RESEARCHERID
THOMSON REUTERS

[Chorey, 7(4): April 2020]
DOI- 10.5281/zenodo.3757407

ISSN 2348 – 8034
Impact Factor- 5.070

GLOBAL JOURNAL OF ENGINEERING SCIENCE AND RESEARCHES

SMART CARD BASED CAR PARKING SYSTEM

Ms. Sonika A. Chorey[*1], Ms. Priyanka A. Chorey[2] & Nilesh S. Pohokar[3]

ABSTRACT

As in the modern world everything is going automatic we have built a system which will automatically sense the entry and exit of cars through the gate and then display the number of cars in the parking lot.
This paper shows the concept of an automatic car parking system. Check-ins and check-outs will be handled in a fast manner without having to stop the cars so that traffic jam problem will be avoided during these processes. Since there won't be any waiting during check-ins and check-outs the formation of emission gas as a result of such waiting will be avoided. Therefore, by this work develops a parking system for an organization to have automated parking system for making best use of space, decreasing the man power and providing authentication for the vehicles from avoiding the theft.

Keywords: *car parking, check-ins, check-out.*

I. INTRODUCTION

In this work used a IR sensor to sense the movement of cars and depending upon the output received they show the status of parking slots over the display, This system open a gate when any car enters in the parking lot with help of RFID and it opens exit gate after being detected by the IR sensor present at exit gate. Each parking slot contain IR sensor which detect the presence of car in front of the parking block and show the status of parking slot over the display which is present at the entry point of the parking. When car leave the parking slot then IR sensor receive no signals and display will display the empty parking slot.

II. LITERATURE SURVEY

Background

The smart parking system implemented mainly in the Europe, United States and Japan is developed with the incorporation of advanced technologies and researches from various academic disciplines [1]. Now-a-days, there is a rapid growth in parking system. Manpower is needed for each car parking slot to select a parking slot manually and give direction to drive properly into slot [1]. So, there is a need to develop an automatic parking system which will reduce manual work as well as will be useful for careful parking of cars and other vehicles [2].

Parking system routinely experience parking related challenges, especially in the urban and metropolitan areas. While doing a survey we have found that this automatic car parking system has been proposed by various researchers using different technology. In some paper some researchers have proposed this system using Around View Monitor (AVM). In their paper they have discusses fusion of AVM and ultrasonic sensor, used to detect the vacant parking slot in the automatic car parking system. The AVM provides a virtually 360 degree scene of the car in bird‘s eye view. The AVM helps the driver to manoeuvre into parking spots. Through the bird‘s eye view, a driver can check for obstacle around the vehicle. First, the parking slot marking detected in the AVM image sequence. A tree structure-based method detect the parking slot marking using individual AVM image sequence and image registration technique. Second, empty slot is detected using ultrasonic sensors. The probability of parking slot occupancy is calculated utilizing ultrasonic sensor data acquired while the vehicle is passing by parking slots, and finally the selected empty slot is tracked and the vehicle is properly parked in selected parking slots [2].

Some other researchers have discuss this system using another technology i.e. GSM Technology. The functionality of the technology is that user sends a message to the GSM modem which is placed at the parking end. The GSM modem will send a conformation message to the user whether the slot is vacant or not. If it is vacant then the user has to message the exact time and duration he/she wants to park the vehicle in the parking slot. Then the GSM

modem will send a password and the parking lot number to access the reserved parking lot. Once the conformation message has been send, the counter for the reservation time will automatically start for sending message [3].
FPGA Technologies

Xiao, Y et.al. attempt to discuss this system using FPGA Technology. They have discuss how to implement an automatic car parking system using FPGA technology ,where the access in the parking which is made by barrier, if there are vacancies with the lifting of the barrier a ticket is issued with a client code and there starts a timer for measuring the time left in the parking. The analog signals transferred through a digital analog converter as input signals in the FPGA. To work with FPGA Xilinx software has to be used [4]. Goodrum, P et.al. discusses a system using some digital key along with some robotic technique. When a car enters the entry of the automated car parking system, an IR detection subsystem detects the presence. Then the driver is promoted to enter a valid key and to choose the option of either parking or retrieving the car. Each key is checked for accuracy and assigned a designated parking slot .Upon entering the correct key, car is picked up along with the pallet from the stack system and placed in the designated spot .When drivers return to pick up the car he enters the valid key for which the system will check in its database and the car is return back to the drive way. The stack system will pull down the pallets to make room for incoming pallet. The system includes robotic lift with motors for picking the car and placing it in the designating spots [5].

