Damian Avery

W963H945

Senior Design I

Caskel Stallard

Work Package

Features

The first semester has been allocated to creating a proof of concept to perform the desired functionality of the SmartPark system. As a prototype this is a rough draft of our finished product for next semester.

The intent for the fully functional polished product is described below:

* Diagnostics

Description: This functionality will provide the SmartPark team with statuses for each individual node. This allows for easy upkeep and maintenance of nodes and outdoor hardware

* + Our data infrastructure will include bi-directional communication
  + Class B devices
  + Battery status
  + Device connectivity

Execution: To implement diagnostics we will create a rollcall within devices that will be activated by the gateway. This requires bi-directional communication which will allow for nodes to receive a signal. Devices that support two-way transmissions in the LoRa network is called “class B”. With the rollcall we can determine inactive or faulty devices. We can also determine battery life of each sensor. Our Lora modules will be programmed to have a predetermined listen window. During this window the rollcall will be implemented, and each node will echo back to the gateway in sequential order.

* Low Duty cycle

Description: Operating each node at a low duty cycle will allow for each gateway to handle more nodes. The transmission of data from a node to a gateway is spread across 8 separate channels.

* + 5% duty cycle
  + Parking lot size
  + Nodes per gateway

Execution: Each sensor will have an amount of time that it must wait before sending a status update to the gateway. We will write this law in the logic of each LoRa modules code. This time is determined by the time it takes for a LoRa signal to reach the gateway called Time on air. If for example, we want our devices to operate at 1% duty cycle we will simply take TOA multiplied by 99. The product of this calculation will be the time needed for each device to wait before sending another signal to the gateway. With 1% duty cycle a gateway with 8 channels can handle 800 devices. At 100% duty cycle a gateway can handle 8 devices. This will help each gateway handle more devices making the overall install cheaper for our customer base.

* Solar

Description: In the community of smart parking lots, the expected life of a LoRa sensor is up to 6 years max. With a small integrated solar panel, we can expect to extend the longevity of the node to 10 years.

* + Packaged
  + Battery life extension
  + Cost effective

Execution: Vigorous research will be administered to find the right unit that can provide optimum power extension while being cost effective for the node. The more areas of integration will create more expenses per unit. We to do a cost benefit analysis to determine if the added price of the solar panel meets the cost saving benefits of extended battery life.