PROTOTYPE OF RFID BASED CAR PARKING

[1]Pashva Shah, [2]Chetna Achar

[1]Student, [2]Assistant Professor

[1]Master in Computer Application,

[1]MET Institute of Computer Science, Mumbai, India

Abstract: As technology is evolving day by day everything is getting automated this creates the need for efficient parking systems. We have tried to implement a prototype using IOT. But present parking system have many problems like high operation cost, inefficient management of vehicles, time consuming process of issuing tokens, opening gates manually and collecting money. Thus we are trying to overcome above stated problems by RFID based automatic parking gates. It uses a microcontroller with sensors to monitoring entry and exit of vehicles. The vehicles are allowed entry only they carry authorized RFID tag at the gate. An account in central database is maintained like every valid RFID tag. It enables us to watch and store the time of entry and exit. This system allows automatic authorization of vehicles. Authorization is done faster which will reduce the wait time for cars to enter into parking. It will deduct amount from the customer's account which makes it cashless. These processes allow parking system to work efficiently and need fewer personnel to manage the parking. Thus, the cost of operating the parking system is significantly reduced.

Index Terms - RFID, IOT, RFID Tag.

I. INTRODUCTION

As within the times everything goes automatic, we've built a system which can automatically sense the entry and exit of vehicles within the parking zone. Therefore, by this prototype we develop an automatic parking system for utilizing best use of space, decreasing labour power and providing authentication for the vehicles. This project is based on RFID Car Parking System. In this project, the car will be given entry into the parking lot only on scanning a valid RFID card. The IR sensor (on the entry gate) will sense the vehicle on the gate and will trigger the RFID reader. After the RFID reader is triggered, the car owner or the user will scan the card and depending on its authorization, the barrier will be raised and the access will be given to that vehicle. If the card is not authorized by the reader, then entry for that vehicle will not be given and that particular card will be declared as invalid. Also if the parking capacity is full, then access will not be given to any vehicles. After the card is authorized by the reader, the barrier will be raised and the vehicle will enter into the parking lot. Since the entry is given to the car, the system will deduct 1 unit of amount from that respective card. Each time a valid card is scanned, 1 unit of amount will be deducted from the card. If the card balance is low, then the vehicle owner can opt for refilling the amount in the card. After the car enters into the parking lot, the vehicle will be assigned a parking slot and the owner will have to park its vehicle in the dedicated Parking slot given by the system. If the car wants to go out of the parking system, then the car owner will have to scan the card on the exit gate. On scanning the card on the exit gate, no amount will be deducted from the owner's card. The amount from the card will be deducted only when the car enters the parking lot. The card will be authorized again and then the barrier will be raised and then the car can move out of the parking lot.

II. MOTIVATION & RELATED WORK

Car parking may be a ubiquitous feature of urban landscape. With increasing number of cars the demand for parking has also increased. And this demand goes to extend even further. To tackle such a quantity as well as the efficiency of a car parking. We are focusing on the latter. To improve efficiency of a car parking the focus is put on minimising the time taken at check-ins and check-outs, reducing personnel involvement in check-ins and check-outs, using the reduced load on personnel in operations to spice up their involvement in internal control and safety supervision. To do all this we will incorporate RFID technology within the car parking which can increase efficiency by reducing time interval, vehicle queue length and personnel requirement. It will also provide a way to watch parking traffic using the accumulated data and analysis of this data to realize useful conclusions and patterns. Such designs are useful for urban planning and management. The main motivation for making Car Parking System is because of the huge amount of time people have to take in order to park their cars in malls, multiplex systems, hospitals, offices and super markets. In the existing system, one has to spend ample time before they find out an empty parking spot and also the conventional payment method requires the user to spend a lot of time to complete their transaction. Creating an automatic system which not only helps users to make parking far more efficient and faster but also automates the payment gateway using RFID thus saving the user a lot of time.

III. RFID SYSTEM

RFID is frequency identification system. This is an ADC technology. The RFID systems are fast, reliable, and don't require physical contact between them. RFID is an automatic identification method wherein the info stored on RFID tags or transponders is remotely retrieved. RFID (radio frequency identification) is a new technology that uses electromagnetic or electrostatic coupling Radio Frequency (RF) portion of the electromagnetic spectrum to uniquely identify an object, animal, or person. RFID technology has inherited the benefits of the previous magnetic card, bar code, contactless IC card. An RFID system comprises of three components: an antenna and transceiver (i.e. Reader module) and a transponder (the tag). The antenna sends a signal

which activates the transponder. When activated, the tag sends data back to the reader. RFID can read the tag using RF, meaning that the RFID tags are often read from a distance, throughout your clothes, wallet, backpack or purse. Besides the RFID tag contains unique ID for every tag. RFID systems have two configurations, Passive Reader Active Tag (PRAT) system and Active Reader Passive Tag (ARPT). The RFID tag includes a tiny RF transmitter and receiver. An RFID reader sends an encoded radio wave to examine the tag. The tag receives the message and responds with its identification information. This may be only a unique identification number, or may be product-related information like a stock number, lot or batch number, production date, or other specific information. RFID tags contain a minimum of two parts: First an microcircuit (for storing and processing information, modulating and demodulating a radiofrequency (RF) signal, collecting DC power from the incident reader signal, and other specialized functions), Second an antenna (for receiving and transmitting the signal).

