Senior Design / BS Project
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Checkpoint: People tracker at your favorite spots

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Abstract

Checkpoint is a people counter, intended to be used to help people comply with social distancing recommendations in public venues. It will enable business owners, workers, and patrons to be certain that it is safe to enter the venue and expect to have enough space to stay abide the social distancing concept we will need to implement from now and further..

Introduction

There have been a number of parking management systems invented and implemented in recent years, but trackers of the number of people within a venue are a new development. Their form and mode of operation varies, depending on the need for precision and cost limitations. Possible limitations that people have to deal with include: privacy protecting laws of a certain jurisdiction, possible environmental interferences that may make some implementations imprecise, constraints in power delivery, limited ability to alter infrastructure to accommodate the addition of a parking or crowd management system.

A possible application for our system is to track whether the venue is compliant with fire safety regulations, which also limits a number of people that can be present in an enclosed space at any given time.

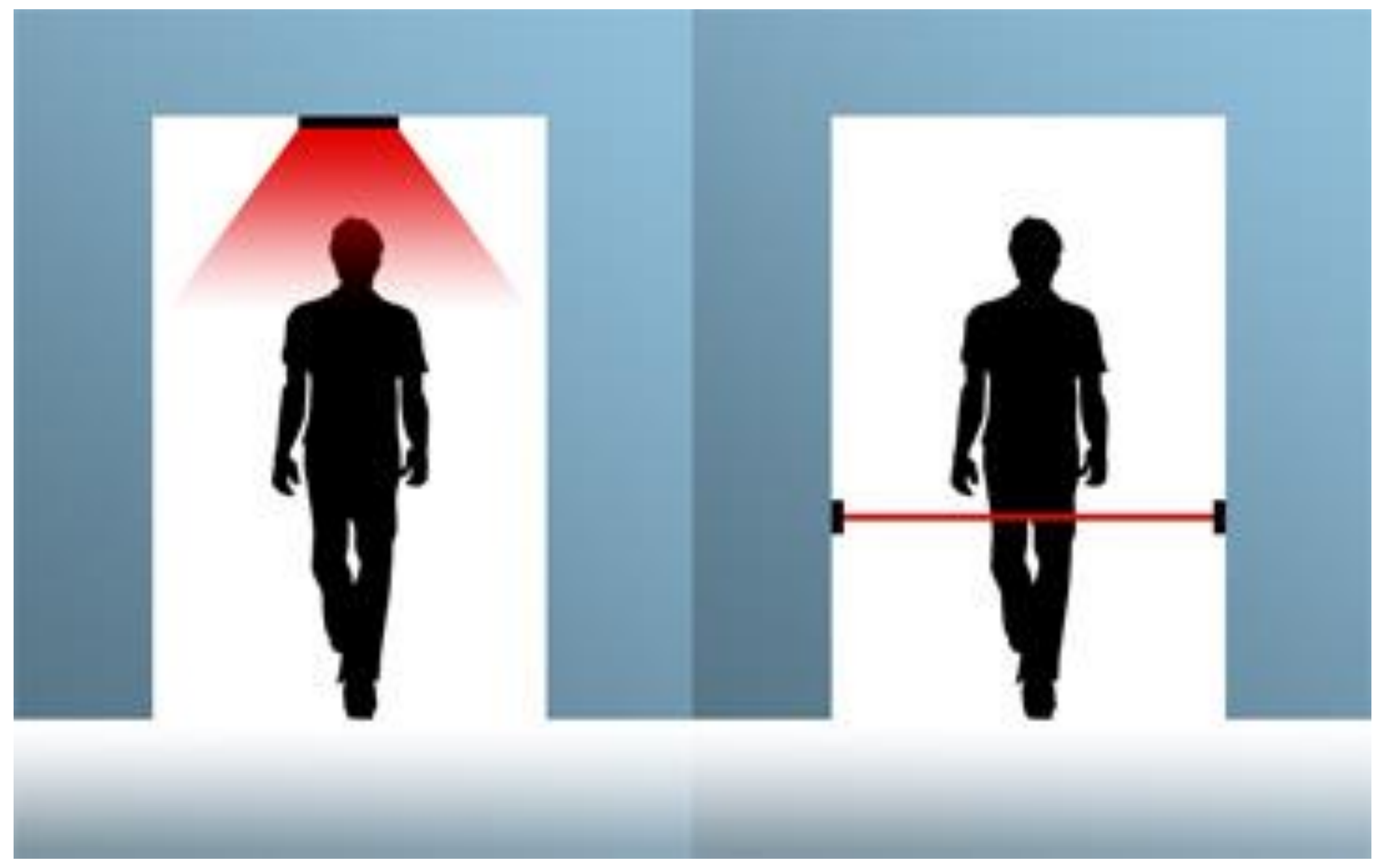


Figure 1. Project visuals

Methods | Design | Analysis

The approach we took in order to successfully develop the whole project consisted in creating pseudo designs of both the hardware and software components before starting to physically create the project. Mobile App developed for the purposes of this project will require registration to be used, and will have a payment option, currently not implemented, to enable users to pay for additional features, such as letting them to favorite stores, receive occupancy information from non-essential stores, receive notifications about their favorite stores being empty, so that they can go there when it is least crowded without having to check their phone all the time.

Upon selection of one of the closest stores which have registered with our service, the user will be redirected to Google Maps, to take them to the desired location in the shortest amount of time. Redirection to Google Maps is necessary, as Flutter does not natively support dynamic maps, which would be required to include navigation to location functionality in an app, and implementing a custom navigation to location functionality can be a start-up project of its own, due to complexity of finding the temporary shortest path under various traffic conditions.

In this project we used a simple set up of a raspberry pi 4 model B and a PIR RobotDyn sensor. In order to connect the raspberry pi to the internet, we used a wifi dongle compatible with the raspberry pi. In order to make the sensor function we used a python code in the linux pi command line.