Radio Frequency Identification Technologies
Pala, Z explains a system where microcontroller 89S51 has been used, in their paper they have discussed a system which is automated with the user being given a unique ID corresponding to the trolley being allocated to him/her. The idea is to park and move cars with no disturbance to the already parked cars in their system [6]. Glover, B et. al. have discussed this system using RFID. According to their system, the vehicle owner has to first register the vehicle with the parking owner and get the RFID tag. When the car has to be parked, the RFID tag is placed near the RFID reader, which is installed near the entry gate of the parking lot. As soon as the RFID tag is read by the reader, the system automatically deducts the specified amount from the RFID tag and the entry gate boomer opens to allow the car inside the parking area. At the same time, the parking counter increments by one. Similarly, the door is opened at the exit gate and the parking counter decremented [7].

III. ANALYSIS AND DESIGN

Analysis
The system can be install in Parking area for avoiding the cramming it consist of Multiple IR sensor which are located at entrance ,Exit and in front of parking slots with the help of registered RFID Tag user can enter his car inside the parking area and can have view of parking slot on Digital display before entering into parking. At the exit point IR sensor detect the car and start the Servo motor. Servo motor opens the gate and car can go out.

Problem Statement
With increase in the population, number of vehicles increases and due to unmanaged parking it leads to many problems. In big cities, people faces difficulties as increasing number of vehicles creates congestion, wastage of space, wastage of time, traffic problems, car napping, car vandalism and many other difficulties.

Intelligent Transportation Systems provides ways to manage traffic and also car parking by using various advanced technologies. Looking at our world today, a lot of advanced systems are developed and also implemented. The use of sensors in addition to their implementation will thoroughly analysed so as to get a better understanding. That's why the focus is more on the fully-automated parking. Different car parking systems will be presented and also its usefulness when it comes to space reservation will be clarified and also an introduction to the fully automated car parking will be analysed together with different features that may be used to implement it will also be mentioned. A little discussion will be made on the automated parking since it is mostly used around Automated Car Parking Systems is widely known to be more complex and computer based. That's why the Semi-Automated Car Parking which is not that complex will be also analysed.

Parking facilities have always been important by allowing drivers to safely leave their car while they can go on to their daily activities. Mostly the information provided together with guidance implemented by the smart parking system has been extremely useful by assisting drivers to find an available space [1].

The payment of the parking has also been made easier with the implementation of the new technology. Sensors are used to help detect the presence of the car. This is absolutely necessary when it comes to the development of the smart parking system because information of the parked vehicle is required. From the sensor, the information can easily be gathered so as the system can use it and the same information will also be sent to the driver.

Software and Hardware Requirements

Following are the software and hardware requirements are as follows

- Arduino UNO
- Arduino Software
- RFID card reader
- RFID card
- IR sensor
- Servo Motor
- Digital display
- Connecting wires
- I2C connector
- Bread Board

Design

The design of the system is broken into modules as follows:

- RFID Scanning

In the RFID based Automatic Parking System the EM-18 RFID reader which operates at 125 KHz is installed at the entry gate. The vehicles are fitted with the RFID tag also operating at 125KHz.When the vehicles approach the entry gate their RFID tag is scanned by the RFID reader and transmitted to central database. Based on validity of the tag scanned, the user may be allowed or denied entry by signalling a green or red light respectively.

- Parking slot monitoring

Every parking slot is equipped with Infrared proximity sensor. These are used to monitor the real time status of each of the parking slots by continuously checking for presence of vehicle chassis above them. They continuously report slot status i.e. empty or occupied to the microprocessor. This status information is used by the display system to control the LED with minimum delay. The sensor works in range of average vehicle chassis height around 10cm and is calibrated for background infrared noise.

- Status Display System

Based on the information available from Infrared sensors placed at each parking slot, the status display system will show which parking slots are vacant and which are occupied. For this purpose it uses LED lights. A glowing LED depicts that the corresponding slot is occupied.

- Result

A step-by-step approach in designing the RFID based system for the measurement have shown that the system performance is quite reliable and accurate. This system requires a number of hardware components, properly integrated in accordance with their specifications. The system requires a continuous and reliable power supply provided to them.

