Innovative Parking Reservation System

Vijay Krissna V | Shyam V |Rajesh Kumara S | Arul Prakash N

[1](UG Scholar, Affiliated to Anna University, Chennai, India, vijaykrissna1409@gmail.com)
[2](UG Scholar, Affiliated to Anna University, Chennai, India,vshyam93@gmail.com)
[3](UG Scholar, Affiliated to Anna University, Chennai, India, rajeshkumarask@gmail.com)
[4](UG Scholar, Affiliated to Anna University, Chennai, India, arul607080@gmail.com)

Abstract—This project proposes an innovative parking reservation system which could be used in huge parking areas. The proposed system will reduce the unnecessary time consumption required for finding the exact location of the available parking area. It also provides with an automatic money collection which could make the work of the vehicle owner simpler. The system provided is a completely automated on with the use of an ARM controller. The controller would accept the request along with the vehicle number from the vehicle owner by using the GSM Modem and also stores the availability of the parking slots with the help of cameras. The controller also responds to the vehicle owner about the availability of slots. When the vehicle arrives the second camera would sense the number plate and inform the controller to open the gate. We also provide with a RTC which notify of the exact arrival and the departure time of the vehicle. The demonstration has proven the capability of the system to reserve the parking, gain entry to the parking area and hence eliminates the hassle of searching empty parking lots.

Keywords—*Parking reservation,Time Consumption,Arm controller,Camera,GSM Modem.*

---

1. INTRODUCTION

All the parking reservation systems are not automated, even if automated they are still lagging in effective usage. Most of the vehicle owners find it very difficult to find the parking slots available and spent time in searching them. If we take a 4 storey parking area the vehicle owner would spend half of his shopping time in spotting the available slot. These problems could be rectified by using the Technology. There have been a lot of systems which have been implemented for the effective usage of the parking, starting from the manual system, but everything has been less than effective.

1.1 Problem of finding the parking slot

Obtaining the specified location of the free parking slot would be one of the biggest problems for the vehicle owners. One of the ways to address this issue is by displaying the number of available parking spaces at each floor of the parking area using the LCD display. Another way is by mounting indication lights on top of each parking lot to inform the users on parking availability. The drawbacks of these methods are that although the searching time is reduced, users will still need to circle around to look for the empty spaces.

1.2 Problem of obtaining the available slots

The next problem would be the usage of obtaining of available slots. For obtaining the exact available slots we could use IR Transceiver or Thermal sensors but are not effective, the usage of IR sensors could be effective for small parking areas but in case of the huge parking areas it would not be effective.

1.3 Problem of waiting to enter the slot

If we want to enter the slot we have to wait in a big queue till the last person enters, it could be time consuming. The other problem would be to make the payment and wait till we get the correct change to be provided, since everything is manually done it could create few errors popping up.

1.4 Proposed system

In the system all the problems would be solved. The vehicle owner would send the request of the parking lot. Once the GSM modem receives the request it would check the first camera for any available slots or not.
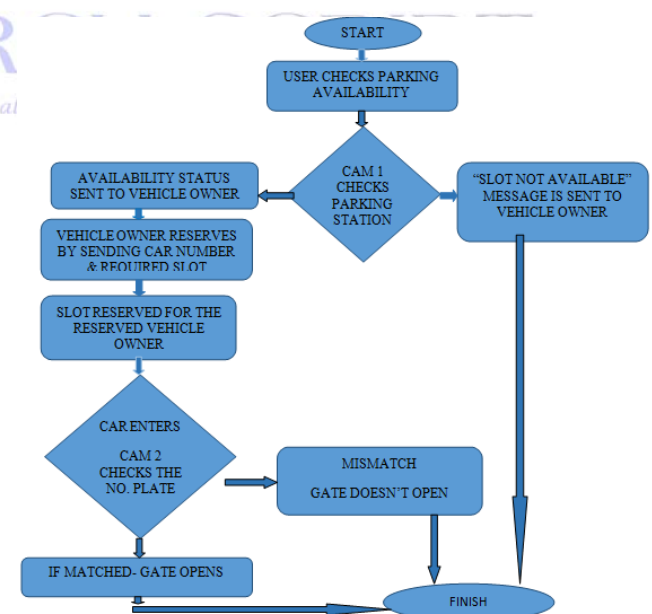
If a free slot is identified it would notify the vehicle owner with the available slot along with the confirmation of his vehicle number. The vehicle owner would reply his confirmation along with his vehicle number. The system would provide the final confirmation of the booking of the slot. The vehicle owner arrives at the parking lot the second camera senses the number on the number plate and compare with the available numbers, if it matches then the gate

