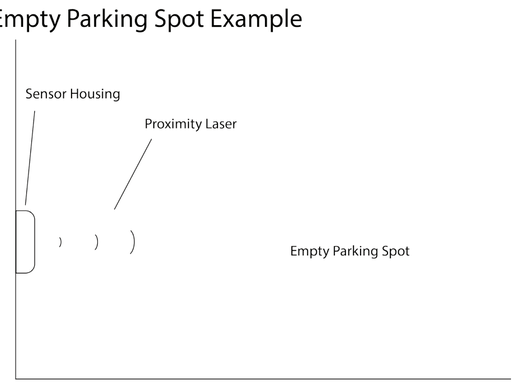
Smart Parking Deck

Abstract

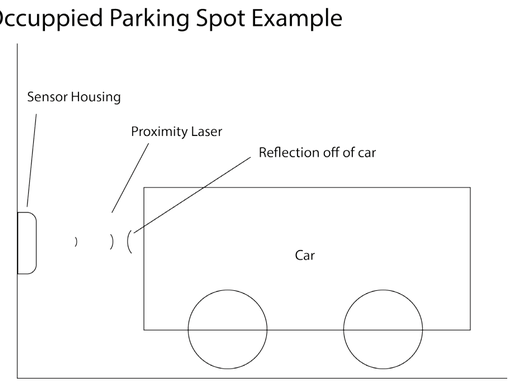
The Smart Parking Deck will employ elementary circuit design elements and mobile application development. Each device module will use laser proximity sensors to check the availability of an individual parking space and a Zigbee unit to communicate with the adjacent device module. The chain of modules will be connected to a network hub that manages all of the incoming and outgoing parking data. This data will be displayed both at the entrance to the parking deck and on the mobile application. The system will be easily manageable and energy efficient, significantly decreasing the costs associated with other smart parking systems on the market. This system is aimed at decreasing commute time for students by allowing them to find available parking spaces with ease.

1	Engineering Requirements	Justification
1, 3	Sensors respond to vehicles that are up to four meters away from module.	Sensors must be able to track both large and small vehicles that may be poorly centered between the lines of each parking space.
7, 10	Sensor networks update every half-minute to conserve battery power and maintain reliable data.	A good estimation of the changes in traffic movement would occur every half-minute, and with concern to the conservation of battery power, one sensor module would initiate every half-minute (at least during the daytime).
9	Module is water-resistant and survives under extreme weather conditions (0 - 40 degrees Celsius).	Module must be able to survive changing weather patterns.
5, 6	Mobile applications must display a warning message to not use device while operating a vehicle. Project must obey traffic regulations.	Safety concerns must be acknowledged so that this application does not contribute in any way to unsafe driving practices.
3, 6	Display and mobile application should receive and update data simultaneously (within one half-minute) to prevent confusion.	Displays must be consistent with one another to prevent confusion.
9, 11	Modules should be placed where there can be little to no damage done to them. They should only be able to be opened by maintenance technicians.	Displays should be locked and out of the way of students or vehicles. Preventative measures should be taken to stop theft of batteries or other parts to the module.
2, 3	The process of replacing batteries must be very easy to perform. A battery system should last for at least four months per module.	If a battery-operated system does not last for many months, the product becomes less marketable in comparison to other designs on the market.
1, 8	A display signal to prove sensor is operating under working conditions should be available to maintenance technicians.	In order for maintenance to be simplistic, a sensor needs to be able to send out a signal that validates proper functionality.
11	Modules can be installed by drilling into wall and changing batteries (with no added requirements to installation).	Each module should only be installed once, but the battery compartment should also be easily removable for maintenance only.
4	Zigbee node network must be able to communicate across entire parking deck to central hub to be accommodating to users.	Nodes must transmit data sequentially across each other in the form of a node network

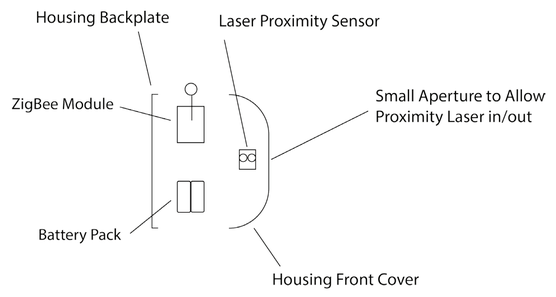
Empty Parking Spot Example



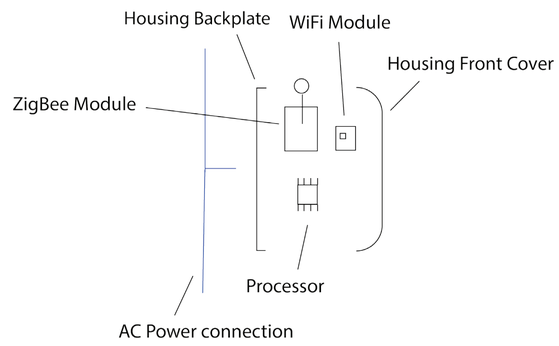
Occuppied Parking Spot Example

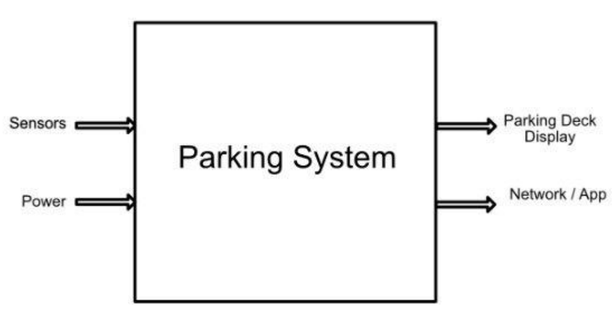


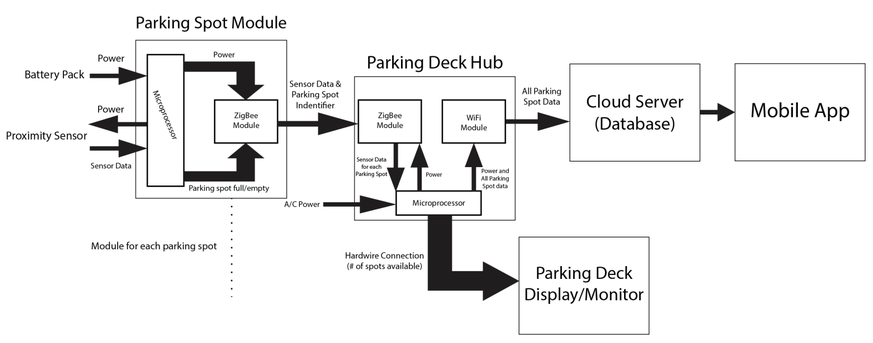
Sensor and housing

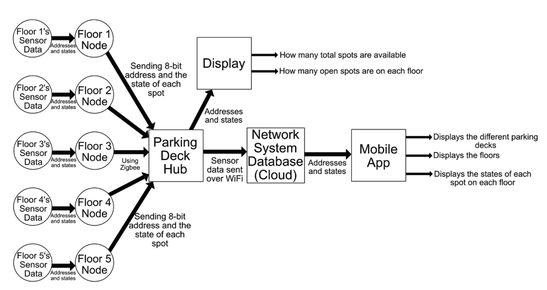


Internet / Display Hub









Level 0 Block diagram

Level 2 Hardware Diagram

Level 2 Software Diagram

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