Smart-MOBApp: Smart Mobility Ontology-Based App



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CYBER-ShARE

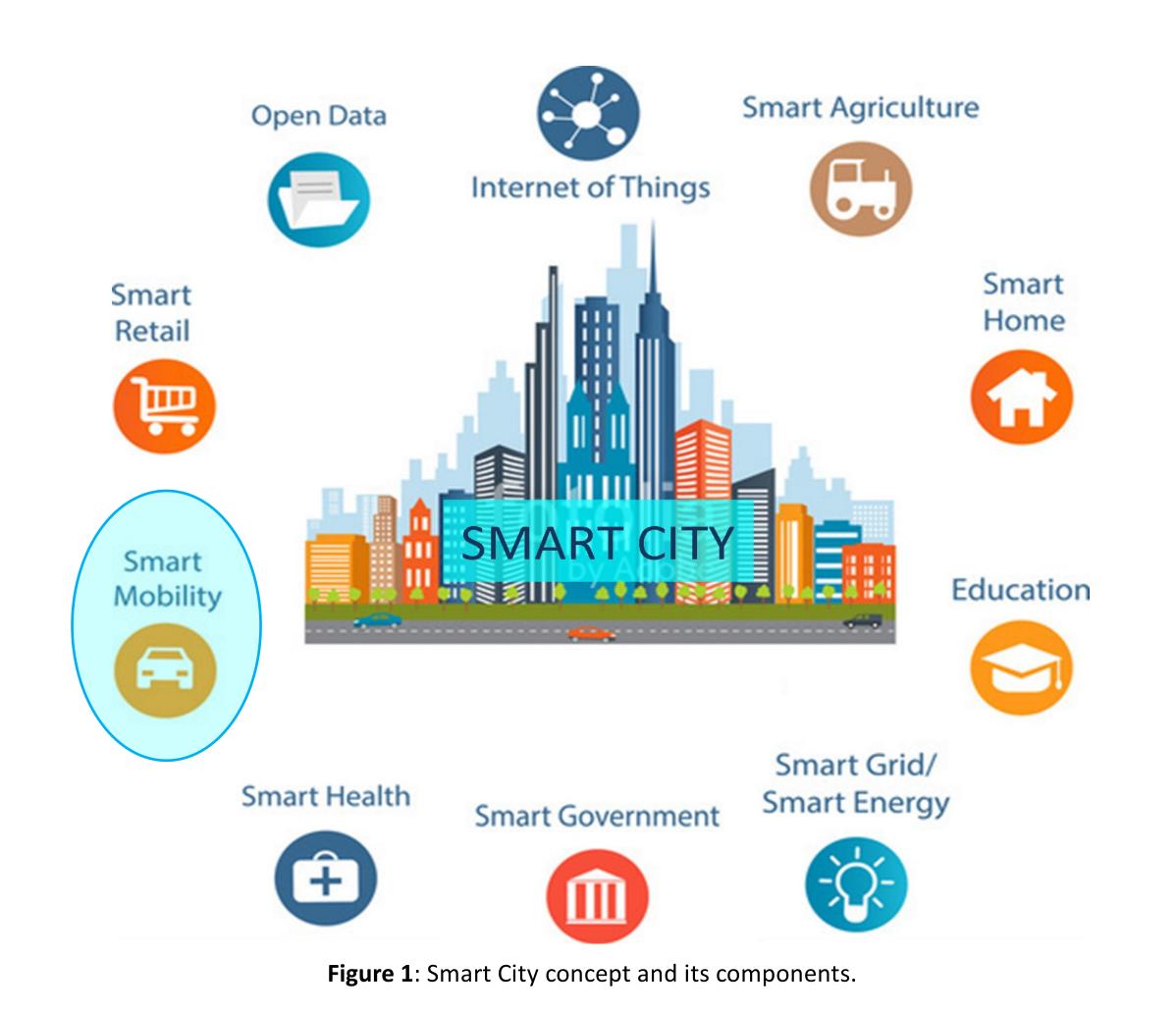
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Abstract and Introduction

In 2014, the number of elderly people was 46.2 million, and is projected to be 72 million by 2030 [1]. Seniors face challenges in their life-style, and indoor and outdoor mobility issues such as obtaining access to some infrastructure system and services (e.g. health care, shopping, and social places/activities)[2]. Their mobility depends on their health conditions and the means and resources available to them.

