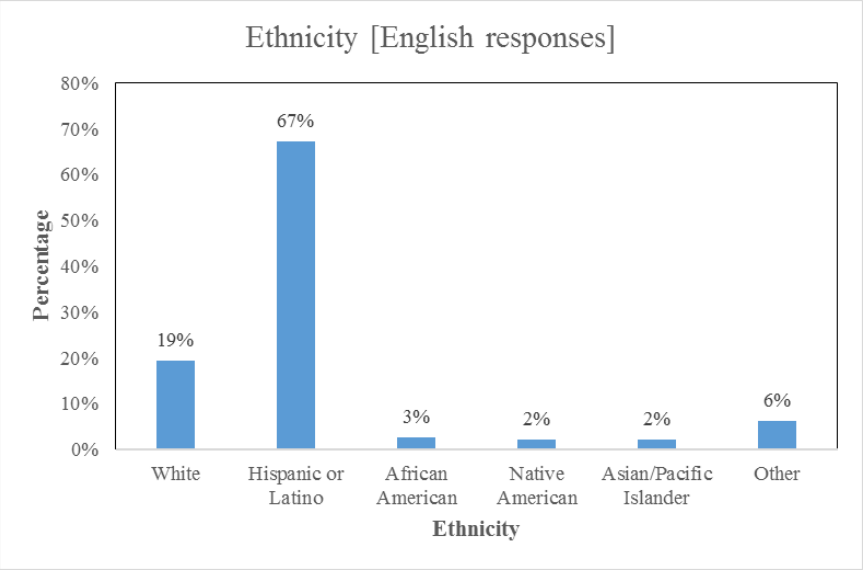


Figure 11. Ethnicity [English responses] El Paso.

Spanish - ¿Cómo se identifica? (etnia/raza) (opcional)?

The same question was asked in Spanish, and there were 216 responses. As shown in **Figure 12,** the majority of participants were Hispanic or Latino, followed by White.

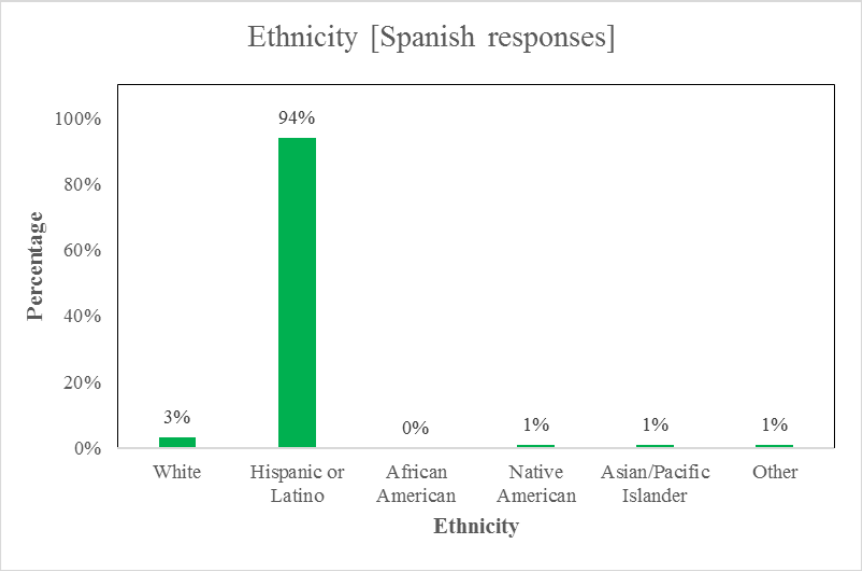


Figure 12. Ethnicity [Spanish responses] El Paso.

Other Answers

Hispanic/Anglo mix
Native American/Hispanic
Black Latina
Mexican American
Mexican

B.1.5. Languages

English – What languages are you able to understand, speak, and write with confidence? (You may select more than one).

This question asked what language the participant was able to use with confidence. The purpose of this question was to determine which language(s) to use in the smartphone application's interface. The results for the 229 English responses are presented in **Figure 13**. As expected, the majority of participants who responded to the English version of the survey reported speaking English with confidence, with a smaller percentage who could also speak Spanish with confidence. The Other category responses included, among others, German, French, Sign Language, and Hebrew.

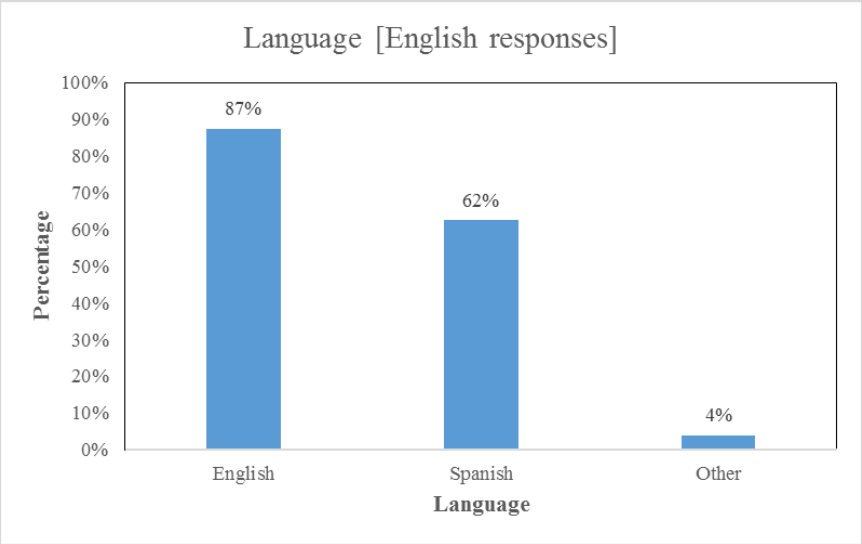


Figure 13. Languages [English responses] El Paso.

Spanish - ¿En qué idioma(s) se comunica con confianza? (entiende, habla, y escribe) (Puede seleccionar más de una respuesta.).

The same question was asked in Spanish, and there were 229 responses. As shown in **Figure 14**, the majority of participants who responded in the Spanish version of the survey reported speaking Spanish with confidence, followed by those who could also speak English with confidence. The Other category responses only included Sign Language.

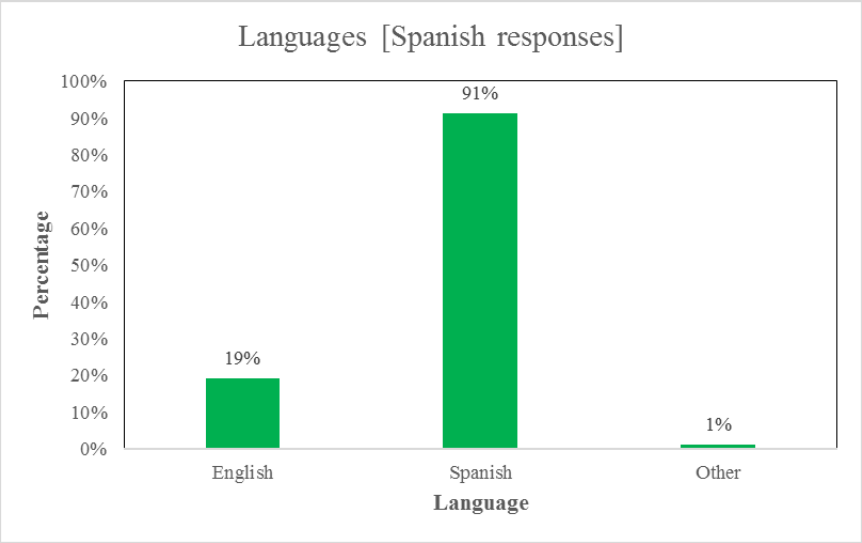


Figure 14. Languages [Spanish responses] El Paso.

Other Answers

very little German
German
FRENCH
Sign language
Hebrew
German
German, Italian
sign language
Spanglish

B.1.6. Zip Code

English – What is the zip code of your residential address?

This question asked what zip code the participant lived in. The purpose of this question is to: (i) verify all areas of El Paso are represented; and (ii) determine what areas of El Paso the potential users live in, so that the initial content of the smartphone application may concentrate on those zip codes. The results of the 223 participants who answered the English version of the survey are presented in **Figure 15.** Virtually all zip codes in El Paso were represented, as well as some in New Mexico (i.e. zip codes greater than 88000).

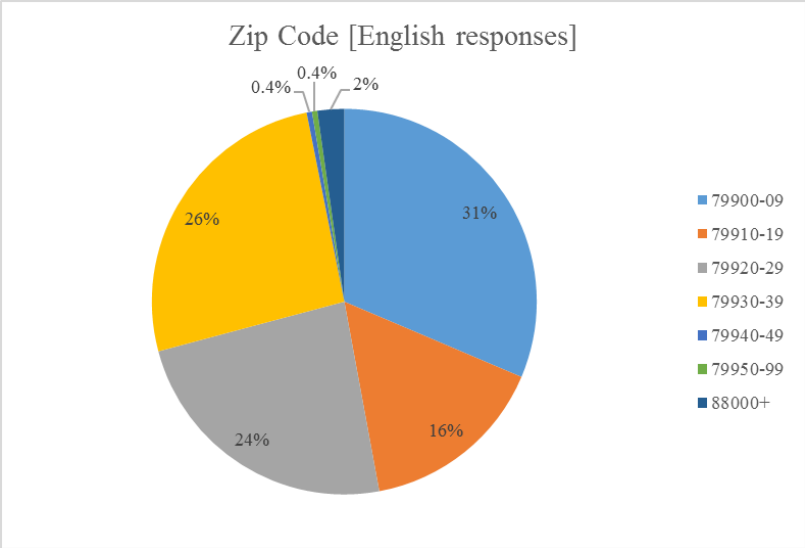


Figure 15. Zip code [English responses] El Paso.

Spanish – ¿Cuál es el código postal del lugar donde vive?

The same question was asked in Spanish, and there were 217 responses. As shown in **Figure 16**, virtually all zip codes in El Paso were represented, as well as New Mexico.

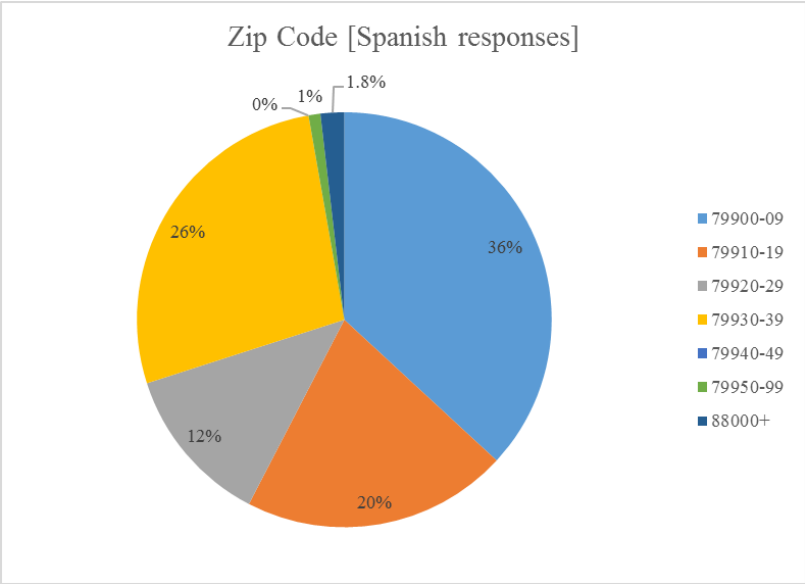


Figure 16. Zip code [Spanish responses] El Paso.

Total

The combined results from both the English and Spanish responses for this question (440 responses) are presented below in **Figure 17**. **Figure 17** provides justification that all areas of El Paso were represented for this survey.

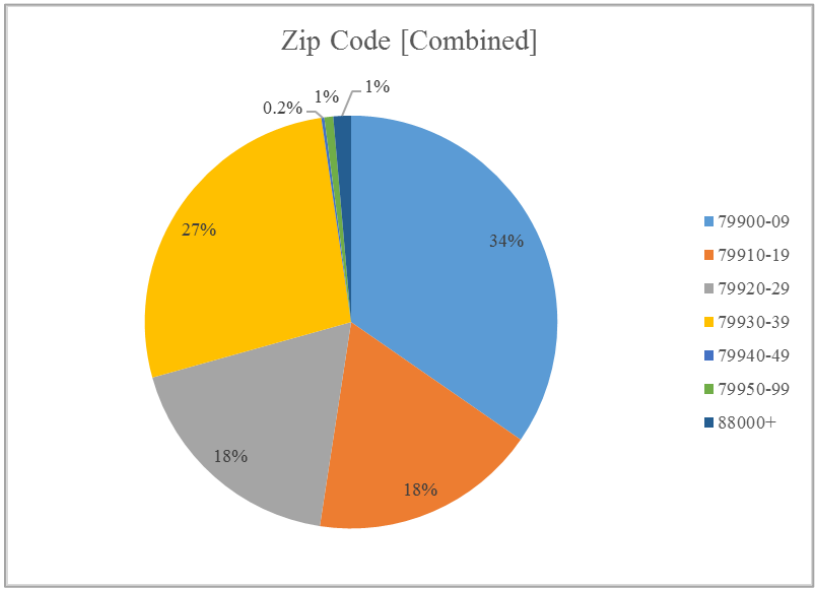


Figure 17. Zip code [all responses] El Paso.

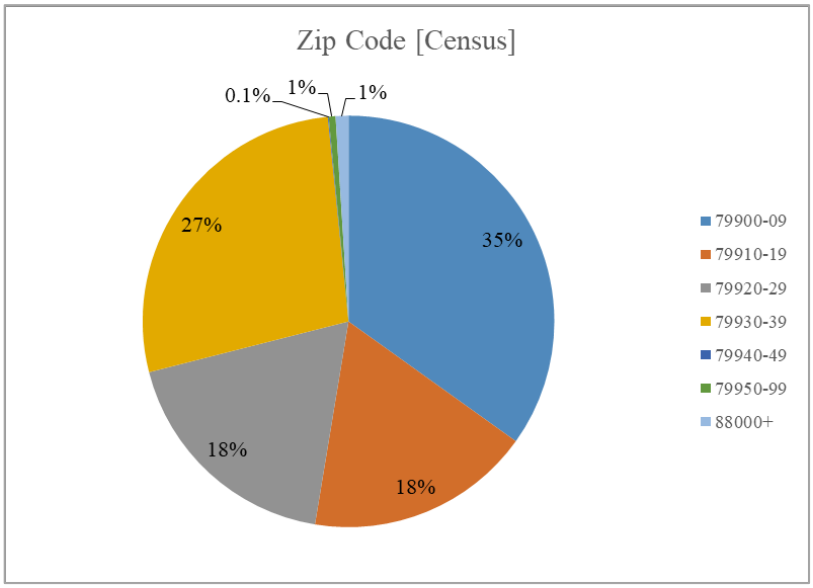


Figure 18. Zip code [US Census data 2010 for El Paso seniors]

In order to understand the spread of the data collection, the zip codes of the respondents are compared to the US-Census data for El Paso. The percent distribution of the survey respondents and the census information of population who are above 65 years old are listed according to the zip codes. The Census data information plotted in **Figure 18** above. As shown, the survey respondents are perfectly distributed compared to El Paso census data.

B.1.7. Type of Residency

English – How would you describe your type of residence?

This question asked the participant to select the answer choice for their type of residence. The purpose of this question was to gain a better understanding of the independence of the seniors. The results for the 224 participants who answered the English version of the survey are presented in **Figure 19**. The majority of participants who answered the English version of the survey reported living in houses, followed by apartments. Very few respondents reported living in senior citizen homes. Other category responses included living with a relative or friend, a mobile home, and homeless. These results are expected, as much of the surveys were conducted at the senior centers, places where mobile and independent seniors frequently visit.

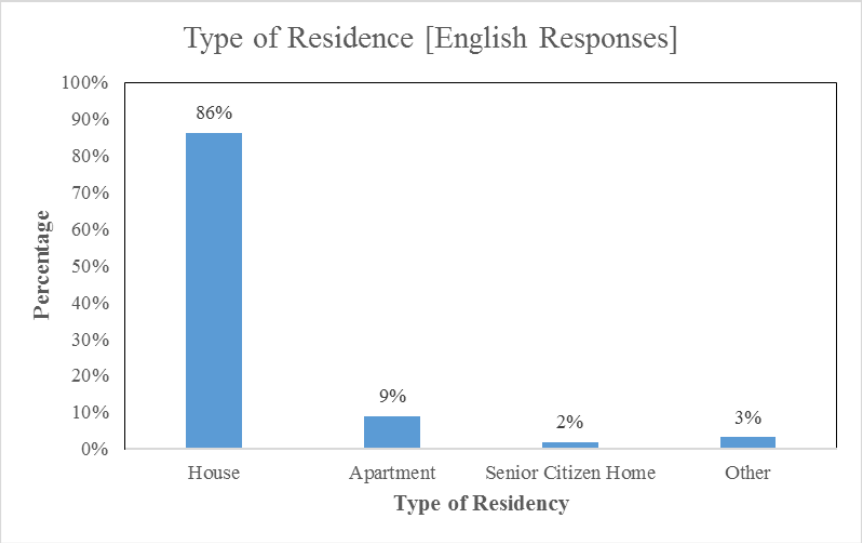


Figure 19. Type of residency [English responses] El Paso.

Spanish – ¿Cómo describe su tipo de residencia?

The same question was asked in Spanish, and there were 219 responses. As shown in **Figure 20**, the majority of participants who answered the Spanish version of the survey reported that they live in a home, followed by those who live in an apartment. There was a greater percentage of participants who answered the Spanish version of the survey who reported living in an apartment, as compared to participants who answered the English version of the survey. There was no participant who lived in a senior citizen home. Other category responses included living with a relative or friend, a mobile home, and military housing.

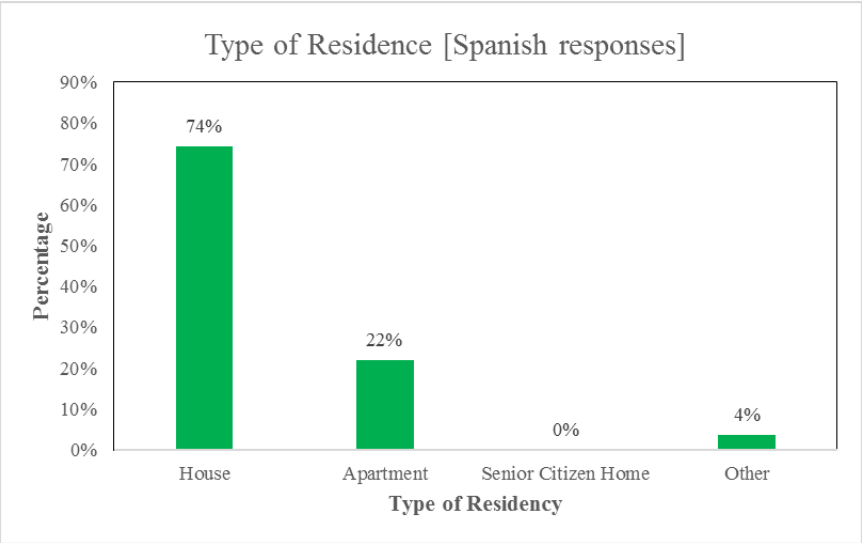


Figure 20. Type of residency [Spanish responses] El Paso.

Other Answers

With my brother/House
no answer
mobile home
homeless
Living with friend
Trailer
Duplex
son's house

Mobil Home
Shelter/ Farm worker's center
adult daycare and special housing
Military Housing (lives with her son)
Mobile Home
rents a studio
Mobile home

B.1.8. Impairments and Disabilities

English – Do you have any of the following impairments or disabilities? (You may select more than one answer)

This question asks the participant to choose all applicable answer choices for the impairments and disabilities that they may have. The purpose of this question was to gain a better understanding of the impairment and disability needs of the seniors. The results for the 229 participants who answered the English version of the survey are presented below in **Figure 21**. Slightly less than half of the participants who answered the English version of the survey reported having no impairment or disability, followed by those with trouble walking. It should be noted that every disability type was checked by at least 5% of the participants who answered the English version of the survey. Other impairments or disabilities included memory loss, arthritis, and fatigue.

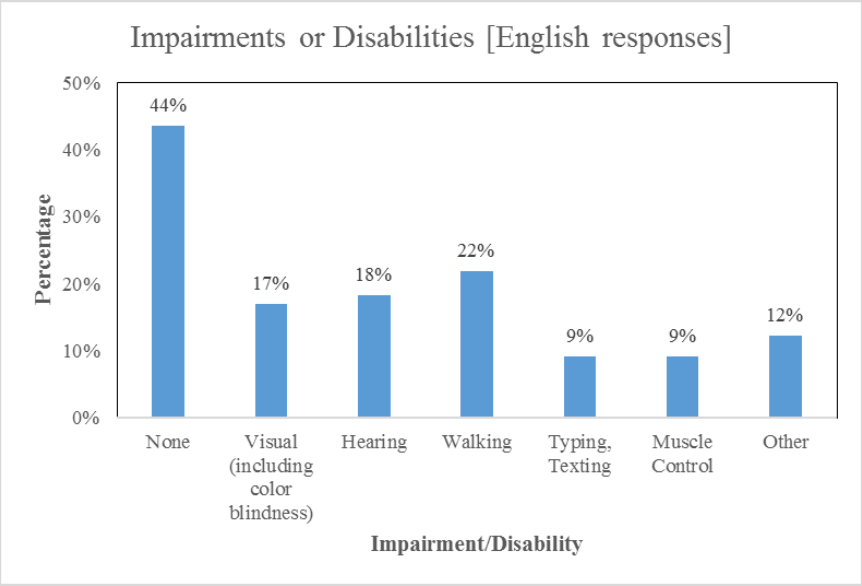


Figure 21. Impairments/disabilities [English responses] El Paso.

Spanish – Indique si tiene alguna discapacidad de la siguiente lista (Puede seleccionar más de una respuesta)

The same question was asked in Spanish, and there were 229 responses. As shown in **Figure 22**, approximately one-third of the responses reported having no impairment or disability. This percentage was lower than those who did the English version of the survey. It should be noted that similar to the English-responses, every disability type was reported by at least 5% of participants who answered the Spanish version of the survey. The Other category included high blood pressure and the ability to understand new information due to age.

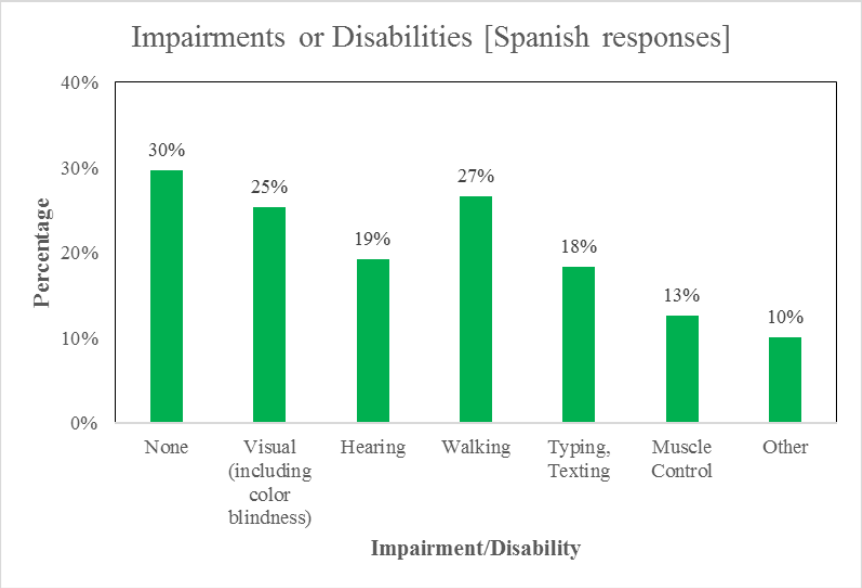


Figure 22. Impairments/disabilities [Spanish responses] El Paso.

Other Answers

military disabled
Knees
fatigue
memory loss
arthritis
Chronic back pain
limited walking
Controlled diabetic
Diabetes, neuropathy
Vertigo
Stroke
Diabetic
Fatigue
I can't Drive
High blood pressure

understanding new information due to advanced age
Padezco de osteopoausis en la columna yertesnol. en ocasiones tengo maneos. Tengo cataratas ojo izquierdo.
Dolor de cuerpo, Visual solo un poco
deaf
Prosthetic leg
my knees hurt when I walk
knee
arthritis and osteoporosis
high blood pressure
heart problems
Autism
pacemaker
Respiratory, oxygen tank
Hernia
N/A
Not specify
Major Depressive Disorder, chronic bronchitis with bursting of blood vessels
Diabeties
Hip fracture
Back Issues
N/A

B.1.9. Electronic Device Used

This question consisted of two sub-questions.

English – Do you use any of the following electronic devices? (You may select more than one answer)

This question provided a different electronic device for each answer choice and asked the respondent to select all answer choices for the electronic devices that they use. The purpose of this question was to gain a better understanding of the market for the proposed application. If a majority of seniors do not even own or use a smartphone for example, then it is likely that the application will not be used, as there is no market for it. Fortunately, for the 229 participants who answered the English version of the survey, approximately two-thirds of seniors use a smartphone, as presented in **Figure 23**. Furthermore, virtually all seniors used at least one electronic device, as only 1% of participants who answered the English version of the survey reported using no electronic device at all.

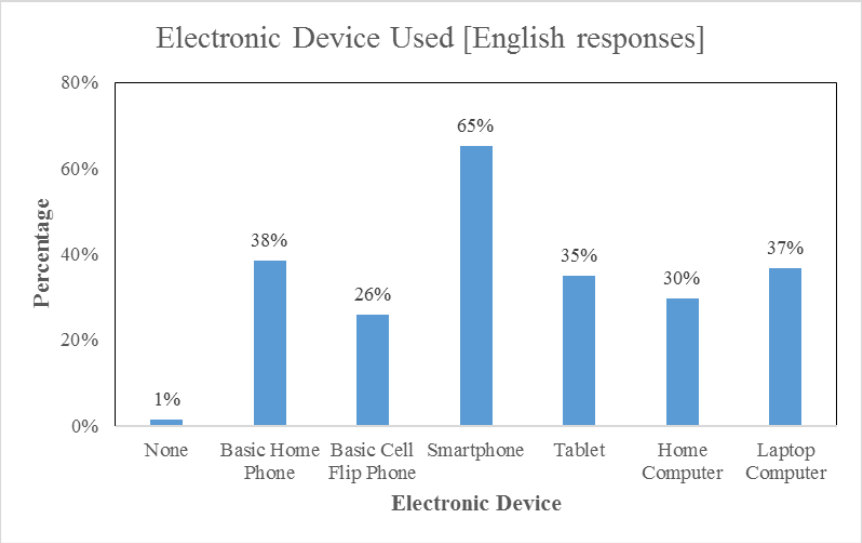


Figure 23. Electronic device use [English responses] El Paso.

English – If you selected one or more options, do you need assistance using these devices?

This question was a follow-up question to the question of electronic device usage. This question asked the participants who used at least one device if they require assistance to use such device(s). The purpose of this follow-up question was to gain a further understanding of their familiarity with the devices. The results of the 224 participants who answered the English version of the survey are presented in **Figure 24**. Over three-quarters of participants reported that they do not require assistance to use electronic devices. The remaining 24% need assistance. This indicates that this segment of the seniors may need some training, or their caregivers may be the users. It should be noted that this question asks the senior directly if they require assistance; therefore, the results for this part of the question are biased.

For example, if a senior believes they do not require assistance to use their smartphone, but they can only perform the most basic of tasks, they do require assistance to operate the smartphone altogether; however, that is not reflected in these survey results.

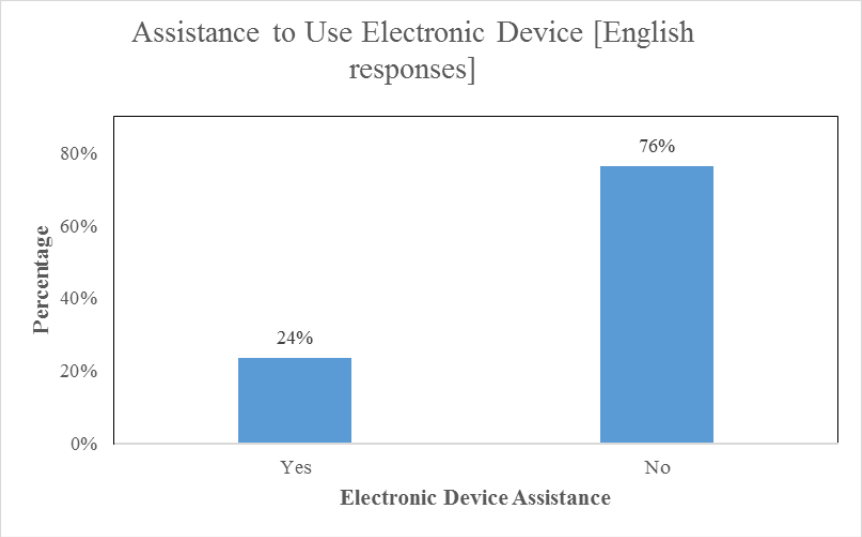


Figure 24. Electronic device assistance [English responses] El Paso.

