IOWA STATE UNIVERSITY

AEROSPACE ENGINEERING DEPARTMENT

Computational Techniques for Aerospace Design

AERE 361

Project Proposal

Team Gimli

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I ABSTRACT

The abstract is a summary of your proposal. In general, your abstract should have enough information so that if I was to copy and paste your abstract into a web site, people would get the general idea of what your proposal is about. It should not go into any heavy detail, just the basics of what your project is about. The who, the what, and the why. You should keep your abstract to 200-400 words. Use this to "hook in" your reader.

II INTRODUCTION

The usage of embedded systems in daily life has become an everyday occurrence in the modern world. Many of these systems are in place to make life more convenient and efficient. This project is an effort to increase the efficiencies and convenience of an everyday aspect of life: finding a parking spot for a car. In an urban environment, finding an open parking spot can be a challenge involving searching through different rows in multiple lots; a problem our project aims to fix.

Our team will create a system that will track the vacancies of parking spots in a lot, to inform users on parking availability. Similar systems have been implemented in places like airports, but we decided to design a individual spot-oriented system that could be used in a parking lot on campus, such as the lot by the Armory. Users would be informed on how full a lot is and even which individual spaces are vacant.

III FEATURES

The first feature of our project is a light indicator at each parking spot. We thought of posts at the front of each parking spots, akin to parking meters, that have a red or green light indicating a taken or open parking space. We moved on from this idea, however, considering material cost of having a post like this at every single parking spot in a lot. Instead, we thought of a strip at the back end of each parking spot embedded into the pavement that has the green or red light indication. As we thought about electricity cost of having a red light on all the time, we decided to have it off if the spot is taken. This system would only run during reasonable hours during the day so that it doesn't eat up electric power in the dead of night with hundreds of active green lights.

The second feature would be a display at any and all entrances to the parking lot. This would receive data from the sensors of each parking spot and display information regarding the relative availability of parking. For example, displaying number of open spots per row, so the driver can quickly see how close they can park to their destination.

The third feature would be a website that would also receive data from the parking spot sensors and display similar information to the second feature. This would allow easy access to the information so individuals can decide beforehand if they should drive over to this parking lot based on how available parking is at a given time of day. A simple statistic to be displayed could be spots open over total spots, which not only gives the nubmer of available

spots, but gives a good idea of what percentage of the lot is full. A parking lot with 100 open spots out of 125 total spots is a lot different than a parking lot with 100 open spots out of 10,000 total spots.

A fourth feature we have as a backup or if we have time would be a timer system. Each spot would have a timer and display how much time is left before the car needs to be moved. This is good information to help out parking police as well as for individuals seeing how close some spots might be to being available.

IV PROBLEM STATEMENT

The problem we are trying to solve is parking on campus. It is a big headache trying to figure out where the best place to park is. Knowing how full a parking lot is, where available parking spots are, or if the best spots at a specific location are available are all problems we are trying to tackle. The solution we are going to make improves parking at different levels. It takes a tool found at airports that helps with parking and incorporates it into locations around here on campus, starting with the armory. As talked about in the feature section, each parking slot will have a visual physical indicator showing which spot in the row/isle is open. These indicators will be all connected to a central hub. Additionally, each spot will have a sensor that is connected to the central hub that displays parking information both when driving into the parking lot and online. Information such as how full the lot is and number of spots available in a specific row. Further information such as where the most open spots are, and how busy the parking lot typically is will be explored.

Taking inspiration from what is done at airports and implementing it at ISU is the key philosophy for this idea. At airports, wayfinding is an important concept requires consideration. "Studies have shown the importance of wayfinding and give it significant weight with respect in the determination of the overall LOS of the terminal." Harding 2011. Parking navigation is an example of wayfinding, and LOS simply stands for level of service. Meaning, how helpful parking directions are and parking navigation is a big thing that is considered at airports as it improves the quality of life. That is the purpose of pursuing this idea. Making parking easier for everyone.