Background

The goal of Smart Cities is to improve the quality of life its citizens. Our smart mobility approach is user-centered and focuses on understanding and fostering changes in behavior or residents more than changing infrastructure. Our specific contribution is the use of cyberinfrastructure to facilitate the mobility of seniors in urban areas, refer to Figure 1.



Domain



Figure 2: Smart Mobility domain representation for this project.

Problem Statement

Mobility of senior citizens is determined by their existing physical and medical condition. Smart mobility should take into account these issues and use them to make informed decisions for mobility choices, as well as the user's needs (See Figure 2).

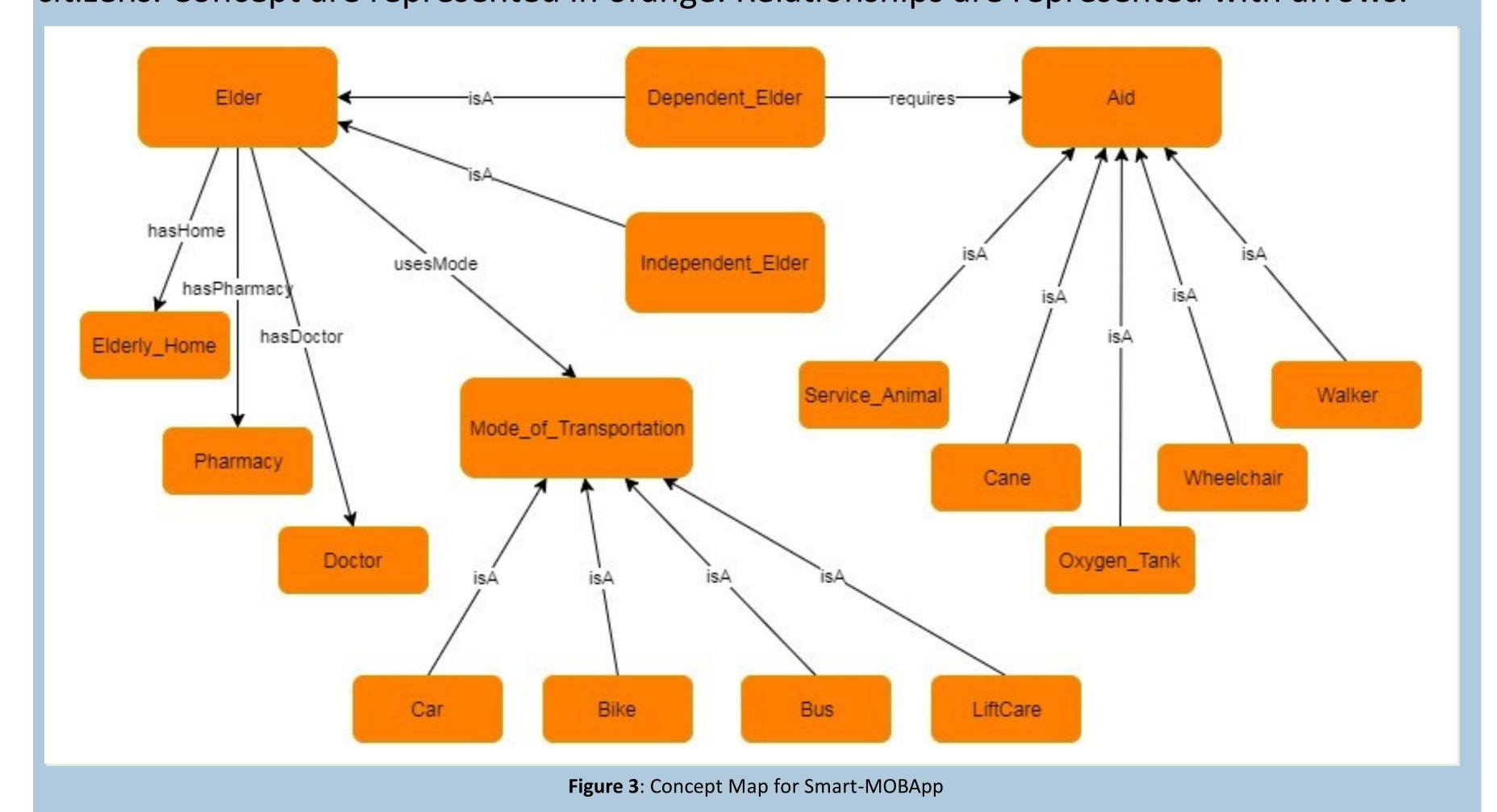
Proposal

We propose the use of an ontology as a high-level data model for the integration of data related to mobility of seniors. Our goal is to create solutions, such as a route recommendations, to facilitate mobility for the elder population to improve their quality of life.