Spanish – ¿Usa algún teléfono o equipo electrónico para comunicarse de la siguiente lista (Puede seleccionar más de una respuesta)?

The same questions regarding electronic device use were asked in Spanish, and there were 229 responses. As shown in **Figure 25**, only one-third of the participants who answered the Spanish version of the survey reported that they use a smartphone. Approximately half of the Spanish speaking respondents reported that they use a basic cell phone (flip phone).

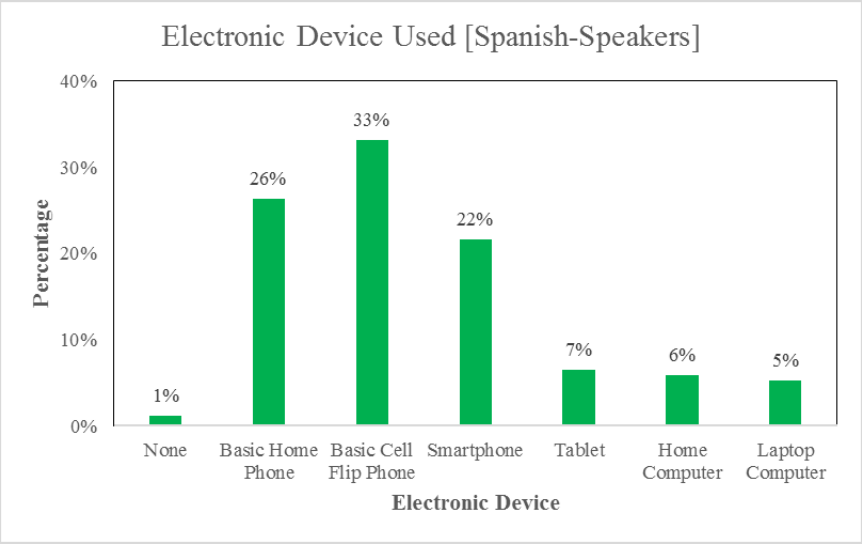


Figure 25. Electronic device use [Spanish responses] El Paso.

Spanish – Si selecciono alguna de las opciones anteriores, ¿necesita el apoyo de alguna persona para usar estos equipos electrónicos?

The same follow-up question regarding assistance to use the electronic device was asked in Spanish, and there were 217 responses. As shown in **Figure 26**, almost three-quarters of participants reported that they do not require assistance to use their electronic devices.

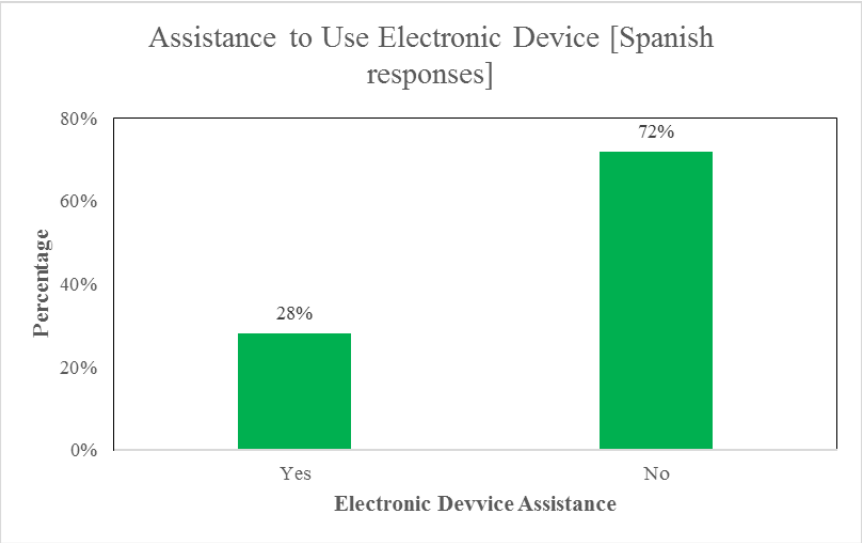


Figure 26. Electronic device assistance [Spanish responses] El Paso.

B.1.10. Mobility Assistance

English – Do you need any assistance when you make a trip to the city? (You may select more than one answer)

This question provided different assistance types for each answer choice and asked the respondent to select all answer choices for the types of assistance they use when making a trip. For this question, a "trip" is defined as a one-way journey of at least ¼ mile from an origin to a destination. The purpose of this question is to determine what types of assistance the seniors require when they travel. If a majority of seniors need a wheelchair when they travel, for example, this should be incorporated into the mobile application accordingly. The results for the 229 participants who answered the English version of the survey is presented in **Figure 27**. A majority of seniors do not require any assistance when making a trip. Among the types of assistance needed, walking cane was most frequently used. These results are expected, as many of the seniors were surveyed at a senior center, a place where mobile, independent seniors frequently visit. It should be noted that the question asks the senior directly for their perception of assistance needed. Many seniors might report that they do not require any assistance when they really do require help from a spouse or family member. This was addressed in the other category answer choice. Some of the other choices are a sister, limited walking, and an escort.

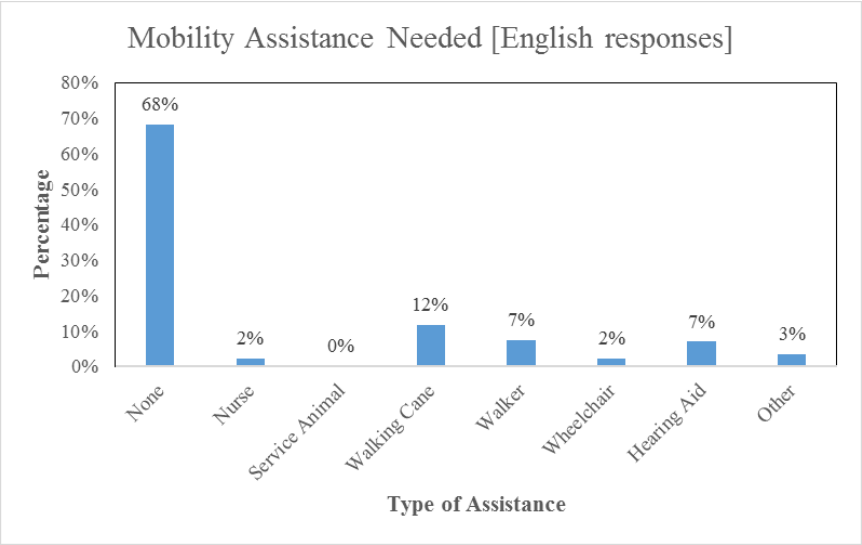


Figure 27. Mobility assistance needed [English responses] El Paso.

Spanish – Indique si necesita el apoyo de alguna de las siguientes opciones cuando realiza un viaje (Puede seleccionar más de una opción).

The same question was asked in Spanish, and there were 229 responses. As shown in **Figure 28**, more than half of the participants who answered the Spanish version of the survey reported that they do not require assistance when making a trip within the city. Among the types of assistance needed, walking cane was most frequently used. The other category included glasses, spouses, and family members.

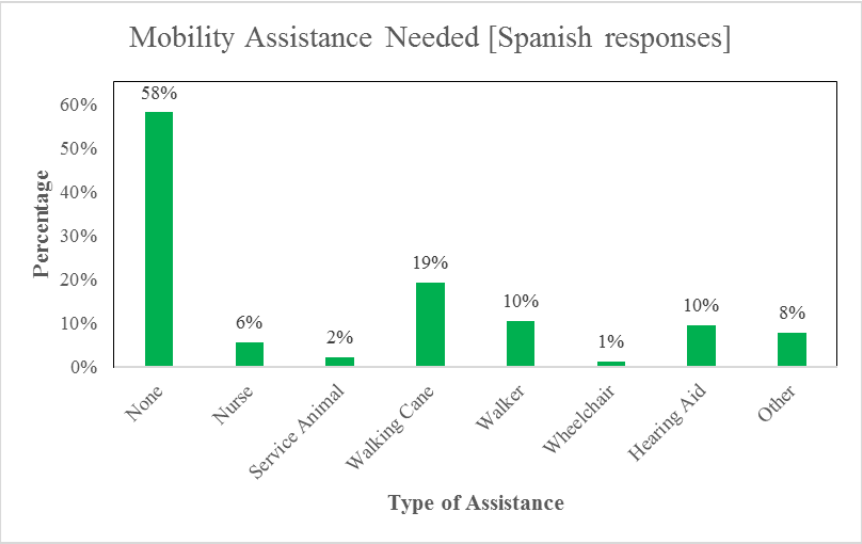


Figure 28. Mobility assistance needed [Spanish responses] El Paso.

Other Answers

Other (please specify) - Text
sister
sometimes I need a cane, other times not
Wait on transport (usually son or daughter)
escort
I have no need for such services
limited walking
Provider services
Needs hearing aid, but doesn't own one

Husband
Hasta ahora no
glasses
supportive belt
glasses
Glasses
glasses, but doesn't likes to use them
N/A
Depend on daughter
machine to sleep, machine for muscle control.
husband/ daughters
assistance with spouse
n/a
Lack of speed, sometimes need help from someone as support
N/A

B.1.11. Trip Frequencies

English – How many times do you visit the following places in a week? (One answer per row)

This question was in tabular form and asked the participant to report the approximate number of times per week that they visit various places. The purpose of this question was to determine the frequency of the trips made by seniors on a weekly basis so that the navigation function of the smartphone application can prioritize the destinations. The results for the participants who answered the English version of the survey is presented in **Table 10**. Each row in the table should sum up to 100%. This question received 214 responses in the English version of the survey. All of them provided the trip frequencies for every destination.

	Never	Less Than Once/Week	1 to 3 Times/Week	3 to 6 Times/Week	7 Times or More/Week
Work Place	70%	1%	3%	22%	5%
Volunteering Place	55%	13%	14%	16%	2%
Family Member, Relative, or Friend	9%	24%	46%	13%	8%
Grocery Store, Market, or Retail Shop	6%	21%	57%	12%	4%
Healthcare Facility, or Pharmacy	14%	67%	13%	5%	1%
Senior Center, Library, Park, or Gym	19%	16%	27%	33%	6%
Civic or Religious Center	23%	27%	44%	3%	2%
Restaurant, Coffee Shop, Diner	7%	30%	49%	10%	4%
Bank, ATM, or offices	14%	58%	23%	5%	0%

Table 10. Trip frequencies [English responses] El Paso.

A majority of the participants who answered the English version of the survey reported that they did not work or volunteer, as many were retired. Close to half the participants who answered the English version of the survey reported that they visited family members, relatives or friends one to three times a week. Similar percentages of the participants also visited the grocery store, market, retail shop, restaurant, coffee shop, diner, and a civic or religious center once to three times per week. A majority of them went to a healthcare facility, pharmacy, bank, ATM, or an office less than once per week.

Spanish – ¿Cuántas veces a la semana visita los siguientes lugares (Seleccione una respuesta por línea)?

The same question was asked in Spanish. The results for the participants who answered the Spanish version of the survey are presented below in **Table 11**. This question received 219 responses in the Spanish version of the survey. All of them provided the trip frequencies for every destination.

	Never	Less Than Once/Week	1 to 3 Times/Week	3 to 6 Times/Week	7 Times or More/Week
Work Place	89%	2%	1%	6%	2%
Volunteering Place	63%	5%	14%	16%	2%
Family Member, Relative, or Friend	20%	20%	42%	13%	6%
Grocery Store, Market, or Retail Shop	9%	21%	53%	13%	4%
Healthcare Facility, or Pharmacy	16%	61%	14%	5%	4%
Senior Center, Library, Park, or Gym	11%	5%	24%	50%	11%
Civic or Religious Center	27%	17%	52%	3%	1%
Restaurant, Coffee Shop, Diner	21%	31%	38%	6%	5%
Bank, ATM, or offices	28%	50%	18%	3%	1%

Table 11. Trip frequencies [Spanish responses] El Paso.

A majority of the participants who answered the Spanish version of the survey reported that they did not go to a workplace or places they volunteered to help. The percentages are higher than those participants who answered the English version of the survey. The frequency distributions of the visits to the various places, especially the most frequently reported number of visits per weeks to the same destinations, appeared to be the same between the participants who answered the English and Spanish versions of the survey.

B.1.12. Modes of Transportation

English – How many times do you use each of the following means of transportation in one week? (Select one answer per row). Count a round-trip as two separate one-way trips. If one-way consists of bus followed by a taxi, count both of them as one trip.

This question is also in tabular form and asked the participants to report the approximate number of times per week that they used various modes of transportation. The purpose of this question was to determine the frequency of each mode of transportation used by seniors on a weekly basis. The result for the participants who answered the English version of the survey is presented below in **Table 12**. This question received 214 responses in the English version of the survey. All of them provided the trip frequencies for every destination.

	Never	Less Than Once/Week	1 to 3 Times/Week	3 to 6 Times/Week	7 Times or More/Week
Walking More Than 1/4 Mile	37%	18%	23%	11%	11%
Bicycle	89%	5%	4%	1%	0%
Motorcycle/Scooter	96%	0%	2%	0%	1%
Car (as Driver)	19%	4%	7%	16%	54%
Car (as Passenger)	35%	23%	20%	13%	8%
Carpool (as Driver or Passenger)	79%	8%	6%	4%	3%
Public Bus	75%	12%	5%	3%	4%
Special Bus (e.g. Lift)	91%	3%	2%	3%	0%
Taxi	94%	6%	0%	0%	0%
Rideshare (e.g. Uber)	94%	4%	1%	0%	0%

Table 12. Modes of transportation [English responses] El Paso.

A majority of the participants reported that they never use bicycle, motorcycle, carpool, bus, taxi and rideshare as their modes of transportation. Of those who traveled by car, a majority of them drove every day,

> *Spanish – ¿Cuántas veces usa cada uno de los siguientes medios de transporte en una semana (Selecciona una respuesta por línea)? Un viaje de ida y vuelta cuenta como dos viajes separados. Si un viaje de ida consiste en un autobús seguido de un taxi, cuente ambos como uno solo.*

The same question (in tabular form) was asked in Spanish. The results for the participants who answered the Spanish version of the survey are presented below in **Table 13**. This question received 219 responses in the Spanish version of the survey. All of them provided the trip frequencies for every destination. The distributions of trip frequencies for each mode of transportation appeared similar to those participants who answered the English version of the survey.

	Never	Less Than Once/Week	1 to 3 Times/Week	3 to 6 Times/Week	7 Times or More/Week
Walking More Than 1/4 Mile	45%	9%	21%	11%	14%
Bicycle	94%	0%	3%	1%	1%
Motorcycle/Scooter	99%	0%	0%	1%	0%
Car (as Driver)	42%	3%	5%	13%	37%
Car (as Passenger)	49%	9%	17%	10%	15%
Carpool (as Driver or Passenger)	79%	4%	9%	5%	3%
Public Bus	68%	10%	9%	5%	9%
Special Bus (e.g. Lift)	88%	5%	3%	2%	1%
Taxi	96%	3%	0%	0%	0%
Rideshare (e.g. Uber)	96%	3%	0%	0%	0%

Table 13. Modes of transportation [Spanish responses] El Paso.

B.1.13. Concerns When Making a Trip

English – What is your main concern when planning a trip? (You may select more than one answer)

This question provided a common concern when planning a trip for each answer choice and asked the respondent to select all answer choices for their main concerns, so the smartphone application can be developed to address such concerns. In the question, the participants were provided with a list of 10 concerns. They may select any number of concerns from the list. There are 229 responses to this question, and the percentage of participants who have similar concerns is plotted in **Figure 29**. The most frequently mentioned concerns were cost, followed by on-time departure, and protection from extreme weather. This indicates that seniors: (i) base their trips on cost (e.g. closer destinations, inexpensive modes of transportation, etc.), (ii) are concerned with on-time departure and arrival; and (iii) base their trips on the current weather.

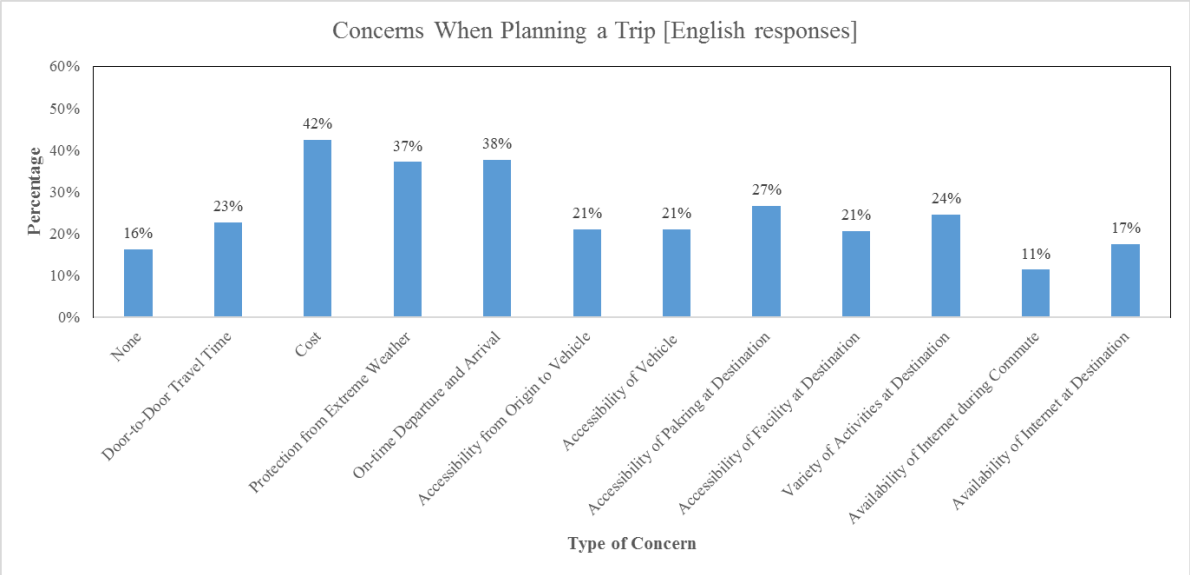


Figure 29. Concerns when planning a trip [English responses] El Paso.

Spanish – ¿Qué es importante para usted cuando planea un viaje (Puede seleccionar más de una respuesta)?

The same question was asked in Spanish, and there were 229 responses. The results for the Spanish-speaking respondents are plotted below in **Figure 30**. The participants who answered the Spanish version of the survey reported that on-time departure, followed by protection from extreme weather, were the main concerns. The Spanish-speaking respondents are more concerned with on-time departure and arrival than the English-speaking respondents.

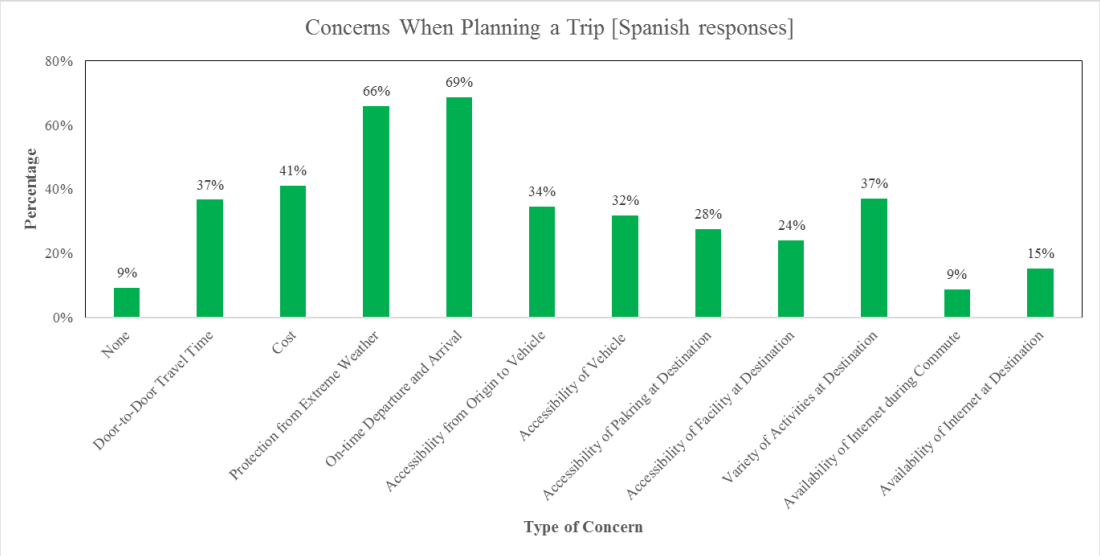


Figure 30. Concerns when planning a trip [Spanish responses] El Paso.

B.1.14. Mobility Challenges

English – Describe your biggest challenge when you commute in the city.

This is an open-ended question, which asked the participant to write down their biggest challenges when they travel in the city. The purpose of this question was to determine which mobility issues were faced by seniors. The results for the participants who answered the English version of the survey are presented below in **Figure 31**. 155 participants answered this question in the English version of the survey. Their written answers were organized into categories and the percentage of the participants who reported challenges in each category out of the 155 written responses was calculated and plotted in **Figure 31**. Traffic congestion and parking was the most frequently reported challenge they faced. There are 45 responses which are not included, as the participant either did not have any challenges or did not provide an applicable answer (e.g. “N/A”).

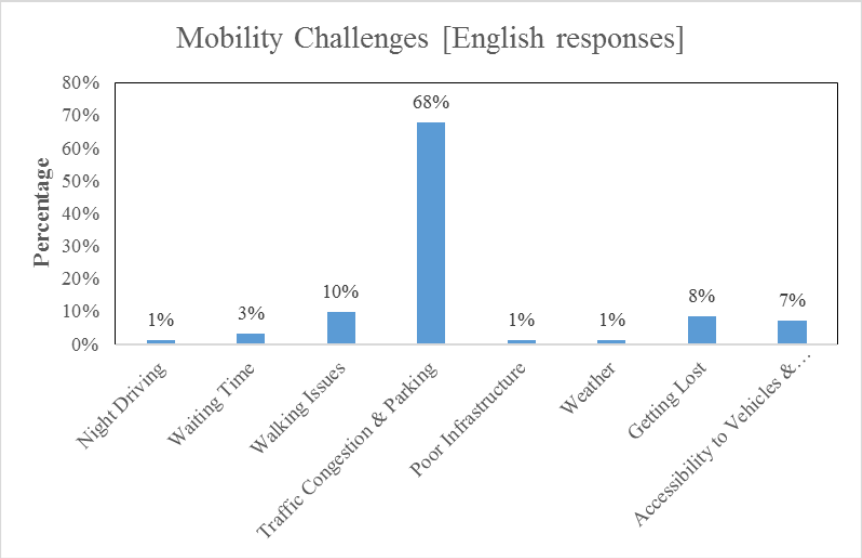


Figure 31. Mobility challenges [English responses] El Paso.

Spanish – Mencione cuál es el mayor reto que enfrenta cuando viaja en la ciudad.

The same question was asked in Spanish, and there were 144 responses, as shown in **Figure 32**. The most frequently reported challenges are traffic congestion and parking, walking issues, and night-time driving. There are 37 responses which are not included, as the participant either did not have any challenges or did not provide an applicable answer (e.g. "N/A"). In general, the responses for the English and Spanish versions were relatively the same.

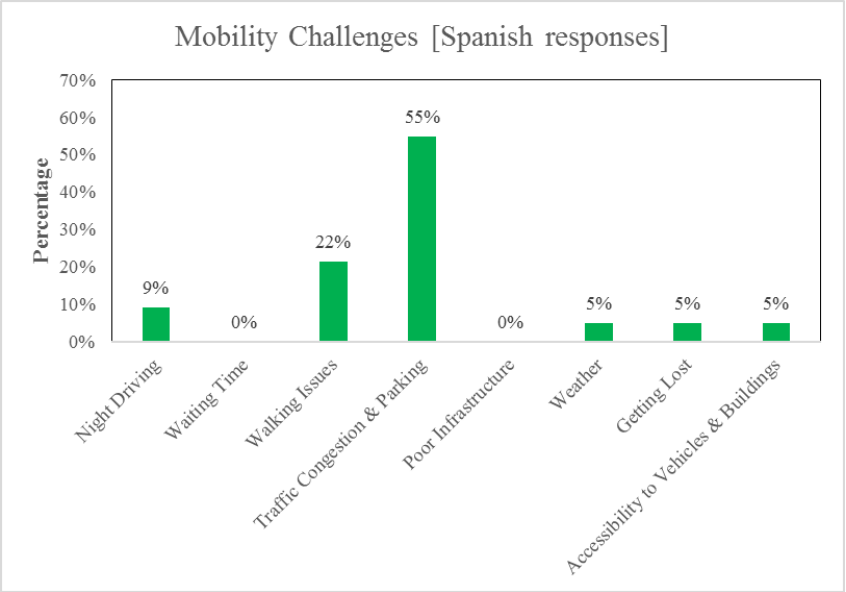


Figure 32. Mobility challenges [Spanish responses] El Paso.

B.1.15. Key Application Functions for Seniors

English – What is one function you would like to see in a mobile application (or App) that would cater to seniors needs?

This is an open-ended question, which asked the participant to write the most important function they would like to have in a smartphone application. The purpose of this question is to determine what functions the smartphone application for seniors should have. The results for the participants who answered the English version of the survey is presented below in **Figure 33.** There are 85 participants who answered the English version of the survey who reported at least one function they would like to have. The most frequently stated functions are traffic conditions and navigation, followed by bus routes and accessibility provided by infrastructure.

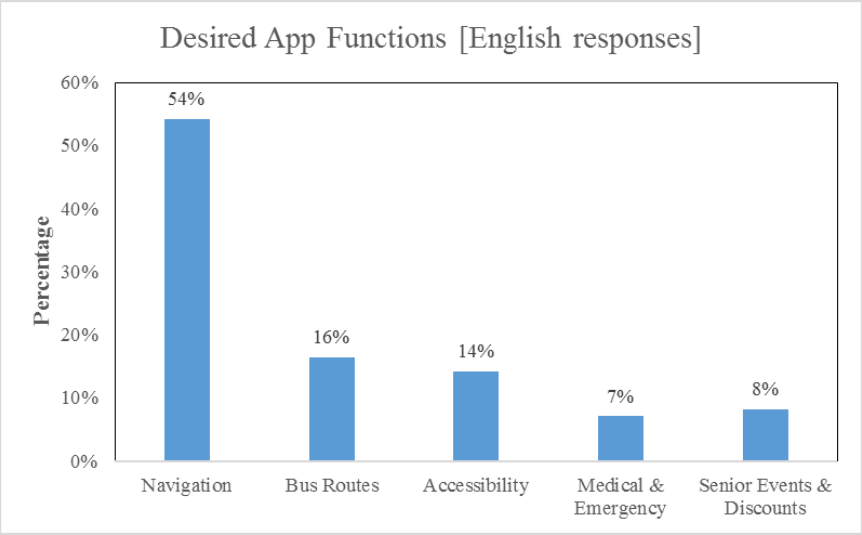


Figure 33. Desired application functions [English responses] El Paso.

Spanish – ¿Qué función o característica le gustaría ver en una aplicación móvil específica para adultos mayores?

The same question was asked in Spanish. 73 participants who answered the Spanish version of the survey wrote down the functions they would like to have in a smartphone application. The written answers were organized and plotted in **Figure 34**. The most commonly desired functions were navigation, followed by bus routes.

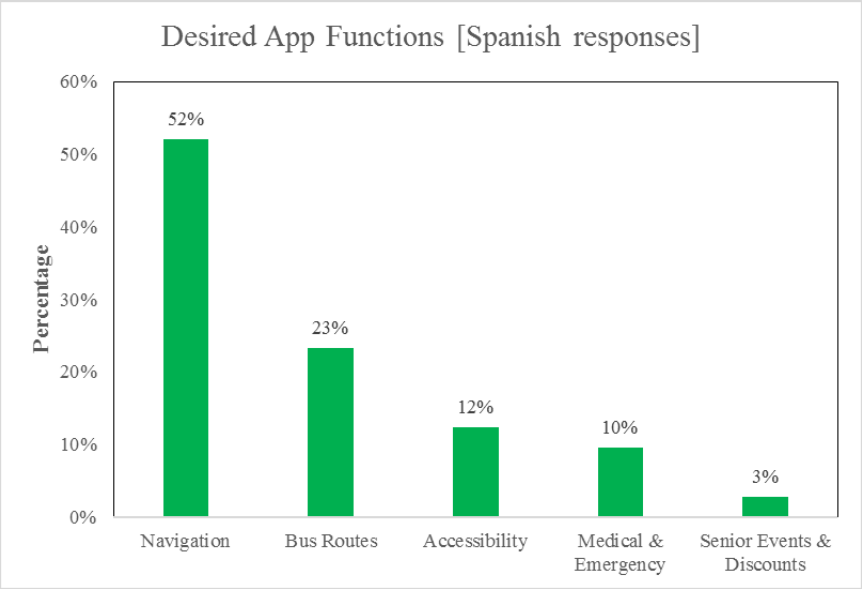


Figure 34. Desired application functions [Spanish responses] El Paso.

