

Undergraduate Thesis Prospectus

Smart Charlottesville: Designing the Future

(technical research project in Computer Science)

The Rise of Smart Cities

(STS research project)

by

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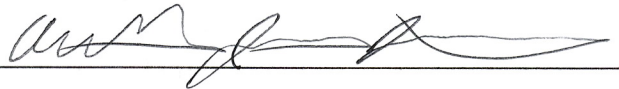
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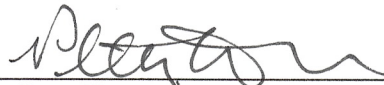
On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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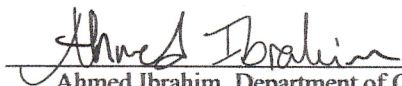


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General Research Problem

How can cities be improved?

Most people now live in cities. In 2014, the World Health Organization (WHO) reported that “urban population...accounted for 54% of the total global population, up from 34% in 1960” (WHO, n.d.). According to WHO, these numbers are rising; soon, even “in less developed countries, a majority of people will be living in urban areas” (WHO, n.d.). The United Nation’s Department of Economic and Social Affairs estimates the “proportion...is expected to increase to 68% by 2050” (UN, 2018). According to WHO, in 2010, approximately 80.8% of the American population lived in urban areas (WHO, 2019). The trend entails challenges such as “insufficient water availability, waste disposal problems, and higher energy consumption” (National Geographic, n.d.).

Smart Charlottesville: Designing the Future

How can the University of Virginia and Charlottesville collaborate to enhance the city?

The implementation of technical online platforms has become an increasingly popular idea to engage residents of a city with local government, and the University of Virginia plays a vital role in this due to its technical expertise. Professor Ferguson and Professor Ku are part of the STS department at the University of Virginia, and they are conducting research with their STS 4500 students to develop research ideas for transforming Charlottesville into a smart city. These ideas, however, need a platform that can be viewed and contributed to by both residents and the local government. The research problem to be solved is how to efficiently communicate these ideas, and others, to the Charlottesville community to improve the city for the future.

Currently, there is no viable platform that solves this problem of lacking communication in Charlottesville, since the research problem demands different user types and custom databases that are unavailable with platforms such as WordPress. The work done by the current capstone group of this academic year will provide the first iteration of a solution to bridge the gap for collaboration between the university and Charlottesville. The capstone project will last the entire academic year of 2019-2020.

Creating a web application public to all users will address the problem in a positive way, by working to provide a safe, non-anonymous site for community members to share ideas of changes they want in the community through engaging discussions. The website will have a feature for users to submit blueprints for proposed projects where they can also add file attachments such as pictures. The platform will require users to register and login to submit posts and interact with other users. The users will be able to look at the projects and comment on them, mark projects as “favorites” for easy access later, and connect with the authors of the blueprints via email. Community members can also submit smaller problems around the city to gain attention from other members so they can be fixed. There will be an “about us” tab where interested visitors can get in contact with the creators of the site and learn more about this initiative. The landing page will have a map that shows the Charlottesville area with ongoing projects pinned so users can explore projects in different areas by clicking specific pins on the map. Finally, there will be a resources tab describing places users can go to learn more about projects and current city work in general.

To build this website a strict set of requirements will be collected from Professor Ferguson and Professor Ku. Requirements contain the attributes and properties of features of a system that the user wants to help solve their problems. It is important to gather system

requirements to correctly understand the goals of the client and to facilitate the work of the developers to best cater towards the stakeholder's needs. Listed below are the capstone group's minimum, desired, and optional requirements:

Minimum Requirements:

1. As a user, I want to be able to comment on a blueprint to give my support or feedback.
2. As a user, I want to be able to filter through blueprints based on what category they fall under.
3. As an administrator, I should be able to manage blueprint content by hiding or removing it.
4. As an administrator, I should be able to manage the privileges of other users (students, community partners, and community members).
5. As a student, I should be able to create my own blueprint space so that others may view it.
6. As a student, I should be able to view other students' blueprints.
7. As a community member, I should be able to leave comments on a students' blueprint.
8. As a community member, I need to be able to post blueprints.
9. As a community member, I need to be able to like specific comments or blueprints.

Desired Requirements:

1. As a user, I should be able to search for keywords that define the type of blueprints posting I want to look at.
2. As a user, I should be able to view blueprints based on specific location

Optional Requirements:

1. As a user, I should be able to comment on other comments.
2. As a student, I should be able to tag my post with specific categories.