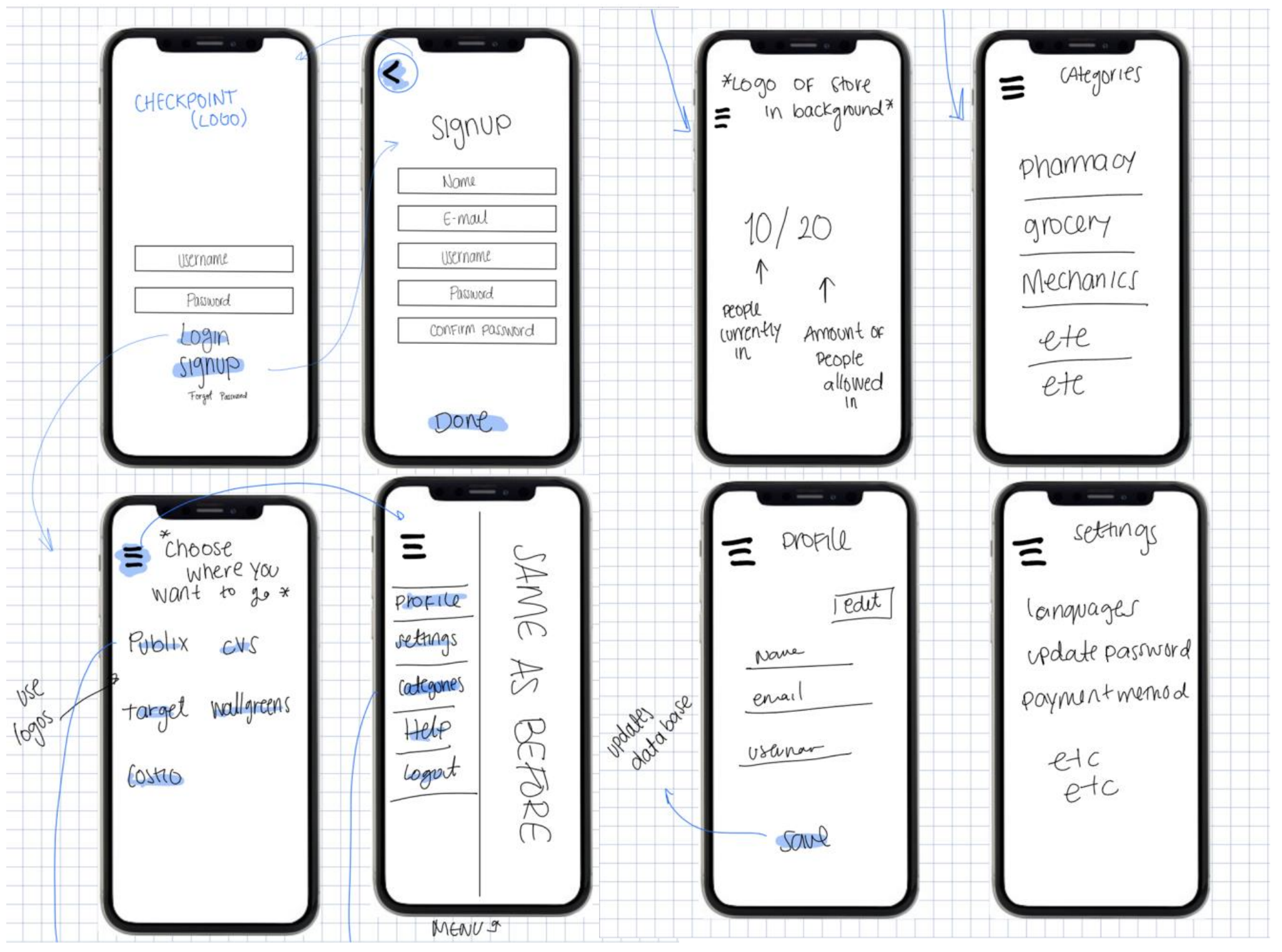


Figure 