would be opened and the vehicle owner could park his vehicle in the provided slot.

The money for the parking would also be automatically collected from the main balance of the mobile phone. Hence the complete system is fully automated and there will not be any need for a person to keep in track of the parking or to collect money. We could also keep track of what time the car arrives at the parking slot and when does it leave by using the RTC.

1.5 Flow diagram of the process

The process could be explained using this block diagram which provides the information about how the process is carried out.

2. TECHNIQUES FOR IMPLEMENTATION

The system is mainly divided two fields one is the Image Processing and the other is the Embedded System part of it. The image processing is used to compare the number plate with the provided number and the embedded would be used to perform all the other tasks.

2.1 Complete block diagram
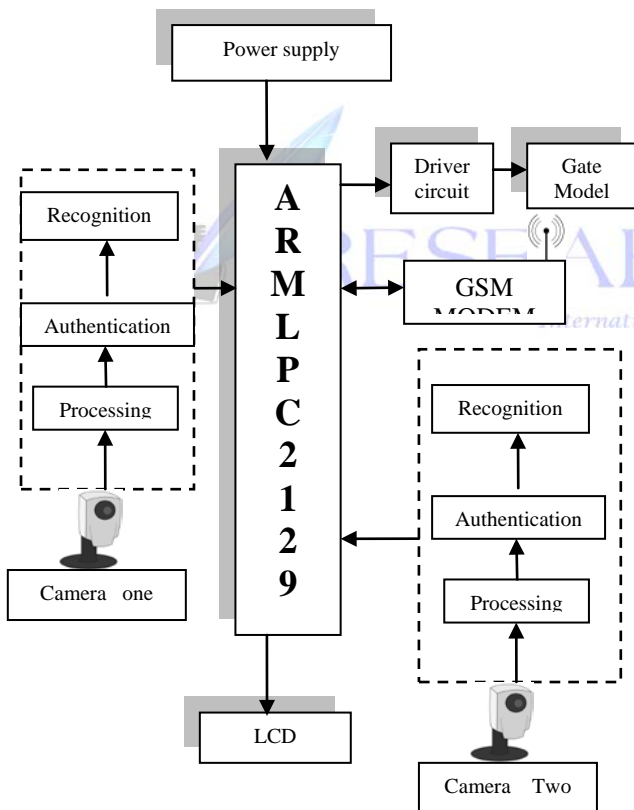
2.2 Reservation system

To initiate the process, specific command is sent through SMS for parking reservation. This command activates the digital output 1 (DOT 1) of the micro-RTU. There are three types of I/O terminals available in micro-RTU, which are digital input (DIN), digital output (DOT), and analog input (AIN) ports. Two DOTs have been used to represent the available spaces for parking lot.

DOT 1 is representing LOT 1 (parking lot 1) and DOT 2 represents LOT 2 (parking lot 2). For this project, the recipient number for the SMS is the number of SIM card used in the micro-RTU GSM modem.

