AUTOMATED CAR PARKING SYSTEM COMMANDED BY ANDROID APPLICATION

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Abstract— **The aim of this paper is to automate the car and the car parking as well. It discusses a project which presents a miniature model of an automated car parking system that can regulate and manage the number of cars that can be parked in a given space at any given time based on the availability of parking spot. Automated parking is a method of parking and exiting cars using sensing devices. The entering to or leaving from the parking lot is commanded by an Android based application.**

We have studied some of the existing systems and it shows that most of the existing systems aren't completely automated and require a certain level of human interference or interaction in or with the system. The difference between our system and the other existing systems is that we aim to make our system as less human dependent as possible by automating the cars as well as the entire parking lot, on the other hand most existing systems require human personnel (or the car owner) to park the car themselves.

To prove the effectiveness of the system proposed by us we have developed and presented a mathematical model which will be discussed in brief further in the paper.

Keywords-Automated Parking, Android Application

I. INTRODUCTION

Our project presents a miniature model of an automated car parking system that regulates the number of cars that can be parked in a given space at any given time based on the parking space availability.

The aim of this project is to automate the car park for allowing the cars into the parking. LCD is provided to display the information about the total number of cars that can be parked and the place free for parking. When a car arrives at the entrance, it will be stopped over a path leading towards the parking lot. The owner, then, de-boards the car and using the Android application on his Smartphone, will command the car to park it. On receiving this command, the car will begin to trace the path that leads towards the parking lot.

When a car comes in front of the gate of the parking, it will wait on the white marking outside the parking space for the searching of free space. On allocation of free slot, the car will further trace its path to free parking spot. On successful parking, the data on the LCD will be updated automatically.

Four basic modules are required for implementation of this system. (1) Interfacing of Microcontroller with LCD. (2) Interfacing of Microcontroller with GSM. (3) Interfacing of Microcontroller with RF Module. (4) Android Application. The car driver initially positions the vehicle on the path leading to the parking space. Then, with the help of an Android Application he sends an encoded SMS saying "Park the car". The car traces the path to the gate of the parking. On the gate, the microcontrollers of the parking unit and the car communicate and availability of free parking slot is checked for. If a free slot is found, it is allocated and the car traces the path to the slot and gets parked. The data on LCD gets updated simultaneously. Thus, the aim of this system is to provide an efficient car parking system with minimal human intervention.

II. LITERATURE SURVEY

Various methods are prevalent for development of autonomous or intelligent parking systems. Study of these systems shows that these require a little or more human intervention for the functioning.

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One of the intelligent systems for car parking has been proposed by making use of Image processing [1]. In this system, a brown rounded image on the parking slot is captured using camera and processed to detect the free parking slot. The information about the currently available parking spaces is displayed on the 7-segment display. Initially, the image of parking slots with brown-rounded image is taken. The image is segmented to create binary images. The noise is removed from this image and the object boundaries are identified. The image detection module determines which objects are round, by determining each object's area and perimeter. Accordingly, the free parking space is allocated.

A vision based car parking system [2] is developed which uses two types of images (positive and negative) to detect free parking slot. In this method, the object classifier detects the required object within the input. Positive images contain the images of cars from various angles. Negative images do not contain any cars in them. The co-ordinates of parking lots specified are used as input to detect the presence of cars in the region. However, limitations may occur with this system with respect to the type of camera used. Also, the co-ordinate system used selects specific parking locations and thus camera has to be at a fixed location. Limited set of positive and negative images may put limitations on the system.

Number Plate Recognition technique [3] for developing autonomous car parking system uses image processing basis to process the number plates of the vehicles. In this system, the image of the license number plate of the vehicle is acquired. It is further segmented to obtain individual characters in the number plate. Ultrasonic sensors are used to detect free-parking slots. Then the images of number plate are taken and analyzed. Simultaneously, the current timing is noted so as to calculate the parking fees. The LCD displays 'FULL' sign to indicate that a parking slot is not available. However some limitations with the system include background color being compulsorily black and character color white. Also, analysis is limited to number plates with just one row.