B.1.16. Motivation to Use Application

English – If you were offered to use a mobile application (or App) that is designed to assist seniors to find places and commute, what would motivate you to use the application?

This is an open-ended question, which asks the participant to state the factor(s) that would motivate them to use an application that is designed specifically for their mobility needs. The purpose of this question is to gain a better understanding of what would motivate a senior to want to use the proposed smartphone application. The results for the participants who answered the English version of the survey is presented below in **Figure 35**.

119 participants who answered the English version of the survey wrote down at least one reason that would motivate them to use the smartphone application. There were 80 participants who did not provide an answer because they do not own a smartphone. The most frequently cited reasons are, in decreasing order of frequency:

1. The navigation function;
2. The application was easy to use and accessible;
3. The cost of the application was low;
4. The application was easy to learn;
5. They needed the application to use in emergency situations.

The above reasons may be divided into motivation related to the application's functions (navigation, emergency) and motivations related to the application's features (easy to use, low cost, easy to learn).

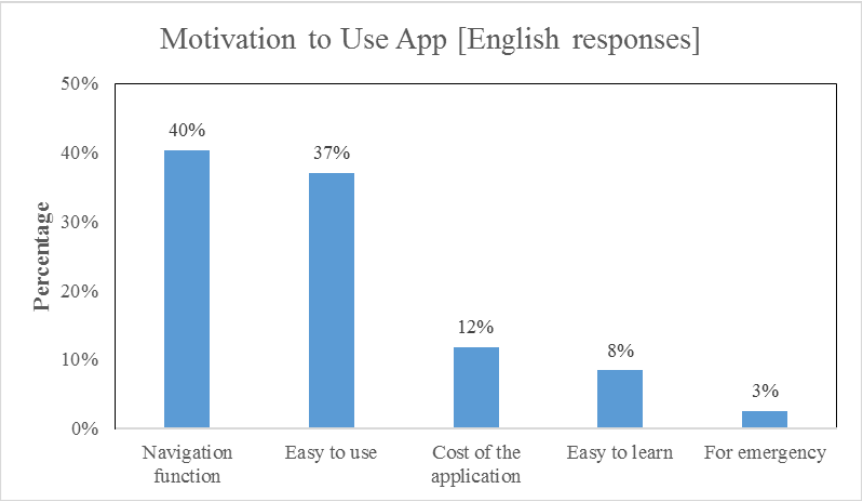


Figure 35. Motivation to use smartphone application [English responses] El Paso.

Spanish – Si hubiera una aplicación móvil para ayudar a adultos mayores a encontrar lugares de interés y viajar en la ciudad, ¿Qué le motivaría a usar dicha aplicación?

The same question was asked in Spanish. For the participants who answered the Spanish version of the survey, 94 of them reported at least one motivation. There were 118 participants who did not provide an answer because they do not own a smartphone. The most common answers, plotted in **Figure 36**, were similar to the motivations as shown in **Figure 35**. The only minor difference was relatively more participants who answered the Spanish version of the survey would use the application if it was easy to learn.

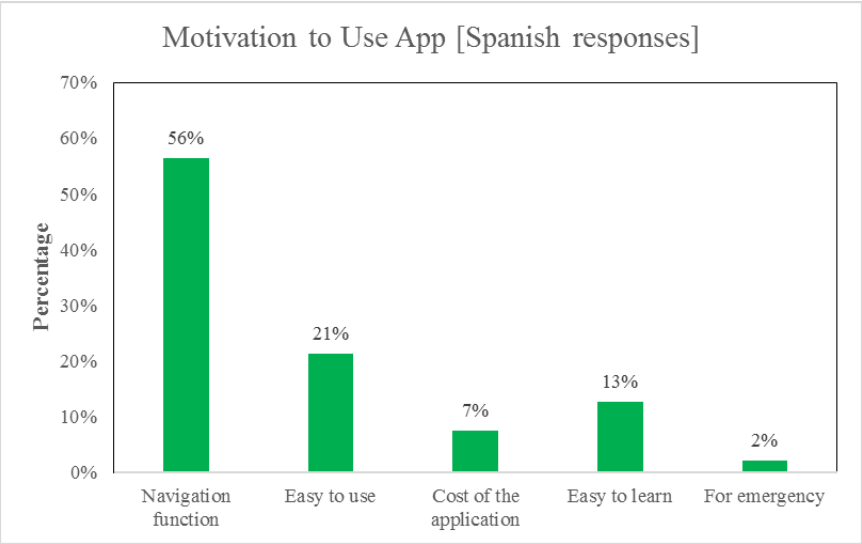


Figure 36. Motivation to use smartphone application [Spanish responses] El Paso.

B.1.17. Data Sharing

English – If you were a user of an App designed to assist seniors to find places and commute, would you be willing to anonymously share your data (e.g. location, route, means of transportation) to improve the services offered by to users (including yourself)?

This question asked the participants if they were willing to share their data (e.g. location, route, means of transportation) to improve the services offered by the smartphone application to the users. The purpose of this question was to determine if the potential users would be willing to allow the application developer to use their usage data to improve the application and its database. The results for the 213 participants who answered the English version of the survey is presented below in **Figure 37**.

Approximately three-quarters of the participants who answered the English version of the survey are willing to anonymously share their data.

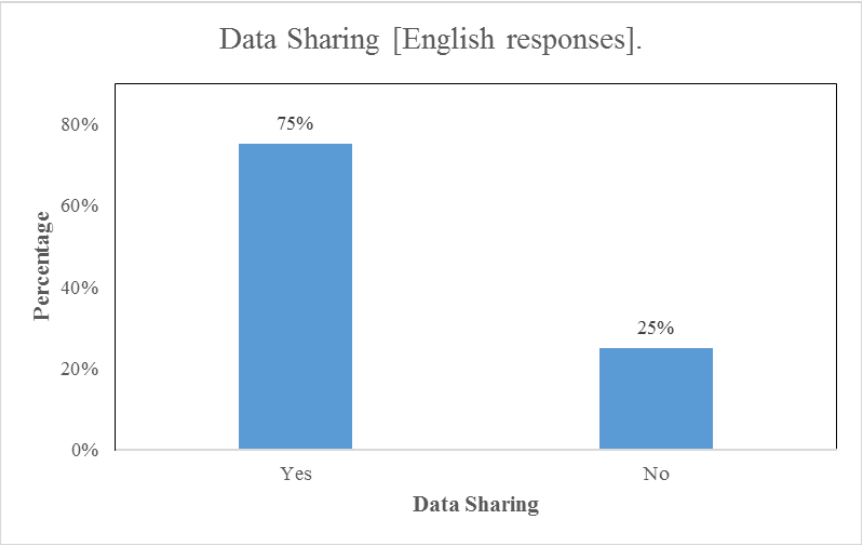


Figure 37. Data sharing [English responses] El Paso.

Spanish – Si usted usara una aplicación diseñada a ayudar a adultos mayores a encontrar lugares de interés y viajar en la ciudad, ¿estaría dispuesto a compartir sus datos de manera anónima (ej., ubicación, rutas) para mejorar los servicios ofrecidos a los usuarios (incluyéndolo a usted)?

The same question was asked in Spanish, and there were 218 responses. As shown in **Figure 38**, and compared to **Figure 37**, an even higher percentage of participants (80%) who answered the Spanish version of the survey are willing to anonymously share their data.

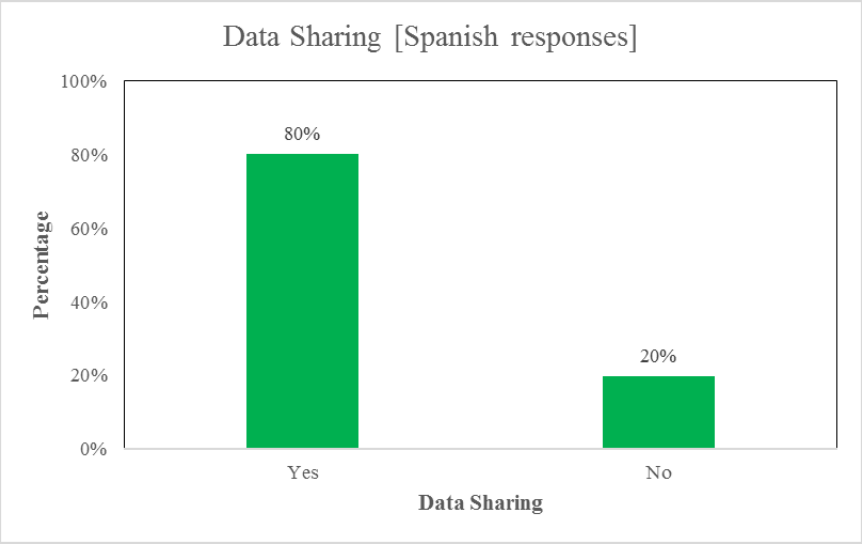


Figure 38. Data sharing [Spanish responses] El Paso.

B.1.18. Describe your biggest challenge when you commute in the city

no
Not experiencing any challenges. I just walk to take the bus. I'm not experiencing any struggles with the bus.
Doesn't drive at night
Not really, I just use it to come here to the center
I pay $5 per day to come to the senior center. They should lower the price. They always pick me up late
None, just driving at night
Legs hurt when I walk too much. It hurts even more when its cold
None, We still drive around our neighborhood
the waiting time for transportation
N/A
It scares me when I'm alone waiting
Getting to appointments on time
traffic (a lot)
walking
traffic and parking facilities
traffic and construction

fighting traffic
don't go much to the city? If I do my daughter goes with me
with main street or streets in the neighborhood they are some in bad situations where I can't even go on the sidewalk I to get off on the streets
no answer
traffic and construction-road work
traffic. depends on spouse to drive or other
traffic on the freeway
no answer
no answer
no courtesy. cant walk too far
no answer
i usually take the bus and get as close as possible to my destination
walking long areas
none
not to get lost and find place
no answer
no answer
construction
finding parking space
traffic
Transportation
Traffic
Traffic
Traffic, bad drivers
Walking
Sense of direction (need GPS)
Transportation

Hoping that i don't fall
traffic and dumb drivers
traffic
heavy traffic
not getting ran over
no problem
finding my way around
mobility
traffic
traffic and construction
being on time because I am always late because of traffic. I walk sometimes
usually getting lost
traffic
traffic
none
traffic
traffic, congestion
knees both
traffic
None
Money, don't have enough money for my expenses. When my car breaks down I need to go to a senior center closer to my house because I can't walk a lot or long distance, and the bus doesn't come this way. It's getting difficult to walk.
Traffic
Not available
TRAFFIC
Money
slow traffic
traffic

traffic & road construction
WEATHER
heavy traffic on I10
parking
changing lanes in traffic
Parking
traffic
Traffic
Street construction/repairs
restroom accessibility
Travel time and sufficient handicap parking
Traffic
traffic
Time
Traffic and health (depending on how I feel)
Climate
Places with too much noise
Forgetting something very important
Level places
Access to areas for easy walking
Long distance walking
The construction on the west side: closures
Parking
None
too many cars on road
Rush hour traffic
Safety in traffic
I am my husbands main care taker, so I struggle careing for his mobility.

Parking
not enough side walk
parking
over-all accessibility, e.g. sidewalks, entrances, bathrooms
My biggest challenge when I travel to the city is that it takes me a long time to reach my destination for so much avenue under construction.
traffic
none
Language
none
sometimes I don't know when buses are leaving or arriving when I'm at a bus stop.
None I use my car.
Parking
N/A
TRAFFIC/CONSTRUCTION
heavy traffic
Not to get stranded especially in the dark or bad weather
none
traffic
Traffic
Transportation car and walking
need to have a road or city map
access to public transportation and money
no answer
being able to find a handicap parking
None
Getting in and down the car
Construction/traffic

Shopping around, had difficulty moving around the stores. She doesn't own a smart phone
Traffic
Walking from parking to facility
Hace an older vehicle. High gas use.
Heavy traffic
Obtaining directions/traffic congestion/do i have enough gas
Dealing with traffic due to active freeway construction
My mother is in a wheelchair, when we have to commute to dr visits or any activity it?s really hard to find handicapped accessible spots. Very few places have ramps, automatic doors or even parking spots.
None
Traffic because of bad driving of other drivers
Traffic
Traffic
congested traffic
Traffic and distracted drivers
City under construction
construction delays
I10 construction problems
Lack of parking spaces available.
Sun metro has been doing a good job. Maybe after the age of 75, bus fare should be free.
NONE
Traffic causes me to only stay on the west side
Finding the place
Visibility (signs/paint not bright enough, especially at night)
Traffic
Traffic is bad, so I only stay on the westside
Staying awake
Timing schedule for buses

I do not use internet and I hate to see people on their phones constantly
Knowledge
Traffic
Mobility or maneuverability
Distance from bus stop to my office. Okay most days, but when transporting things can be a bit far. I also hate crossing Mesa after dark--I often take Lyft so I can avoid crossing Mesa after dark.
My health, access to bathrooms
I rely on my husband and it's dangerous driving
Traffic, young people cutting me off
Traffic, speed bumps, cars going too fast
No challenges, I can move around well
Finding good places to eat
Traffic, speed, getting lost
Traffic
People drive too slow
Traffic
Cost, gas
Cars cutting me off
To get to the destination on time
Memory, losing consciousness, forgetful. I like to be at senior center by 9:00 AM and I get my hair done once per week
Time management (making appointments on time)
N/A
N/A
Traffic (safety, more traffic control and not enough police)
Traffic
N/A
N/A
Bus scheduling and making sure I can carry all my stuff when I get on the bus

Many stores do not have the motorized carts. I cannot walk for any length of time
I don't drive
N/A
N/A
Don't like to drive in heavy traffic
N/A
None
Traffic
Traffic and condition, safe route for bad weather.
Walking
None
Secure transportation, drive with precausion.
I cannot drive at night
Traffic
Knowing where everything is
Being on time
Being on time
Parking downtown
N/A
My nephew takes me
To know where I go, Knowing
The traffic and the closing of streets.
None
caminar
I walk to slow so the bus leaves me behind.
can't go by myself, I can't walk by myself anymore, I fall easily. I need my husband to take me.
walking
Traffic. Safety, need to drive cautiously to prevent accident.

parking
None
Bad drivers
Traffic
traffic
When I need to take the bus. My daughter takes me to places
Fall risk. Has trouble walking. When she goes to the store she can only buy a few items because she needs to carry them back home. It is hard going to the stores and buying stuff when you ride the bus. She has a hard time attending her doctor's appointments. The other day one of her friends gave her a ride to her appointment, but there was no one to pick her up.
I rest when I get tired of walking. I struggle with the schedule that is why I go walking. On the weekend the bus schedule is even worst, it takes a while.
The street where I get the bus will be closed for three weeks. I don't think I'll be able to come here (senior center) in the meantime
the bus is sometimes far and I'm not sure when I need to get off. When that happens I call my children so that they can give me a ride
Traffic and accidents
traffic, construction & and closed streets
Sometimes the bus is late and we have to wait
No, I walk everywhere. I like to walk to remain active. I only use the bus when I have a doctor's appointment
I don't like to drive at night or when it's snowing. He is independent
Not yet. I'm still driving at night and on the freeway
Not yet
On Saturdays morning the bus is always late and on Sundays its even worse. Sometimes I need to ask my sister or I'll go a little earlier to get on time to work. At nights when I get off from work, I need to walk all the way from here (montana and ochoa) to EPCC to take the bus.
traffic
Uses the Lift to go to the senior center. Bus (lift) sometimes picks her up on the opposite side of the building and she has a hard time walking. She no longer drives long distances. Her children don't want her driving anymore so they drive her around.
Completely depends on the adult day care program
Getting to know important places
When there is no transportation and I have to walk to go somewhere

Finding a ride. Right now I have to go to San Vicente and I do not have anyone to take me. At this moment I don't use the lift yet, but I would likke to get those services the problem is that they charge a lot. Sometimes I walk to my appointment or to different places, but right now its really cold to do that.
Drives and walks slow.He doesn't go out when it's snowing.
I have a hard time walking. I do not drive anymore, my husband takes me to places. The bus is expensive, the charge us $ 5 to bring us here to the center and pick us up from here. A lot of people cannot afford and that is why they do not come everyday to the center. We get a very small check
For all of us to drive well. There are several accidents for that reason. We need to drive in a calm manner and follow the laws.
I don't go out as often anymore. Today I came to the senior center because they brought me here, but I hardly come. I'm not interested in going out anymore. Now I just stay at home because I don't want to bother my children by asking them for a ride. They already take me to my doctor's appointment. The doctor said I need a surgery on my knee to help me walk.
Mi condicion fisica debil
Planificacion del viaje para llegar a tiempo
La segunidady puntualidad en la hona de necogida y regreso a mi casa
N/A
N/A
Trafico
Ya no puedo ir sola
to walk
my son takes me in the car. If not, I use the bus
I hardly go out, my daughter drives me around. She sometimes doesn't wants me to drive because of traffic and because I have a hard time seeing at night
doesn't drive long distance. Her daughters or friends take her to places. She doesn't drive in the freeway
safety/traffic
cannot walk long distance that why she doesn't uses the bus
not a lot
loneliness
the time it takes me to get to my destination when there is traffic or construction work going on
driving with precaution
transportation

waiting for the bus
staying alive
the fatigue
Nothing
Ella dice que su mayor reto es estar sola. Ella dice que ella a estado en muchas situaciones donde ella a tenido que hacer cosas ella sola como cambiar una llanta o ir a agarrar gas porque se a quedado tirada pero para ella siempre es muy dificil
precautions
Le preocupa de so seguridad. Ella siente que su edad la pone mas a arriesgo de que la puedan asaltar.
traffic
not enough awareness for the deaf community and the lack of services
walking where there are no sidewalks
a lot of traffic and closed streets
she has the lift to go to places and its $5
bus schedule
closed streets
Become familiar with streets and when the street is one way only
traffic and closed streets
it's uncomfortable the waiting time at the bus station
traffic
the traffic and appointments when it's rush hour
I have to arrive on time otherwise i miss the bus
traffic
Traffic
Finding parking nearby, I can't walk long distance. There are only a few spots for handicapped in most places. I have to wait until there is one available to park. I hardly go to the stores for the same reason.
There are several people who are in a hurry and do not obey the traffic laws.
Not yet
N/A
Trafico

N/A
N/A
Llegar a tiempo
none
ninguno
traffic, dark
insomnia
I hardly leave my house because i don't have a ride. I only walk to my son's house and to the gas station.
I don't know the schedule for the bus
traffic
the traffic, wait for rush hour to pass, can't see at night
I'm still strong for my age, but the weather is strong during summer.
batteries for my hearing aid
find someone who can help me when I cannot move my arms
They don't allow my dog in several places
transportation
batteries for hearing aid
traffic
traffic
Traffic
long distance. if the place i'm going to is nearby i'll drive, but when it's not I look for someone to take me. Also, i didn't qualify for the bus card.
none
traffic
Has problems with his leg. He uses public transportation and the bicycle as means of transportation
When I drive long distance I need to stop for a break
none
traffic

none
He uses public transportation, doesn't own a car. Doesn't have family in El Paso, friends usually give him a ride or uses public transportation.
I don't go to places that are far from my house anymore.
remembering to bring with me my glasses and other things
Sister assisted participant complete survey. My brother only needs a calm environment when traveling.
my wheelchair gets stuck in some streets. I'm afraid of falling
I have visual problems, have difficulty driving at noon
I know how to use Uber and my son transports me, but my only problem is to move around with my oxygen tank
traffic, doesn't drive at night
stress due to traffic, fear of falling
moviendome
no puedo conducir
carreteras rapidas, muy saturadas..freeway.
Traffico
asegurarme que sepa donde estoy en cada momento para no perderme y saber como regresar a hi hogar.
Traffic
The waiting time of the bus.
When the bus is not in time. This is important because we have doctor's appointments we need to attend. The bus takes a long time. My daughter and grandsons sometimes take me to places.
There is no public transportation outside city limits. The time that I need to wait for the Lift is a lot. After calling to schedule my pick up i need to wait half an hour for the bus to arrive. We time we spend waiting for the lift is longer than the travel time.
Has limited places she visits
Traffic
none, I depend on my daughter.
Trafic
Hates trafic, not afraid to go out, 1/2 hr 1/2 mile on sunland
Not enough signs with large font on the street.

I don't experience any challenges. I don't drive on the freeway anymore because there are a lot of big trucks
The parking lots
Trafic
Trafic
when the bus does not arrive
The trafic
Reckless drivers
El trafico
My feet get swollen
I can't be alone, I need to be with someone.
I don't have a car, my husband is the one who drives.
I have a car
Car exhaust makes me cough and vomit violently, dizziness, anxiety attacks, convenience
Be punctual
trafico
traffico
None
No puedo usar transporte publico porque no funciona bien. Camino, uso el coche o uso Uber
Tragic
weather and driving long distance
to have a safe trip
"I have no problem". Reported that her daughter does not allow her to use public transportation, and she feels limited. Fall risk/ history of falling.
make people happy, trouble walking
weather, fear of driving when it is snowing or raining.
walking around the stores
I walk slow
Needs help from a provider. Provider helps her move around.

Being alert and distractions while driving
driving long distance and poor eyesight
Husband helps her when she needs to go to places
none
getting up and down of the car. My back hurts
none
traffic
walking
None, I don't drive. My daughter takes me to places. She is always available for me.
Everything is fine, I can still drive.
Traffic
Not experiencing any problems
The traffic
Daughter drives me around, I don't know how to drive or use public transportation. I have poor eyesight.
Traffic, sometimes people drive bad
Traffic. Have trouble driving at night
The weather, I don't like hot weather. Sometimes there is no one to take me to places and there is no bus stop near home
Getting up and down the bus
Driving long distance. When I use public transportation I have difficulty getting in the bus
El no saber manejar limita mis actividades
walk
I'm worried about the weather because I have diabetes.
no answer
Traffic, needs help, owns a cane and walker-she is fall risk, cost of app.
doesn't drive. Her husband takes her and she depends on her children.
no, she already know her way around
don't drive long distance

Tall stairs
the traffic and the schedule.
El clima de afuera y dentro del bus
it is safe to commute in taxi than driving myself. Traveling in public transportation is difficult because my legs hurt.
Que haya mas informacion sobre las paradas y horarios del transporte publico en mi communidad. Y lugares para saber donde esta desponible el transporte publico?
Traffic, protecting self from those who drive recklessly
needs to walk, uses the bus and needs to know the route. Her sister picks her up.
problems with her car/ cost of gas/ cost of living. Has app, but does not know how to use them.
spending a long time sitting
traffic and depends on her husband and children to move around
fear of falling, arriving late, house is 20 min. away from food city
none
Traffic
gets rides from friends
traffic, don't know where to go.
traffic and translation
Traffic and transfer
construction in downtown, and moving around the city when the streets are closed.
traffic
transfer time
getting lost or not knowing how to get to my destination. I get lost easily. For example, when I go to the hospital I don't know how to find the exit. I only know how to use my smart phone to make calls.
traffic and transfer
traffic, excessive traffic/ too many cars
none
Lack of money and scare of falling
traffic
bad drivers

n/a
none
traffic notifications
None
Traffic
weather
Traffic,have difficulty walking on Mesa street, and need ride to doctor's appointments.
Nothing
The weather
Traffic
Be late

B.1.19. What is one function you would like to see in a mobile application (or App) that would cater to senior needs?

No answer
I'm not sure. No smartphone
I would like a smartphone
transportation information
N/A everything is good
None
I tend to stay to my self. My sister in law tells me that I'm not friendly. Maybe information to socialize
N/A everything is fine
distinguish what type of transportation is
N/A
if I would like but I do not use it
Sites to sit down
give bus routes that people can take when no car

area of service
easier access to transportation
to be easy
to facilitate handicap
i don't use a mobile
to have better equipped doors in stores, doctors, and offices. No equipped automatic doors
no answer
no answer
smartphone
no answer
none
on time departure
i don't know
no answer
no answer
n/a
no answer
no answer
senior discount
no answer
Ambulance and medical
no answer
no answe
Accuracy in destination
Easy access
Easy access
Parking accessibility
Large font

Directions
Simplicity
How much time it takes to get to my destination.
not sure
senior events
i don't have access to an app
no answer
none
map
to better use technology
learning what transportation is available. Learning how to use technology
service information for older adults
when traffic is down
when using public transportation, a reminder of when I should get off the bus
show when there is less traffic
no answer
simplify technology to seniors
lifts on all buses
emergency alert
none
night drivers when it gets dark
I hardly use the cellphone. I lose it all the time
Navigation
Bus routes and times
HOW TO USE APP
Gps
large text for eye problems
n/a

That it include Southern NM
LARGE VISUAL ICONS
Traffic warnings
destination parking availability
know in advance about road closures or accidents
none
First aids aboard
accurate information regarding street closings
easy picture identification
bus schedule app that works like google maps. Put in origin and destination and it shows bus routes and transfers along with time table
Best routes and how long it will take
things to do
Easy to operate
How long it will take to get from one place to another
Doctor appointments
Places for seniors
Places for seniors to go
Transportation and reminders
Transportation
Easy route directions
understandable icons
Hand free should not ask to enter a number
None
Hands off voice commands
Simplified
An app for flip phones or a service line.
Easy use.

map driving
"I'm at this bus stop -- how soon will the bus be here?"
simplicity
Be easy to use for everyone
informaci?n
more buses
I don't know
none
something that would allow me to see time departures of public buses around the city.
Easy call for medical service transportation
Easy to use
Appointment Scheduling
VOICE INFO
Social Security App
easy magnification
Larger letters ok
Availability of transporation choices and places if I can't drive
n/a
no cellphone; make it easier to understand like where other stress/ freeways are located. where libraries are located.
no answer
Places that are handicap friendly
Easy navigation
no
to show me how to get to places
bus information
Formularies of medications that way dr cant rip you off
Where to find places that offer senior discounts

Rideshare info
Easy bilingual instructions in large print
Simplicity
Age friendly
Buildings that are easily accessible with a wheelchair.
Do not use apps
None
An app that tells me what is happening in the city
None
info about drugs and doctors and local hospitals
Accessibility simple and big letters
Construction obstructions
not sure
Ease of use.
Mobility options.
Able to see bus routes, times, and see where tbe bus is
none
Events/construction downtown (ball games) and help with parking
Easy to use for senior
N/A
Route to avoid traffic congestion
Easily accessible, simple
Wheelchair access
More training to use a smartphone
I rely on my daughter as my driver
N/A
Recreation places (camping)
Traffic updates and where I am in the city (big picture)

accurate arrival times
Very large print
N/A
Walking routes with sidewalks (not gravel) and places where it's safe to walk (no traffic)
Bigger letters
I don't know how to use Google Maps or other apps, need to learn or someone to teach me
Places to eat
To help me get around
N/A
Shortest route to destination and traffic warnings
Big enough to see and use (if I don't have my glasses)
N/A
Ability to call 911 from App
I don't know
Main concern is to go see the doctor
Availability and knowledge of local resources
Look for stuff
I have a flip phone
Tracking the bus to expedite pick-up and not be in extreme heat/cold on the street, not enough money to buy smartphone
Transportation (Sun Metro does not have enough lifts and drivers)
Learn languages
N/A
Include cost of service for the bus so I can administer money and know what service goes to what place (help identify services I need) so I can make sure I have a schedule to go back home
Simple app that is easy to see. I don't want to mess with phone pop-up settings and there must be room for error (if I enter the wrong information)
Large address numbers
Resources
N/A

Bigger prints
N/A
food delivery
Traffic condition information, where to avoid traffic, and good reception.
Information about transportation at night
How to get somewhere by myself without assistance
None
Having exact addresses and more information about the destination place
Make it less complicated
N/A
Schedule
Schedule
Don't even want to mess with it
None
None
Information about the places I can go (Medical clinic & senior center)
Easier to use
To find the place.
none
Don't know how to use it.
Don't use any of that, not even the computer.
very user friendly
to tell you when you arrive to your destination.
safety
Community Centers
accessibility of destinations
up to date and accurate information on local resources
picture of the bus