The Smart Mobility Ontology (SMO), which is at the backbone of our senior mobility infrastructure, describes concepts related to the commute of seniors in urban settings.

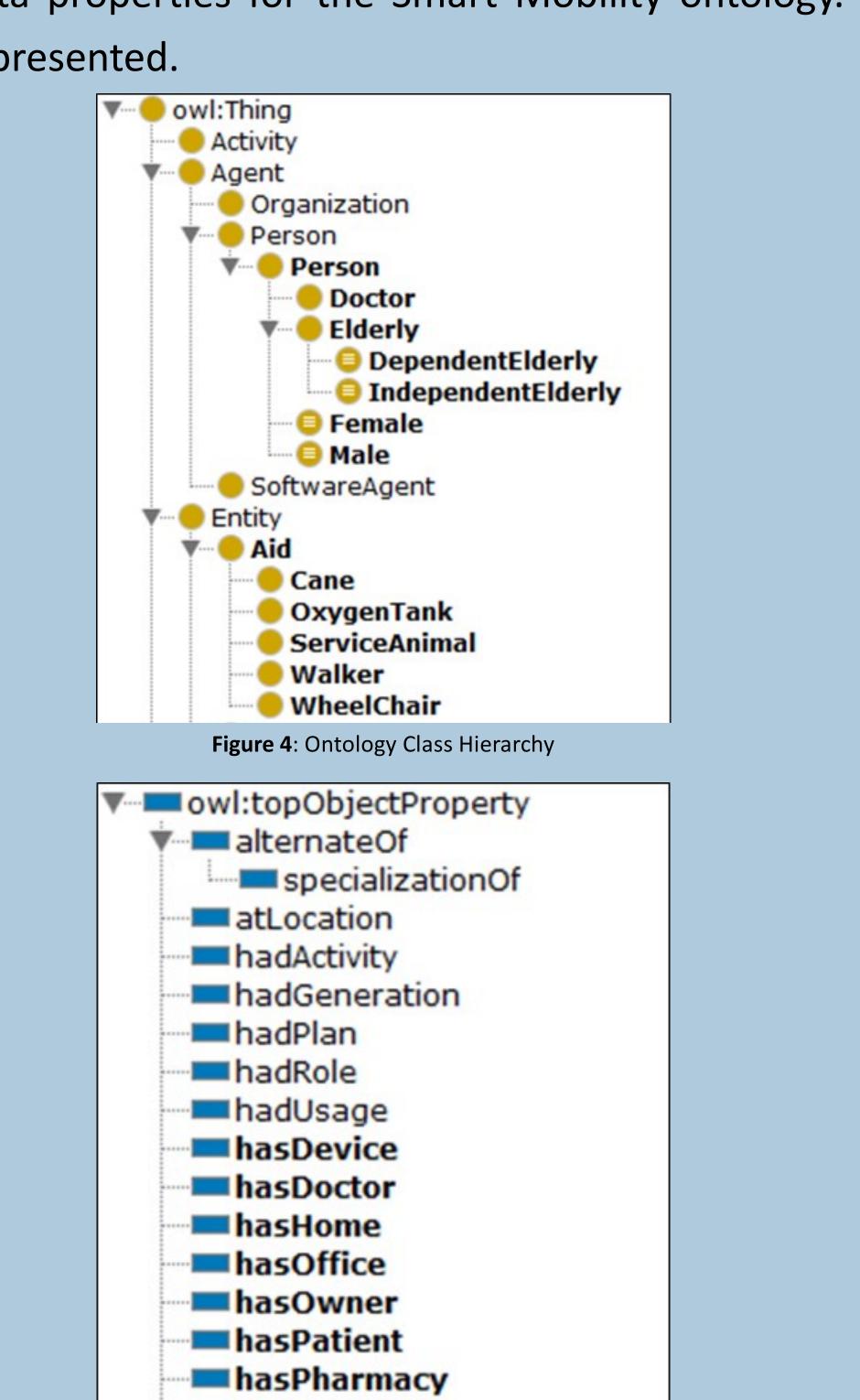
Concept Map

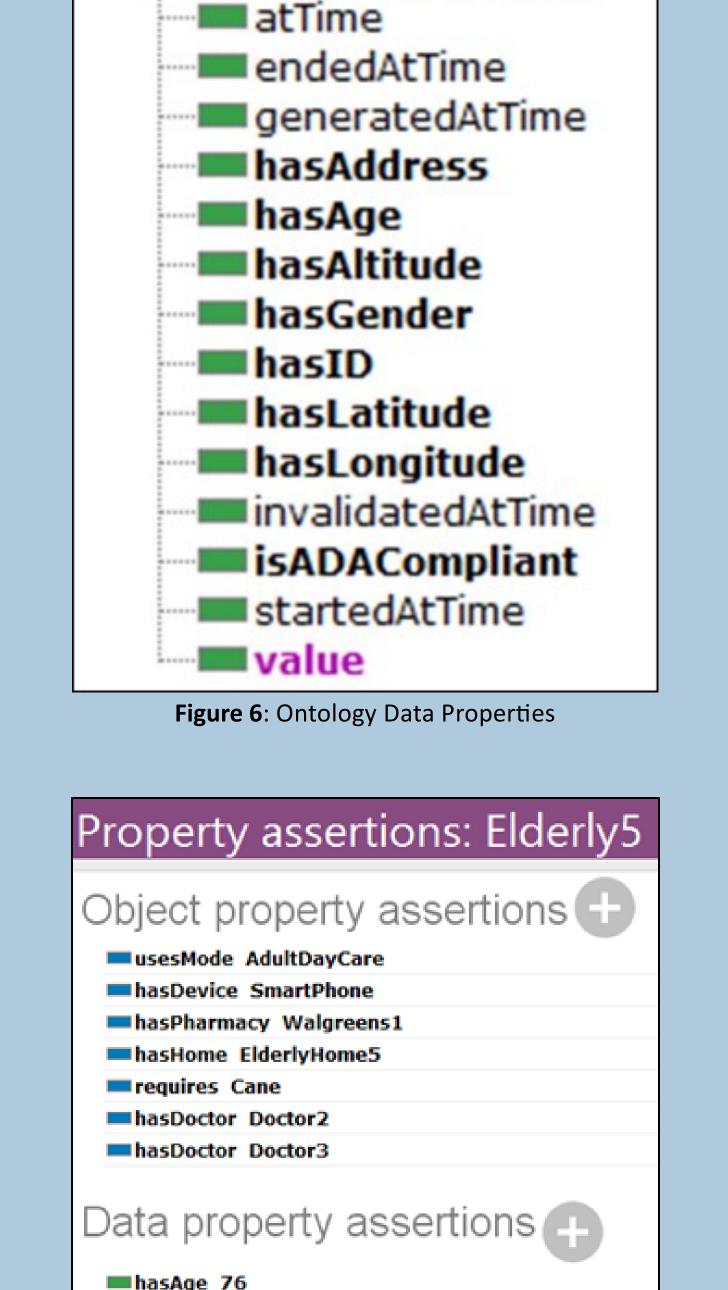
Figure 3 shows the concept map created to describe the domain of mobility for elder citizens. Concept are represented in orange. Relationships are represented with arrows.



Ontology Design

Figures 4, 5, and 6 show the different hierarchies of classes, object properties, and data properties for the Smart Mobility ontology. Figure 7 shows how data of "Elder" is represented.





▼ owl:topDataProperty

System Model

Figure 8 shows the system model for the Smart-MOBApp Project. The Smart Mobility Ontology is mapped to the PROV-O Ontology [3] in order to represent provenance of data. The model is color-coded as follows:

Ontologies are represented in green.