IV. BASE OF PROTOTYPE

RFID based parking system prototype is completely independent. All the functions needed is performed by one or other component of the system itself and all the inputs and outputs concerned with our system is handled by various components of the system itself like sensors, display, processor, transducer etc. Thus, the RFID based parking system is totally self-contained

4.1 Arduino board:

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.

4.2 EM-18 reader module:

It will read the signal received from RFID tag. This signal is now passed to arduino board which will authenticate the tag and also to check different validation like appropriate balance.

4.3 RFID tag:

Each RFID tags have unique serial number which will help to authenticate unique user. Arduino or micro processor has list of tags pre-registered which are provided to users. Vehicles with valid tag will get access to parking.

4.4 IR sensor:

Sensors are placed at both parking gates , so when any object is detected it will pass the information to arduino which will display the information on LED display after checking with data in the system.

4.5 LED Display 16X2:

This LED component act as a display unit in the system. It gives all the information related to system. It asks user to tag the card on reader and shows if the user is valid or not. It also displays the information related to balance in the RFID card and also is parking slots are available or not.

4.6 DC Motor:

DC motor is used as a prototype to showcase gate of the parking when valid tag is scan the motor will rotate and gate will be open for user. I will act as a barrier.

4.7 Basic Architecture

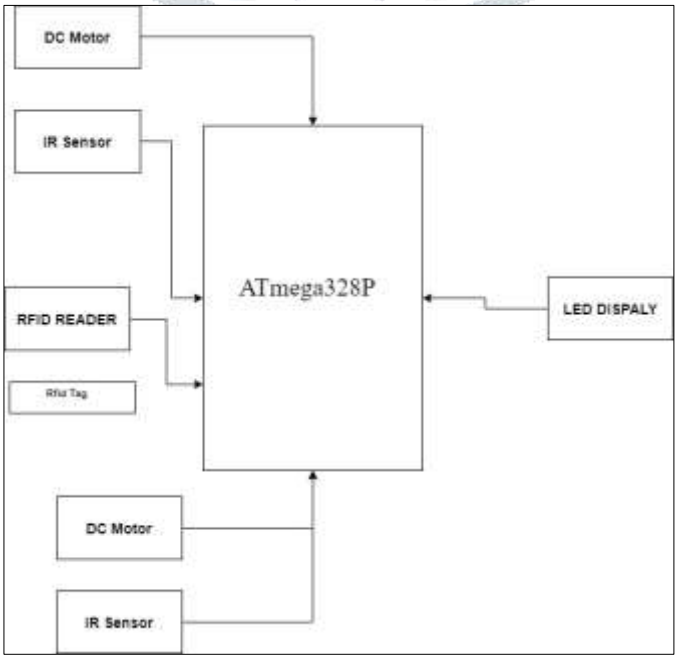

Fig 1. RFID Basic Structure

V. WORKING PRINCIPLE

The design of the system is broken into modules as follows

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

5.1 RFID Scanning:

As a vehicle comes near the gate IR Sensors will sense the object and RFID reader module will get activated. It will ask user to tap the tag on the scanner and it will transmit the information to database where RFID tag would be authenticated based on that user will get access to parking.

5.2 Parking slot availability:

Total numbers of parking slot available are already inserted into database. When a vehicle enters into parking database will decrement the parking slots and the available space will be there in database. If no slots available then vehicle won't be allowed to enter parking. On exit users need to scan the same card on the reader and at this moment database will again increment a parking space. All the related the information will be displayed on LED display.

5.3 Balance Management:

When users are registered into the database they will get a specified amount integrated to their RFID tag so when a user accesses the parking amount will be deducted from tag. When a tag does not have required balance the corresponding user won't be allowed to access the parking. Users can recharge the card whenever they require.

5.4 LED Display

A 16X2 LED display is connected to the system which will display all the information related to system. It will ask user to scan the card and also display if authentication is valid or not. It also displays remaining balance for the user and also availability of parking slots.