I don't have a cellphone
Information on the bus or someone that can pick me up for my appointments. She has a hard time getting the services because there are a lot of instructions she needs to follow.
places that are safe to go on our own. Uses smartphone to answer and make calls
Lift and information on transportation. I don't know how to use my cellphone. I only use it to answer calls. I'm scared that my phone will lock if I do something wrong
bus schedule is what I struggle the most with. Somtehing easy to use
easy to use; doesn't have a smartphone
simple
Doesn't know how to use her cellphone. Sometimes I don't understand it (cellphone)
Information on much time I have to get to a place
Transportation information is necessary for everyone that comes to the senior centers
maps
Discounts for older adults. He doesn't own a smartphone
Other options for the bus. For example, like if the bus doesn't get here on time you can take this other bus. Or even discount for the Uber.
Doesn't uses his cellphone, something easy to use
Something that I can use it and order transportation on my own. That's something I don't like about Uber, I need to call my daughter so that she can order an Uber for me. I don't want to be asking her to do it for me. Something that we can use even if we don't own that type of cellphones (smartphones).
for it to have music
picture of the bus
picture of the bus
Information on who could take me to my doctor's appointments which are every three months. The bus takes a while to arrive.
transportation
Transportation, the majority of older adults don't drive
More access for older adults such as sidewalks and special doors. There are several people that struggle with that, but not me yet.
No, I can't think anymore. I don't use my cellphone and I don't have that type of equipment
Localizar rapido un camion
Hovarios y rutas de los viajes ademas, costos
Communicacion direct y practica. Facilidad en la aplicacion en su disenu e imagen. siempae

Si tubiera un telefono lo usaria
Emergencias
Algo gratis
Foto del autobus
auditory
Information on services. I hardly sees
no cellphone
Doesn't have smartphone. Transportation for when one can no longer drive
heath
doesn't uses her cellphone
transportation information
buses to travel
for it to be simple and practical
app to use uber
nothing
nothing
nothing
none
signing classes
Ella quisiera que la aplicacion la haga sentir felic e acompañada.
none
Ella quisiera una aplicacion donde ella pudiera tener todas sus contraseñas.
none
services that facilitate mobility among deaf older adults
i need to know what an app is
large font, and light contrast settings
no
large font

cheap
Ability to keep in touch with my PCP
provide information to older adults without asking for personal information
large font
the weather
handicapped parking and weather
easy to use. i don't want to be answering or doing a lot of things for it to work.
something that is easy such as a button
just one button that gives you the map fast and easy
parking availability, to know what places are handicapped friendly.
You cannot see the signs at night or the names of the streets
Everything needs to be more clear, I hardly see
N/A
Como llegar a lugares mas facil
N/A
Descripcion de lo que hay disponible
Tiempo que toma para llegar a lugares
no
none
don't know
learn how to use the bus and taxi.
to tell me the exact time for the bus. Like the time, days, and location the bus comes.
I would like to know more and how to get to places with the map. Information on specials
interested, but does not have a smart phone
none. i'm not interested in that, they should work on other things.
no answer
I would like an app that offers uber services but for older adults.
no, my children and grandchildren order taxis or ubers for me

locate transport areas
reminders of appointments or stuff for personal use
I hardly use my phone
equipped transportation
transportation that is well equipped
I prefer having it on paper, and something with easy questions or commands. At this age its hard to understand what they want. It needs to be easy to use and understand. I'm afraid of using the internet.
easy to use, doesn't know how to use smartphones
doesn't own a smartphone and doesn't know how to use them
information on social services. I use the map service on my phone and struggle to use it, but I eventually I get it to work. I think something easier to use
music or things to distract me. Sometimes I struggle because I have poor vision and need help from my provider
He is on the process of getting a free flip phone
no answer
none
don't know, doesn't own a cellphone
Only uses phone to answer and to make calls.
reminders for doctor's appointments.
Not only for adults, but also for the nurses.
I don't have a smartphone, I would prefer for the streets and buses to improve
i don't use apps, I don't need them
I would like to have an app that is actualized and specific to El Paso
easy
easy to use
simple de usar
Horario del autobus
no entiendo a que se refiere?
Practicalidad

un mapa de la parte de la ciudad donde me encuentre.
Mas disponobilidad
uber
I don't know how to use it, you would have to teach me. Maybe if we could have classes to learn how to use the cellphone.
the bus, faster transportation options and routes.
Does not have a smart phone, For emergencies
Had a cell phone, no longer has one
Easy to use
Finding the route to take with less traffic.
Not a user, just calls
Major information on services and maps of your destination.
No answer
Doesn't apply
Show how to use the app
Easy to use
Information on bus schedule, I leave my house at 8 AM
To not take to much space on my phone.
show how to arrive to destination
None
Games
I don't use my phone, I use a walker.
Everything is okay, if it was probably in Spanish
no answer
No selling or sharing data on me. Privacy. No invasive permissions. No tracking.
The time that the trip would take
pay in cash
facil de usar

none
No entiendo para que serviria
doesn't uses apps and doesn't own a smartphone.
let us know about traffic.
Doesn't know how to navigate the internet. She needs classes to learn and needs a smartphone.
something similar to google maps
Only uses phone for calls and social media apps. It helps her keep in touch with friends. She is not a social person, she hardly goes out.
easier ways to arrive to place of destination
Only uses cellphone to answer calls and to make calls
does not uses cellphone
Does not uses cellphone
information on where I can seek help.
weather information. struggles when it's extremely cold.
Maps
Already uses google maps and understands it. If anything, medication information would be useful. Sometimes he struggles with that when he visits the doctor.
none
doesn't own a smartphone
Maps
Doesn't have smartphone
I don't know how to read or write. I don't have that type of phone (smartphone)
Does not has a smartphone. Provide information on transportation services for those who do not have transportation or means to come to senior centers. A lot of people don't come for that reason
Doesn't own a smartphone
Amplitude
I don't know how to use apps. Needs help using phone
I still drive. I don't have a smart phone
Big letters
Transportation options

Don't have a smartphone
Information about transportation and for it to be accessible
Facil de usar
don't know
Information on health, someone to pick me up
no
hasn't used apps
hasn't used apps.
uses phone to make calls, hardly uses apps.
doesn't own a cellphone
big letters
what the best routes are, and locations of interest.
to help us move around the city and information on health.
Que nos informe donde y a que horas va pasar el transporte publico para poder usar lo en mi communidad.
don't know
map of routes and directions
learn how to use the programs in the phone.
no answer
doesn't have a smart phone
how to get from one place to another, and how to use apps.
learn to use other applications
the cost of the phone, don't have one.
does not know how to use computer
the cost for a smart phone/ and accessible
a car
not to know where to go
updates on traffic, what places have the most traffic, and what the easiest routs is. Get notifications when the freeway is closed and for the app to have an auditory feature

the cost of the phone
the phone to use the cost
transportation information and to learn how to use the app
have access to uber
do not have interest/ need
to teach me how to drive and play the piano
let it be easy to use, and in spanish
transportation to tourist places
traffic information
bus schedule
none
N/A
accessible and easy
Map service
Map service
GPS map
Easy access
Free for everyone
To let me know when there are accidents
Information about public bus

B.1.20. If you were offered to use a mobile application (or App) that is designed to assist seniors to find places and commute, what would motivate you to use the application?

No answer
No smartphone
No smartphone. She needs to learn how to yse it
No smartphone just a basic cellphone

No
in the future when I can't anymore
I try not to get involved
I think in the future when I needed I would
if I did not have to go until the last of the way
I do not see anymore I should talk
I had the big name so that I can see it
To get to where I go
places to go to eat, have fun (not be stuck at home)
if it's safe
easy way of accessing app
yes
no answer
yes
to get more convenient designated access to place I go to
no answer
no answer
smartphone
to find how to get to places
no answer
yes
maybe
no answer
we have a Garmin and also an app-map on our computer and we use it frequently
yes
no answer
no answer
yes

no answer
the need for it
no answer
no answer
Simple to use
One touch connect
One touch connect
Helpful information
Accuracy
Yes
Easy to understand
yes
easy access and form
to find out about seniors
training
no answer
someone teach me how to use it
having a map designed for hospitals
more education on use of new technology
yes
have access to internet and maps to move around
being on time
being able to take the bus without feeling like I am going to get lost
if the app accurately showed traffic live time on the roads of el paso tx.
no answer
no answer
time, knowledge, and actual use
more concern on event attendance

none
speak to the application
I already know how to move around, but sometimes I don't know the name of the streets. I would use it so I can show people how to get to places.
User Friendly
More technology education
EASE OF USE
Nothing
if it made my travel faster
time of commute
accessibility & inclusion in program
NO
Need
YES!
user friendly
none
traffic reports
For Dr appt
ease of use
user friendly
Simplicity, ease of use
Easy to use
ease of accessability
Yes
N/A
N/A
N/A
N/A

N/A
N/A
Friendly use
nothing
Yes
Easy maps
already using GPS
Easy steps to navigate
Safety, no falls
If someone can teach me then yes.
Fair prices.
when needs to travel
ease of use
simplicity
Be on time to any destination
ease of use
doctor
To visit places
none
reassurance that it can be used by a family member to track me down if I ever get lost.
I dont need it
Accuracy
Efficiency of app
HEARING, rather than reading instructions
fast and easy
Easier way to communicate with children and grandchildren from out of town.
Conducting business from home
easier than Google maps

Its for seniors
Need this App to stay active
to get to y destination faster
to find places & to show you where there are better places, libraries to use the computer.
to go where we need to go as much as we need to
if it told me that handicap parking is close to the place I want to go.
Being able to help
no answer
to show me how to arrive easier to my destination
If I was by myself.
Cost
Any cost savings that would be involved
Usefulness
Real Needs
Big, bold print
Functionality
Yes
Do not have smart phone
If it is really helpful
Free
No
free of charge
It can get me to my destination with ease and for it to be simple to use, one two or three steps not more
Don't know
easily understood
Ease of use.
Points for rewards similar to those used by Metropia.

Make it easy to use and understand
yes
To guide someone who is taking me
To find places
N/A (no interest) - Older people are afraid of technology (build a wall against)
Getting around (avoiding traffic and construction)
Being able to meet all the concerns
When I can't drive
Yes 100%
No
Reliability
A good app that is possibly free
Traffic to avoid time wasted during commute
finding new places to get to with public transportation
I do not have a cell phone
I only use my phone for emergencies
Help seniors and encourage them to walk
Help me move around
Understand how to use it and classes on how to use it
Easy to read and surf
Affordable price
N/A
Warning about traffic problems
Yes
N/A
I have one
To be taught the app and what's new with technology
When is there less traffic and my daughter lives far so I don't get to see her often

Economics
Look for places to visit
Need phone first
Visiting museums (going downtown for walking) and visiting friends more often and going to events
If the app was easy to use
N/A
N/A
My own personal needs
Easy to use
Free
N/A
N/A
Finding locations
N/A
Yes
if it were actually helpful and easy to use
If bad weather & have to travel long distance & time of date depends on traffic.
Don't have to worry about who can take us.
Learn how to use the App
improve the mobility for peoples services
Not a big fan of technology
Emergencies & other
Cost
Free and not complex (as simple as possible)
Free and not complex (as simple as possible)
Free (low cost)
None
I don't have a way to move around

To be able to move and discover places.
It would be good to go out and distract myself.
The Price
none
For emergencies when I need to use the phone for something.
To learn
Being taught how to use it
sometimes I don't know the address and it tells me where its at.
relevance to my situation
Events
handicap accessibility
how useful it is after trying it.
picture of the place. Go to the grocery store
No cellphone
no
to go to places and for distraction purposes
doesn't know how to use her cellphone
in case I get lost
no
no
No smartphone
Doesn't own a cellphone
the transportation, like how to drive at night
I don't understand how to use the cellphone that much
I don't have the need for that yet. I have my two cars that are still working well.
Information that is there like what the schedule for the bus is or other options on what bus to take
Doesn't own a smartphone
Being able to use it without asking my daughter to do it for me.

Grandfather
Ability to talk to the device to say things like "take me to this place"
picture of the place
It's really good for older adults to use. There are several that live on their own.
none
transportation
Doesn't own a cellphone. that there would be more ease and opportunity
I don;t like to leave my house anymore so that I don't bother my family, and I don;t like to seek attention
Si la utilizaria si me ensenan
Si
Museus, luganes histoaicus y tunesticos; teatnos; restaurantes y tiendas
Algo de torar
Citas medicas
Que me ensenen
Foto del lugar
doesn't have a smartphone. Has a flip phone, but has a hard time hearing it
no cellphone
no cellphone
no smartphone
to socialize
I don't have that equipment, how would I be able to have access to this service (app) if I only have a flip phone
no, i don't have a cellphone. She is not in the stage where she forgets a lot of things
trip or go out for a ride
si
when they are older and depend on someone
no answer
no answer

no answer
only if i couldn't move
no answer
Lo le que motivaria seria si ella viera que otra gente como ella tambien lo estan usando.
social services
Que no cueste dinero y fuera facil de comprender.
none
my mobility
for it to facilitate my mobility when I go out
routes to get to places, directions, weather
no
learn to use the cellphone
becoming familiar with different routes to get to places
to find my destination in a fast and easy way
in case i want to go somewhere
to go to the doctor
maps and routes
maps
maps
a map
maps
I would like to use it because it takes us a while to learn new things and we forget everything
I don't need it
I don't need it
N/A
Que seria facil de usar
N/A
El podaer llegar al lugar indicado

Si
no
none
don't know
learn to use the bus and taxi to be able to go out
when my daughter cannot take me somewhere, I would like to be able to move around by myself using the bus or taxi
yes, to learn.
access. Questions on how to qualify for services
no
no answer
It would facilitate my mobility
no
Not interested
i'm not interested
I would like to learn, but I don't know how
there are several new streets that now a days we don't even know
maps
when I have doctor's appointments
doesn't own a smartphone
none
none
Right now I'm fine, but when I get older I'll probably need things like special transportation with medical equipment such as a wheelchair
Doesn't own a cellphone
no answer
information
doesn't own a cellphone
Doesn't own a smartphone

i'm not interested
not at this moment.
nothing
I wouldn't use it
yes, I like museums and parks a lot
easy and cost
cost and easy to understand
educacion tecnologico
Si la gente me diera paseos
no se..
Que sea gratis
como en realidad no conozco la ciudad, algo que me ayude a saber donde estoy y que tan lejos estoy de mi casa.
Costo
Spanish and large font
n/a
For myself and for other people who come. We cannot afford to buy a car and it's necessary to know what options are available for us.
no
None
None
Easy to operate
Not use tech
no answer
No answer
Would like to know more
To show if the place accepts credit cards
To conect with friends
no answer

Easy to use.
to see new places in El Paso
None
Spending time with more people
I good to know how to move through the city with my daughter.
no answer
no answer
Convenience of access, immediate access without reservations, reliability, timelines
to know how long it will take to get there
Easy to understand (someone explain)
Facil de entender; una persona que por favor me explique
none
No entiendo para que serviria. Acuerdense que no somos fanaticos de explorar apps. Necesitamos que nos los expliquen
Conocer
none reported
make life easier and not get lost.
Learn how to use the cellphone
To not get lost
To have updated information and well informed.
It would make her daughter's life easier to drive
Doesn't know how to use cellphone, only uses it to answer calls.
does not uses cellphone or apps.
doesn't know
Being able to go out.
don't know
I don't have a smartphone, I don't even know how to use it.
When he needs something (ex: finding locations)

more map information
the stability to move around
Dirrectons to places I don't know how to get to.
Needs to learn how to use it
Maybe in the future when I need it
Needs to learn how to use phone. It would be easier to find places
Learn how to use smartphone
Finding places of interest and travel to meet places in the city
My daughter uses it and she takes me to places.
I just know a few streets but not all the streets sometimes I get lost looking for an address
Move around and go out with my friends. We usually go out for dinner on Wednesdays
Don't know
Don't know
Don't know
Que fuera gratis
don't know
spend time with people
no
better options to move and how much it costs.
no answer
has friends that struggle to move around the city.
no answer
map services
find places easier
Que hubiera mas lugares interesantes que visitar
to go downtown or civic center.
Que sea sencilla para aplicar en mi telefono y este en mi idioma.

for emergencies like getting directions when needed. Wife uses the phone and guides him when he drives.
use the map
accurate information and easiest way to arrive
no answer
directions to get to places
would like to use it to visit and spend time with her children.
information on senior centers
don't have a smart phone
relies on granddaughter
no answer
know how to use technology, have access to uber
access to uber
I need to know since I move around the city a lot.
being able to pay the cost of the phone
cost
learn more about technology
access to uber
n/a uses flip phone
know what other places people go
If I was to be hurt for me to be able to use the application without any issues
museums
no
motivated to go to new places
none
availability of schedules and various routes
free and comfortable
easy to use

easy to use
easy to use
Learning how to use it
that it caters to all type of needs
To make life easier while driving
not a fan of technology

B.2. New York Results

B.2.1. Gender

What category best describes your gender?

In this question, participants were asked to select the answer choice for their gender. There were three answer choices: male, female or other. The results for the 61 responses collected in the survey for this question are presented in **Figure 39**. There were almost four times as many female participants as male.

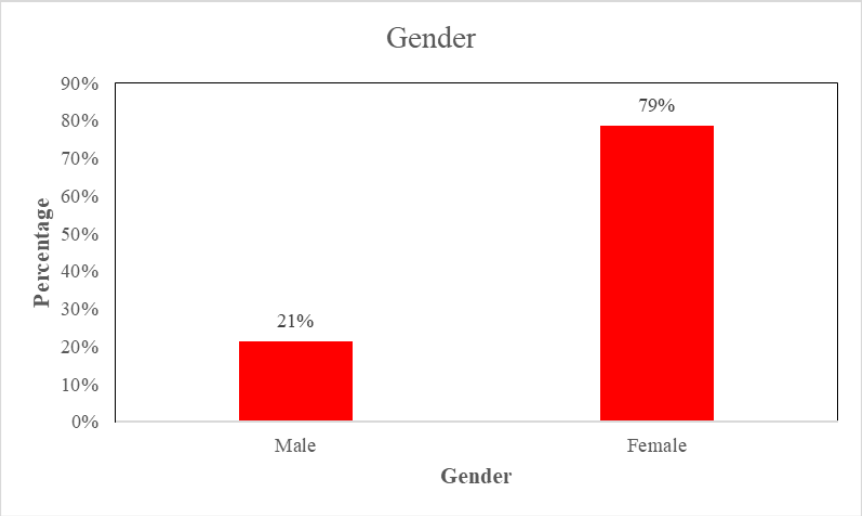


Figure 39. Gender, New York City.

B.2.2. Age

What is your age?

In this question, participants were asked to declare their age. Then the responses are distributed among the ranges which were already defined in the El Paso survey. The number of participants who answered this question was 58. As shown in **Figure 40**, the highest group was between the age of 65 and 74. This was followed by the age range of 75 and older.

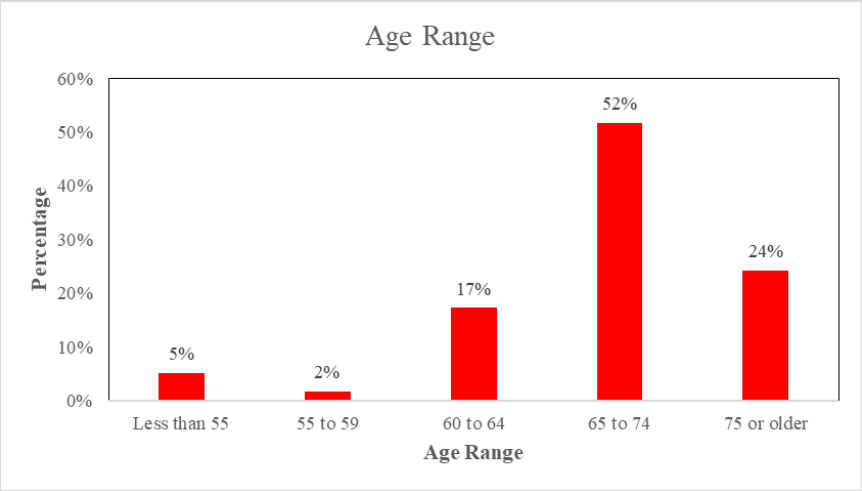


Figure 40. Age range, New York City.

B.2.3. Employment Status

What is your current employment status?

61 participants answered this question. For this question, participants were asked to select the answer choice for their employment status. Each answer choice was a range of the number of working hours per week. Choices such as volunteer and retired were also given. The results of this question are presented in **Figure 41**. A vast majority of the participants who answered the survey were retired, followed by the others with the same percentages. These results are expected, as many of the seniors who frequent the senior centers were likely retired.

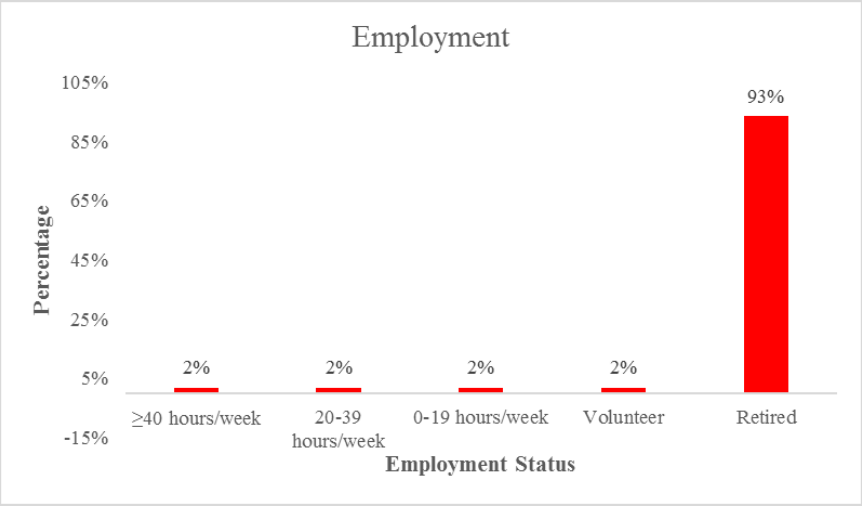


Figure 41. Employment, New York City.

B.2.4. Race & Ethnicity

Choose one or more races that you consider yourself to be:

This question asked the race of the survey participant and allowed the respondents to select more than one. There were 61 responses. One participant has two races. The results for the participants who answered the survey are presented in **Figure 42**. The majority of participants reported being African American, followed by Hispanic or Latino.

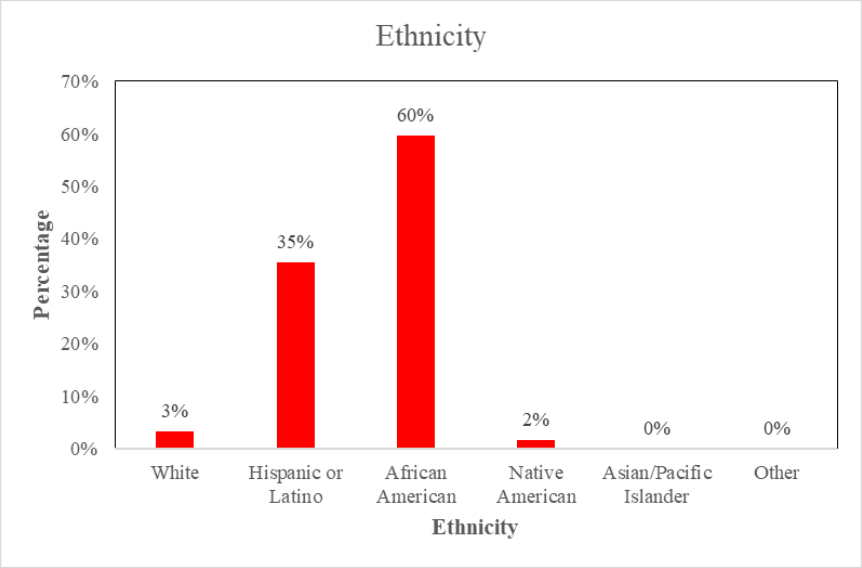


Figure 42. Race & Ethnicity, New York City.

B.2.5. Languages

What languages are you able to understand, speak, and write with confidence?

This question asked what language the participant was able to use with confidence. The purpose of this question was to determine which language(s) to use in the smartphone application's interface. The results for the 61 responses are presented in **Figure 43**. As expected, the majority of participants who responded reported speaking English with confidence, with a smaller percentage who could also speak Spanish with confidence.

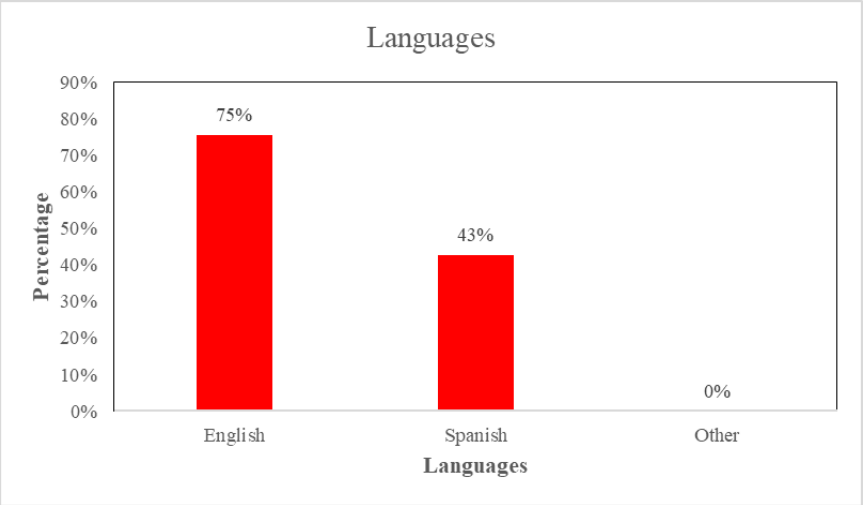


Figure 43. Languages, New York City.

B.2.6. Zip Code

What is your zip code?

This question asks what zip code the participant lived in. The purpose of this question is to: (i) verify all areas are represented; and (ii) determine what areas the potential users live in, so that the initial content of the smartphone application may concentrate on those zip codes. The results of the 60 participants are presented in **Figure 44**. It is not as well distributed as the El Paso results.

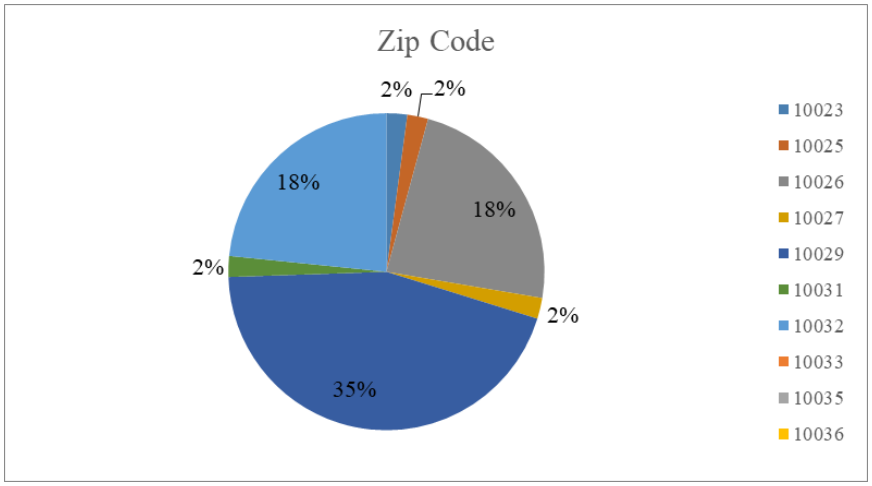


Figure 44. Zip code, New York City.

B.2.7. Type of Residency

How would you describe your type of residence?

This question asked the participant to select the answer choice for their type of residence. The purpose of this question was to gain a better understanding of the independence of the seniors. The results for the 61 participants are presented in **Figure 45**. The vast majority of participants reported living in apartments, followed by houses and senior citizen homes. These results are expected, as much of the surveys were conducted at the senior centers, places where mobile and independent seniors frequently visit. The results are quite different from El Paso results where most of the respondents reported they live in houses.

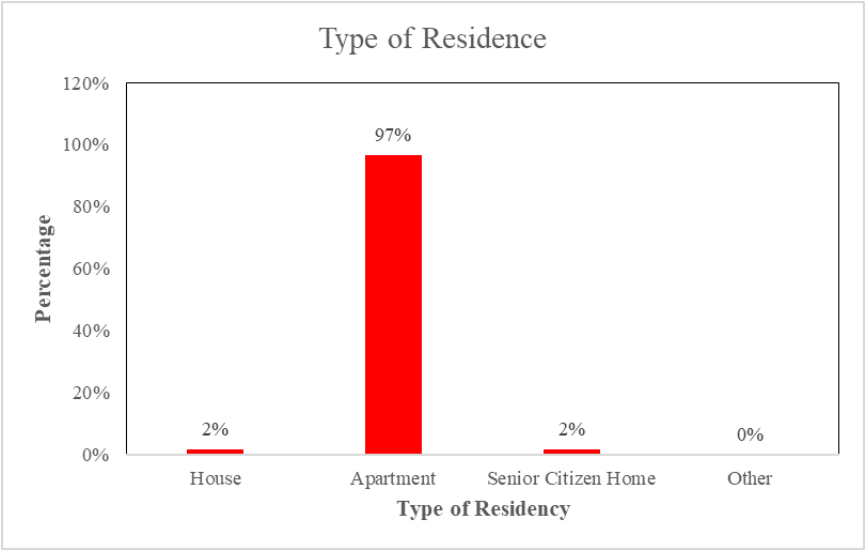


Figure 45. Type of Residency, New York City.