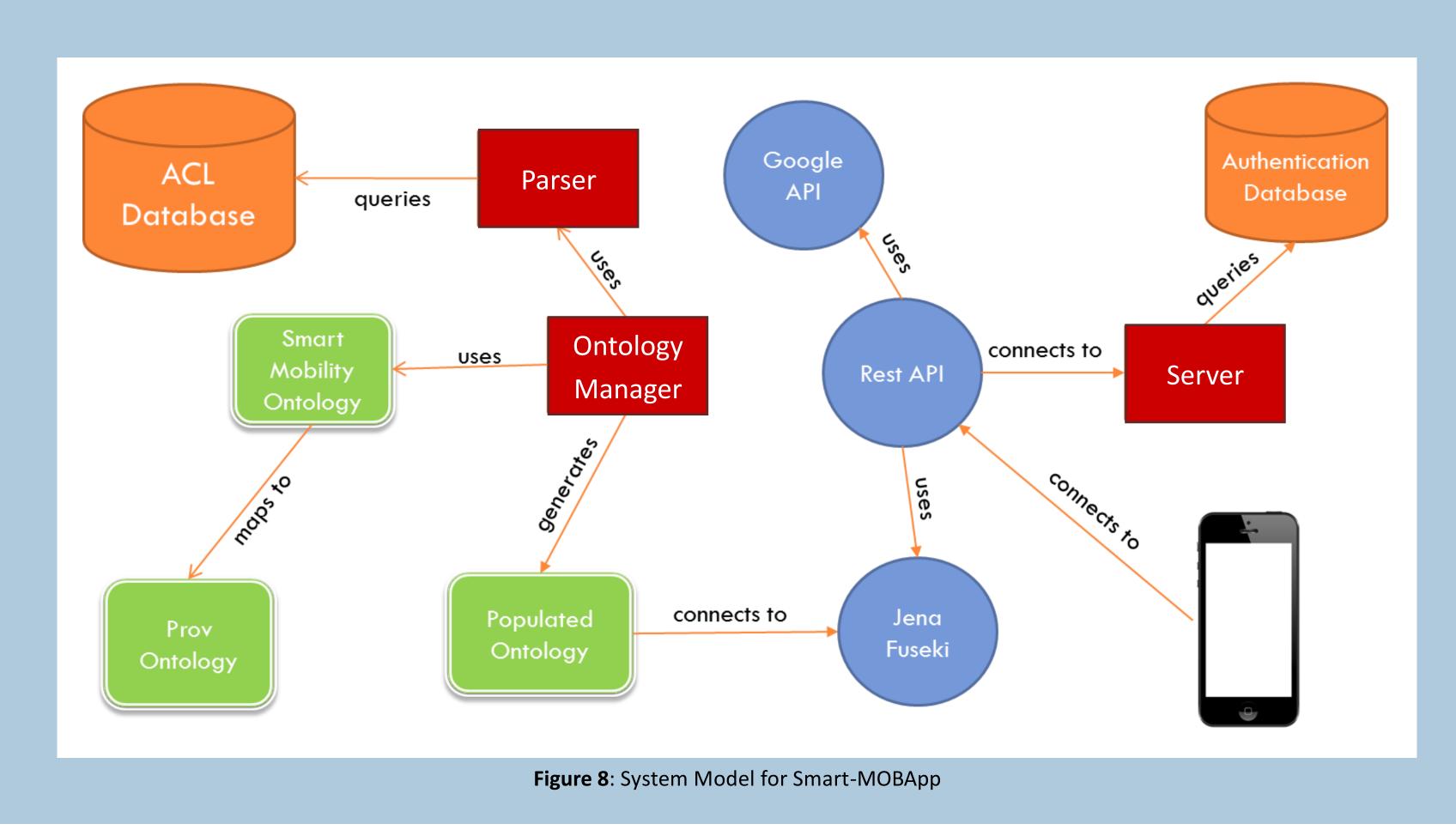
Figure 5: Ontology Object Properties

- Web services are shown in blue.
- Databases are represented in orange.

hasName "Matt Vechione"^^xsd:string

Figure 7: Elder Instance Properties Example

Project software is shown in red.



Competency Questions

SMO was validated with competency questions provided by a civil engineer with expertise in transportation [2], including:

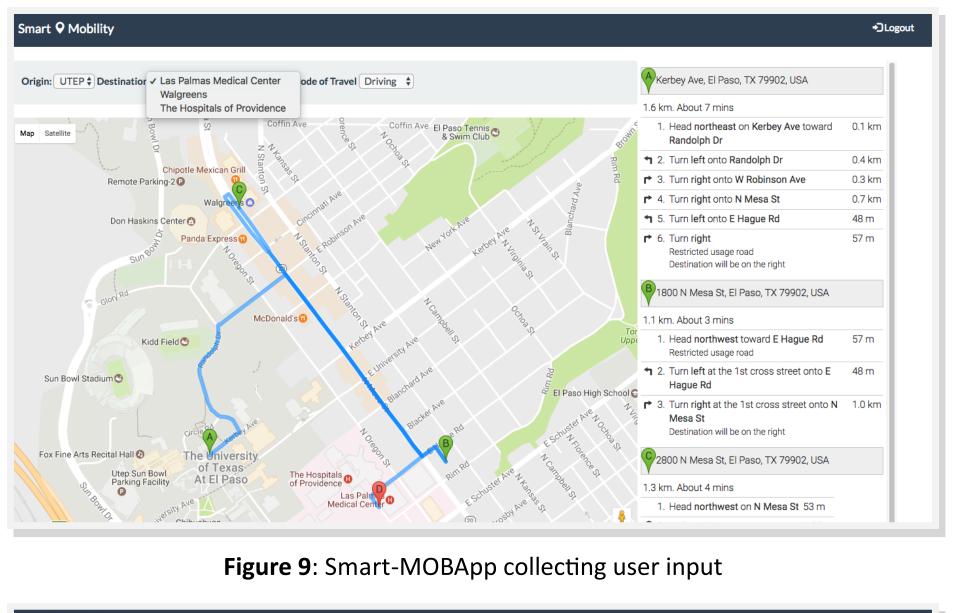
- Which doctor(s) does Elder2 have?
- 2. Is Doctor5's office ADA compliant?
- 3. Which elderly use the bus?
- 4. Which elderly use a smartphone?
- 5. Which elderly require aid?

Query results can be seen in the following section.

Query Results **DL Query** Result **Competency Question** Which doctor(s) does Elder2 Doctor and hasPatient value Elder2 Doctor9 DoctorOffice9 DoctorOffice10 Is Doctor5's office ADA DoctorOffice isADACompliant value DoctorOffice5 compliant? Elder765 Elder766 Which elderly use the bus? Elderly and usesMode some Bus Elder592 Elder763 Elder764 Which elderly use a Elderly and hasDevice some Elder762 SmartPhone smartphone? Elder24 Elder23 Which elderly require aid? Elderly and requires some Aid Elder21

Discussion

A working prototype of the Smart-MOBAapp was created and includes the feature of filtering route results based on user's profile and mobility needs (Figures 9 and 10).



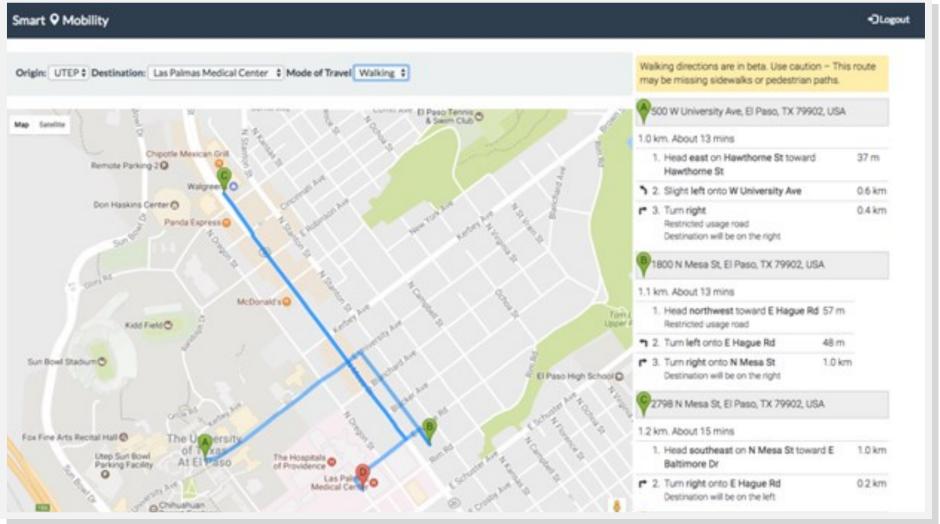


Figure 10: Smart-MOBApp providing personalized results

Future Work

Future work for this project includes:

- Collect survey data from elderly in the El Paso region
- Integrate further data needed to answer questions about senior mobility
- Create prototype of Smart-MOBApp for Android devices
- Conduct usability study of prototype

References

[1]U.S. Department of Health and Human Services. (2014, September 8). Projected Future Growth of the Older Population. Retrieved from Administration for Community Living: https://aoa.acl.gov/Aging_Statistics/future_growth/future_growth.aspx. Last accessed on: May 4, 2017.

[2]Cheu, K. (2017, February 28). Initial Interview. (M. Jimenez, J. Martinez, A. Ortega, & M. Vechione, Interviewers)

[3]W3C. (2013, April 30). PROV-O: The PROV Ontology. Retrieved from W3C Recommendation: http://www.w3.org/TR/prov-o/. Last accessed on: October 4, 2017.