The user would initiate the request for parking in this manner.
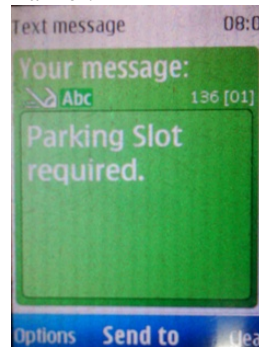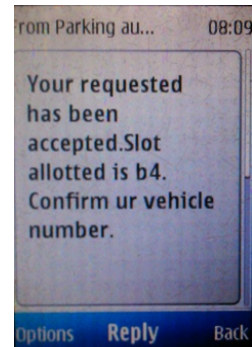

1.Requesting slot   2.information of available slots

1)The user would sent the message "Parking slot required" to the GSM simcard number provided. Once the request has been accepted the GSM unit would provide to the controller of the request. The controller will check for the availability of the slot 2) inform the controller which slot is available and respond to the vehicle owner of the allotted slot and asking for the confirmation of the vehicle number.

At the same time the money for the booking would also be taken from the service provider from the main balance of the mobile phone.
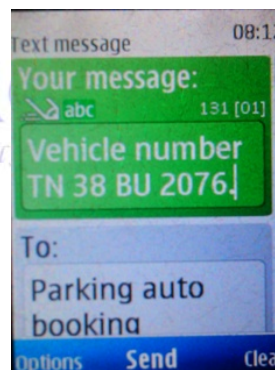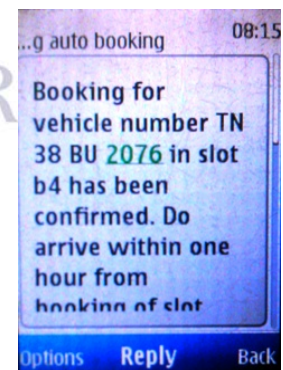
3.CONFIRMATION OF   4.FINAL CONFIRMATION
VEHICLE NUMBER

3) Once the user receives the request from the parking area asking for the vehicle number, he has to send his vehicle number which could be used for easy entry into the parking lot.4) finally the last confirmation message would be processed to the user from our system.

2.3 Embedded systems part

The embedded part of the system comprises of the reservation mechanism and they would open the gate when the camera identifies the number on the number plate.
It is being subdivided into further components lets see the methods by which these components are being used in the system.

2.3.1   ARM Controller

ARM is a family of instruction set architectures for computer processors based on a reduced instruction set computing (RISC) architecture developed by British

company ARM Holdings. It is abbreviated as Advanced RISC Machines.

The main purpose of the controller in the system is that it would help to access all the subcomponents of the embedded systems. In our system we have used the GSM modem, RTC, Gate opening motors, ULN driver circuit.

All the other components provide the inputs to the controller which helps to process all the information and helps other output devices to perform the required tasks.

The GSM modem will help to initiate the request and next the controller would check the first camera if the any slot is available. If it obtains the slot then it would inform the GSM modem of the available slot. The GSM would then send the message to the vehicle owner of the slot.

In the other side the second camera would sense if the vehicle number matches will the provided information, if it matches then the camera would provide the input to the controller which would process it and would give signal to the gate circuit to open the gate. Hence the ARM acts as the brain of the system.

The ARM controller could be programmed using Embedded C programming and the software used for programming the controller is KEIL.

2.3.2   GSM MODULE

The main purpose of this module is to act as a transceiver. It accepts the request from the user and sends to the ARM controller for processing and transmits to the vehicle owner the specified to be send to him. The GSM net used by cell phones provides a low cost, long range, wireless communication channel for applications that need connectivity rather than high data rates. The modem is provided with a sim card which is the toll free number to which the user has to transmit the message. In this system we provide with the SIM 900a GSM module.
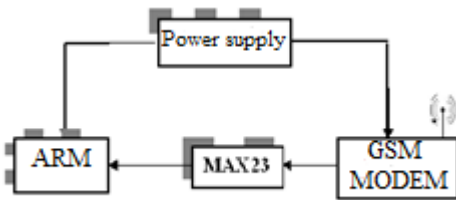
The GSM module is connected with the controller using UART communication protocol. This helps for the serial communication of the information between the two devices.

