Park-It-CdA

Project Requirements Specification

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**Document History**

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# Objective

Park-IT-CdA is a parking garage monitoring system located in Coeur d’Alene, Idaho at the parking garage between 3rd and 4th Avenue and along Coeur d’Alene Avenue. It is capable of detecting when a car is parked in a stall and will relay this information to a server which will monitor the parking garage’s statistics such as: time from entering the garage to finding a stall, average time a stall is occupied, average number of stalls used.

The objective of this document is to state the requirements of the Garage Sensor System (GSS). This document will define what the GSS is to do and not go into the details about how it is to be achieved. The GSS is comprised of 5 Garage Sensor Units (GSU). The GSUs will decide among themselves which is to be the Garage Sensor Gateway (GSG).

# References

## Cited Documents

University of Idaho, Color Identity,

<https://www.uidaho.edu/brand-resource-center/visual-style-guide/color-identity>

## Acronyms and Abbreviations

* Den – Innovation Den, located at 418 E Lakeside Avenue, Coeur d’Alene, ID
* GSS – Garage Sensor System
* GSU – Garage Sensor Unit
* GSG – Garage System Gateway
* PGS – Parking Garage Simulator

# Functional Requirements

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

There are 3 categories of users of the GSS.

* Drivers – people who use the garage and park inside it. Drivers interact with the GSS when they park their car in a stall that is monitored by a GSU.
* Maintenance staff – a person who must monitor the physical condition of each GSU and clean them, change batteries as required.
* Owner – the person who owns the garage must be able to see the real time statistics of the garage.

## What it should do

* The Garage Sensor System (GSS) is comprised of 5 GSUs.
* The GSS must periodically check and accurately detect whether a car is parked in a stall
* A Garage Sensor Unit (GSU) is assigned to a parking stall and must indicate externally whether a stall is occupied
* The GSU must use sensor(s) to determine whether a car is parked in a stall
* One GSU must be placed at the entry of the parking garage
* One GSU must be placed at the exit of the parking garage
* The GSUs must be arranged in a mesh network
* The GSUs must determine amongst themselves which will be the Garage System Gateway (GSG)
* The GSG must rotate on a periodic basis to conserve battery life
* The GSUs must transmit data periodically about the state of their parking stall to the GSG
* The GSG must transmit data periodically about the status of all GSUs to the Innovation Den
* The receiver at the Innovation Den must process this data and simulate the rest of the parking garage
* The Parking Garage Simulator (PGS) must display statistics of the parking garage such as the number of and location of currently occupied stalls, number and location of available stalls, average time from entry to find a stall.

# Physical Requirements

The GSS consists of 5 GSUs located in the garage and a receiver at the Innovation Den.

## Strength Requirements

The GSU must be capable of supporting its own weight.

## Spatial Requirements

The enclosure of a GSU must fit within the following:

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

## Weight/Mass Requirements

The mass of the GSU must be light enough that it will not fall from its mounting point – see 4.4.

## Mounting / Interface Requirements

* The GSU must be mounted to a concrete ceiling.
* The method of mounting used must not cause any permanent damage and be removeable leaving no evidence of having been there.
* The GSU must be removeable from the mounting bracket used.

## Appearance Requirements

* The GSU will have a bubble-dome camera cover over it (will this be part of the spatial requirement?)
* The GSU must display the UofI colors – gold, silver, black, white
* The following are the primary colors used by UofI and the values used for printers, images, websites, etc.
* Pride Gold
  + Pantone 3514 C
  + CMYK 0-27-100-0
  + RGB 241-179-0
  + #F1B300
* Silver
  + CMYK 0-0-0-50
  + RGB 128-128-128
  + #808080
* White
  + CMYK 0-0-0-0
  + RGB 255-255-255
  + #FFFFFF
* Black
  + CMYK 20-20-20-100
  + RGB 25-25-25
  + #191919
* Metallic Gold
  + PMS Metallic 871

## Durability Requirements

Each unit must be designed to operate for 1 year continuously. Maintenance must be performed at the 1-year mark to clean the surface of the sensors and change batteries.

# Electrical Requirements

## Operational Voltage

* The GSU must be capable of running off batteries
* During operation the voltage of the GSU must run at 5.0V/ 3.3V as required by hardware

## Operational Power Capability

During operation, the GSU must be capable of supplying enough power for all electronic components.

## Energy Storage Capacity

* The batteries of the GSU must have enough capacity to run for a year
* The hardware and software must minimize power usage
* The GSU must have the ability to go into a sleep mode to conserve battery life
* The total mass of the batteries must not be so high as to compromise the mounting system

# Software Requirements

## Functionality

* The software for this project will consist of the control software for the GSU and the simulation
* The GSU software must interface with the sensors to identify when a parking stall is occupied
* The GSU must be in a sleep state to conserve battery when not transmitting or detecting
* The GSU must be activated from its sleep state when a (1) sensor detects a car in its parking stall
* The GSU must use all its sensors to confirm whether the first sensor successfully detected a car or not
* The GSU must have multiple positives to confirm that a car is parked or not
* Each GSU must be able to communicate with every other GSU in a wireless mesh network
* There must to be a priority system in place to determine which of the GSUs will be the GSG
* The GSUs must transmit its data to the GSG periodically
* The GSG must periodically transmit all the GSU data wirelessly to the receiver located at the Den
* All communication between the GSU’s and the gateway must provide Integrity and Availability
* The receiver at the Den must have the ability to be able to remotely reset all the GSUs.
* The simulation software must use the data received from the GSG to perform a simulation of the entire garage
* The simulation must graphically display the current state of each parking stall, the average time from when a car enters the parking garage to when it parks, the number of occupied stalls and number of available stalls

## User Interface

# Environmental Requirements

## Temperature

The GSS must have full operational capabilities in a sheltered outdoor environment and run under industrial temperatures (-40 to +85 C).

## 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 is expected.

* The GSU must be waterproof and dust tight
* The external sensors of the GSU must be able to perform without maintenance for a year with any debris build up that does occur

# Regulatory Requirements

## FCC Requirements

The GSS must comply with all FCC requirements when transmitting wirelessly.

# Cost Requirements

## Prototype Cost

The cost to build and install 5 prototype GSUs, including test units, batteries and housings, must not exceed $3000.