Easy Park

Group 26

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Project narrative:

To help everyone spend the least amount of time to find parking, to help with traffic congestion, possible accidents and overall make everyone worry less about parking at UCF. For years on end, students and faculty complain about on campus parking. Why allow more purchases of decals when there are not enough spaces to support the numbers being sold? Why build a research facility instead of a new parking garage? The answer is simple, the collective body never addressed their complaints to the president of UCF himself...and money. Alas, on top of the other suggestions, there is way to make things slightly better for a majority of students. In terms of time management, the future is the Easypark.

Goals and Objectives:

The few goals of this project is to use computer vision or even a deep learning algorithm to detect empty and non-empty parking spots, sending this data to a low power microcontroller that would aid in flashing LEDS for those specific parking spots. This is mostly to minimise the upfront setup cost. While the initial objective was to use ultrasonic sensors to detect and report back any available parking spaces, the goal is create a device that is cheap enough for UCF's board of approval and actually does the easy parking job.

Project idea and function:

The scope of this project is to make it easy for students, teachers, guests, or anyone to find available parking spots in the UCF garages. For students, this is usually a major toll to find parking spaces due to the limited availability, so in essence, it would save time so that every potential driver that enters the garage can easily be directed to find a parking spot, or would be told to find alternate parking, may be in a different garage, or parking area.

The camera would be mounted towards the middle of a row of cars on both sides, on the rooftop of the garage. Using computer vision or a deep learning algorithm, the camera would detect the vehicles in the parking spaces. Copper wires, providing power and control from a microcontroller to the LED will change the LEDs color to red when an object is occupying a parking space. When the space is not occupied, the LED will display green to signal motorist available parking.

Requirements Specifications:

1. Each camera should be able to scan at least six to ten parking spaces, depending upon the limited visibility of the camera and the hinderance of somewhat larger vehicles.
2. The parking system would be able to check for space availability at a refresh interval of 5 seconds or lower.
3. The camera would be able to provide live feed and video record for security measures. When the garage spaces are not occupied, the cameras will be in low power mode.
4. The system will have an app to view open spaces ahead of time for timely convenience
5. The system will be able to count the number of cars presently parked and match it with an outside digital sign, capable of displaying "open" or "full"

6. The LEDs, when the garage have empty floors or rows, will shutdown to conserve energy. The alternative is to display LED when the space is occupied then turns off when the space is vacant.
7. The LEDs will be emitted from the ground, in front of the parking space entrance. The network is wireless for every LED and is battery powered.

Alternative Approaches and issues

Parking improvement projects have been made in the past, but suffer from complexity and pricing. Having wires to connect to every LED serves as an unruly, concrete tangled mess that costs much more than implementing a bluetooth device to each LED. Each LED will follow the all for one approach, where a main microcontroller and image processing cameras will communicate with the LEDs. If the project stops here, UCF is happy. The project will require features that will most likely be ignored, but will help in endeavors of the students that choose to solve the parking issue. From this point on, the features provided is not to aid UCF's budget constraints, but to aid each engineer's post graduation skills and reputation.

Feature 1 (Park Density): As such in previous parking projects, the wifi interface involved allows for the app based user to gauge for themselves how dense parking is at UCF from the safety of their homes. No point in implementing wifi technology to tell students what they already know. Besides, when you have a class at a certain time, and cannot plan ahead for it, you will still be stuck in the concrete maze.

The Park Density will utilize the, soon to be...placed, parking sensors to showcase the number of occupied spaces per floor. Having this connected to the pre existing full/open sign in every garage will give a clear idea of the current hopelessness in buying unnecessary parking decals and instead carpool or shuttle ride to campus.

Feature 2 (primal park density): This approach, if matched with the total number of parking spaces in the garage, will tell everyone that the parking garage is not full yet. Like the car scanner at mcdonald's drive-through, the device will count how many cars have entered/exited. This would most likely be overshadowed by feature one, but can be used by ucf to properly state the conditions of the garages.