Smart Parking system [4] designed proposed a mechanical model with an image processing facility. The car would be parked with the use of lift at multiple levels. Also, image processing is used to capture the number plate and store in database for comparison to avoid illegal car entry.

Thus, we aim to design a car parking system that represents a fully automated model with minimum human intervention and overcome the limitations of previous systems.

III. PROPOSED WORK

In this paper, we present the proposed architecture of our system. We aim to develop an autonomous car parking system which is commanded by Android application and thus aim to provide an efficient car parking system.

The Proposed system architecture diagram gives a schematic of the design required to develop this system. Here, we see two sub-architectures – One for the car and one for the Parking area. The Parking system is commanded by the Mobile Phone with Android application as shown in the figure. The Parking system communicates with the system installed in the car so as to control the motion of car to the parking space.

The Parking control system is solely responsible for ensuring proper parking of the vehicle to the destined position. The system installed in the car is responsible for movement of the car as per the commands received from the Parking system.

The proposed system is divided into following 4 modules: -

1) Interfacing LCD with Microcontroller.

2) Interfacing GSM with Microcontroller. [5]

3) Interfacing RF Module with Microcontroller.

4) Android Application Development.

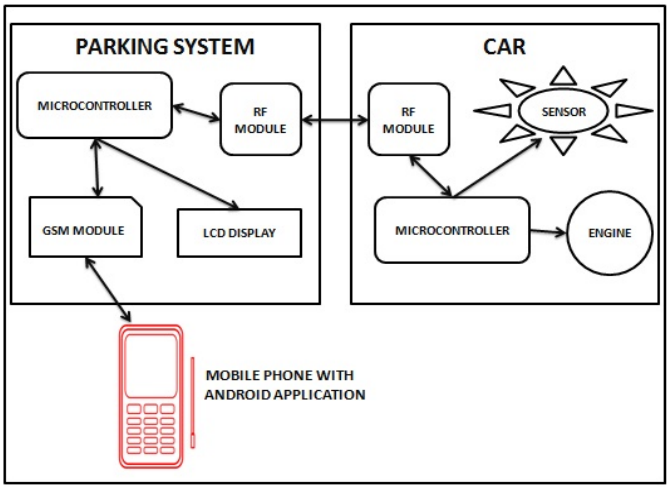

Figure 1. Proposed System Architecture

Modular Description: -

A. Interfacing LCD with Microcontroller

Interfacing of microcontroller with LCD Unit is mainly used for displaying the parking slot status data to the system user. The LCD module can represent data in alpha-numeric data along with some pre-defined characters. The LCD module communicates with the micro-controller and displays the number of free slots to the user.

B. Interfacing GSM with Microcontroller

GSM stands for Global Systems for Mobile Communications. The GSM module is used for sending and receiving encoded messages to or from the microcontroller. The GSM module is retrofitted in the Parking slot as shown in the system architecture diagram. Data obtained from the mobile phone or the microcontroller is stored into the buffer of the GSM module and then transmitted further in serially synchronized form.

C. Interfacing RF Module with Microcontroller

RF stands for Radio Frequency. RF Module is a small electronic circuit to transmit and receive radio signals on number of carrier frequencies. In our proposed system, we are using the RF module for inter-microcontroller communication. It serves the purpose of data communication in between the

microcontroller of the parking area and that of the car. The data communication takes place in serial synchronous form.

D. Android Application Development

In this module, an Android Application is developed to instantiate the system. The Android Application would be developed by making use of Android ADT-bundle and the platform used would be Eclipse – Kepler. The Android application to be designed would generate encoded message which will be sent to the parking unit, every time a user sends a "Park my Car" command. The message would be decoded at the parking control unit and depending on the status of the parking area, reply would be sent back. Also, at the time of retrieving the car from the parking, the Android application would send an encoded "Get my Car" form of message to the parking slot to retrieve the appropriate car.

