Project Garage Sensor

Product Requirements Specification

Team Garage Sensor

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**Document History**

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# Objective

The objective of this document is to document the requirements of the Garage Sensor Unit (GSU)

# Scope

The scope of this document is to define the requirements…

# References

## Cited Documents

This is place to cite any relevant standards, regulations, etc. relevant to the requirements…

## Acronyms and Abbreviations

GSS – Garage Sensor System

GSU – Garage Sensor Unit

GSG – Garage System Gateway

Den – Innovation Den Coeur d’Alene

EPO Engineering Purchase Order

ER Engineering Release

POC Proof of Concept

…

# Functional Requirements

## ****User Interface Requirements****

//The operator shall not be required to apply any more than 40 lbs of pedal effort to stop the vehicle.

## What it should do

The Garage Sensor System (GSS) will detect when a car is parked in a stall.

The Garage Sensor Unit (GSU) will indicate whether a stall is occupied or not.

The GSUs will be arranged in a mesh network.

One GSU in the mesh network will be the master GSU.

The master GSU will send data of each GSU’s status to the Garage System Gateway (GSG) located in the Den using a wireless technology.

The GSG will relay this data to the simulation software.

The simulation software will use the GSU data to simulate the rest of the parking garage.

The simulation software will display statistics of the number of stalls currently occupied, number available.

(Which parking locations are available? This would require each GSU to have some ID attached and mapped out in some manner on the simulation)

# Mechanical Requirements

The GSS will consist of 5 GSG’s, a Gateway and a server

## Strength Requirements

//The design shall be able to carry a static load of 1000 lbs.

## Spatial Requirements

The Enclosure shall fit within the following:

* Length 4 in
* Width 4 in
* Height 4 in

## Weight/Mass Requirements

The unit shall weigh no more than (probably pretty light since it’s going to be supported from above)

## Mounting / Interface Requirements

The unit shall be mounted to a concrete ceiling using (duct tape/glue/cement/sugru?). The adhesive used must not cause any permanent damage and be removeable leaving no evidence of having been there. The unit must be removeable from the mounting bracket used. (like a ceiling light or smoke detector?)

## Appearance Requirements

//The final product shall be painted black with…

## Durability Requirements

Each unit shall be designed to operate for 1 year continuously without any scheduled maintenance.

## Reliability Requirements

//All components (bearings) shall have 90% reliability

# Electrical Requirements

## Operational Voltage

During operation the voltage of the unit will run at 5.0 V.

## Operational Power Capability

//During operation, the Battery pack shall be capable of delivering or absorbing power per the table below:

## Energy Storage Capacity

The battery of a Garage Unit will have enough capacity to run for a year. The hardware and software must be designed to minimize power usage whenever possible to meet this requirement. The GSU will have the ability to go into a sleep mode to conserve battery life.

# Software Requirements

## Functionality

The software for this project will consist of the control software for the GSU and the simulation.

The GSU software will interface with the sensors to identify when a car park is full.

The GSU will be activated (on a timer/when a sensor detects something). The GSU needs to be in a sleep state prior to activation to conserve battery.

Each GSU must be able to communicate with every other GSU in a mesh network. There needs to be a priority system in place to determine which of the GSUs will be the master GSU (battery life, location relative to the Den)

The GSU will transmit its data to the master GSU.

Data to be included in a GSU packet: parking spot open/empty, date?, time?, GSU Identifier

The master GSU will periodically transmit all the GSU data wirelessly to the GSG located at the Den.

All communication between the GSU’s and the gateway must be encrypted to provide Integrity and Availability.

The gateway must have the ability to be able to remotely reset all the GSUs.

The gateway contains

## User Interface

# Environmental Requirements

## Temperature

The Product is expected to have full operational capabilities in a sheltered outdoor environment with ambient temperatures of -30C (-22F to 50C (122F).

(Hottest temperature recorded in CDA is 42.8 C / 108 F, but this will be in a car park enclosure which will probably bake in the summer.

Coldest temperature recorded in CDA is -34.4 C / -30 F)

## Environmental Sealing

The unit is not expected to be directly exposed to rain. However, water – brought in from vehicles during wet and snowy weather, dust – from wind, oil from vehicles and smoke from vehicles will be expected. The unit will need to be dust tight and have protection against vapor intrusion. The unit shall have an IP rating of 54 – Partial protection against dust that may harm equipment and protection against water splashes from all directions.

(We could probably go with less protection than that but I am being more of the safe side in this)

# Regulatory Requirements

## UL Requirements

//The components shall comply with the UL XXXX Standard

## Shipping Requirements

# Cost Requirements

## Prototype Cost

The cost to build 5 prototype sensors, purchase a gateway shall not exceed $3000.

## Production Requirements

//Estimated annual volume of the product will potentially be 100 units/month = 1200/year

//Projected cost for production units shall be < $250.

# Schedule Requirements

The following are the major Project Milestones:

* Approval of Requirements Sept. 30, 2018
* Concept Design Review Nov. 30, 2018
* EPO of long lead parts Dec. 8, 2018
* Detailed Design Review Feb. 9, 2019
* ER of drawing package March 2, 2019
* Complete Prototype build April 5, 2019
* UI Design EXPO April 26, 2019
* Final Report / Drawings May 4, 2019