Smart Parking System

Documentation

SOFE 4610U - Project Report

Group Members:

Devante Wilson 100554361

Sikandar Shahbaz 100566271

Emin Avanessian-Zadeh 100563462

Cherlyne Santhirarajan 100540234

Ebrahim Merchant 100559443

Ghaith Haddad 100553215

Introduction

For our term project, our group decided that the most interesting project for us to develop would be a Smart Parking System. This is especially exciting for us because it finally gives us a chance to showcase our skills relating to Internet of Things and other topics that we have learned over the years as software engineering students. This opportunity also gives us a chance to become more familiar with the hardware related aspects of an engineering project - since most of our group and individual assessments consist of software programming. Most of all, this project stands out to us because it is something that we can legitimately see being used in a real world scenario rather than just another project that is only useful in theory.

The basic concept is as follows; every experienced driver has been in a parking situation where they seem to either waste too much time searching for an empty spot in a parking lot or they wish that they could have reserved a spot beforehand in order to attend their destination on time. With our innovative smart parking system, we hope to help drivers avoid these situations entirely. The primary service that this product provides users is the ability to make reservations for a designated spot in a parking lot so that their spot waits for them rather than vice-versa. While this feature definitely eliminates the issues discussed above, it also attacks the everlasting issue of parking fee evasion. Almost every parking lot encounters this issue on a daily basis; when drivers attempt to park their vehicle in a spot for a certain amount of time and not pay for the service used.

Body

Hardware

   The first of our three hardware devices used in this project is the ultrasonic sensor (model HC-SR04). It is single-handedly the most efficient proximity sensor on the market. This is used to detect whether or not a parking spot is empty or taken by sensing the proximity to any stationary object in a certain spot. If the sensor detects that a vehicle is in-fact parked in a spot, it sends that information to the corresponding Raspberry Pi Model 3B+. This is the second main hardware device integrated in this system. The RPi should be looked at as the brains or controller of the product. Everything that goes in and out of the PostreSQL database flows through the RPi. Once the RPi receives info from the sensors, it processes the information and sends it to the database to record that specific spot as officially taken. The third and final piece of Hardware used in this project are the LED lights. These are connected to all of the spots and they are used to signal whether or not a parking spot is empty or reserved. If the sensor reads a spot as taken or reserved, the LED is illuminated.
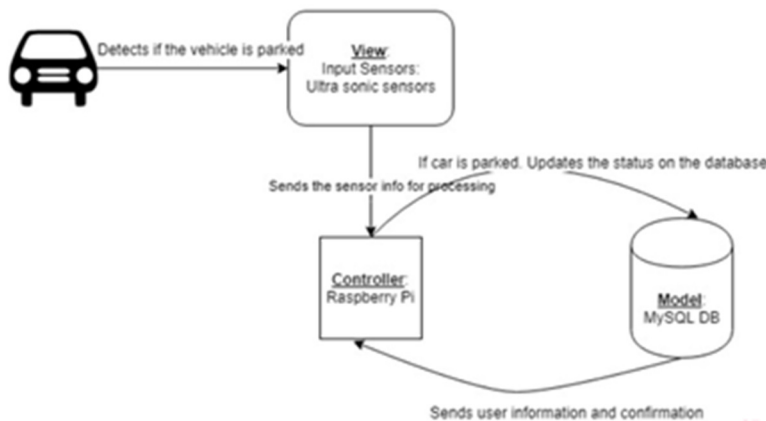
Software

   In order for a user to make a reservation, they need to book the parking spot through their mobile application. This is the first of the three main software components of the system. This is application allows the user to reserve a designated parking spot ahead of time and keep track of the status of their spot. The mobile application was designed using Android Studio and the corresponding languages - Java for system design and XML for visual design. Once the user has finished reserving their spot in the mobile app, the information is sent over to the controller module. This is the second software component of the project. This is written purely using Python3 and it serves the purpose of processing and validating the reservation information before it sent over the PostreSQL database. This is the final software component of

this product. This database is the focal point of the entire project as it stores all of the information regarding the parking spots and their reservation status.
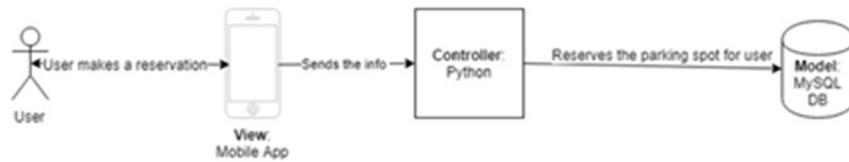
Application Domain & Use Cases

Besides the primary use of the product, it can be used for many other useful purposes. The first one being a college/university seating arrangement system. Often times, students run into situations where they arrive to a lecture a little bit later than they had intended and thus have a difficult time finding a spot to sit in. With the use of this technology, students can take a look at a screen that displays which seats in a room are taken and which are absent. The sonar sensors in this case would be stored underneath the desk and would detect if a seat is taken and would transmit that information to the screen. This would alleviate the nuisance of student walking through the rows and disrupting the ongoing lecture.

Another situation where this product could be used is at entertainment shows (sport game, concert, oprah, etc.). In this scenario, the reservation feature could also be used in order to reserve your seat. In order to reserve a seat, the user would need to provide a proof of their purchase of the ticket to ensure fairness and efficiency. This could also be used for conferences and other related events. The reservation system would also come in handy for booking rooms for meetings or booking other private areas for designated uses.

Conclusion

After completion of this project we were able to gain knowledge on how sensors can be integrated into IoT systems. With the aid of sensors, we were able to build a system that successfully monitors parking spot vacancies for users. We adapted the MVC architecture for our system which proved effective in creating a system that successfully provides users with a view of the information they are required and a simple way of interacting with the system. Our system successfully takes input from users, & uses that data to perform a task for them & store everything necessary in the database so that the otherwise tedious task of looking for a parking spot is made easy for users.