2.3.3   Real Time Clock

The purpose of this module is to notify the exact time of the entrance and the departure of the vehicle to and from the parking lot.

The DS1307 serial real-time clock (RTC) is a low power, full binary-coded decimal (BCD) clock/ calendar plus 56 bytes of NV SRAM. Address and data are transferred

serially through an I2C, bidirectional bus. The clock/calendar provides seconds, minutes, hours, day, date, month, and year information. The end of the month date is automatically adjusted for months with fewer than 31 days, including corrections for leap year. The clock operates in either the 24-hour or 12-hour format with AM/PM indicator.

2.4   Image Processing unit

The term digital image refers to processing of a two dimensional picture by a digital computer. In a broader context, it implies digital processing of any two dimensional data.

2.4.1 Software for image processing

MATLAB (matrix laboratory) is a paradigm numerical environment and fourth-generation programming language. Developed by Math Works. MATLAB allows matrix manipulations, plotting of functions and data, implementation of algorithms, creation of user interfaces, and interfacing with programs written in other languages, including C, C++, Java, Fortran and Python.

FEATURES:

- High-level language for technical computing.
- Development environment for managing code, files, and data.
- Interactive tools for iterative exploration, design, and problem solving.
- 2-D and 3-D graphics functions for visualizing data.

The process of image processing is :
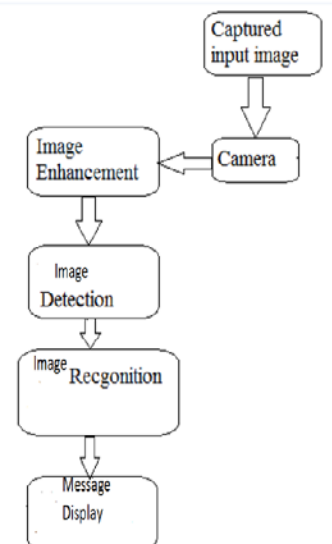
- The image is captured first.

- It is then sent for image enhancement.

- Thirdly the image is detected comparing the old images.

- Once the image is recognized then the display message is given.

2.4.2   Camera one

This camera is being situated in the slots which could help to obtain the available and unavailable slots. The images of the emptying slots are stored and parking of each slot is being stored, the comparison of each would be performed and finally the available free slot could be found out and the controller could notify the user accordingly which slot is free and if none are free it could notify the vehicle owner of unavailable slots.

The usage of camera is an effective in huge parking storey's. The advantage of it than other IR sensor is that, the IR could be effective for small ranges and if the slots become it could provide wrong information; this is eliminated in case of camera. There could be any number of slots which could be identified using the camera.

2.4.3   Camera to detect the number plate

Number plate extraction is hotspot research area in the field of image processing. Many of automated system have been developed but each has its advantages and disadvantages. It is assumed that this algorithm worked on images which have been captured from fixed angle parallel to horizon in different luminance conditions. It is also assumed the vehicle is stationary and images are captured at fixed distance.