At the end of the project, we will have a collaborative, online workspace reachable by both the Charlottesville community and academics at the university. Users will be able to post ideas, gather feedback, collaborate, and connect with university resources; the university can do

the same, as well as be able to identify problems in the community that may have otherwise remained hidden.

The Rise of Smart Cities

How is the smart city movement impacting the urban population?

Smart cities are equipped to manage the increase in urban populations. No full “smart city” yet exists, but component systems are common. For example, photo enforcement of red lights. According to the Virginia Department of Transportation (VDOT), “the objective of the photo enforcement program is to improve intersection safety” (VDOT, n.d.).

According to CISCO, a leading provider in smart city technology, “a smart city uses digital technology to...enhance the lives of citizens” by “collect[ing] and analyz[ing] data from...sensors and video cameras” (CISCO, n.d.). A smart city network, the Smart Cities Council, claims that its goal is “to create smart, sustainable cities with high-quality living and high-quality jobs” (Smart Cities Council, 2015). Grow Smarter, a smart city interest group, claims that “in total 52,000 citizens have directly benefitted” from its projects (Grow Smarter, n.d.). CTIA, a trade association who “bring[s] together...companies that enable consumers to lead a 21st Century connected life,” expresses that “smart cities will power economic growth and produce significant benefits” (CTIA Mission, n.d. ; CTIA About, n.d.). They promote their agenda by “advocat[ing] for policies to support smart city growth (CTIA About, n.d.).

Sustainability is important to consider when observing smart cities. Urbanization impacts the environment as cities produce “60 percent to 80 percent of energy consumption, and 75 percent of carbon dioxide emissions” (Barrionuevo, 2012). “Build[ing] cities that can function as habitable and sustainable ecosystems” is a large challenge that comes with the increased

urbanization (Barrionuevo, 2012). Long-term sustainability is a major goal of smart cities. Research shows that “by tackling pollution, managing water efficiently, and supporting green buildings and alternative energy, cities can become cleaner, more pleasant places to live” (Barrionuevo, 2012). However, in order for sustainability to work, participants “must be invited to participate at every step of the way” (Barrionuevo, 2012).

Smart cities entail risks. Lee Tien, a lawyer for the Electronic Frontier Foundation, claims that “Cities don’t know enough about data, privacy or security” (Williams, 2019). In March 2018, the city of Atlanta’s internal computer system was hacked, causing “outages on various internal and customer facing applications;” the network was “compromised” (Deere, 2018). Smart cities gather vast information. Companies such as Sprint “collect data from users...including their home ZIP codes, internet searches and location” (Williams, 2019); companies seldom disclose data collection practices, inducing distrust. A Kansas City Council member, Quinton Lucas, stated his “concern about monitoring inner cities in a different way than other neighborhoods” (Williams, 2019). Other council members, however, are enthusiastic. Cheryl Barnes claims smart systems “will provide a measure of hope to the neighborhood” (Williams, 2019). In San Francisco, civil liberties groups “express unease about...potential abuse by government” of facial recognition technologies, claiming they may lead to an “oppressive surveillance state” (Conger, 2019). Future of Privacy Forum, a nonprofit aiming to protect privacy in the face of emerging technologies, express some data privacy concerns about smart cities. These concerns involve “revealing personally identifiable information to the public” and the possibility of algorithms “reinforce[ing] existing societal bias and block[ing] opportunity for diverse populations” (Future of Privacy Forum, n.d.) The Future of Privacy Forum also expresses concerns of surveillance, data spills, and unexpected uses of data.

The smart city movement attracts companies such as CISCO that sell the requisite technology. Some cities collect revenue through deals with suppliers, risking citizen distrust. In Chicago in 2016, vendors shared revenues from red-light cameras with officials. Judge Virginia Kendall stated that such conduct “erodes faith in our government,” and trust “takes years to rebuild” (Kidwell, 2016).

Citizen involvement is key for smart cities. Smart cities are unable to function in their full capacity if “citizens are...not using all the potential that is offered” (Klimovsky, n.d.). Research points towards “a strong...correlation between education, occupation and age and the use of” information and communications technologies (Klimovsky, n.d.). Similarly, “a gap in how people perceive the role of technology” prevents them from experiencing the benefits that smart cities have to offer (Klimovsky, n.d.).

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