2. Pseudo app design

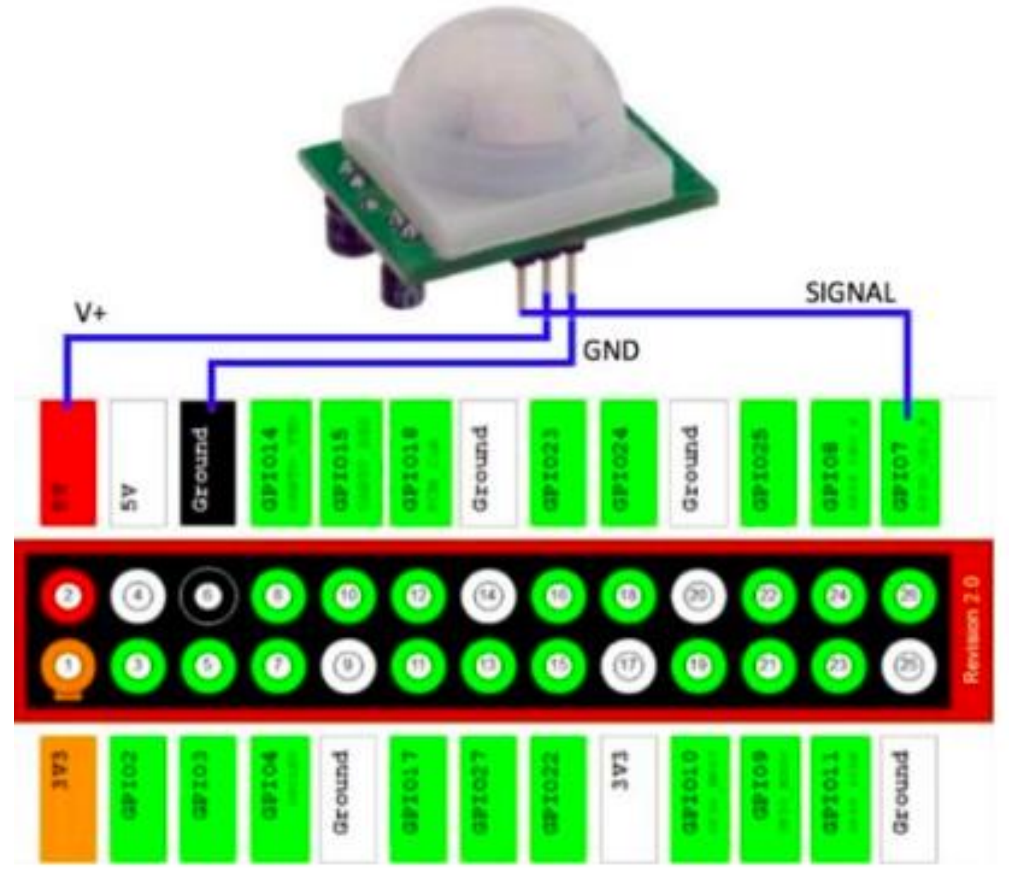