5.5 Database:

For working of parking system every user must be registered in database and receive a RFID tag card. Thus all the information related to that will be stored into central database. Apart from that it also has information regarding the total parking spots and balance for those users. All this information is processed transferred to LED display which will be available for user to see.

VI. DESIGN CONSTRAINTS

6.1 Limited Range of RFID Reader:

The RFID reader is placed to read the RFID tag from the vehicles entering or leaving the parking. But the range of RFID reader used here is 10 cm only. Therefore, drivers will have to drive quite close to the reader to allow it to read the tag.

6.2 Cannot be implemented in residential areas:

It's very unlikely to deploy this system in residential areas as a vehicle can go in and out of the parking lot as many times its owner wants in a single day. The user will be charged every time his/her car goes in the parking lot.

6.3 Economic:

The system should not exceed cost of Rs. 3000 for a prototype module handling 4 car slots. Each additional slot should not exceed the cost of Rs. 150.

6.4 Environmental:

The system should not cause pollution or damage environment by releasing harmful solid, liquid and gaseous waste. Also the radio frequency used must not cause harmful radiation or disturb animals, birds, insects etc.

6.5 Ethical:

The system should maintain privacy of the individual and follow codes of ethical sharing of collected data. The personal details should not be shared with unauthorized parties. They should only be shared with law enforcement agencies and courts on their demand and following legal and standard procedure.

6.6 Health and Safety:

The system should not cause any health related problems especially related to electromagnetic radiation, or pollution of immediate environment by solid, liquid or gaseous waste. It should also be safe to handle and should not cause electric shocks, cuts from sharp edges, burns from heated components etc.

6.7 System Breakdown:

Since whole process is automated system should be up and running 24/7. If system goes down then vehicles would be stuck in parking. Also new vehicle won't be given access.

6.8 Tradeoffs:

6.8.1 Cost versus Range of Sensors

High power active sensors using better class of RFID tags and higher frequency transducers can function at a very large range but they are costlier than low frequency passive RFID tags which function in a smaller physical range. Due to focus on making the system cost effective and only a slight increase in inconvenience due to decrease in range, we are using passive RFID tags.

VII. CONCLUSIONS & FUTURE WORK

Currently the RFID Based CAR Parking is in prototype stage and works with a limited number of sensors and on a smaller scale. Thus, its scale can be adjusted according to the needs of the specific client. Also, it can be enhanced to add more features according needs or to adjust its cost benefit ratio. The parking system provided solution to the efficient parking and reduces man power. This system can be employed in multiplexes, airports and corporate offices. We can develop an android application and collect all other parking spaces information in urban areas we can include that into the application.

Future research work would be the extension of this system by calculating the duration of stay of a vehicle in a parking lot as well as deduction of the parking charges on the basis of time spent. Improving the security of the vehicles we will note the number plate of each vehicle and also, we can install live cameras where the vehicle is parked and send the live feed to the owner.

REFERENCES

[1] "To learn specifications of Arduino" Available: https://www.arduino.cc/

[2] "To connect RFID reader with arduino" Available: https://www.instructables.com/Arduino-and-RFID-from-seeedstudio/

[3] "How to connect reader and LCD with arduino board" Available: https://create.arduino.cc/projecthub/akshayjoseph666/interface-16x2-lcd-parallel-interface-with-arduino-uno-2e87e2

[4] How to connect IR sensor module to Arduino. Available: https://www.instructables.com/Using-Infrared-Sensor-With-Arduino/

[5] "Radio-frequency identification" Available: https://en.wikipedia.org/wiki/Radio-frequency_identification

[6] "R.Kannadasan et al". Available: https://www.researchgate.net/profile/Prabakaran-N/publication/295979433_Rfid_Based_Automatic_Parking_System/links/56d13cc208ae4d8d64a39c51/Rfid-Based-Automatic-Parking-System.

[7] Du Shaobo et al, "The Research and Design of Intellectual Parking System Based on RFID", 9th International Conference on Fuzzy Systems and Knowledge Discovery, 2012, PP 2427-2430

[8] Zeydin PALA et al, "Smart Parking Applications Using RFID Technology", RFID Eurasia, 2007, PP 1-3.

[9] S. C. Hanche, Pooja Munot, Pranali Bagal, Kirti Sonawane & Pooja Pise, Automated Vehicle Parking System using RFID, ISSN (PRINT) : 2320 – 8945, Volume -1, Issue -2, 2013.

[10] C. Jechlitschek, "Radio Frequency IDentification - RFID," pp. 1–13, 2013.

[11] Karma Tsheten Dorjee , Deepak Rasaily , Bishal Cintury ,RFID-Based Automatic Vehicle Parking System Using Microcontroller,IJETT,Volume 32 , Number 4, February 2016.