B.2.8. Impairments and Disabilities

Do you have any of the following impairments or disabilities?

This question asks the participant to choose all applicable answer choices for the impairments and disabilities that they may have. The purpose of this question was to gain a better understanding of the impairment and disability needs of the seniors. The results for the 61 participants are presented below in **Figure 46**. Slightly less than half of the participants reported having no impairment or disability, with the same amount of respondents reporting having other impairments or disabilities including heart problems, diabetes, asthma, and paresis. The next most common impairment or disability is walking, which nearly one-third of the respondents reported.

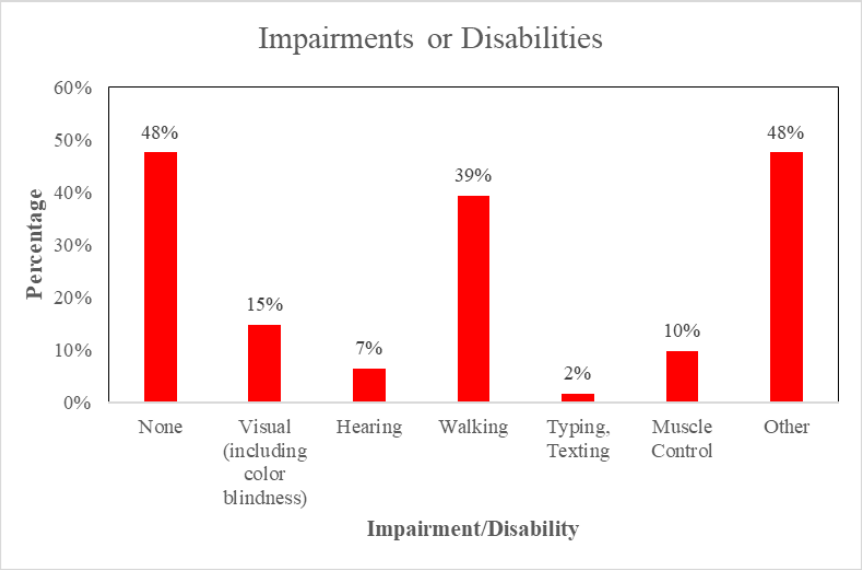


Figure 46. Impairments/disabilities, New York City.

B.2.9. Electronic Device Used

This question consisted of two sub-questions.

Do you use any of the following electronic devices?

This question provided a different electronic device for each answer choice and asked the respondent to select all answer choices for the electronic devices that they use. The purpose of this question was to gain a better understanding of the market for the proposed application. If a majority of

seniors do not even own or use a smartphone for example, then it is likely that the application will not be used, as there is no market for it. Fortunately, for the 61 participants, approximately two-thirds of seniors use a smartphone, as presented in **Figure 47**. Furthermore, the majority of seniors used at least one electronic device, as only 7% of participants reported using no electronic device at all.

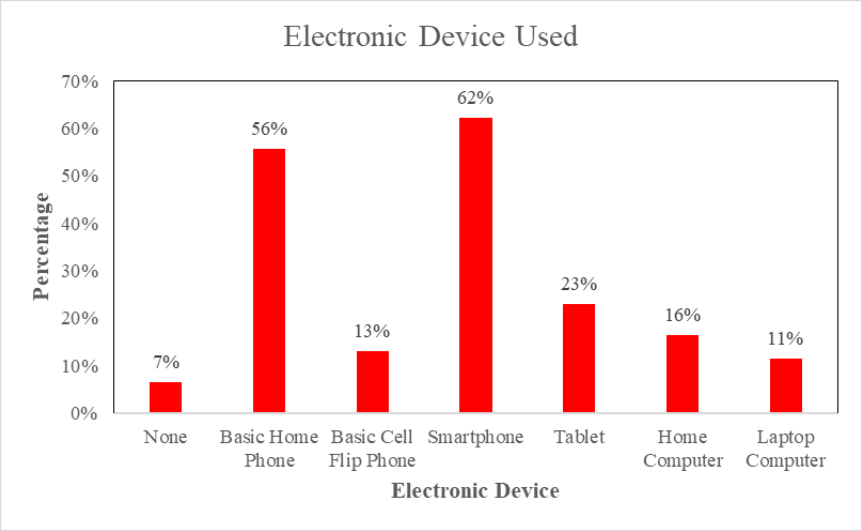


Figure 47. Electronic device use, New York City.

Do you need assistance using these devices?

This question was a follow-up question to the question on electronic device usage. This question asked the participants who use at least one device if they require assistance to use such device(s). The purpose of this follow-up question was to gain a further understanding of their familiarity with the devices. The results are presented in **Figure 48**. Slightly less than three-quarters of participants reported that they do not require assistance to use electronic devices. The remaining 30% need assistance. This indicates that this segment of the seniors may need some training, or their caregivers may be the users. It should be noted that this question asks the senior directly if they require assistance; therefore, the results for this part of the question are biased. For example, if a senior believes they do not require assistance to use their smartphone, but they can only perform the most basic of tasks, they do require assistance to operate the smartphone altogether; however, that is not reflected in these survey results.

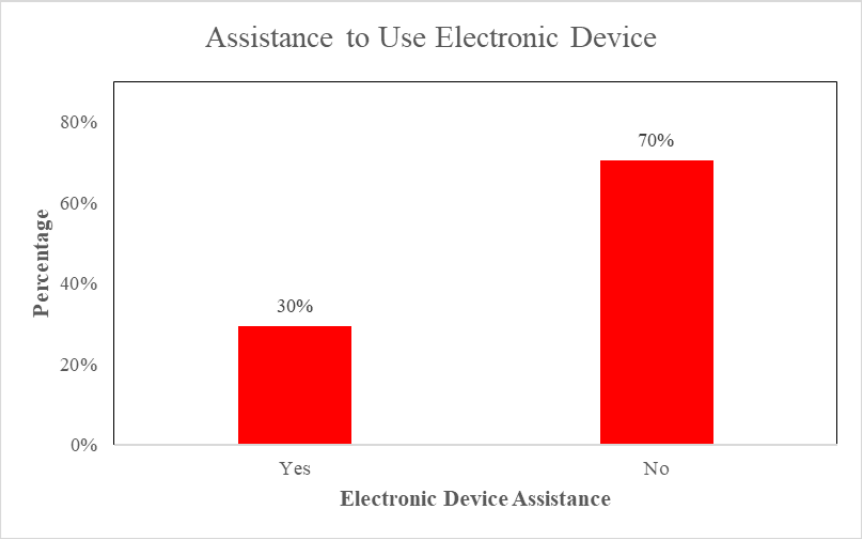


Figure 48. Electronic device assistance, New York City.

B.2.10. Mobility Assistance

Do you need any assistance when you make a trip in the city? (For this part "a trip" is defined as a one-way journey of at least ¼ mile from an origin to a destination.)

This question provided different assistance types for each answer choice and asked the respondent to select all answer choices for the types of assistance they use when making a trip. For this question, a "trip" is defined as a one-way journey of at least ¼ mile from an origin to a destination. The purpose of this question is to determine what types of assistance the seniors require when they travel. If a majority of seniors need a wheelchair when they travel, for example, this should be incorporated into the mobile application accordingly. The results for the 61 participants are presented in **Figure 49**. One-third of seniors do not require any assistance when making a trip. Among the types of assistance needed, a walking cane was most frequently used. These results are expected, as many of the seniors were surveyed at a senior center, a place where mobile, independent seniors frequently visit. It should be noted that the question asks the senior directly for their perception of assistance needed. Many seniors might report that they do not require any assistance when they really do require help from a spouse or family member. This was addressed in the other category answer choice. Some of the other choices are oxygen tank, home member, and a supporter.

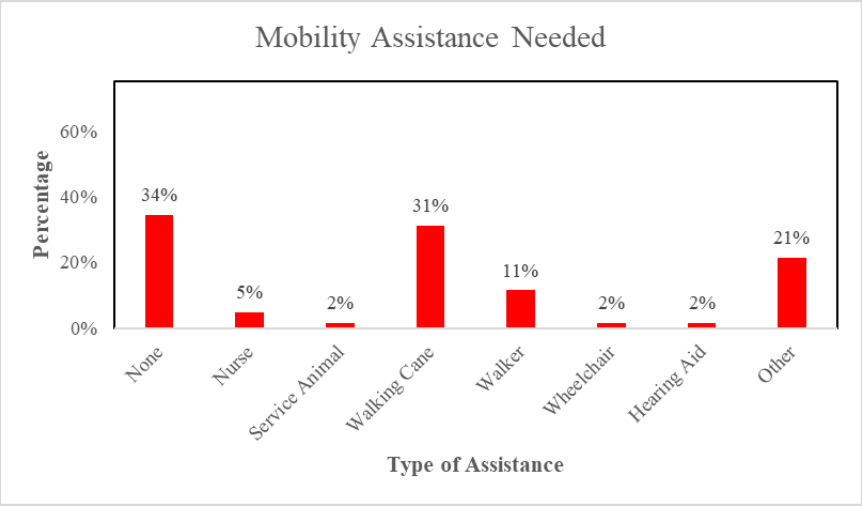


Figure 49. Mobility assistance needed, New York City.

B.2.11. Trip Frequencies

How many times do you visit the following places in a week?

This question was in tabular form and asked the participant to report the approximate number of times per week that they visit various places. The purpose of this question was to determine the frequency of the trips made by seniors on a weekly basis so that the navigation function of the smartphone application can prioritize the destinations. The results are presented in **Table 14**. Each row in the table should sum up to 100%. This question received 61 responses. All of them provided the trip frequencies for every destination.

A majority of the participants reported that they did not work or volunteer, as many were retired. Around one-quarter of the respondents reported that they visited family members, relatives or friends less than once a week. Over one-third of the participants visited the grocery store, market, or retail shop one to three times a week. 30 % of the respondent visited a healthcare facility or pharmacy less than once a week. Nearly half of the respondents reported that they visited a senior center, library, park or gym three to six times a week. A similar percentage of the respondents visited civic or religious centers less than three times a week. Only one quarter visited a restaurant, coffee, shop or diner less than once a week. A majority of them went to a bank, ATM, or an office less than once per week.

	Never	Less Than Once/Week	1 to 3 Times/Week	3 to 6 Times/Week	7 Times or More/Week
Volunteering Place	69%	2%	15%	5%	10%
Family Member, Relative, or Friend	41%	26%	15%	11%	7%
Grocery Store, Market, or Retail Shop	21%	11%	38%	20%	10%
Healthcare Facility, or Pharmacy	33%	30%	20%	15%	3%
Senior Center, Library, Park, or Gym	7%	5%	15%	44%	30%
Civic or Religious Center	43%	20%	28%	7%	3%
Restaurant, Coffee Shop, Diner	48%	25%	15%	10%	3%
Bank, ATM, or offices	31%	36%	25%	5%	3%
Other	85%	3%	3%	2%	7%

Table 14. Trip frequencies, New York City.

B.2.12. Modes of Transportation

How many times do you use each of the following means of transportation in one week? Count a round-trip as two separate one-way trips. If one-way consists of bus followed by a taxi, count both of them as one trip.

This question is also in tabular form and asked the participants to report the approximate number of times per week that they used various modes of transportation. The purpose of this question was to determine the frequency of each mode of transportation used by seniors on a weekly basis. The results are presented below in **Table 15**. This question received 61 responses and all of them provided the trip frequencies for every destination.

A majority of the participants reported that they never use a bicycle, motorcycle, car as a driver, special bus and rideshare as their modes of transportation. Of those who traveled by car as a passenger, one-fifth of them drove less than once a week. The public bus usage was well distributed among frequency selections. Nearly all the responses were around 20%. The most frequently used mode of transportation according to the New York City survey was public buses. Nearly one-fifth of all respondents reported that they used public buses seven times or more in a week. Other modes of transportation included subway and train.

	Never	Less Than Once/Week	1 to 3 Times/Week	3 to 6 Times/Week	7 Times or More/Week
Walking More Than 1/4 Mile	16%	10%	21%	23%	30%
Bicycle	93%	5%	0%	0%	2%
Motorcycle/Scooter	100%	0%	0%	0%	0%
Car (as Driver)	90%	5%	2%	2%	2%
Car (as Passenger)	54%	20%	7%	11%	8%
Carpool (as Driver or Passenger)	87%	5%	5%	2%	2%
Public Bus	20%	26%	20%	16%	18%
Special Bus (e.g. Lift)	80%	5%	10%	5%	0%
Taxi	56%	26%	11%	5%	2%
Rideshare (e.g. Uber)	87%	5%	5%	2%	2%
Other	93%	3%	2%	2%	0%

Table 15. Modes of transportation, New York City.

B.2.13. Concerns When Making a Trip

What is your main concern when planning a trip?

This question provided a common concern when planning a trip for each answer choice, and asked the respondent to select all answer choices for their main concerns, so the smartphone application can be developed to address such concerns. In the question, the participants were provided with a list of 13 concerns. They may select any number of concerns from the list. There were 61 responses to this question, and the percentage of participants who have similar concerns is plotted in **Figure 50**. The most frequently mentioned concerns were cost, followed by protection from extreme weather and on-time departure and arrival. This indicates that seniors: (i) base their trips on cost (e.g. closer destinations, inexpensive modes of transportation, etc.), (ii) are concerned with on-time departure and arrival; and (iii) base their trips on the current weather.

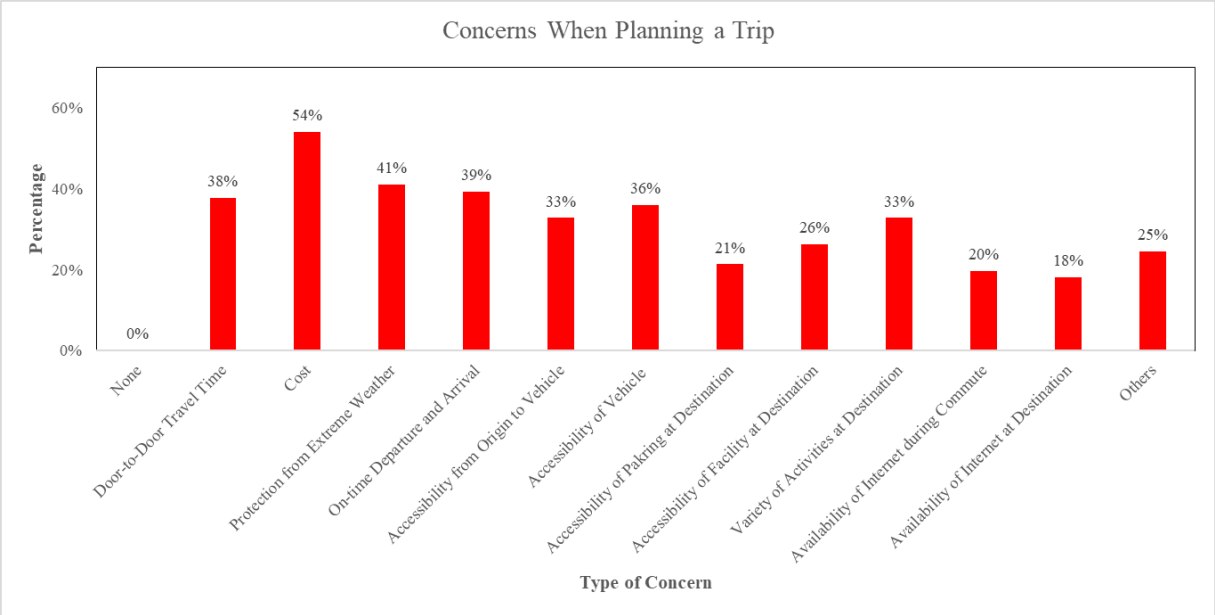


Figure 50. Concerns when planning a trip, New York City.

B.2.14. Mobility Challenges

Describe your biggest challenge when you commute in the city.

This is an open-ended question, which asked the participant to write down their biggest challenges when they travel in the city. The purpose of this question was to determine which mobility issues were faced by seniors. The results for the participants are presented below in **Figure 51**. Only 21 participants answered this question for the survey. Their written answers were organized into categories that fit the El Paso results, and the percentage of the participants who reported challenges in each category out of the 21 written responses was calculated and plotted in **Figure 51**. Waiting time was the most frequently reported challenge they faced, followed by traffic congestion & parking, accessibility to vehicles & buildings and other challenges including safety and train use.

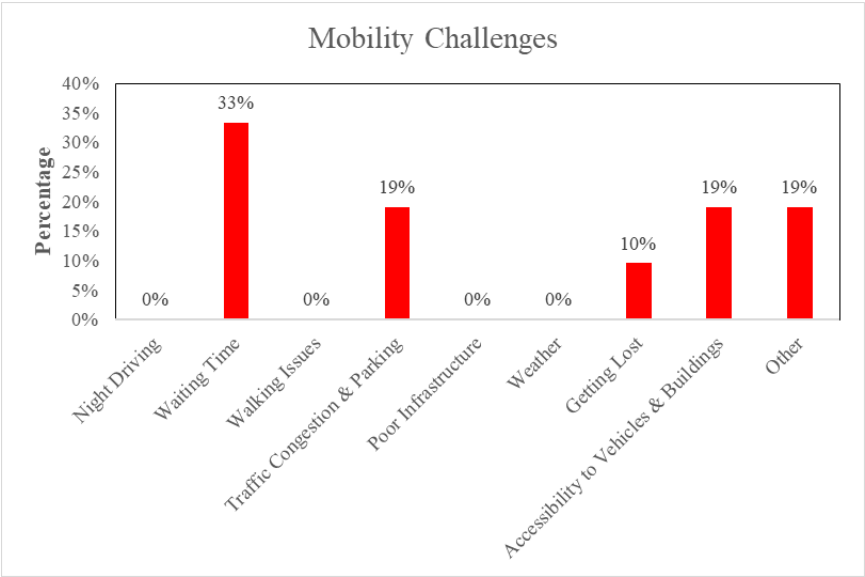


Figure 51. Mobility challenges, New York City.

B.2.15. Key Application Functions for Seniors

What is one function you would like to see in a mobile application (or App) that would cater to seniors needs?

This is an open-ended question, which asked the participant to write the most important function they would like to have in a smartphone application. The purpose of this question is to determine what functions the smartphone application for seniors should have. The results are presented below in **Figure 52**. There were 15 participants who answered the survey who reported at least one function they would like to have. The most frequently stated functions are related to features of the application followed by bus routes and navigation. The other response was eager to learn the new technology about applications.

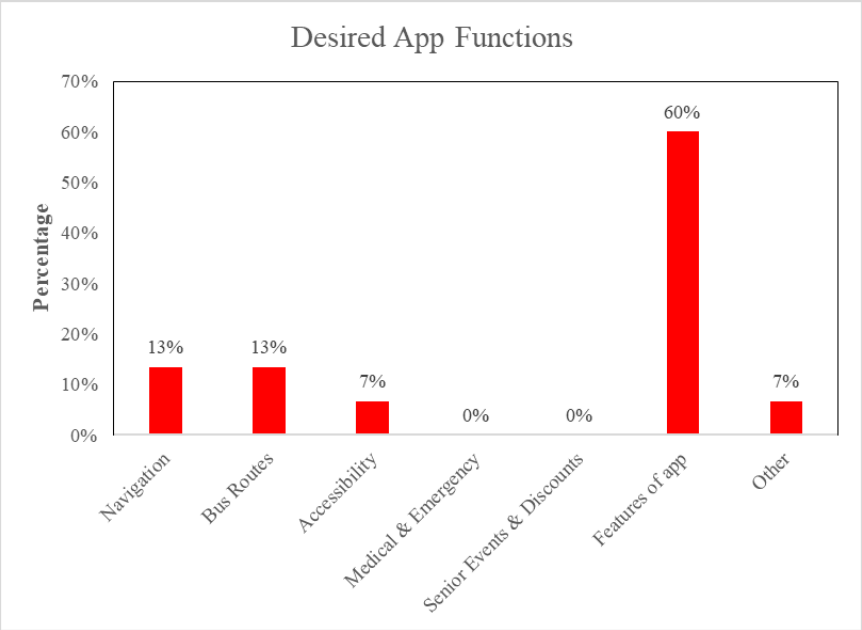


Figure 52. Desired application functions, New York City.

B.2.16. Motivation to Use Application

If you were offered to use a mobile application (or App) that is designed to assist seniors to find places and commute, what would motivate you to use the application?

This is an open-ended question, which asks the participant to state the factor(s) that would motivate them to use an application that is designed specifically for their mobility needs. The purpose of this question is to gain a better understanding of what would motivate a senior to want to use the proposed smartphone application. The results for the participants of the survey are presented below in **Figure 53**.

13 participants who answered the survey wrote down at least one reason that would motivate them to use the smartphone application. The most frequently cited reasons are, in decreasing order of frequency:

1. The navigation function;
2. The application was easy to use and accessible;
3. The application was easy to learn;

The above reasons may be divided into motivation related to the application's functions (navigation) and motivations related to the application's features (easy to use, easy to learn).

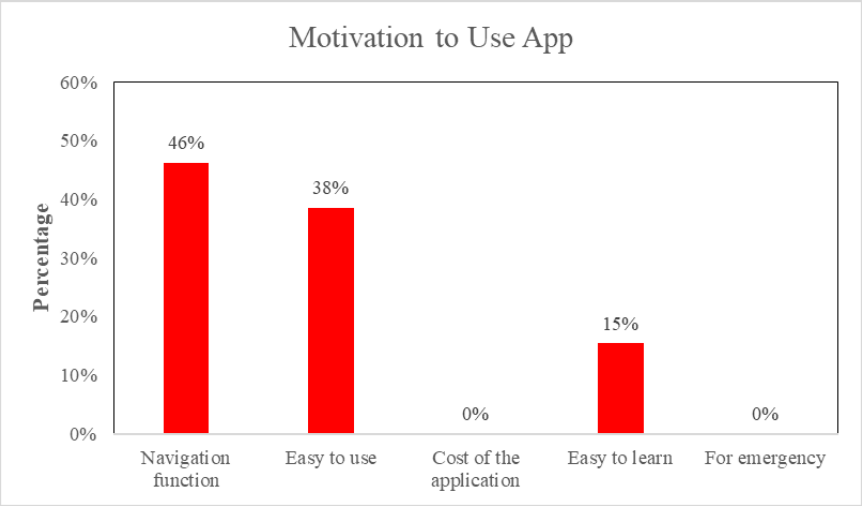


Figure 53. Motivation to use a smartphone application, New York City.

B.2.17. Data Sharing

If you were a user of an App designed to assist seniors to find places and commute, would you be willing to anonymously share your data (e.g. location, route, means of transportation) to improve the services offered by to users (including yourself)?

This question asked the participants if they were willing to share their data (e.g. location, route, means of transportation) to improve the services offered by the smartphone application to the users. The purpose of this question was to determine if the potential users would be willing to allow the application developer to use their usage data to improve the application and its database. The results for the 61 participants who answered the survey are presented below in **Figure 54**. More than half of the participants in the survey are not willing to anonymously share their data.

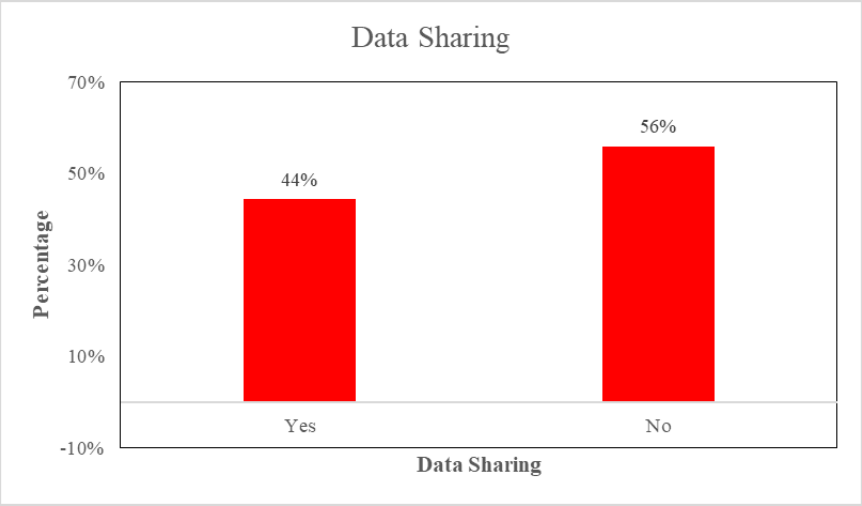
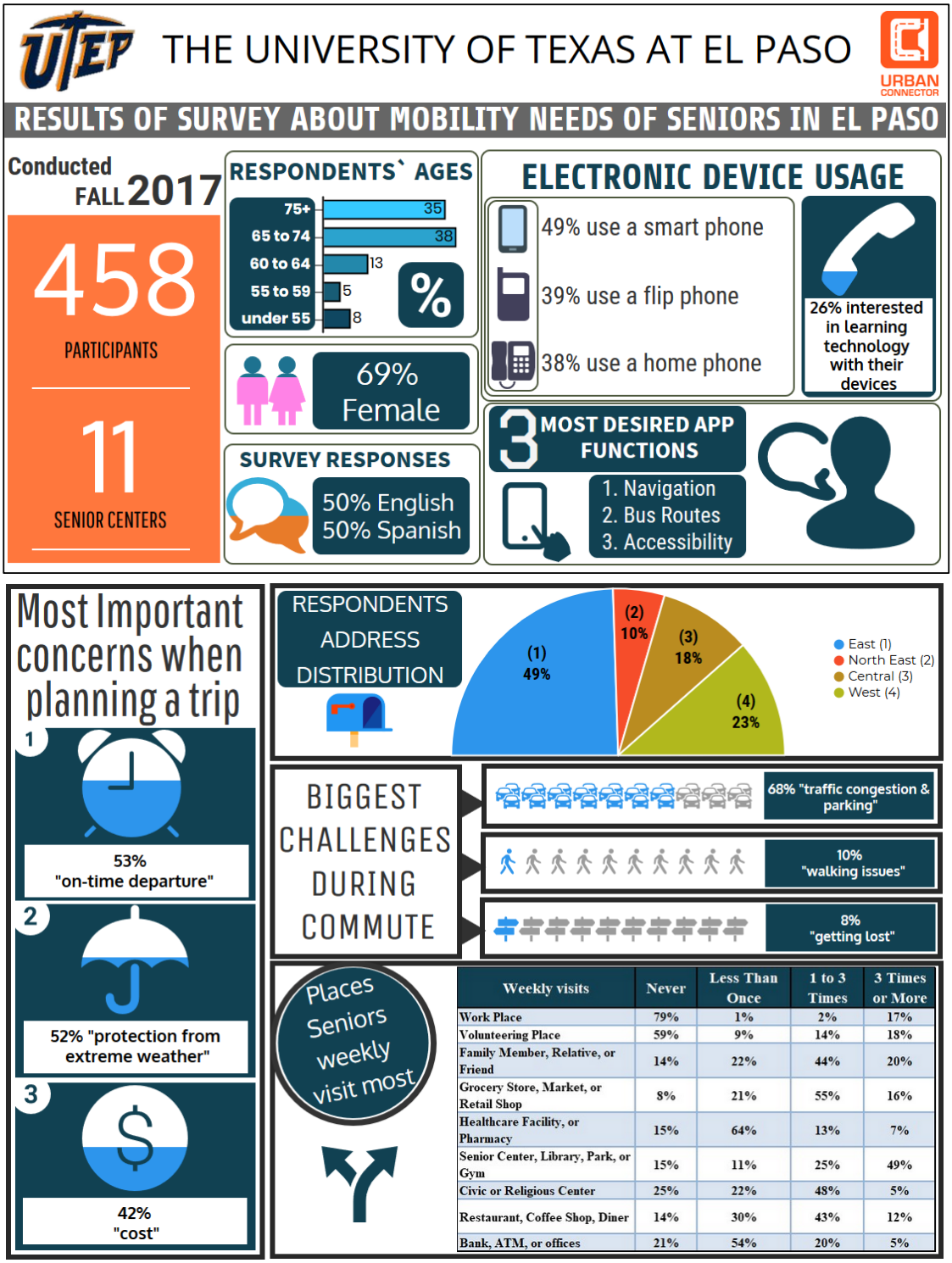


Figure 54. Data sharing, New York City

APPENDIX C – Pilot Survey Infographic Flyer



Weekly visits	Never	Less Than Once	1 to 3 Times	3 Times or More
Work Place	79%	1%	2%	17%
Volunteering Place	59%	9%	14%	18%
Family Member, Relative, or Friend	14%	22%	44%	20%
Grocery Store, Market, or Retail Shop	8%	21%	55%	16%
Healthcare Facility, or Pharmacy	15%	64%	13%	7%
Senior Center, Library, Park, or Gym	15%	11%	25%	49%
Civic or Religious Center	25%	22%	48%	5%
Restaurant, Coffee Shop, Diner	14%	30%	43%	12%
Bank, ATM, or offices	21%	54%	20%	5%

UNIVERSIDAD DE TEXAS EN EL PASO

URBAN CONNECTOR

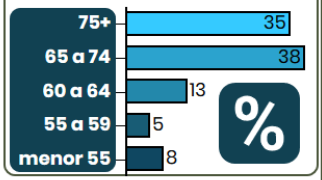
RESULTADOS DE ENCUESTA SOBRE LA NECESIDAD DE MOVILIDAD EN ADULTOS MAYORES DE EL PASO

Realizado en OTOÑO 2017

458 PARTICIPANTES

11 CENTROS PARA ADULTOS MAYORES

EDAD PROMEDIO DE ENCUESTADOS



69% FEMENINO

RESPUESTAS DE ENCUESTA

50% Inglés
50% Español

USO DE APARATOS ELECTRÓNICOS

- 49% usa teléfono inteligente
- 39% usa teléfono móvil de tapa
- 38% usa teléfono de casa

26% están interesados en aprender sobre la tecnología con sus aparatos

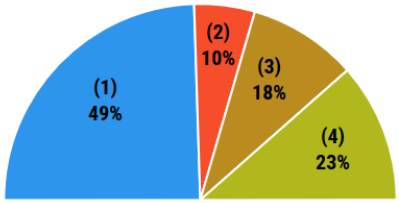
3 FUNCIONES MÁS REQUERIDAS EN LA APLICACIÓN

1. Navegación
2. Rutas de Autobús
3. Accesibilidad

La preocupación más grande al planear una salida

1. 53% "salidas a tiempo"
2. 52% "protección en climas extremos "
3. 42% "costos"

Distribución de encuestados por dirección



DESAFÍOS EN VIAJES CORTOS

- 68% "congestión del tráfico y estacionamiento"
- 10% "problemas al caminar"
- 8% "temor a perderse

Lugares más visitados por adultos mayores

Visitas Semanales	Nunca	Menos de Una	1 a 3 Veces	3 Veces o Más
Lugar de Trabajo	79%	1%	2%	17%
Lugar de Voluntariado	59%	9%	14%	18%
Miembro de Familia o Amigo	14%	22%	44%	20%
Tienda de abarrotes y Despensa, Supermercado	8%	21%	55%	16%
Centro Médico o Farmacia	15%	64%	13%	7%
Centro para Mayores, Biblioteca, Parque, o Gimnasio	15%	11%	25%	49%
Centros Cívicos o Religiosos	25%	22%	48%	5%
Restaurantes, Cafeterías, Cenas	14%	30%	43%	12%
Bancos, Cajeros Automáticos, u Oficinas	21%	54%	20%	5%

Este proyecto es patrocinado por C2SMART (Deptartamento de Tranposte, Tier 1, Centro de Investigación sobre Transporte).
Para más infromación, contacte a Dr. Guillermina Gina Núñez-Mchiri (ggnunez@utep.edu) o
http://c2smart.engineering.nyu.edu/current-projects

APPENDIX D – Pilot Survey Results

D.1. Smart Device Use

I am a smartphone or tablet user. (Please write yes or no):

The combined results from both the English and Spanish responses to this question (65 participants) are presented below in **Figure 55**. A majority of the survey participants (68%) reported having a smartphone or tablet. The results of the previous survey demonstrated that there were fewer smartphone or tablet users (49%). This indicates that smart device users (current possible users) were more likely to participate in the second survey where the participants are asked to use the smart devices and share their feedback. The survey responses of the remaining 32% of the participants were still useful, as they may acquire smart devices in the future, becoming potential users of the mobile application. Their responses were integrated and analyzed with those who have smart devices.