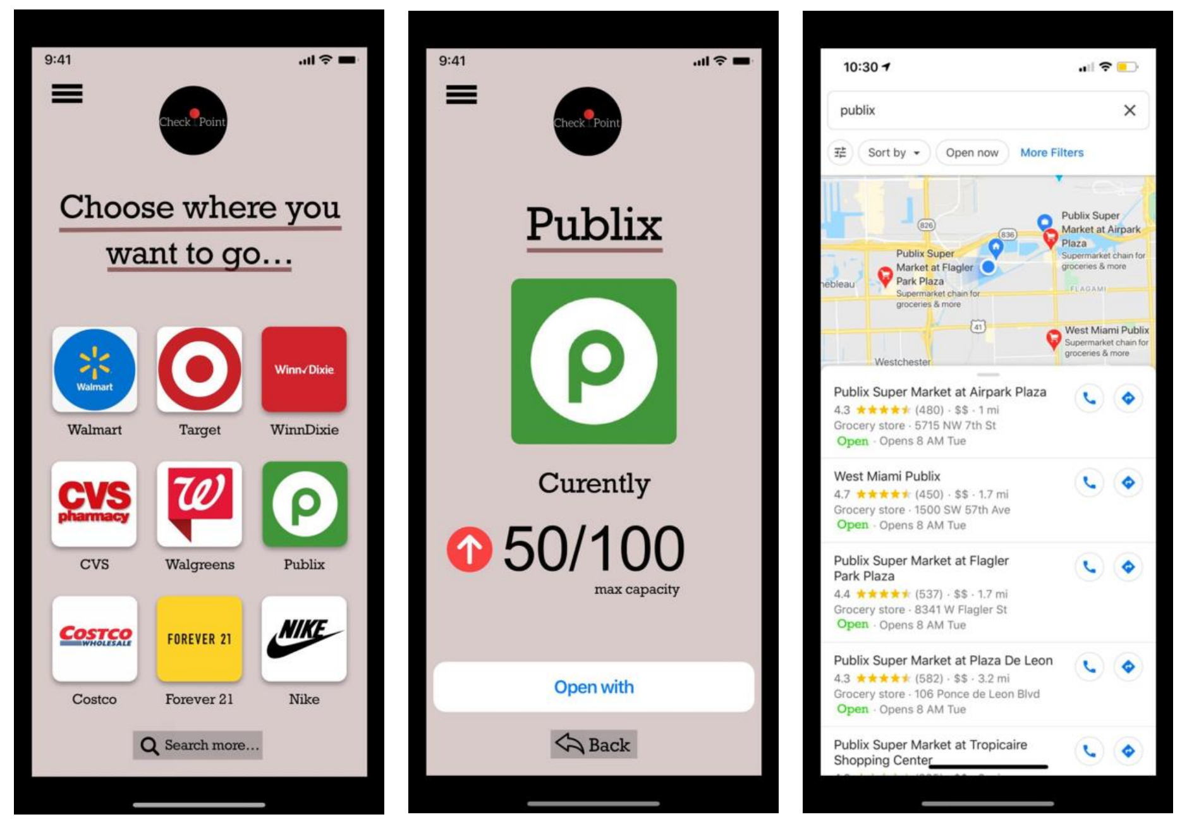


