Functional Specification

Year: 2016 Semester: Fall Team: 7 Project: ANPR Parking System

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Assignment Evaluation:

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| --- | --- | --- | --- | --- |
| **Item** | **Score (0-5)** | **Weight** | **Points** | **Notes** |
| **Assignment-Specific Items** | | | | |
| **Functional Description** | 4 | x3 | 12 |  |
| **Theory of Operation** | 4 | x3 | 12 |  |
| **Expected Usage Case** | 4 | x3 | 12 |  |
| **Design Constraints** | 4 | x3 | 12 |  |
| **Writing-Specific Items** | | | | |
| **Spelling and Grammar** | 3 | x2 | 6 |  |
| **Formatting and Citations** | 5 | x1 | 5 |  |
| **Figures and Graphs** | 5 | x2 | 10 |  |
| **Technical Writing Style** | 2 | x3 | 6 |  |
| **Total Score** | 80 | | |  |

5: Excellent 4: Good 3: Acceptable 2: Poor 1: Very Poor 0: Not attempted

General Comments:

Good attempt following the template. And ideas for designing the project are explained.

However, the writing of this document is so poor that it significantly influences communicating ideas behind the project. The Purdue Writing Lab provides help on academic writing free of charge. You can find more information about it at: <https://owl.english.purdue.edu/writinglab/>

For the evaluation, it is explicitly required in the To-Do list of Week 2 that “a functional block diagram of the major functionality anticipated by your project” should be provided. Did you forget to add it in this document?

Anyway, you should be able to do much better. Let us know if there is anything we can do to help.

1.0 Functional Description

The Automatic Number Plate Recognition (ANPR) Parking System provides drivers with parking lot occupancy status and automatically charges the parking fee by recognizing license plate. More specifically, the system detects every parking spot and gives route instructions leading to empty spots vis LEDs. Also, by detecting all the spots, the microcontroller shows the number of remaining spots on the display screen. For parking fee, the system recognizes the license plate and records the time when the car goes in/out of the parking lot. Thus, it can calculate the parking fee for each car.

2.0 Theory of Operation

The ANPR Parking System makes use of images captured by the camera. The camera transmits the image data to the Raspberry Pi and Raspberry Pi recognizes the plate number via open source algorithms and OpenCV library.

The microcontroller collects IR sensors’ status and sets LEDs to either green or red accordingly. The LED will be green if IR sensor does not find a car on the corresponding parking spot and red if otherwise. The LCD screen will display messages and available amount of parking spots. The microcontroller will keep tracking the number of parking spots in use and the number of empty parking spots.

3.0 Expected Usage Case

The ANPR system will be used in social parking lot to read vehicle number plate. This system is expected to enhance efficiency of parking and make things easier for drivers. The ANPR system will not only benefit every driver who enters the parking lot, but also the drivers who are trying to get into a full parking lot, because they will be able to tell the parking lot is full at the gate. Since we are developing a product that targets all end users of automobiles, we cannot make any swaying assumptions about the technical literacy of our end users, but all users should be expected to be above the minimum driving age.

4.0 Design Constraints

4.1 Computational Constraints

Totally for ANPR project, there are several main functions that need computation power. In those main functions, several functions will be implemented using the microcontroller, such as controlling the gate bar, calculating the number of residue parking lots, and indicating it by the LCD screen. On the other hand, the plate image recognition requires more memory and computational power that can be supported by the microcontroller, so a Raspberry Pi will be used for that function.

4.2 Electronics Constraints

The main electrical components will include: A Raspberry Pi, a microprocessor, a number of IR sensors, a screen, a number of LEDs. The interfaces for these will be either UART or SPI. Since we have many sensors and LEDs, the microcontroller will require inputs from IR sensors. Then based on the IR sensors’ input, the microcontroller sets corresponding LECs to green or red, and available parking spots will be displayed on the LCD screen. The microcontroller is also responsible to raise and lower the gate bars by driving motors or servos based on the command from Raspberry Pi. Raspberry Pi will capture the license plate picture and recognize the license plate number. Then it will transmit data to microcontroller to display available amount of parking spots and message on the LCD screen.

4.3 Thermal/Power Constraints

Since this project should be implement in parking garages, the microcontroller and Raspberry Pi will need to be powered using power supply. These devices are running at a lower power consumption compared to other part of this project, such as the motor to raise and lower a gate bar. Power consumptions of microcontroller and Raspberry Pi are not very important considerations in this project. Most microcontrollers, sensors can operate in high temperatures. the target maximum operating temperature for project is aimed to be 35 ᵒC (95 ᵒF). The gate bar module will be main power consumption. The target voltage for gate bar motor will be 120V.

4.4 Mechanical Constraints

Since the ANPR parking system will be implemented in real parking garages, the criteria should be designed according to real world constraints and human being’s common sense. The size prototype cannot be too large. Because it is for live demonstrations, its size will be designed as about three feet times four feet. The simulation car and the car plate are expected test real height and length. In order to fulfill this requirement, around one-foot height of car is expected. Also, so as to test whether the infrared wave detector can reflect the space occupancy of each parking lot, each car will be hollow so that it just like the height of real car’s base. Last, for protecting environment, we shall utilize the electrical prototype car to do the demonstration.

4.5 Economic Constraints

The ANPR system, while implementing many original ideas and additional features, still would have some level of competition with other providers. To ensure that the ANPR system is moderately priced, we will try to use the cheapest materials to implement the system. For the real parking lot, the expense depends on the size of the parking lot, since we need to implement sensor to each parking spot. For a 500 spots parking lot, we estimated the total cost to build our system in is about 30k dollars, which compares to our competitor, Smart Parking [1], is a lot cheaper.

5.0 Sources Cited:

1. “Car Parking Solutions | Smart Parking,” Car Parking Solutions | Smart Parking. [Online]. Available: http://www.smartparking.com/. [Accessed: 01-Sep-2016].