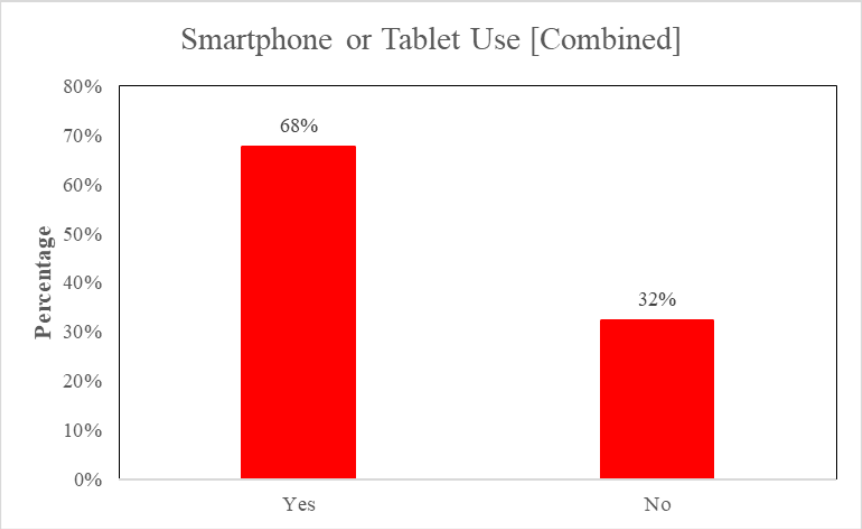


Figure 55. Smartphone or tablet use [all responses].

D.2. Operating System Use

The type of smartphone or tablet I am using is,

In this question, participants were asked to select the answer choice between Android or Apple iOS. The combined results to this question (44 participants) are presented below in **Figure 56**. A majority of the survey participants (68%) reported having Android operating system on their smart devices, so it

seemed developing the application for Android devices was a good starting point. To reach the other 32% of the participants, the Urban Connector application should be developed for Apple iOS in future research.

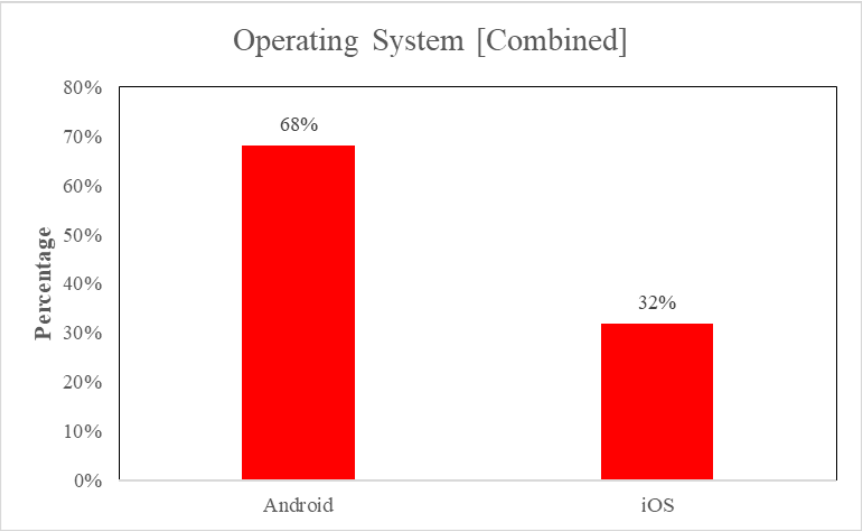


Figure 56. Smart device operating system [all responses].

D.3. Need assistance to demonstrate the app

I prefer UTEP assistance to demonstrate the application (Please write yes or no):

In this question, participants were asked to select yes or no regarding whether they prefer the student-assistant to demonstrate the prototype Urban Connector application. The results with 65 participants are presented below in **Figure 57**. A majority of the survey participants (88%) reported that they need assistance to demonstrate the application before the student-volunteers handed them the mobile devices installed with the application. This indicates the need to educate seniors on the use of mobile devices (smartphones, tablets) so that they feel confident to operate them without assistance.

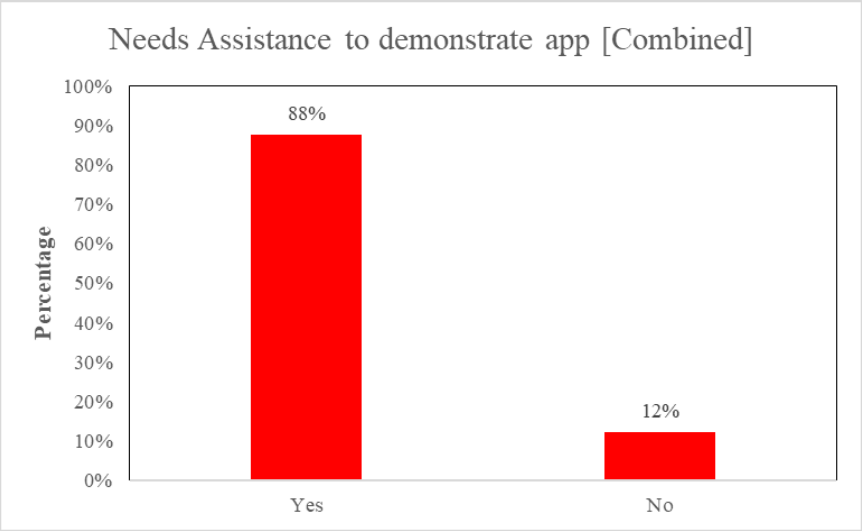


Figure 57. Needs assistance to demonstrate the app [all responses].

D.4. Age

What is your age range?

In this question, participants were asked to select the answer choice which included their age. The choices given were based on the age ranges in the definitions for seniors (i.e. 55 to 65), as reviewed in Section 2. The responses to this question (65 participants) are presented below in **Figure 58**. Majority of the survey participants (78%) reported being age 65 or over. In the previous survey, the rate was 73%. Both surveys indicate that the volunteers were successful in recruiting the target participants (i.e. seniors over the age of 65).

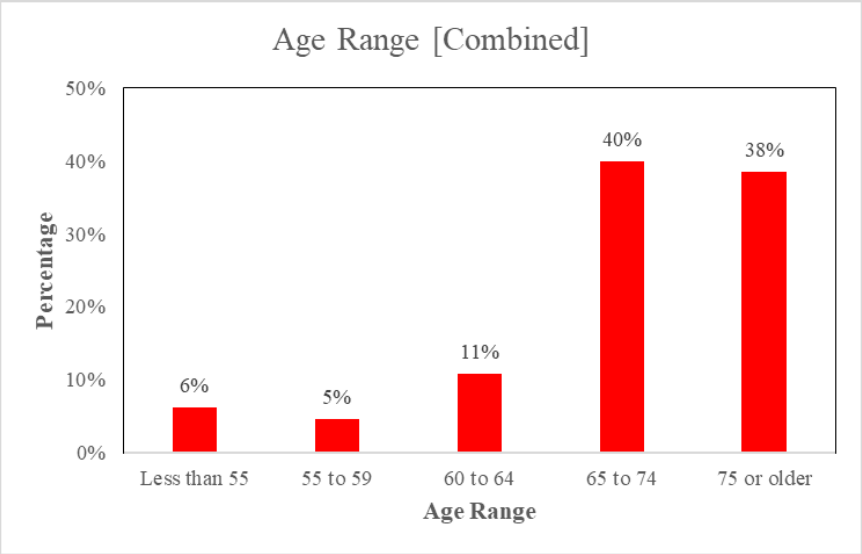


Figure 58. Age range [all responses].

D.5. Gender

What is your gender?

In this question, participants were asked to select the answer choice for their gender. There were only two answer choices: male or female. Results are presented below in **Figure 59**. A majority of survey participants (75%) were females. In the previous survey, it was 69%.

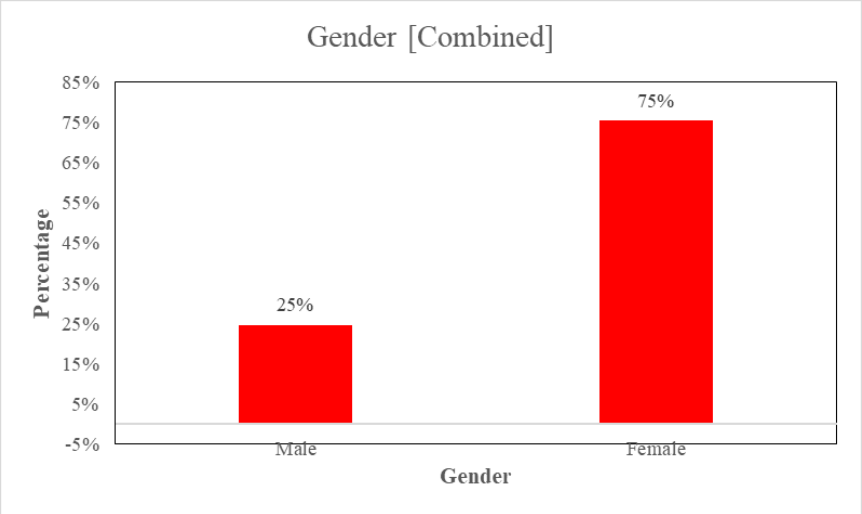


Figure 59. Gender [all responses].

D.6. Electronic Device Used

Do you use any of the following electronic devices? (You may select more than one answer)

This question provided a list of different electronic devices for the respondent to select "yes" or "no" for each of them. The purpose of this question was to gain a better understanding of the market for the application and check the sample profile with the previous survey results. The responses to this question (65 responses) are presented below in **Figure 60**. Almost two thirds (65%) of the participants reported that they use a smartphone, followed by a basic cell flip phone (28%), and a home phone (23%). The results from **Figure 60** provide justification for the previous survey results and evidence that there is a market for a smartphone application for seniors.

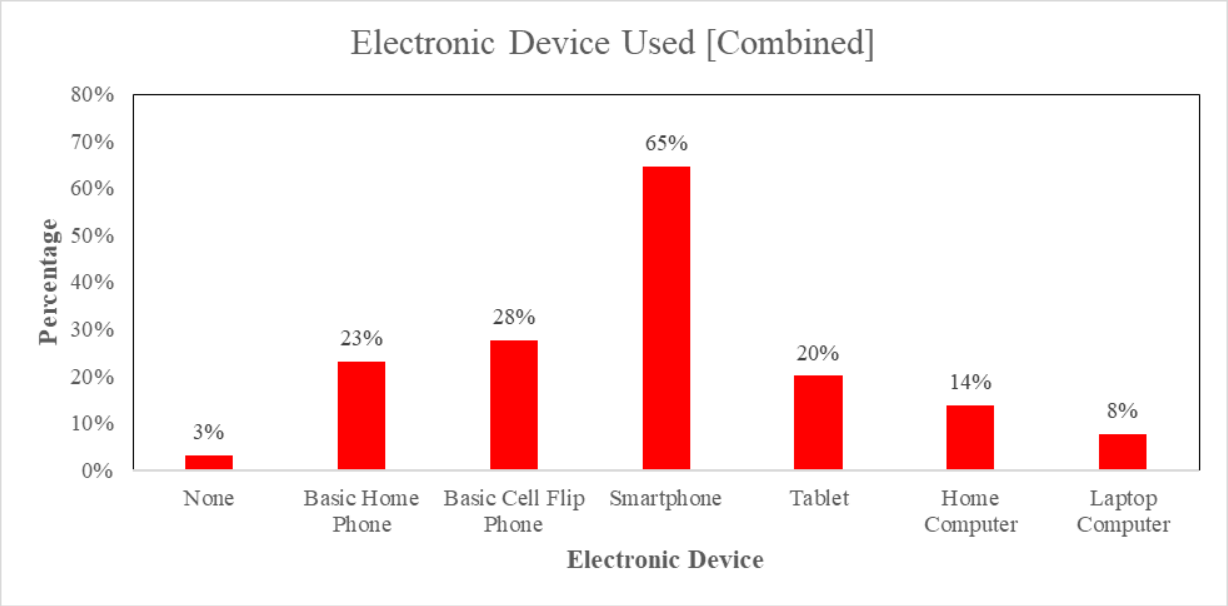


Figure 60. Electronic device use [all responses]

D.7. Assistance to Use Electronic Device

If you selected one or more options, do you need assistance using these devices?

This question was a follow-up question to the question of electronic device use. This question asked the participant if they require assistance to use any electronic device. The purpose of this question was to gain a further understanding of their familiarity with the devices and identify the need for assistance. The combined results from both the English and Spanish responses for this follow-up question are presented below in **Figure 61**. More than half of the total participants reported that they do not

require assistance to use their electronic device (62%). The results from **Figure 61** provide justification that, not only are the seniors using smartphones and other electronic devices, they believe they do not require assistance to use their smartphones and other electronic devices.

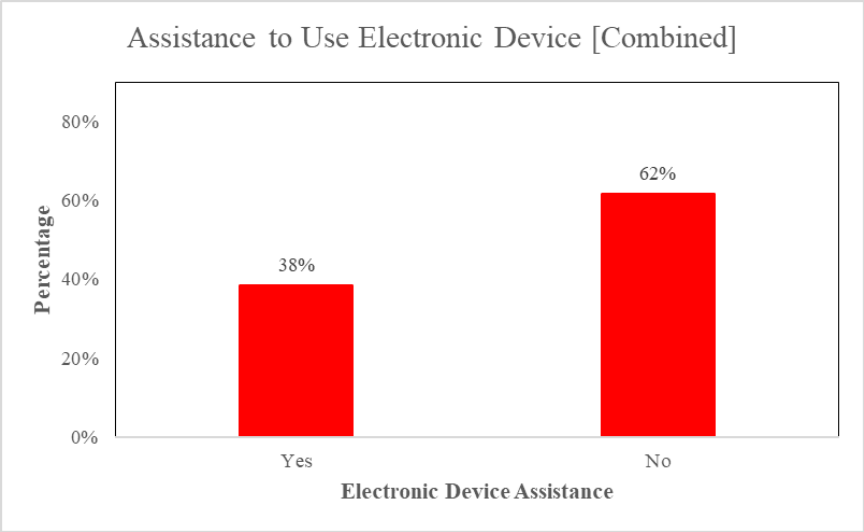


Figure 61. Electronic device assistance [all responses].

D.8. Smartphone Use

What do you do on your smartphone (select all that apply)

This is a question in which the participant can select more than one answer. This question asked about the seniors' use of their smartphones. It asked the participant to select the functions in their smartphones they always used. The combined results from both the English and Spanish responses to this question are presented below in **Figure 62**. The functions, in order from the three most selected functions, are calling (voice), texting and taking photos.

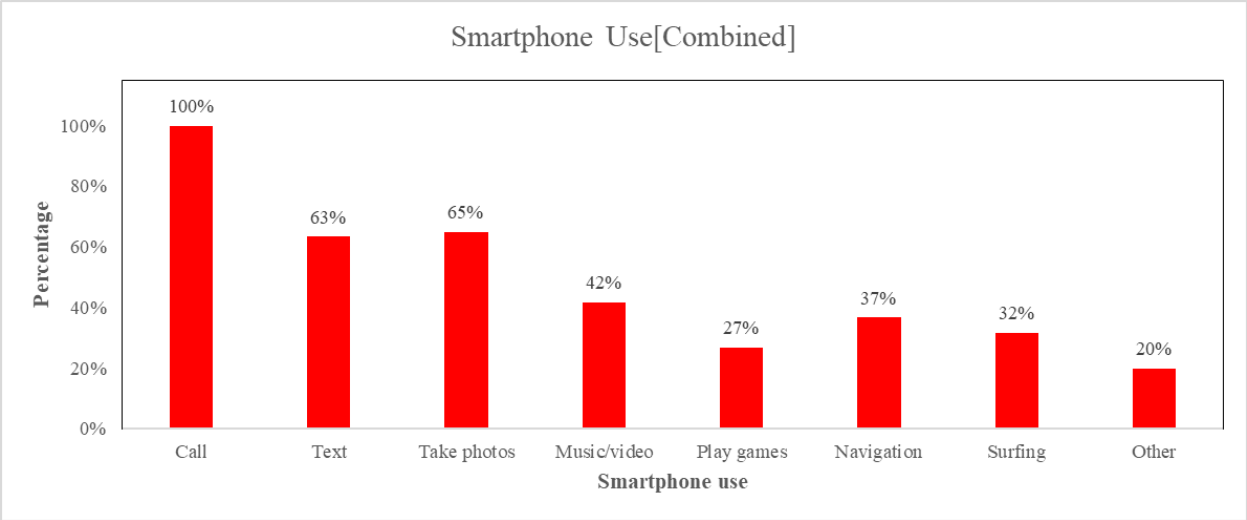


Figure 62. Smartphone use [all responses].

Other Answers

facebook
hobbies
email
email
make payments
none
email,bank,pay bills, create videos
time, location

D.9. Home screen menu

From Question 6 onwards, participants were asked about their opinion and to provide feedback for the prototype Urban Connector application.

The Home Screen menu is easy to use.

The Home Screen is the main menu from which the user can reach all the different services that the Urban Connector application provides. The participants are asked to comment on the ease of use of

this menu. There are 5 choices ranging from strongly agree to strongly disagree. The combined results from both the English and Spanish responses to this question are presented below in **Figure 63**. 25% of the participants do not agree that this menu is easy to use. The most frequently mentioned issue with this menu is the non-adjustable font size.

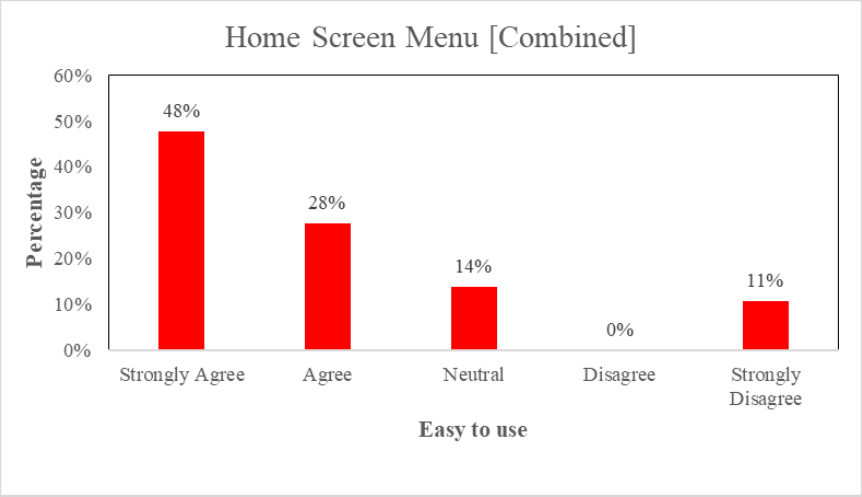


Figure 63. Home screen menu [all responses].

D.10. Frequent Places menu

The Frequent Places menu is easy to use.

The Frequent Places menu allows users to add or remove the locations of frequently visited places. Once a location has been stored, the user will receive alternative routes to the address with the help of the phone's navigation function. The participants were asked to comment on the ease of the use of this menu. The responses to this question are presented below in **Figure 64.** Of the 63 participants, 97% of them agreed or strongly agreed that the Frequent Places menu was easy to use.

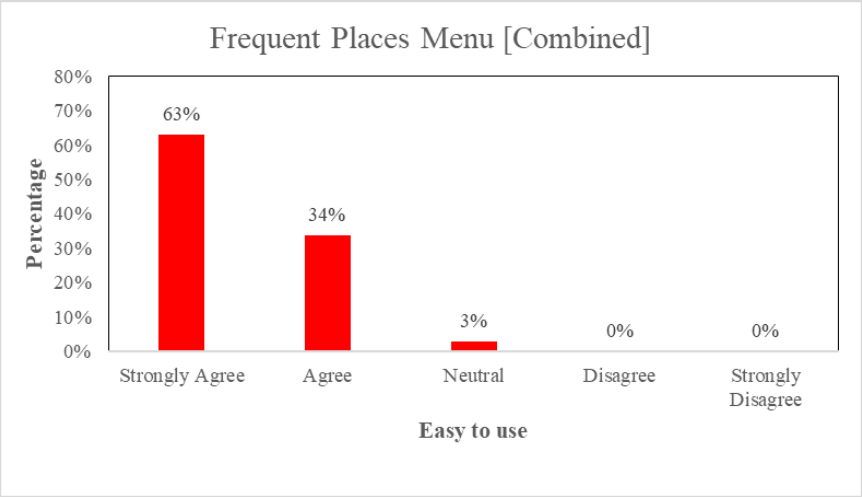


Figure 64. Home screen menu [all responses].

D.11. Transportation Services menu

The Transportation Services menu is easy to use.

This is the menu that links users to the transportation services (City of El Paso, Sun Metro, Sun Metro Lift, Texas Department of Public Safety, etc.). The user can reach the most commonly used web pages for these services from the Transportation Services menu. The participants are asked to comment on the ease of use of this menu. There were five choices ranging from strongly agree to strongly disagree. The combined results to this question are presented below in **Figure 65**. 93% of the participants agreed or strongly agreed that this menu was easy to use.

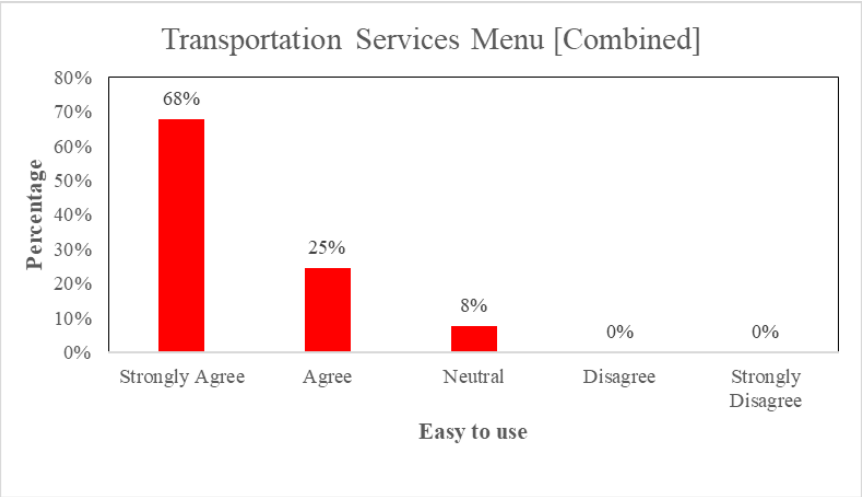


Figure 65. Transportation Services Menu [all responses].

D.12. The Graphic Images

The graphic images (buttons, icons) of Urban Connector Application are easy to understand.

This question asked users` opinion about the intuitiveness of graphic images (buttons, icons) used in the application. There are 5 choices ranging from strongly agree to strongly disagree that the buttons and icons were easy to understand. The combined results from both the English and Spanish responses to this question are presented below in **Figure 66**. 68% of the respondents strongly agreed that the buttons and the icons were easy to understand. Another 25% of the respondents agreed that the buttons and the icons were easy to understand.

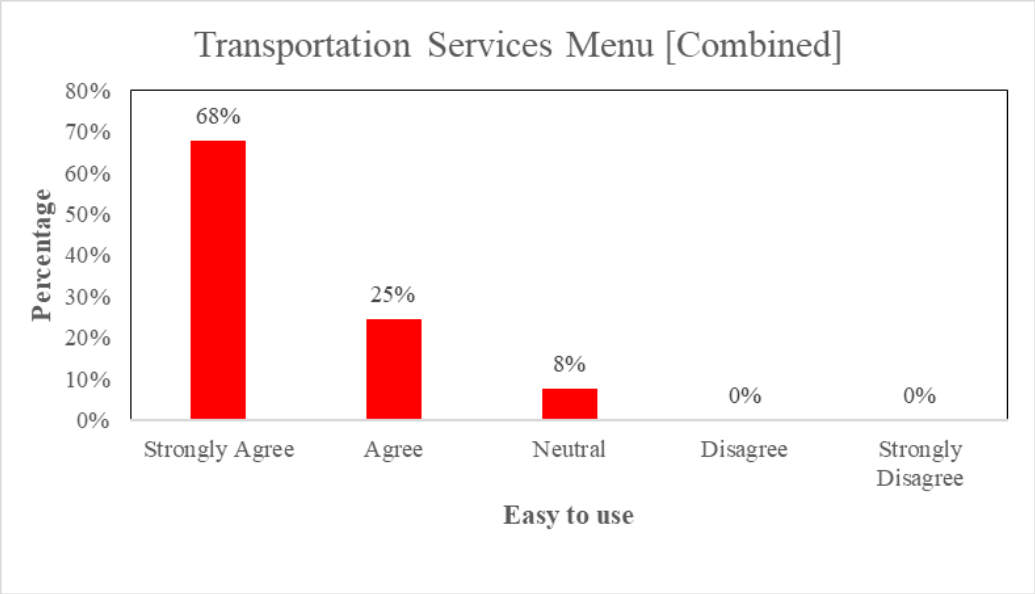


Figure 66. The Graphic Images [all responses].

D.13. Entering Preferences

The prototype Urban Connector application starts with asking users to enter his/her preferences about the application, including the font size, the language and the disability or impairments the user has. Then, the user has the opportunity to enter his or her home address and this address is stored in the Frequent Places menu. Whenever the user clicks the Home icon, the routes to his home address appears on the screen. This question is designed to understand the users' opinion about the ease of entering their preferences.

Entering my preferences on Urban Connector was easy.