Figure 3. Sensor wiring design

Results



Publix Super Market at Airpark Plaza
4.3 ★★★★★ (480) · $$ · 1 mi
Grocery store · 5715 NW 7th St
Open · Opens 8 AM Tue

West Miami Publix
4.7 ★★★★★ (450) · $$ · 1.7 mi
Grocery store · 1500 SW 57th Ave
Open · Opens 8 AM Tue

Publix Super Market at Flagler Park Plaza
4.4 ★★★★★ (537) · $$ · 1.7 mi
Grocery store · 8341 W Flagler St
Open · Opens 8 AM Tue

Publix Super Market at Plaza De Leon
4.3 ★★★★★ (582) · $$ · 3.2 mi
Grocery store · 106 Ponce de Leon Blvd
Open · Opens 8 AM Tue

Publix Super Market at Tropicaire Shopping Center

Figure 4. Main Functionality of the App

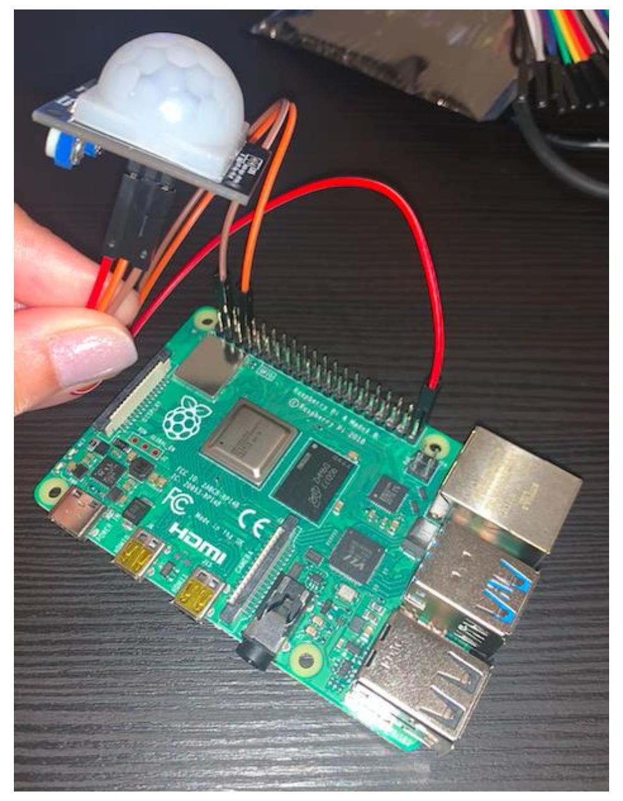


Figure 5. Hardware setup

Conclusion

After the original design was made impossible to implement due to COVID-19, an arrangement of plans was developed, so that our design met the new and arising needs of society better. It enabled us to develop a product that does not require ventures outdoors to test and debug. However, as COVID-19 offset a lot of our plans and the concepts were changed. The scope of the project was reduced hence developing a lower scale sensor that is able communicate with an API for further design development.

Future implementations can be made to recognize separate people in the crowd, as our design currently relies on people passing the sensor one by one, which can be done using multiple sensors scanning people's legs, which our research has shown to be one of the more reliant ways to determine the number of people without limiting their movement. The accuracy can be further enhanced by implementing complex algorithms on the server, which would then return the results to the application.

Acknowledgments

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