An automated system is developed using MATLAB in which image is captured from camera and Converted in Gray scale image for pre processing. After conversion, dilation process is applied on image and unwanted holes in image have been filled. After dilation, horizontal and vertical edge processing of has been done and passed these histograms through low pass filters. Low pass filters filter out unwanted regions or unwanted noise from image.
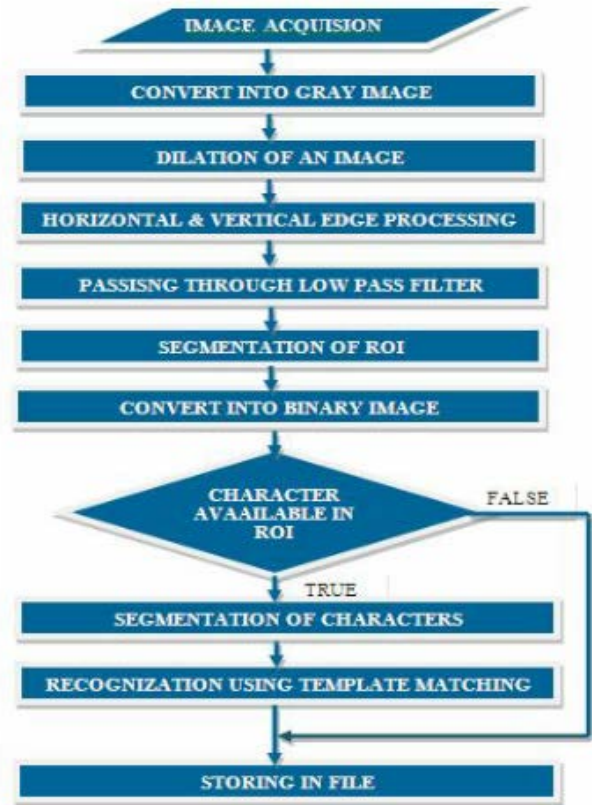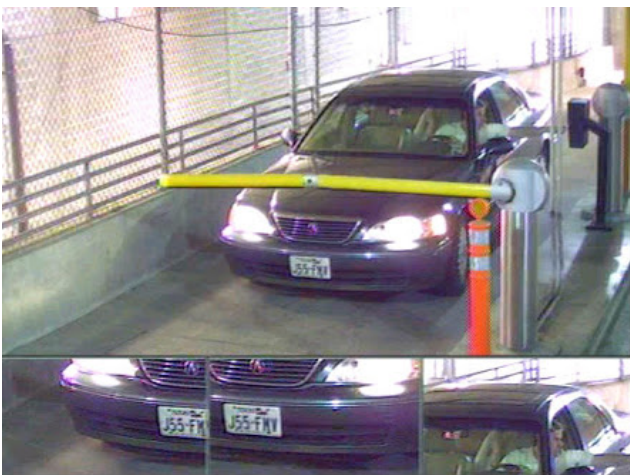

Figure 1. Flowchart

After this filtering, image is segmented and region of interest is extracted and image is converted into binary form. Binary images are easily processed as compared to colored images. After Binarization, each alphanumeric character on number plate is extracted and then recognized with the help of template images of alphanumeric characters. After this, each alphanumeric character is stored in file and whole number plate is extracted successfully

Number plate extraction needs extremely high accuracy when working on images of busy roads or parking areas. This system gives about 90% of efficiency and has been tested with nearly 40 vehicles Hence this effective method would reduce the time consumption for waiting to enter the parking lots. It would take less than 15s to process and the entering time would be reduced to few minutes. This helps to automate it fully without any maual intervention to ask for booked parking or providing the direction to enter the lot and specify which lot has been granted. The Complete process of converting the number plate to serial numbers is given in the below flowchart.

3. DISCUSSIONS

The prototype shows the capability of the proposed system to reserve parking through SMS as well as gaining entry to the parking area. At the moment, only a few parking lots were created and included in the microcontroller for database and control. The number of parking lots could be increased depending on areas. The microcontroller could also handle a few reservations at a time. Some upgrades are currently being done to ensure better reliability of the proposed system.

4. CONCLUSIONS

This system provides an innovative way to enter the parking lots as well as booking the parking reservations. This could be very much effective in high congested parking lots. The integration of the GSM and the microcontroller along with the camera has made it become a smart system with no human interventions; the whole processes of reservation and access system are fully automatic. The coding for the controller is done using KEIL IDE. The image processing is done with MATLAB.This provides for a smart parking which could be less time consuming to park the vehicles.

REFERENCES

1. Mr. Arun Josh, Research and Development-AJ Technologies.

2. "Tracking number plate from vehicle using matlab" by Manisha Rathore and Saroj Kumari.

3. "Smart parking reservation using short message service" by Noor Hazrin Hany Mohamad Hanif, Mohd Hafiz Badiozaman and Hanita Daud