There were five choices ranging from strongly agree to strongly disagree to evaluate their opinion about the easiness of entering the preferences. The combined results from both the English and Spanish responses to this question are presented below in **Figure 67**. 86% of the participants reported that entering their preferences were easy and only 3% of the participants reported that it was not easy.

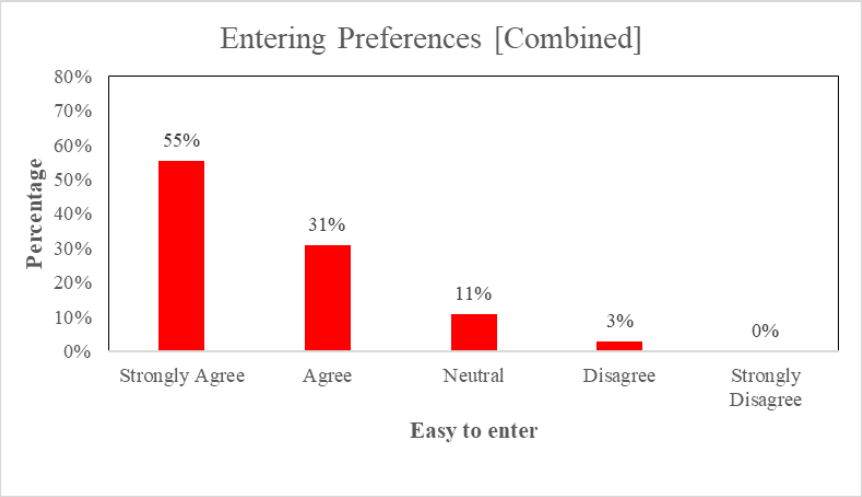


Figure 67. Entering Preferences [all responses].

D.14. Names of Menus

The names of the menus accurately reflect their functions.

This question asked the users if the names of the menus accurately reflect their functions. There are 5 choices ranging from strongly agree to strongly disagree. The responses to this question are presented below in **Figure 68**. 60% of the participants strongly agreed that the names of the menus reflect their functions accurately, while another 35% of the participants agreed with the same statement.

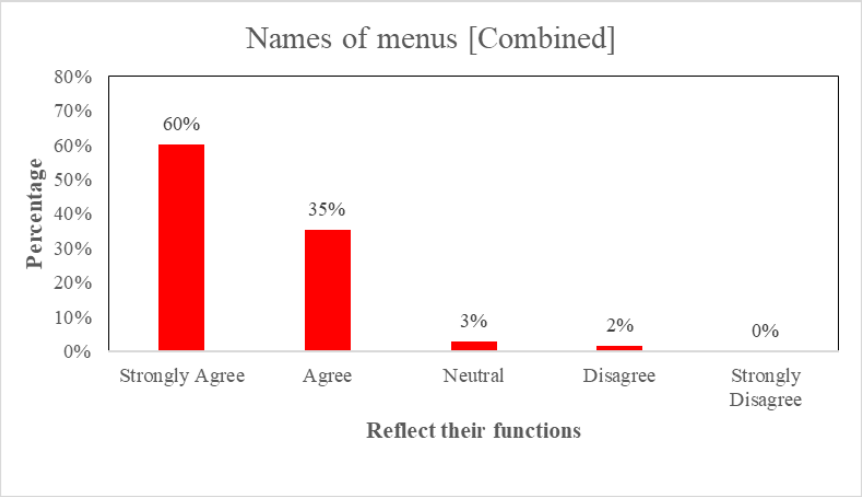


Figure 68. Names of Menus [all responses].

D.15. Size of the buttons and text

The size of buttons and text met my visual needs.

The user has the opportunity to adjust the size of the displayed text in Urban Connector. This question asked if the size of the buttons and the text are large enough, or need to be adjusted to meet the participant's visual needs. There were five choices ranging from strongly agree to strongly disagree. The combined results from both the English and Spanish responses to this question are presented below in **Figure 69.** In total, 95% of the participants agreed or strongly agreed that the size of the buttons and texts met their visual needs.

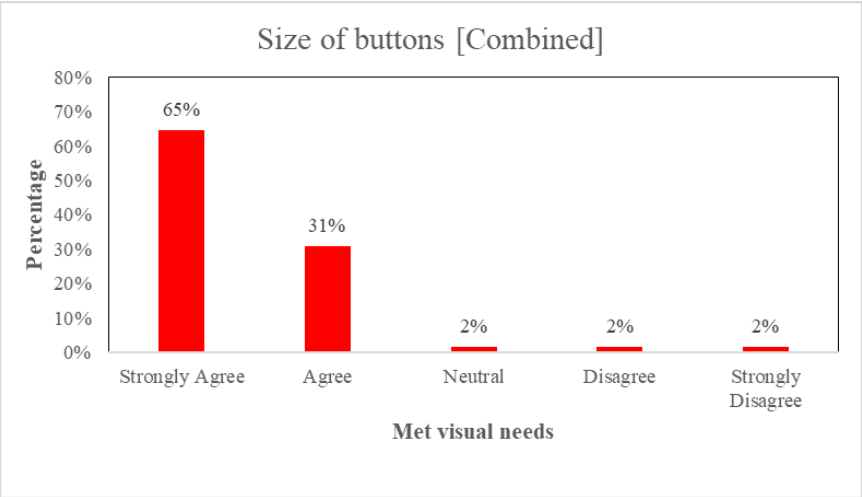


Figure 69. Size of buttons and text [all responses].

D.16. Colors used

The colors used in the application met my visual needs

Although the user has the option to adjust the size of the text, the colors were set by the designer. This question asked the participants if the pre-set colors meet their visual needs. There were five choices ranging from strongly agree to strongly disagree. The combined results from both the English and Spanish responses to this question are presented below in **Figure 70**. In total, 96% of the participants agreed or strongly agreed that the assigned colors met their visual needs.

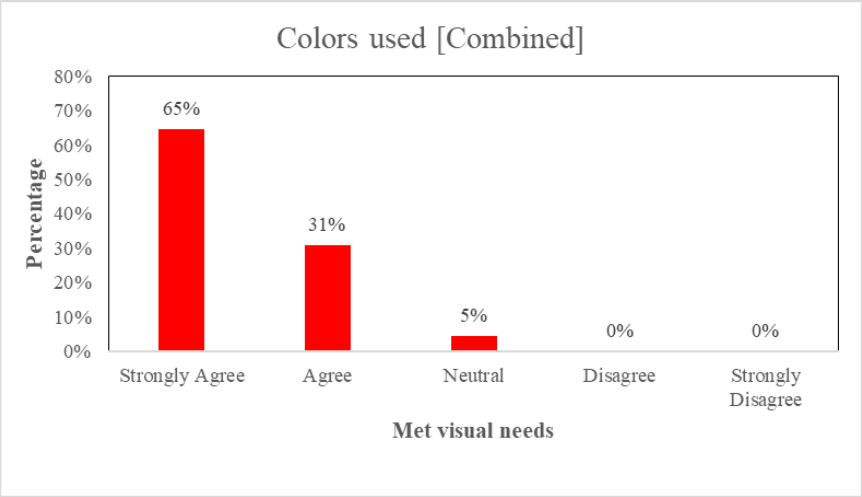


Figure 70. Colors used [all responses].

D.17. Final Evaluation

What would be your rating for the application?

The five-star rating system was used to evaluate the overall performance of the prototype Urban Connector application. This question asked participants to rate the overall impression on the application. There were five different choices, from excellent (5 stars), good (4 stars), average (3 stars), fair (2 stars) and poor (1 star). The combined results from both the English and Spanish responses for this question were aggregated. From all the 55 participants, the average rating was 4.63 stars. This is a good indicator that the overall evaluation of the prototype application was between good and excellent.

D.18. Recommendation of the app to a friend

I would recommend Urban Connector Application to a friend.

If an application is useful, users will naturally recommend it to their friends. This question asked if the participant would recommend this application to a friend. There were three choices; yes, no or not sure at this moment. The combined results from both the English and Spanish responses to this question are presented below in **Figure 71**. In total, 97% of the participants reported they would recommend the application to a friend. Another 1.5% of the participants stated that they were not sure right now and the last 1.5% of the participants stated they would not recommend this application to a friend.

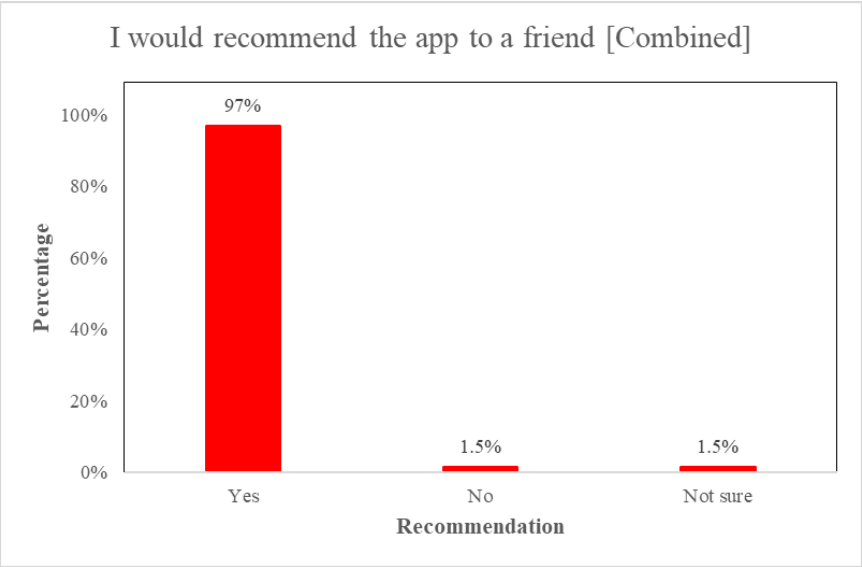


Figure 71. Recommend to a friend [all responses].

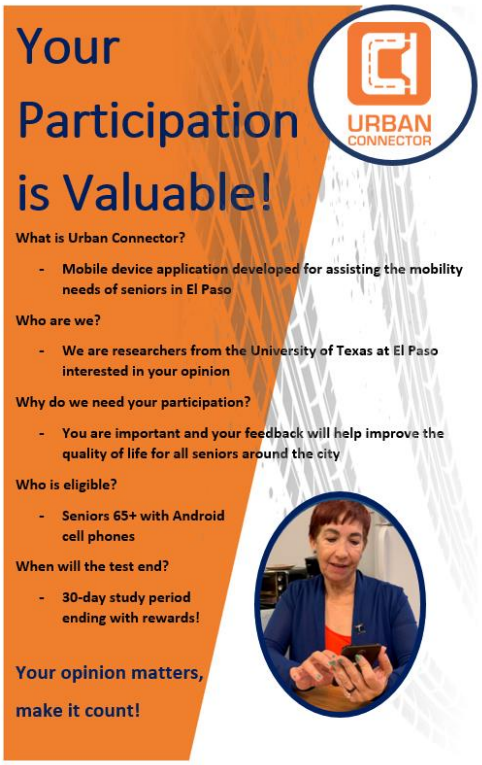
D.19. Suggestions for Improvement

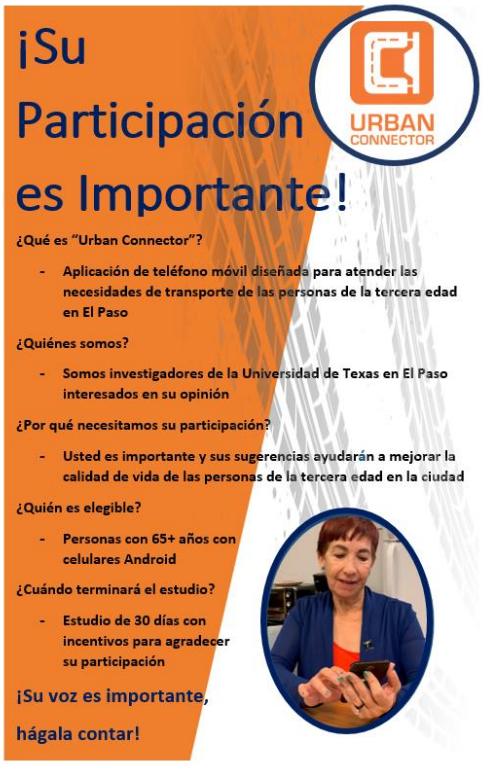
allow images and buttons to be larger. After release someone to come to centers and teach how to use the application
just to need to understand hoe to use the buttons
personalized routes with drivers
option for calling or texting that you add to the list can be good
there should be no limit on number of addresses you can add
trolley and parking information, your location sending to your friends and family members
you have covered everything probably include drug store. medical appointment, information or medical emergency, police department

excellent
it is sufficient, find a way to communicate and explain app to older adults
no pop-up screens when clicking other things
has no internet and use of computers at senior centers
not every seniors have vehicles or smartphones, my advice is sun metro should provide a special bus for seniors,
letras en el menu se quedar chicas avando cambiamos el tamano
come more time to fully explain
mas grandes letras
main menu letters bigger
ayuda a usar aplicacion
ayuda para usar aplicacion y letras mas grandes
easier bus schedules
come and teach, vengan a enseñar todo para preparacion
ofrecer mas ayuda para entenderla
n/a
que vengan a enseñarnos la aplicacion a nuestro telefono
n/a
esta bien, tracker
na, se me hizo suficiente lo que vi y esta bien
more applications for senior citizens
esta bien
brighter color
muy bien
n/a
teach senior citizens how to utilize the application
parece que todo esta bien solo mejorar las letras para que sea mas grande
muy bien todo

n/a
n/a
No hasta que nola vea por completo
perfect
excellent
suggestions of churches, times of metro, direction suggestions
que se termine lo mas pronto posible

APPENDIX E – Usability Survey Infographic Flyer





APPENDIX F – User Usability Survey Results

F.1. Age

The following five questions inquire about the participants' demographics and technological proficiency.

What is your age range?

In this question, participants were asked to select the answer that accurately represented their age. The answer choices included less than 55, 55 to 59, 60 to 64, 65 to 74 and 75 or older. The combined results from both the English and Spanish responses amounted to a total of 38 responses. As seen in **Figure 72**, the highest answer frequency corresponds to the age group of 65 to 74. The majority (79%) of the participants were older than 65. Compared to the age distribution results from the previous two surveys, this survey has the highest rate of over 65 years old senior participants.

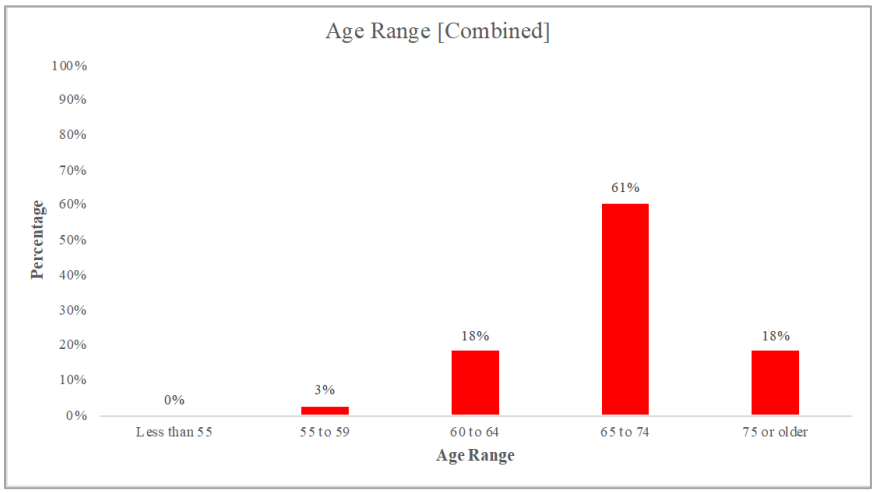


Figure 72. Age Range [all Responses].

F.2. Gender

What is your gender?

This question required the recruited seniors to select the answer corresponding to their gender. The possible selections were either male or female. The combined results are presented in **Figure 73**. It is noted that 79% of the participants were female and 21% were male. Similar to the previous survey results, female participants are more interested in the study.

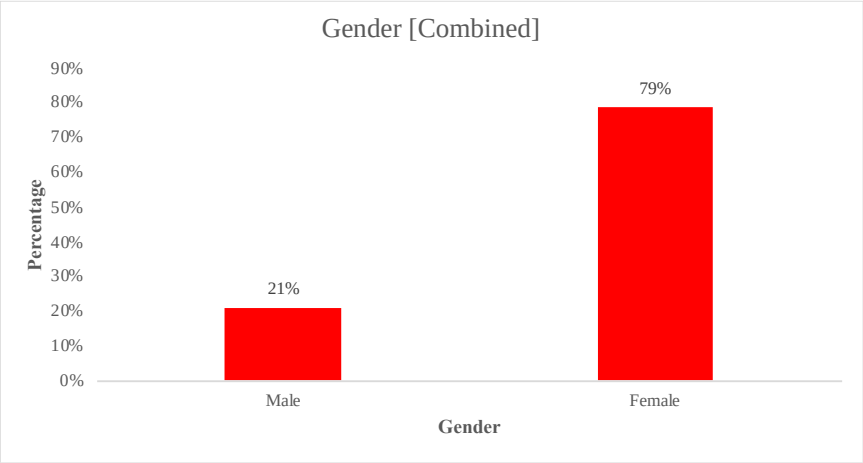


Figure 73. Gender [all Responses].

F.3. Electronic Device Use

Do you use any of the following electronic devices? (You may select more than one answer)

In this question, participants were given a list of electronic devices and were asked to select those they have interaction with. These devices include smartphones, flip phones, and laptop computers. The question was included in the usability survey with the goal of obtaining a better understanding of the participants' technological proficiency. As seen in **Figure 74,** for the combined English and Spanish responses, 100% of them used a smartphone. Other popular electronic devices were tablet at 42% and home computer at 42%. These results differ from the first survey because this survey recruited seniors who had smartphones.

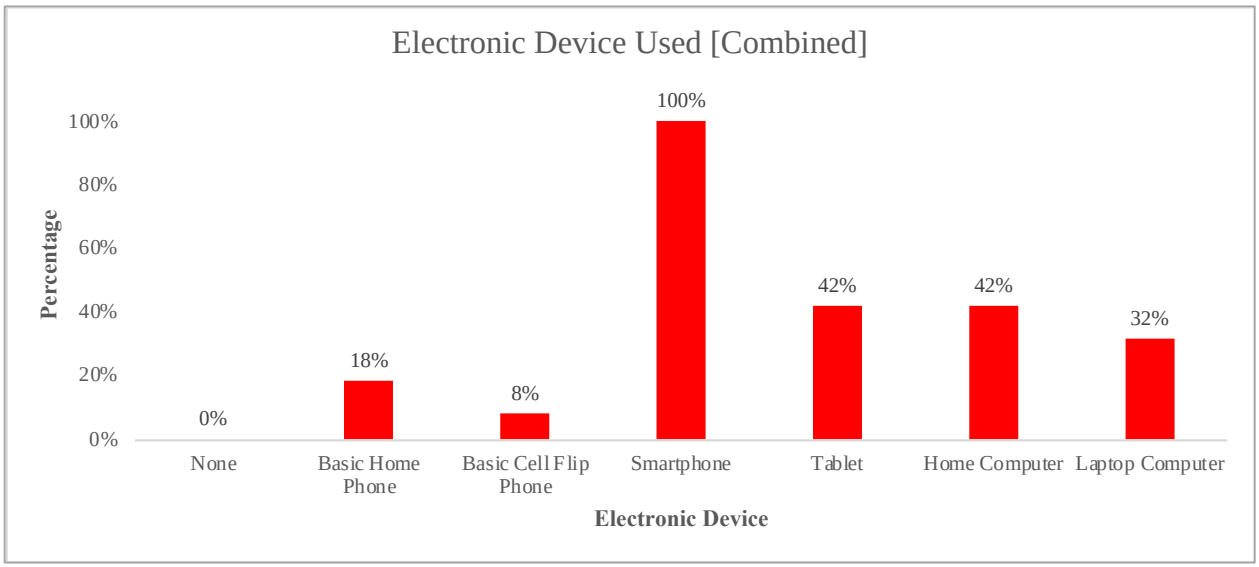


Figure 74. Electronic Device Use [all Responses].

F.4. Device Assistance

If you selected one or more options, do you need assistance using these devices?

This question was a follow-up question to the previous one on electronic device use. This question is intended to gain a better perspective of the sample as well as to identify the need for assistance for those seniors who want to use an electronic device. The combined results from both the English and Spanish responses to this question are represented in **Figure 75**. About 55% of the participants did not need any assistance and 45% of participants needed assistance when using electronic devices. This may be interpreted as seniors using a new application in their devices are more likely to seek technical support.

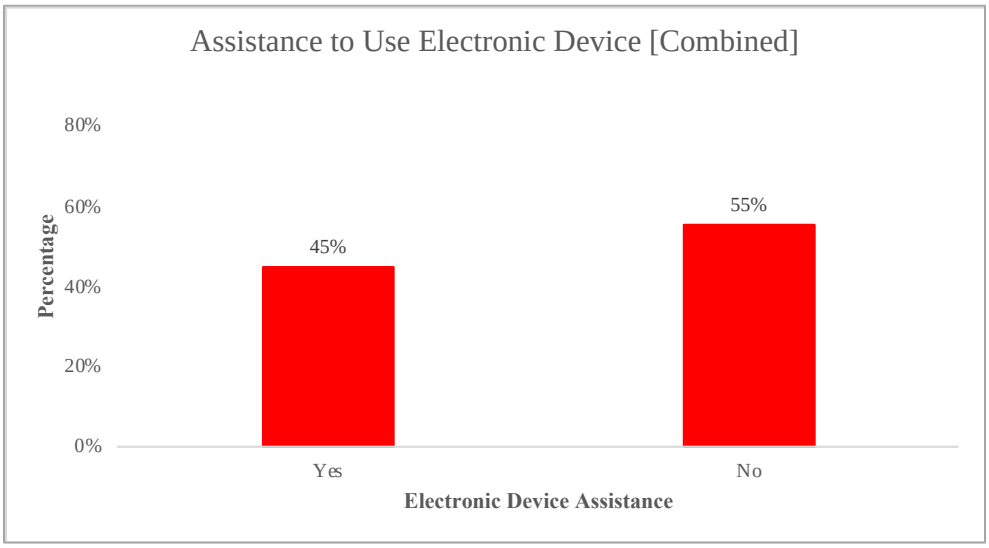


Figure 75. Device Assistance [all Responses].

F.5. Smartphone Use

What do you do on your smartphone? (Select all that apply)

This question allows for multiple selections. The purpose of this question was to gain a better understanding of the capabilities of the senior in using smartphones through the usage pattern. The combined results from both the English and Spanish responses to this question are presented in **Figure 76**. Smartphones are used by 100% of the participants for calling and 89% for texting, followed by 84% for taking photos. Only 61% of the participants used their smartphone for navigation purposes.

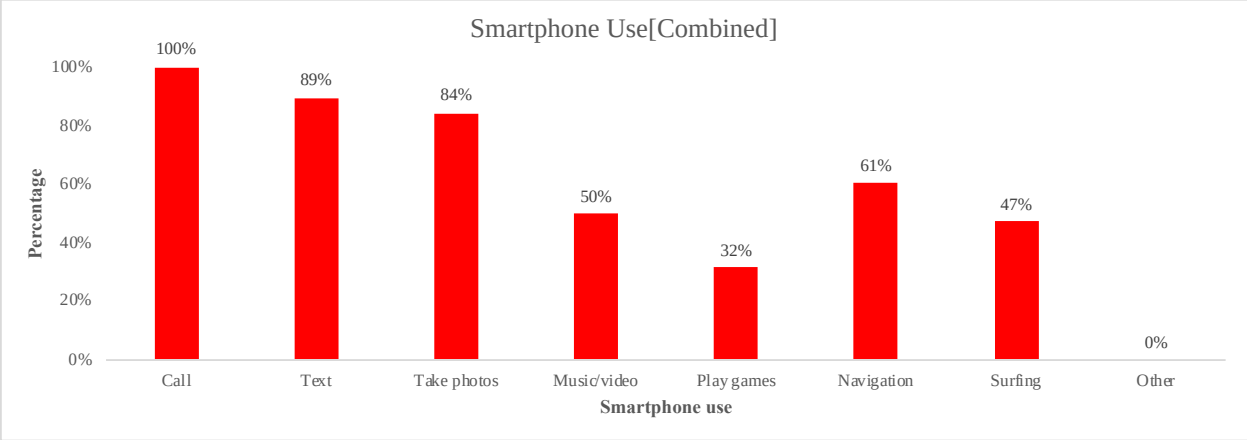


Figure 76. Electronic Device Use [all Responses].

F.6. Application Use

The following ten questions inquire about the participant's interaction with the Urban Connector application in general.

How often did you use the Urban Connector application since the installation?

This question refers to the frequency of the participant's interaction with the application. Users were asked to select the option that best fits their usage of the Urban Connector. A total of 38 participants provided answers. **Figure 77** presented below shows that on average, at least 92% of the participants used the application at least once per week.

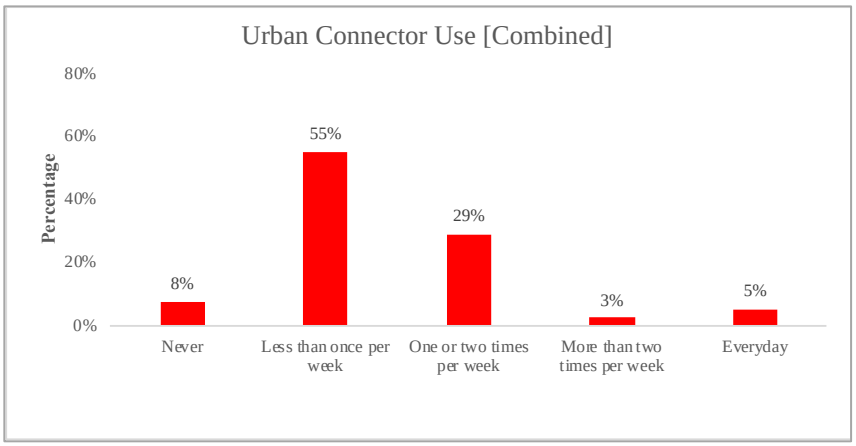


Figure 77. Application Use [all Responses].

F.7. Reason of Use

What was the reason you used/did not use the application?

This question allows seniors to provide open-ended feedback based on their personal opinion as to why they did/did not utilize the application. The response statements are listed and grouped into five main reasons. The combined results of this question are presented in **Figure 78**. Navigation resulted in the most answered response with 38% of participants saying this was why they used the application. 13% of participants mentioned they did not use the application because it did not work.

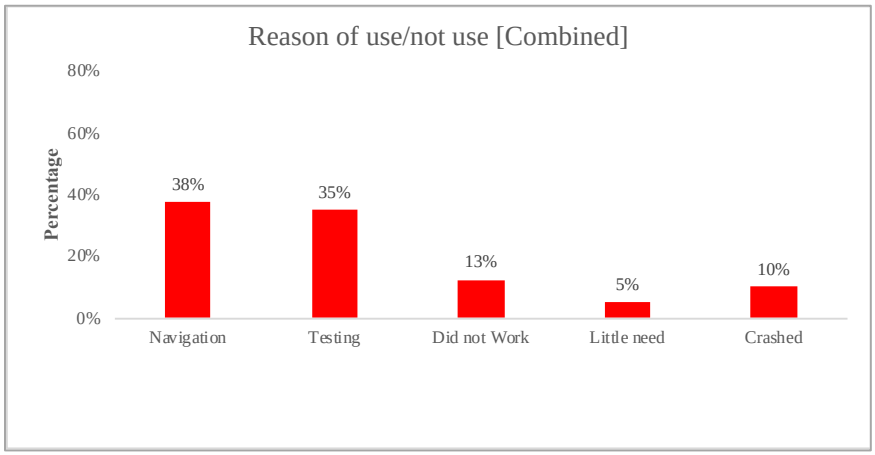


Figure 78. Usage Reason [all Responses].

F.8. User Preferences

The following eight questions required the participants to rate their level of agreement with the statements. They were prompted to select their answer based on the following options: Strongly agree, agree, neutral, disagree or strongly disagree.

When you started using the application, entering your preferences (selecting the font size, language, and impairments) and your home address were easy.

In this question, participants were asked to enter their level of agreement with the statement that entering their preferences for the application's graphics, as well as their personal user information, was easy. The combined results were given by 38 participants, and are presented in **Figure 79**. The results demonstrate that more than 90% of the participants strongly agreed or agreed it was easy to enter their user preferences.