IV. SYSTEM IMPLEMENTATION

Software Part

- Arduino software (IDE)

The Arduino integrated development environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in the programming language Java. It is used to write and upload programs to Arduino compatible boards, but also, with the help of 3rd party cores, other vendor development boards.[2]

[Chorey, 7(4): April 2020] ISSN 2348 – 8034
DOI- 10.5281/zenodo.3757407 Impact Factor- 5.070

The source code for the IDE is released under the GNU General Public License, version 2.The Arduino IDE supports the languages C and C++ using special rules of code structuring. [4] The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program with the GNU tool chain, also included with the IDE distribution. The Arduino IDE employs the program avrdude to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware. [6]

- Embedded C

Embedded C is a set of language extensions for the C programming language by the C Standards Committee to address commonality issues that exist between C extensions for different systems. Embedded C programming requires nonstandard extensions to the C language in order to support exotic features such as fixed-point arithmetic, multiple distinct memory banks, and basic I/O operations.

The C Standards Committee extended the C language to address these issues by providing a common standard for all implementations to adhere to. It includes a number of features not available in normal C, such as fixed-point arithmetic, named address spaces and basic I/O hardware addressing. Embedded C uses most of the syntax and semantics of standard C, e.g., main() function, variable definition, data type declaration, conditional statements (if, switch case), loops (while, for), functions, arrays and strings, structures and union, bit operations, macros, etc. [1]

Hardware Implementation

- RFID

In its simplest form a product tag, made of a microchip with a tiny antenna, is attached to a product. An associated tag reader puts out electromagnetic waves. The tag antenna receives the waves and the tag itself draws power from the field generated by the reader, powering the chip, and then modulates the reader signal, sending it back where it is converted into digital data. The electromagnetic waves are harmless at the low end of the spectrum and no more dangerous than a car radio.

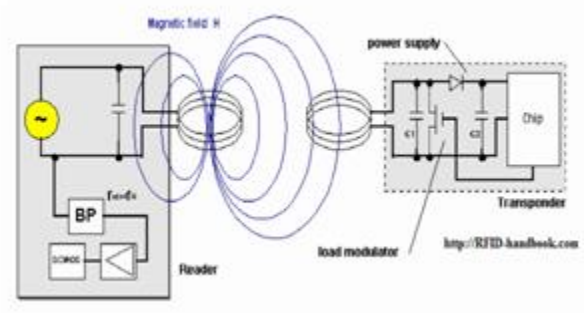

Fig. 1 Working of RFID card reader

RFID tags come in a wide range of flavours including the passive type described above, battery-powered, multi-frequency and tag-talks-first. RFID antenna types can vary too. What's more, not all RFID systems use low-frequency EM waves. There are read-only tags and read-write tags. There are tags holding up to 2K of product data and tags that contain only a single product ID. Tags can also be used for more than product IDs; they can be used in environmental monitors, security devices, and product integrity mechanisms

- RFID Frequencies

Radio waves are the carriers of data between the reader and tags. The approach generally adopted for RFID communication is to allocate frequencies depending on application. The frequencies used cover a wide spectrum.

These specified bands are Very long wave 9 - 135 kHz Short wave 13.56 MHzUHF 400-1200 MHz Microwave 2.45 and 5.8 GHz

The allocation of frequencies is regulated by government agencies, requiring care in considering RFID applications in different countries. Efforts at standardization should avert these problems. The many varied applications will work their best at different frequencies; therefore, it is important to understand the requirements before selecting a particular type of RFID system. The most common uses of low frequency systems are in security access, asset tracking and animal identification. They generally have short reading ranges and lower system costs. High-frequency systems are used for such applications as railroad car tracking and automated toll collection. They offer long reading ranges and high reading speeds. This higher performance usually entails higher costs. The power level of the interrogator and the power available within the tag to respond will determine the reading range that can be achieved in an RFID system. Like the restrictions on carrier frequencies there are legislative constraints on power levels. Environmental conditions, particularly at the higher frequencies, can also influence the range of communication.

- TYPES OF TAG

Most RFID tags contain at least two parts. One is an integrated circuit for storing and processing information, modulating and demodulating a radio-frequency (RF) signal, and other specialized functions. The second is an antenna for receiving and transmitting the signal. There are generally two types of RFID tags: active RFID tags, which contain a battery andthus can transmit its signal autonomously, and passive RFID tags, which have no battery and require an external source to initiate signal transmission.

