**Final Project Proposal**

**Year: 2023 Semester: Spring Team: 10 Project: Parking Tracking System**

**Creation Date: 1/11/2023 Last Modified: 1/12/2023**

**Team Members (#1 is Team Leader):**

**Member 1: Heath A. Lovell Email: hlovell@purdue.edu**

**Member 2: Jonathan Doorn Email: jdoorn@purdue.edu**

**Member 3: Dan English Email: englishd@purdue.edu**

**Member 4: Frederick Kepler Email: fkepler@purdue.edu**

**1.0 Project Description:**

The Parking Tracking System project includes tracking the parking availability of a single entrance/single exit garage for the purpose of a more efficient parking experience. This project will utilize a system of wirelessly communicating ultrasonic sensors (the HC-SR04), and 7-segment displays in order to accurately determine when cars enter and leave the garage for the purpose of effectively tracking the amount of available spaces available to the current parker. The wireless communication will be handled with Zigbee wireless modules. This data will be shown on a display outside of the garage for the parker to be able to conveniently observe whether or not they will have the ability to park in the garage. The system will utilize a keypad and OLED screen on the main module that will allow the user to initially configure and set-up the system, along with allowing the user to make changes after the system is set-up, such as adding/removing car detector modules.

**2.0 Roles and Responsibilities:**

As the Team Leader, Aaron Lovell will be responsible for communicating with the rest of the team to determine what will need to be accomplished. Along with this, he will be assisting in issues that the rest of the team is facing with regards to their roles. He has experience with computer vision from his past internships with Matrix Design Group and John Deere, as well as experience with leading a team at John Deere with a new type of camera used for autonomy. Aaron will also be helping Dan to work on designing the PCB.

As the Systems Engineer, Fred Kepler will be responsible for maintaining the integration of both the hardware and software components included in the Parking Tracking System. He has experience that qualifies him to being the team’s systems engineer during his internship at Cleveland Cliffs where he acted as a Systems Engineer for a previously faulty Coke Oven Gas Booster.

As the Hardware Engineer, Dan English will be responsible for maintaining all electrical and mechanical components necessary to complete the functionality of the project. His coursework related to circuit analysis and power electronics will bring valuable insight to the PCB design. Additionally, his internship with Eaton Corporation, where he worked on component analysis of parts on a DC-DC converter, soldering on a PCB, and verifying prototype boards, will be crucial during board design, assembly, and testing.

As the Software Engineer, Jonathan Doorn will be responsible for maintaining the project’s codebase. He has experience that qualifies him to being the team’s software engineer through his internships at Los Alamos National Laboratory, developing firmware for a mesh network; and his recent contract job at the ETH Juniors Consulting firm, architecting the backend for a curriculum management website.

**2.1 Homework Assignment Responsibilities**

| ***Design Component Homework*** | | ***Professional Component Homework*** | |
| --- | --- | --- | --- |
| A3-Software Overview | Aaron | A9-Legal Analysis | Fred |
| A4-Electrical Overview | Dan | A10-Reliability and Safety Analysis | Dan |
| A6-Mechanical Overview | Fred | A11-Ethical/Environmental Analysis | Jon |
| A8-Software Formalization | Jon | A12-User Manual | Aaron |

**3.0 Estimated Budget**

| **Item** | **Estimated Cost** |
| --- | --- |
| ***Electrical*** |  |
| Boards | $49.00 |
| Sensors | $16.00 |
|  |  |
| Printed Circuit Board | $50.00 |
| Displays | $75.00 |
| ***Mechanical*** |  |
| Mounts | $30.00 |
| Packaging | $50.00 |
| ***Other*** |  |
| Shipping | $30.00 |
| **Total Estimated Budget** | $300.00 |

Mechanical Items include the non-electrical components related to our design. For our design, these will include parts necessary to fixing the electrical components outside.

Electrical Items include all the components related to our design that require power to operate. These items will contribute to the core of the functionality of our design, and thus take up the largest portion of the budget.

Other includes all services necessary for us to build our design. The main service we will be utilizing is shipping all of our components not already owned by the team or acquired from the lab.

**4.0 Project Specific Success Criteria**

Below are the criteria necessary to the success of our project.

1. An ability to communicate with the HC-SR04 ultrasonic sensor using the the UART protocol to determine when a car is entering or exiting the garage.
2. An ability for our microcontroller to send data to an OLED screen using I2C to configure the system.
3. An ability to use a row column matrix to determine what value is pressed on a keypad to set the initial number of parking spots available.
4. An ability for our microcontroller to communicate with the 7-segment display using the SPI protocol to show the total number of parking spaces available.
5. An ability to interface between a Zigbee wireless module and the microcontroller to send and receive data about the cars entering and exiting the garage.

**5.0 Sources Cited:**

A. Industries, “VCNL4010 proximity/light sensor,” adafruit industries blog RSS. [Online]. Available: https://www.adafruit.com/product/466?gclid=Cj0KCQiA\_P6dBhD1ARIsAAGI7HBGVO82MbwziyYe7dS9X0CPgKx4MJSy3Ug4SBjghiJL-7BaFrfDayIaAoihEALw\_wcB. [Accessed: 12-Jan-2023].

A. Industries, “VCNL4010 proximity/light sensor,” *adafruit industries blog RSS*. [Online]. Available: https://www.adafruit.com/product/466?gclid=Cj0KCQiA\_P6dBhD1ARIsAAGI7HBGVO82MbwziyYe7dS9X0CPgKx4MJSy3Ug4SBjghiJL-7BaFrfDayIaAoihEALw\_wcB. [Accessed: 12-Jan-2023].

“Nvidia Jetson Nano Developer Kit (945-13450-0000-100).” [Online]. Available: https://www.amazon.com/NVIDIA-Jetson-Nano-Developer-945-13450-0000-100/dp/B084DSDDLT. [Accessed: 12-Jan-2023].