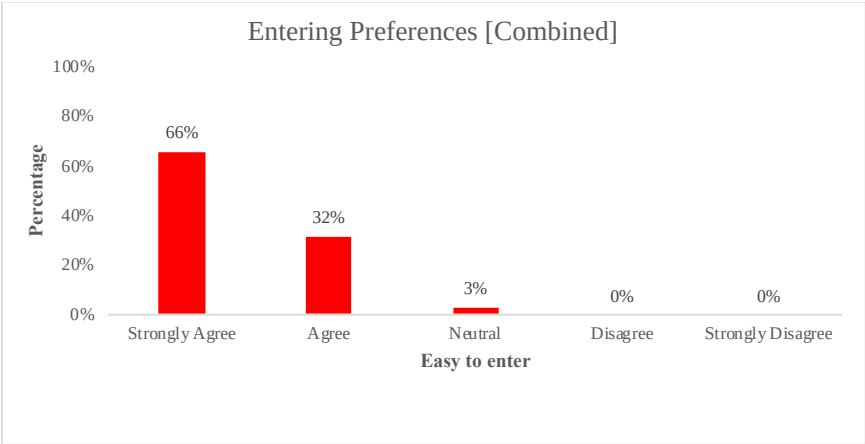


Figure 79. User Preferences [all Responses].

F.9. Frequent Places Menu

The Frequent Places menu is easy to use.

The Frequent Places menu allows the Urban Connector users to input the addresses of their most-visited locations, such as their personal address or that of friends, family members, stores, etc. Once a location has been stored, end-users will be shown routes from their current location to these locations by tapping on the menu's graphical icons. This question prompted the seniors to evaluate how easy it was to use the Frequent Places menu. The combined results from both the English and Spanish participants for this particular question are presented below in **Figure 80**. Overall, there were 38 participants and 82% of them reported that the menu was easy to use. There was 10% who disagreed or strongly disagreed.

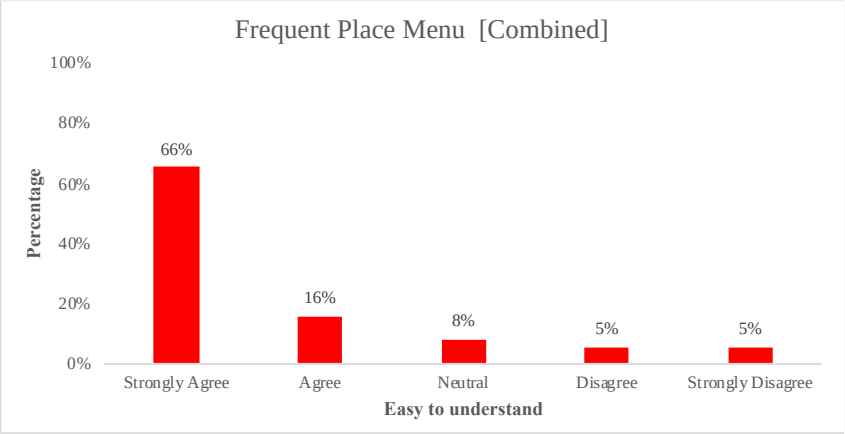


Figure 80. Frequent Places Menu [all Responses].

F.10. Home Screen Menu

The Home Screen menu is easy to use.

The Home Screen menu is the main menu where Urban Connector users have access to different options, including the City of El Paso's transportation services. The participants were asked to comment on the main menu's ease of use. The combined results from both versions of the survey were analyzed by plotting **Figure 81**. Sixty-eight percent (68%) of all the participants strongly agreed or agreed that the Home Screen menu was easy to use. Those who disagree or strongly disagreed made up 16% of the respondents. They commented that the font size should be larger.

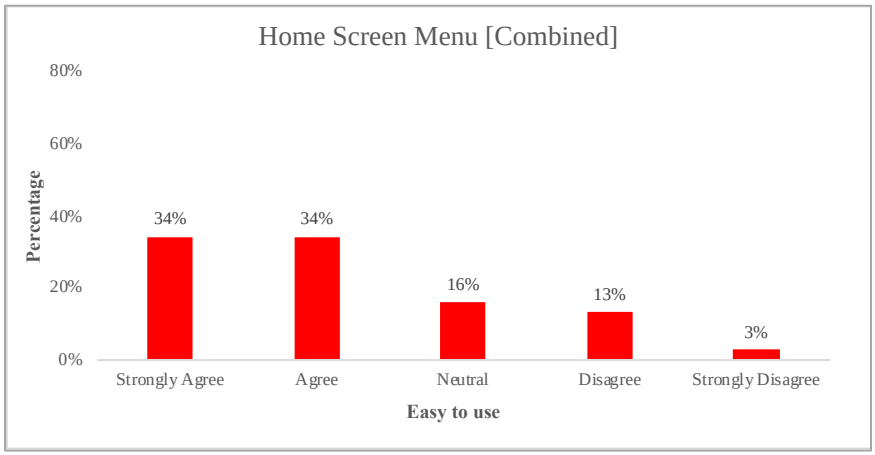


Figure 81. Frequent Places Menu [all Responses].

F.11. Graphic Images

The graphic images (buttons, icons) of the application were easy to understand.

This question asked participants to comment on the intuitiveness of the graphical images presented within the Urban Connector applications. Specifically, they were required to take into consideration if the home, family, store, and other icons within the application were easy to understand. For example, if it was easy to understand that tapping the Home icon in the Frequent Places menu would provide users with a route to navigate to the address stored under the tapped icon. The combined results for both the English and Spanish versions of the survey for this question are presented below in **Figure 82**. Of all the 38 participants, 82% of participants strongly agreed or agreed that the graphic images were easy to understand. On the other hand, 10% of the participants disagreed or strongly disagreed.

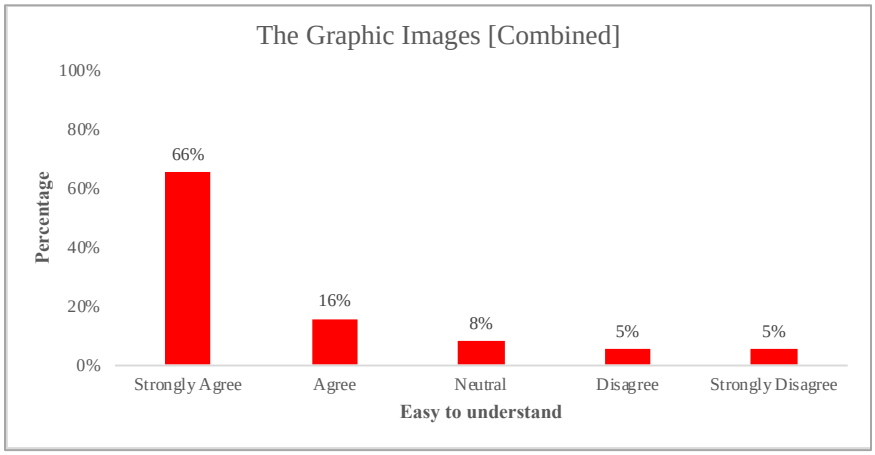


Figure 82. Graphic Images [all Responses].

F.12. Entering Addresses

It was easy to add your family members and friends' addresses in the Frequent Places menu.

This question asked participants to comment on how comfortable their experience was when inputting their addresses in the Frequent Place menu. As mentioned previously in question nine, this menu offers users the flexibility to enter the addresses of their most-visited locations. The combined results for this question for both the English and Spanish version of the survey are presented below in **Figure 83**. Half of the participants agreed that entering their preferences was easy. A total of 32% of participants found it difficult to input family members' and friends' addresses.

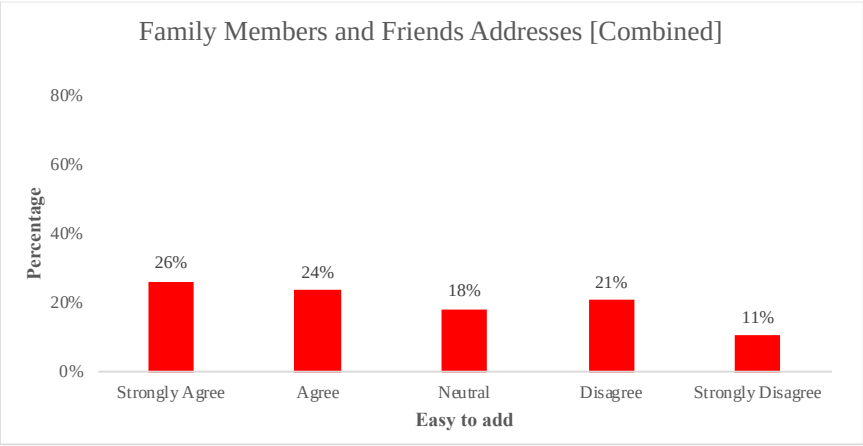


Figure 83. Entering Preferences [all Responses].

F.13. Disorientation

Your fear of getting lost is reduced with the use of the application.

The results from the previous surveys from both El Paso and New York demonstrated that seniors commonly experience fear of getting lost or disoriented, which directly hinders their mobility. In this question, participants were asked if they agree that the fear of getting lost is reduced with the use of the Urban Connector. The combined results for both the English and Spanish responses are tabulated in **Figure 84** below. About 53% of the participants strongly agreed or agreed that their fear of getting lost was reduced by using the application and 21% disagreed or strongly disagreed.

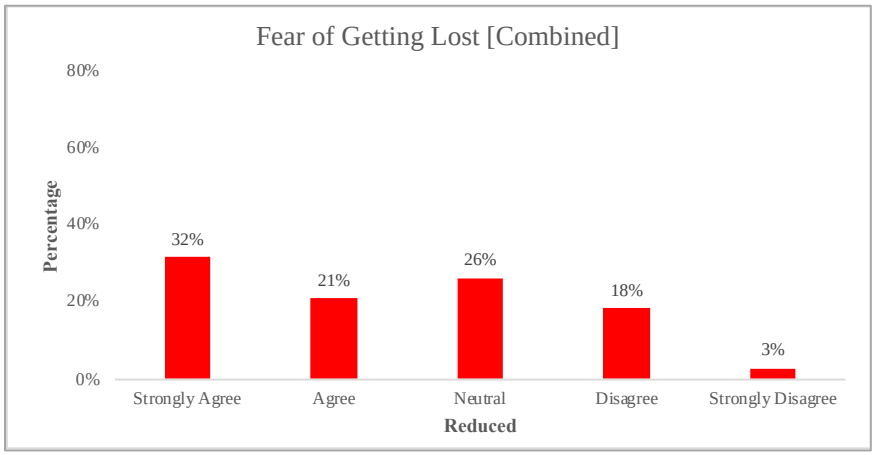


Figure 84. Disorientation [all Responses].

F.14. Traffic Congestion

The Urban Connector application helped you avoid traffic congestion.

This question asked the participants if they agreed that the Urban Connector application helped them to avoid traffic congestion. The combined results for both the English and Spanish responses to this question are presented in **Figure 85**. It should be noted that 52% of the participants strongly agreed or agreed that they avoided traffic congestion by using the application whereas 27% of the participants reported the application did not help them to avoid traffic congestion.

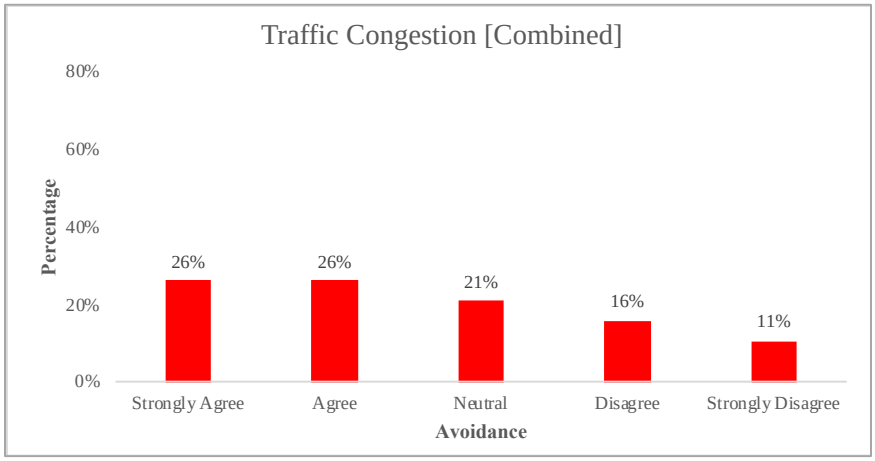


Figure 85. Traffic Congestion [all Responses].

F.15. Late Arrivals

Your concern for arriving late to an appointment is reduced with the use of the application.

The last mobility concern expressed by seniors during the previous surveys was arriving late to their personal events or medical appointments. This question asked the participants if their chance of late arrivals was reduced by using the Urban Connector. The combined results were organized and plotted in **Figure 86**. Approximately 53% of the surveyed seniors agreed that their concern for arriving late was reduced by using the application.

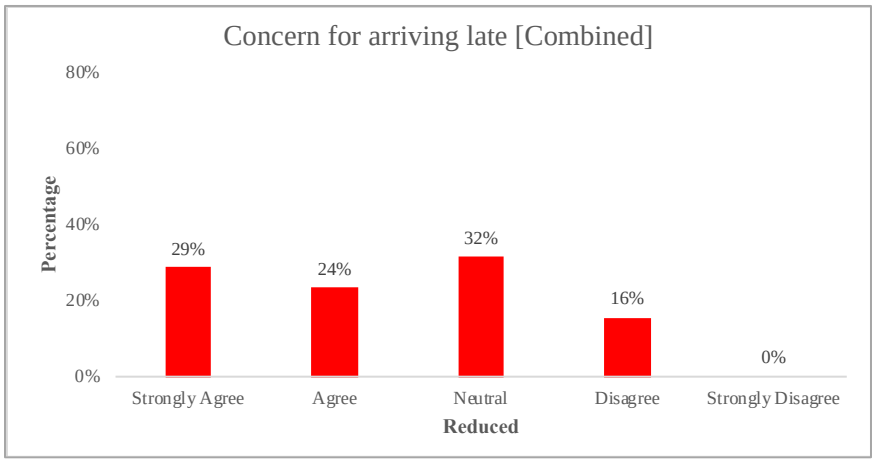


Figure 86. Late Arrivals [all Responses].

F.16. Size of Buttons

The following three questions solicited feedback about the participants' level of agreement with statements about the application's user interface.

English – The size of buttons and text met your visual needs.

Once the application has been installed on the user's personal mobile device, the application will require the user to adjust the size of the buttons and text based on his/her personal preferences. This personalization is necessary to meet the visual needs of the user. This question directly asked participants if the application's size configuration adjustment helped them meet their visual needs. Responses to this question were organized and plotted in **Figure 87**. To summarize, 95% of the participants agreed or strongly agreed that the size of the buttons met their visual needs. Only 6% of participants mentioned that the size of the buttons did not meet their visual needs.

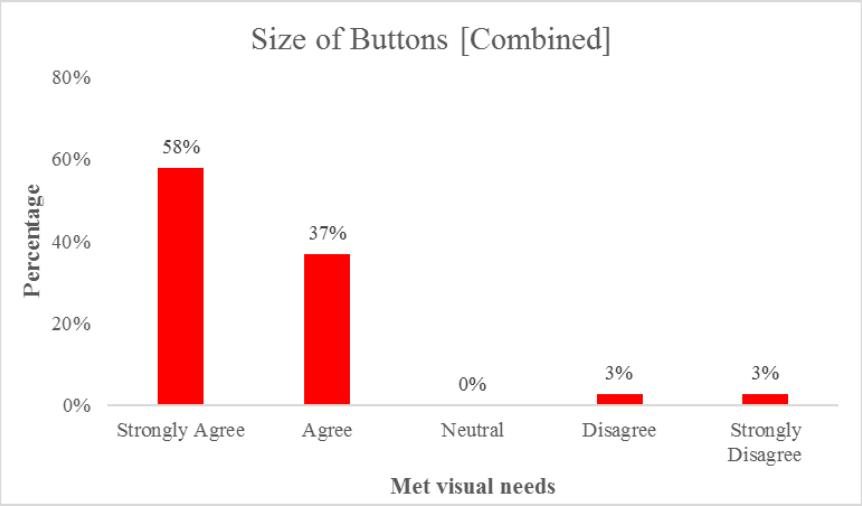


Figure 87. Size of Buttons [all Responses].

F.17. Menu Options

The menu options accurately reflect their functions.

This question was incorporated into the usability survey to measure the accuracy of both the Frequent Places and Home menu functions. As expected, the combined results show the same trend that all respondents agreed that the Frequent Places and Home menu accurately reflect their functions **(see Figure 88)**.

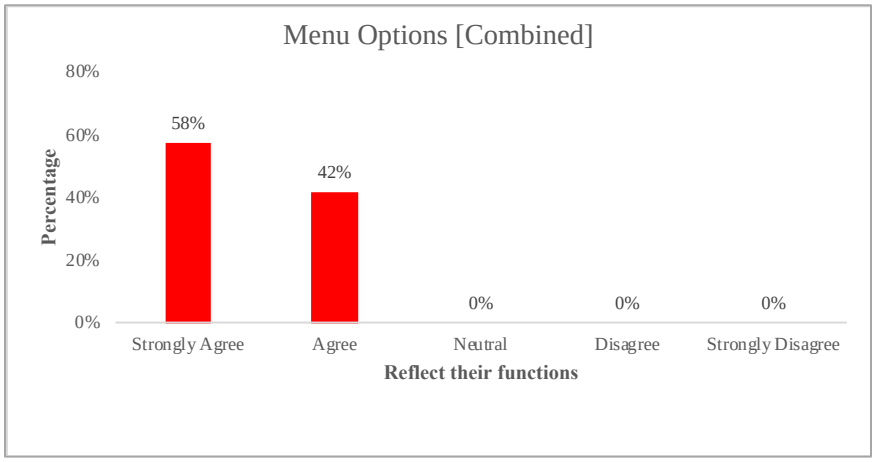


Figure 88. Menu Options [all Responses].

F.18. Visual Needs

The colors, labels, and images used in the application met your visual needs.

Although the user has the flexibility to adjust the size of the buttons and text based on their personal preferences, the colors are standardized. This question required the respondents to state if the selection of colors met their visual needs. The combined results from both the English and Spanish responses for this question were aggregated and are graphically presented in **Figure 89**. A majority of the respondents, at 92%, strongly agreed or agreed that the colors, labels, and images used in the application met their visual needs. There was no disagreement.

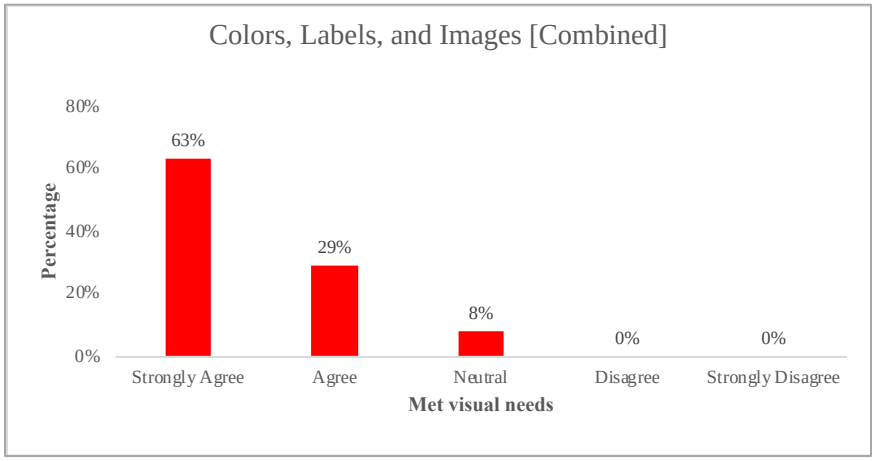


Figure 89. Visual Needs [all Responses].

F.19. Crash/Freeze

The remaining six questions asked the participants to evaluate the Urban Connector application. These questions ranged from yes or no responses to an open-ended format.

Did the Urban Connector application crash or freeze during use?

This question was included in the usability survey in order to obtain a status of the application's stability. The available response choices included from yes- several times, yes-just once, and no. The combined results from all the responses to this question, in both languages, are presented in **Figure 90**. The majority of participants (55%) mentioned that the application did not crash or freeze during use followed by 32% who mentioned it crashed and froze several times. Only 13% of the participants said it crashed only once.

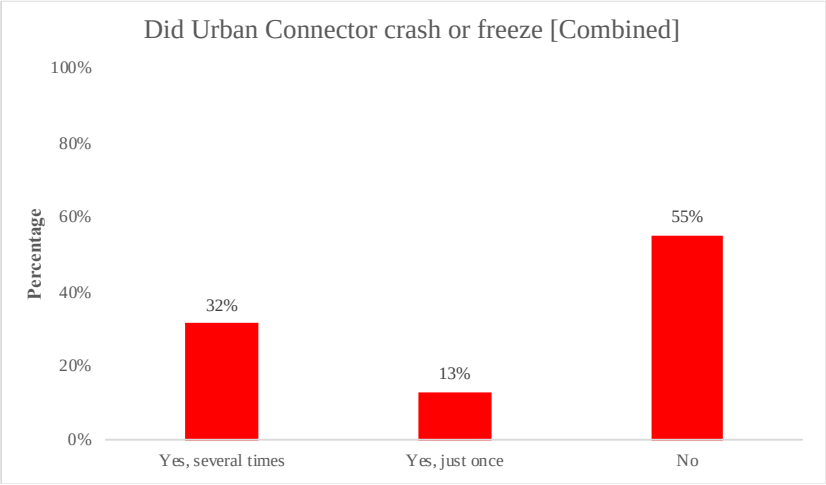


Figure 90. Crash/Freeze [all Responses].

F.20. Fast Learning

Did you learn how to use the application quickly?

During the design process of Urban Connector, the authors alongside the design team envisioned a relatively easy to use application, as the target population is not familiar with mobile applications and technology in general. This question is intended to measure the adaptability of users, taking specifically into account if they were able to learn to use the application in a rapid manner. The combined results from both the English and Spanish responses to this question are presented below in **Figure 91**. Overall, 47% of all participants learned how to use the application quickly. Of the remaining participants, 29% were not sure and 24% did not learn how to use the application quickly.

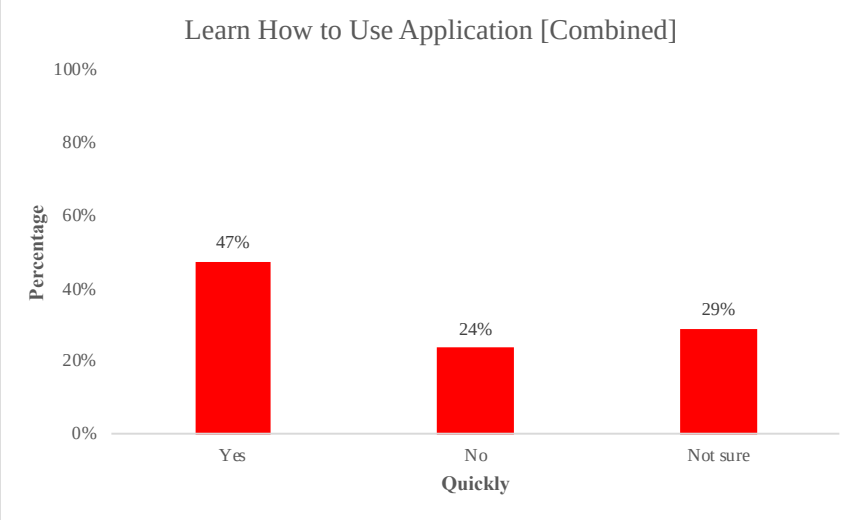


Figure 91. Fast Learning [all Responses].

F.21. Productivity

Does this application help you become more effective and productive in your everyday activities?

This question was incorporated into the survey to understand the benefits experienced by the users. The three possible answers were yes, no, and not sure. The combined results from both the English and Spanish responses to this question are presented below in **Figure 92**. Half of the participants responded that they were not sure if the application helped them to be more productive. This is followed by 42% of the participants who said that the application helped. The last 8% of the participants responded that it did not help.

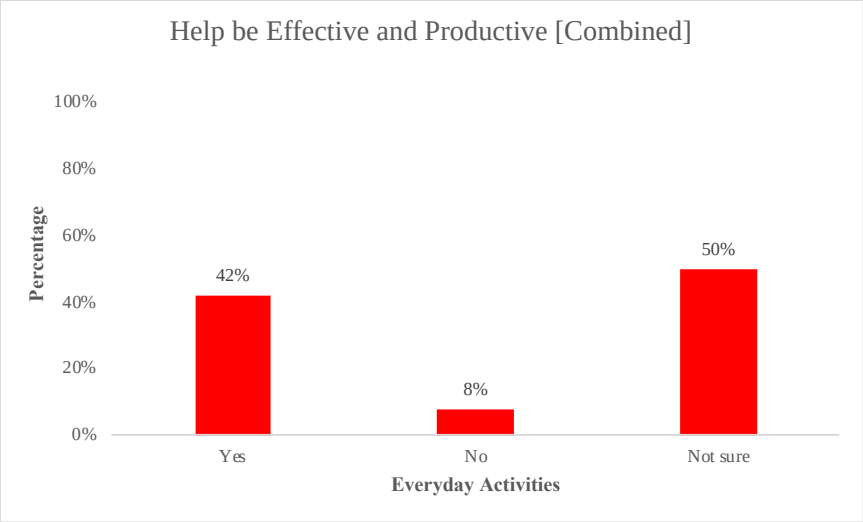


Figure 92. Efficiency/Productivity [all Responses].

F.22. Friend Recommendation

Would you recommend the application to a friend?

To have a better understanding of the usefulness of the Urban Connector application, this question is incorporated to measure the users' inclination to recommend the mobile application to a friend. The question consisted of three possible answer selections including yes, no, and not sure at this moment. The combined results from both the English and Spanish responses to this question are presented below in **Figure 93**. In total, 68% of participants would recommend the application to a friend, while 32% of participants said they were not sure if they would recommend it to a friend. No participant responded they would not recommend it.

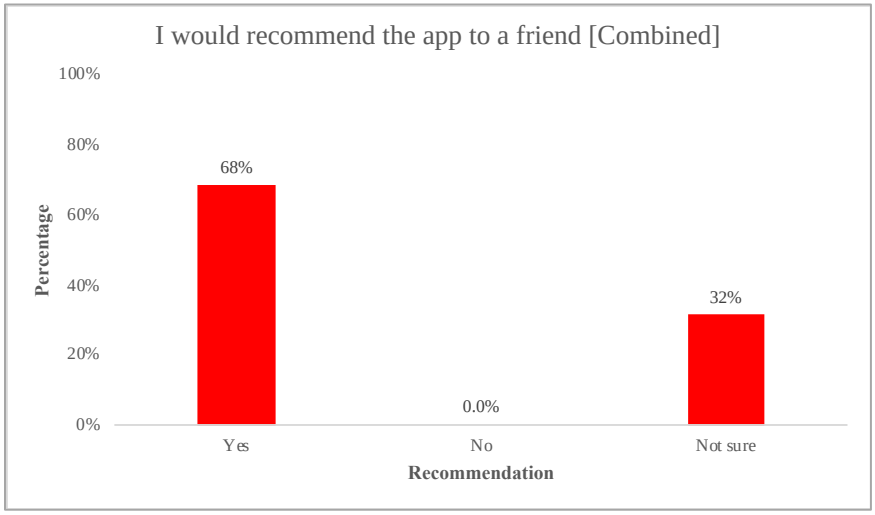


Figure 93 Friend Recommendation [all Responses].

F.23. Application Rating

What would be your rating for the application?

The commonly found 5-star rating system was used to evaluate the participant's overall opinion of the Urban Connector application. This question asked users to rate their overall impression of the product by selecting one of the following choices: excellent (5 stars), good (4 stars), average (3 stars), fair (2 stars) and poor (1 star). The combined results from both the English and Spanish responses for this question was 3.47 stars.

F.24. Features Suggestion

What features do you think we should add to the application?

In order to understand the features that users would like to see implemented in the future versions of Urban Connector, this question invited seniors to provide additional recommendations. The response statements are listed below and have been deliberately left unedited (including spelling and grammatical errors) to capture the users' real input.

- make it easier to use
- Voice activation- like google microphone should send location (current location) to other people There are some icons inactive- they should be functional
- make it simpler explain better how to use it fix the application
- Fix icons to make it work

- Fix application
- Make it work Name of places instead of addresses
- Modifying it to make it work fix icons
- make it simpler
- mimic other existing applications not user friendly make it easier
- Voice command more icons Emergency phone numbers contacts and 911 Be able to locate wherever they are
- Improve icons to work
- Map did not work. it did not ope. it kept on crashing. Explain how to use it better
- Put name intead of addresses because it took me to new mexico instead of texas or make it easier to fill in the address in friends and family icon
- Safest not fastest Piggybacking google- it is making me use google maps
- Work on icons and it would even be more excellent
- Improve icons so they can work
- More icons
- Make it work could not get very far in the app
- We don't need familiar places
- Events happening in the city, and parks
- Name the place instead of addresses More icons
- More icons like going to mall
- Write name of place instead of address More icons (doctor)
- Doctor icon
- Open the icons
- More options/ More icons such as fine arts, theaters, movies, events
- Fix icons make it easier to put addresses on friend and family Name of place instead of address voice activation
- voice command
- Make it easier to see the buttons