[Chorey, 7(4): April 2020]
DOI- 10.5281/zenodo.3757407
ISSN 2348 – 8034
Impact Factor- 5.070

System flow diagram

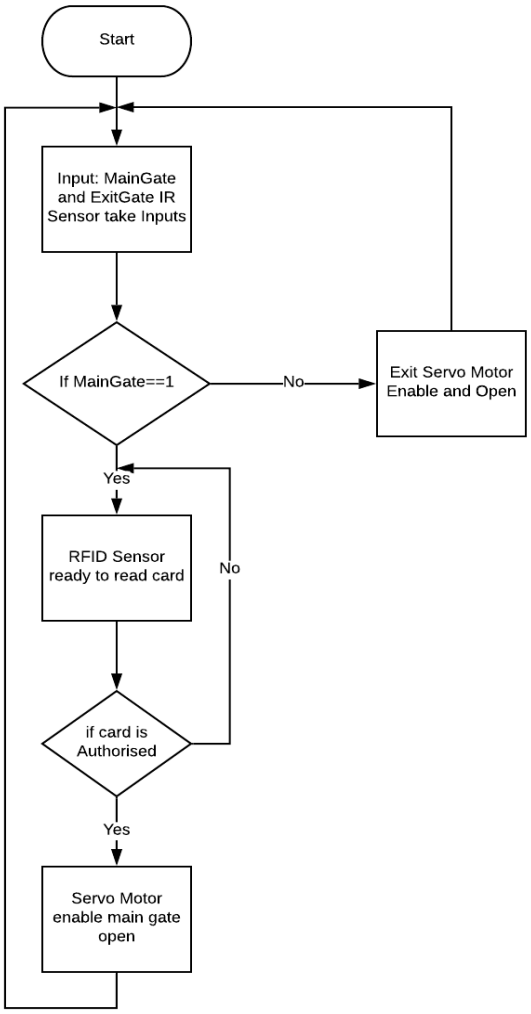

Fig. 2 system flow Diagram

V. CONCLUSION

Currently the RFID Based Automatic Parking System is in prototype stage and works with a limited number of sensors and on a limited scale. However it is scalable and can easily accommodate more IR sensors to monitor a far greater number of parking slots. Thus its scale can be easily adjusted to the needs of the specific customer. Also it can be modified to add more features to suit specific needs or to adjust its cost benefit ratio. Efforts are also being made to advance from the prototype stage into a more finished and polished product that will be suitable for demonstrations and promotion. All these aspects are currently being considered in detail to decide future course of the system.

[Chorey, **7(4): April 2020]** **ISSN 2348 – 8034**
DOI- 10.5281/zenodo.3757407 **Impact Factor- 5.070**

REFERENCES

1. *K. Penttila., M. Keskilammi, L. Sydanheimo, L., M. Kivikoski, "Radio frequency technology for automated manufacturing and logistics control". International Journal of Advanced Manufacturing Technology, 2nd ed. Vol. 31,2006, pp. 116-124.*
2. *L. Zhang, "An Improved Approach to Security and Privacy of RFID application System". Wireless Communications, Networking and Mobile Computing. International Conference. (2), 2005, pp. 1195- 1198.*
3. *N. L. Higgins, T. Cairney, "RFID opportunities and risks". Journal of Corporate Accounting & Finance, Vol, 17 (5),2006, pp51-57.*
4. *Y. Xiao,S. Yu, K.Wu, Q.Nil, C. Janecek, J. Nordstad, "Radio frequency identification: technologies, applications, and research issues". Wiley Journal of Wireless Communications and Mobile Computing. (Accepted for publication) 2006.*
5. *P. Goodrum, M. McLaren, A. Durfee, A, "The application of active radio frequency identification technology for tool tracking on construction job sites". Automation in Construction, vol. 15 (3), 2006, pp. 292-302.*
6. *Z. Pala, Z., "Automation with RFID Technology as an application: Parking Lot Circulation Control (MSc)", YuzuncuYil University, Van.2007.*
7. *B. Glover, H. Bhatt, "An Introduction to RFID, Chap. 1. RFID Essentials",2006 pp. 221-223*