The system proposed initiates by the user sending a "Park My Car" message through the Android application. The message sent would be in encoded form. This message would be retrieved at the parking area unit by the GSM. The GSM would send the message to microcontroller and depending on the status information stored with the microcontroller, an appropriate reply would be sent to the user. If a parking space is free, the car would automatically trace the path to the gate of the parking area. It would wait here to get the exact information about which slot is free.

This information would be obtained by the communication between the microcontrollers of car and the parking area. Once the information would be obtained, the car would further trace the path to the free parking slot and get parked. Data on the LCD display would be updated automatically. Later, the driver would send an encoded "Get My Car" message through the Android Application. This message would be retrieved at the parking area unit and depending on the information stored the particular car would trace its path back to initial position.

IV. MATHEMATICAL MODEL

The mathematical representation of the proposed system focuses on the function for searching of free parking space and on the function to retrieve the appropriate car from the parking space.

P- denotes the set of Parking Areas P={ P1 ,P2 …..,Pn}

I- denotes the set of slots I={ I1 ,I2 ,I3 ,…,In}

Let -

ES - set of Empty Slots {I1, I2, I3,…In}

FS - set of Full Slots {I1', I2', I3',….In'}

Then -

{ES,FS} □ I ……. ……..(1)

Let, S denote the strip numbers in the parking space - S= {S1, S2, S3, ... Sn}. Here the strips are the horizontal marks outside each parking slot, to assist the car in taking left/right turns.

Let T denote the direction of Turn (0=left, 1=right) - T={0,1}

Let, C be the "Park My car" function which implements sequential search strategy.

Therefore, C {strip_no , turn} i.e. C{S,T}

C : P*I*ES …….. (2)

Thus 'Park My Car' operates on Parking area consisting of various slots in it and then finding an empty slot.

Let, G- denote "Get My Car" function such that G{S,T}

Then-

G:S*T …… (3)

This function retrieves the car based on the stored slot number(S) and the direction of turn (T).

V. EXPECTED RESULT

A proposed system on Autonomous Car parking commanded by an Android application has been discussed in this paper. The result expected from successful implementation of the system is an efficient car parking and retrieval method. The successful implementation of system consists of allotment of free parking slot to the car and a proper path-tracing to the slot. Also data on the LCD display is updated as per allotment and de-allotment. If the parking space is full, no car is allowed to enter the parking space until any of the parking slots, is made available.

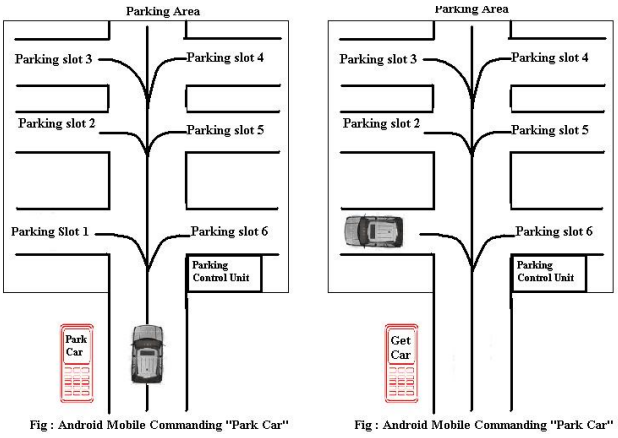

Figure 2. Expected Result

VI. CONCLUSION

A proposed architecture of the automated car parking system commanded by Android application is presented in this paper. The allotment of the parking slot by an autonomous searching method makes the parking of vehicles at public places more efficient. The searching and allotment of parking slot, based on the status of available slots, as communicated to the microcontroller, makes the path-tracing for the vehicle, to the appropriate free slot, easier. The proposed system makes use of Android application to facilitate the parking and retrieval of the vehicle, for the user. We hereby aim to reduce the human efforts required for parking of vehicle at public places like shopping malls, public parking, 5- star hotels etc. Thus, the proposed design would provide an efficient car parking system by using an efficient searching method, supported by the efficient functioning of the GSM Module, RF Module and the microcontroller.

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