V PROBLEM SOLUTION

The solution that was decided on, is to place sensors in each parking spot to detect if there is a vehicle occupying it. This sensor can be a pressure, ultrasonic, or electromagnetic sensor. When a parking spot is empty a light strip at the entrance to the parking spot will turn green indicating the spot it open and available. When a vehicle drives into the spot and over the sensor, the light will turn off and a signal will be sent to the micro-controller (Adafruit Circuit Playground Express). The micro-controller will then update an LCD display positioned at the entrance of the parking lot, indicating how many open spots there are in each row. The micro-controller will also update a website with the number of spots open out of the total number of spots and a percentage of how full the parking lot is. These three functionalities

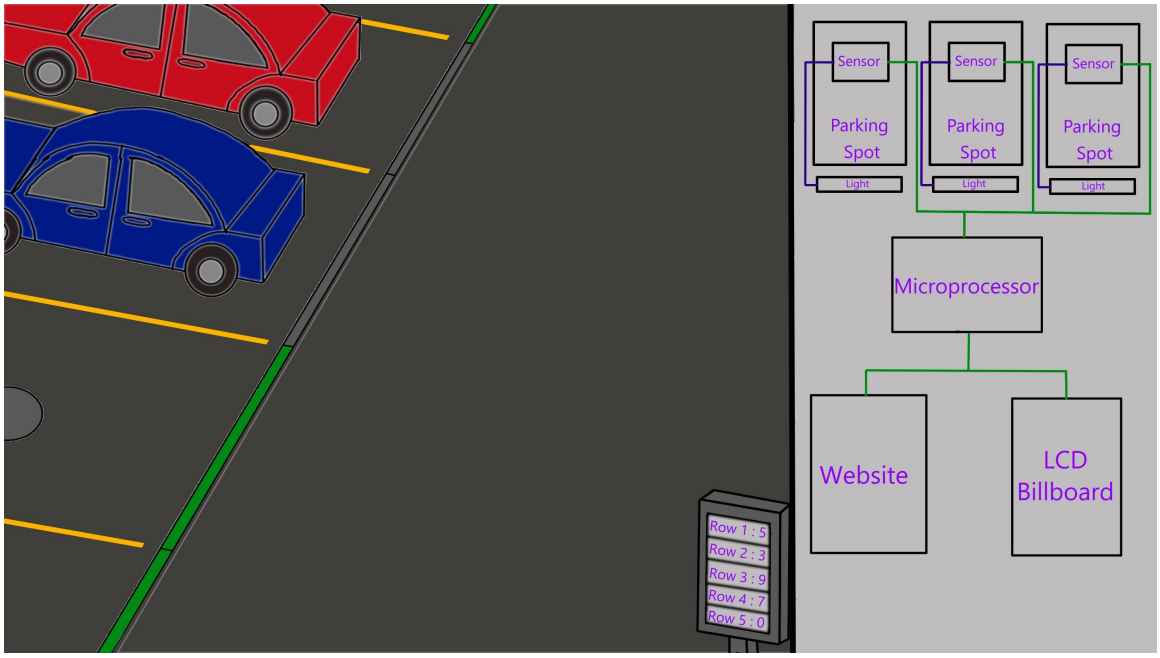

Figure 1: Example and Circuit Diagram

will allow drivers to check if there are parking spots prior to driving over, update drivers who are looking for an open lot, and help indicate to drivers where free parking spots are. Figure 1 shows what a parking lot row would look like with our system implemented. The light strip at the base of parking spot are green when the spot it empty and off when the spot it filled. There is a billboard LCD at the entrance to the parking lot showing the breakdown of how many empty spots there are per row. On the right side of Figure 1 there is a breakdown of the wiring diagram for 3 parking spots. Each parking spot has a sensor and a light strip, which communicate with the microprocessor which updates the website and LCD billboard. According to a study done by the Transportation Research Board Harding 2011 these systems aid in the experience of parking, making parking a stress free activity so that patrons can effortlessly get to their destination. Students are under enough stress trying to keep up with their project, labs and exams, they do not need added stress of finding a parking space.

Table 1: Parts required for project

Part description	Qty
Adafruit Circuit Playground Express	1
AAA Battery Holder	1
USB Cable	1
Ultrasonic Sensor	3
Neopixel Strip	1
LCD	1

VI CONCLUSION

The primary goal of this project is to assist users of a parking lot to save time. We implemented multiple features to be able to achieve this. Our main concept is to install sensors in parking spots that detects the presence of a car. This data is used to calculate the number of parking spots available. We plan on implementing lights at the entry of the parking spot, as shown in the diagram. These will allow the user to see where the empty parking spot is, which allows them to navigate to the spot efficiently. We will display the number of spots left and the row where the empty spot is on an LCD at the entrance of the parking lot. We also plan on displaying this information on a website which will allow users to plan ahead of time.

VII References

References

Harding, James R (2011). *Wayfinding and signing guidelines for airport terminals and landside*. ACRP report Wayfinding and signing guidelines for airport terminals and landside. Transportation Research Board. ISBN: 1-62198-285-8.