Feature 3 (RFID card reader): Any faculty member would have access to a card and each card is assigned to a parking spot. The card would store the individual's identification and a time log in which the cardholder occupied/vacated the parking spot. Authorities are alerted when an unauthorized vehicle is parked at a spot. The card reader may be fine for faculty parking, but it serves little purpose in a public university that holds more students with decals than the spaces themselves.

Feature 4 (GPS to nearest parking spot): The app itself does not need to be limited to parking space density, there can also be GPS parking to add on to make parking density more useful. The GPS parking app, as assumed, will provide the user directions to the nearest opened parking space. The main issue for this app is what to do when the destination is already taken by another driver. Well, these parking apps and devices are just aids to finding a parking space. They just may not be as useful as the ti nspire is in aiding engineers. This idea is great for open lots or the top floor of a parking garage. Another issue is that GPS only does XY positioning. Digital labeling will be required for higher floors.

Milestones:

TASK	Start Date	Due Date
SENIOR DESIGN 1		
Choose a project idea and learn from the time consumption	August 23, 2017	August 31, 2017
Provide rules and doctrines to promote speedy choices	August 23, 2017	N/A
Create contingency potential projects in case of failure	August 23, 2017	September 14, 2017
I**. Research Paper**		
Research ultrasonic sensor technology and its applicability	September 1, 2017	October 23, 2017
Research Computer Vision Technology and	September 1, 2017	October 23, 2017
*Research wireless components and interface vs costs(bluetooth, mesh networking, etc)	September 1, 2017	October 23, 2017
Research the potential of LEDs via visualization and power usage vs size	September 1, 2017	October 23, 2017
Research long lasting power systems for long term device usage	September 1, 2017	October 23, 2017
II. PCB Design		

Research multiple boards and its capabilities vs project specifications	September 1, 2017	November 3, 2017
Soldering practice and mastery	September 1, 2017	November 3, 2017
Purchase components for testing	September 1, 2017	November 3, 2017
SENIOR DESIGN 2		
Draw expected image of the finished product	December 20, 2017	
Design and test divided workload components and test its capabilities	February 3, 2018	
Create a working prototype	March 5, 2018	
Create the final product for presenting	March 27, 2018	

Estimated Project Budget:

PARTS	**PRICE**	**QUANTITY**	**SOURCE**
LED(Red and Green)	$0.05 each	48/8=6	Ch town electronic
Ultrasonic sensors	$1.00 each	3	Sensesmart
Power System (batteries)	$0.27 each	9	BlueDot Trading LLC
Protective padding that is able to withstand vehicle weight	$1.00	3	
PCB	$1.75	4	
Packaging	$0.50		
Microcontroller(MSP430)	FREE-$3.50	2-3	TI

Copper Wires, resistors, capacitors, etc	$3.50		
Soldering kit and tutorials	$5.00	2-4	
Cameras	$25.00 each	1-2	Sricam
TOTAL	$40-$50 or $12/sensor		

House of Quality			Engineering Requirements						
			Response Time	Cost	Output Power	Install Time	Field of Vision	Dimensions	Weight
			-	-	-	-	+	-	-
Marketing Requirements	Install Ease	+				↑↑			↑
	Low Cost	-		↑↑	↑				↑
	Minimal Output Power	+		↑	↑↑				
	Small Size	+			↑			↑↑	↑
	Features	+	↑				↑		
	Maintenance	-		↑↑	↑				
	Lightweight	+						↑	↑↑
Targets for Engineering Requirements			< 5 seconds	< $10 per unit	< 10 W	< 10 mins	5-10 cars	1 cubic foot	< 10 pounds

Legend	Description
↑	Positive correlation
↑↑	Strong positive correlation
↓	Negative correlation
↓↓	Strong negative correlation
+	Positive polarity (increasing the requirement)
-	Negative polarity (decreasing the requirement)

Software block diagram:

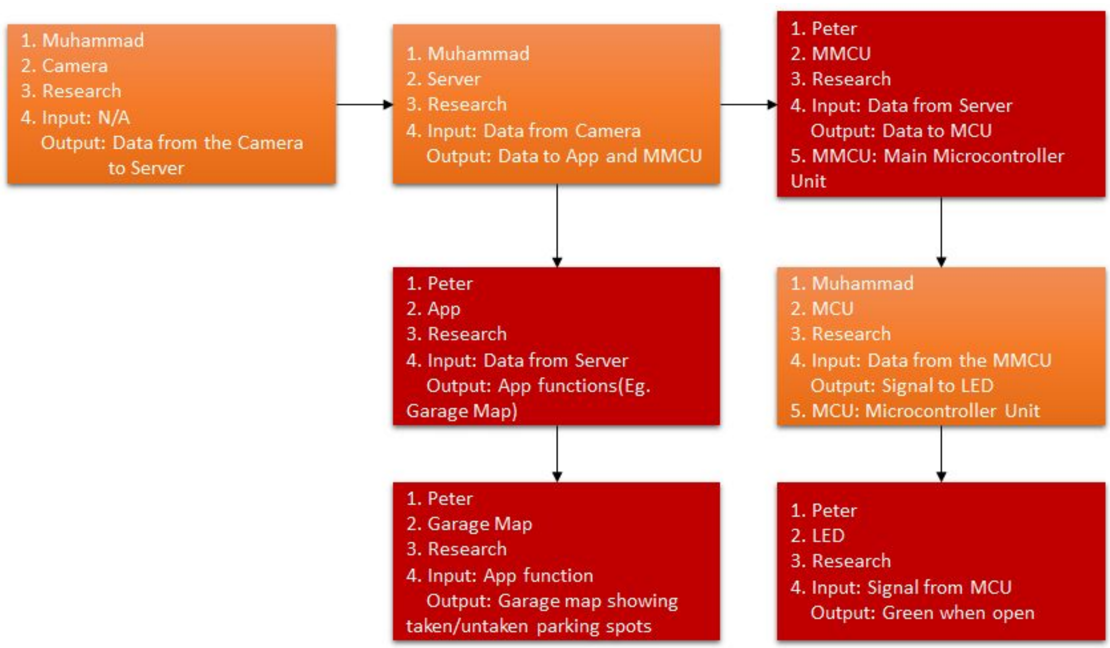

Figure 1 - Block Diagram for Software Implementation

Hardware block diagram:

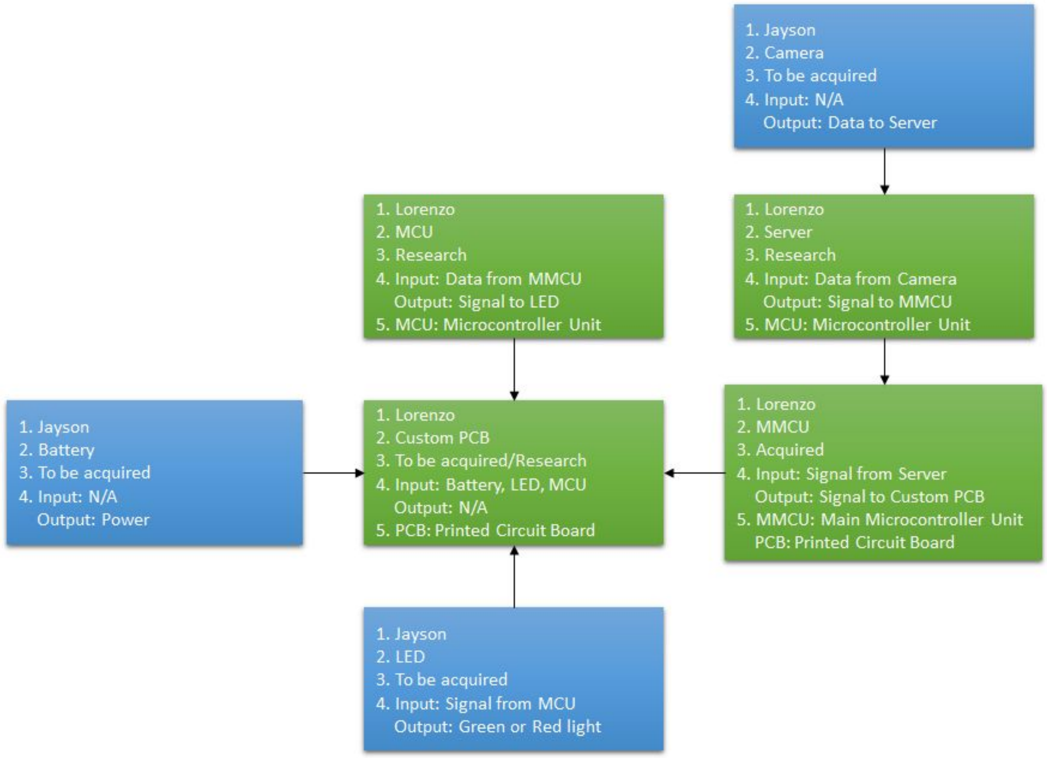

Figure 2 - Block Diagram for Hardware Implementation

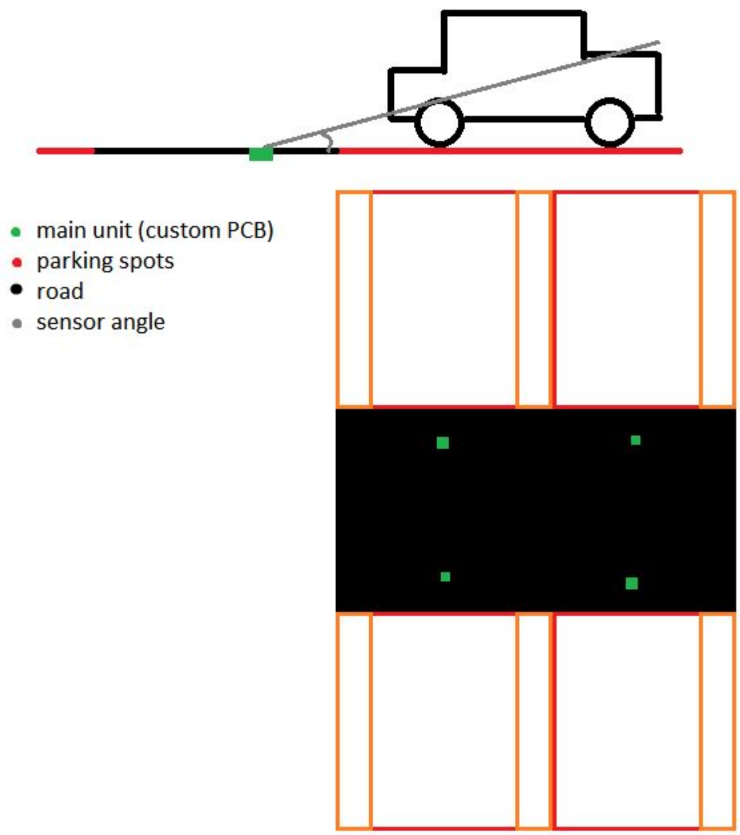

Figure 3- Sketch of side view(top) and overhead view(bottom)

Sources for reference:

http://www.eecs.ucf.edu/seniordesign/fa2009sp2010/g06/

http://www.eecs.ucf.edu/seniordesign/su2012fa2012/g11/

http://www.eecs.ucf.edu/seniordesign/sp2016su2016/g09/

http://www.eecs.ucf.edu/seniordesign/sp2014su2014/g06/

Links to tools for reference:

Coin Cell Button Battery(USA)

Ultrasonic Sensor(China)

LED(USA)

LED (China)

Camera(USA)