*Smart Park*

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*Abstract*— Smart Park is an application that will direct users to an available parking stall on campus via a UI (user interface). To accurately determine an occupied or vacant parking stall, the team has implemented a sensor package that can detect a vehicles presence and then send the data to the app. The team is split into a CS component and an EE component. The CS side is responsible to the app while the EE team is responsible for vehicle detection and wireless communication. Since this is an EE technical document only the EE component will be discussed in detail.

Keywords—component, formatting, style, styling, insert (key words)

# Introduction (Purpose/background/Need)

The objective of the Smart Park system is to deliver convenience to end users. It accomplishes this by providing directions to open parking stalls on campus. This saves time, increases traffic efficiency, incentivizes parking permit acquisitions, and boosts user admissions. This package utilizes a wireless communication protocol to transmit parking updates from end nodes to the UI. Intended use of the system can and may be customized to suit interested parties’ specific needs.

Functionality

## Challenge

Executing vehicle detection and wireless communication creates technical constraints. We must have a wireless device that absorbs minimal power maintaining charge for 6 + years. Vehicle detection must be achieved with variable ride heights and extreme weather conditions. Detection must be reliable, and this information must be passed wirelessly from long and differentiating distances. Lastly this product must be of high quality to maintain convenience factor for customers.

## Solution (Sensor Package)

The sensor package or node signifies the starting point for the Smart Park data infrastructure. The node’s function is to reliably detect a vehicles presence and then transmit the data to a local gateway. The sensor package is made up of 4 separate components. The 1st component is the LoRa module which utilizes a long range-low power-low data protocol to wirelessly communicate with other devices. The 2nd component is the sensor which will determine the vehicles presence utilizing a tandem of detection methods. This ensures a 2-point-of-failure detection rate mitigating unreliable or faulty sensing. Next is the power supply which will consist of a battery enabling the device to be wireless. Lastly the housing which will protect the internal components from the agricultural environment. This includes insulating any heat generated by electrical components for low temperature operation.

1. *Summary*

# Project Description

1. LoRa Module

The LoRa module is a microcontroller PCB from Arduino called the MKR WAN 1310 that includes a LoRa protocol transmitter and antenna (Murata chip enter transmitter name). This microcontroller is programmable using the Arduino IDE (integrated developmental Environment). We have wired the module with two distinct sensors utilizing the 5V, GND, SCL (), and SDA () pins. Through the utilization of code, we can extract data from these sensors and from that data we define what equates to a vacant or occupied parking stall. Once our module determines the status of a stall it transmits a Boolean logic to a local gateway. Low level logic implemented in the code includes a baseline reading upon start up, reading ranges for each sensor that equate to true, and lastly an OR logic (only one of the two sensors must return true). The controller is also programmed with EUI () device and application keys to successfully transmit data to a gateway.

1. Sensors

Enter serial monitor screen shot of data.

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*a**b* 

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* The subscript for the permeability of vacuum **0, and other common scientific constants, is zero with subscript formatting, not a lowercase letter “o”.
* In American English, commas, semicolons, periods, question and exclamation marks are located within quotation marks only when a complete thought or name is cited, such as a title or full quotation. When quotation marks are used, instead of a bold or italic typeface, to highlight a word or phrase, punctuation should appear outside of the quotation marks. A parenthetical phrase or statement at the end of a sentence is punctuated outside of the closing parenthesis (like this). (A parenthetical sentence is punctuated within the parentheses.)
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