International Journal of Innovative Technology and Exploring Engineering (IJITEE)
ISSN: 2278-3075 (Online), Volume-9 Issue-1, November 2019

Automatic e-ticketing and Vehicle Parking System

Viknesh M R, J Swaminathan, Mahakaleshwar P, Anju S Pillai

Abstract: ***Smart cities have been the vision for the country for a while, and one of the features for the development of a smart city is to develop a good mobility for transport with efficient car parking management systems. A good parking management system must assist people to find vacant parking slots and provide automatic on-line payment options, to reduce the traffic and to save time. In this paper, implementation of prototype of automatic e-ticketing and vehicle parking system is presented. The proposed system consists of automatic gate control, e-ticketing and vacant space monitoring, implemented using Raspberry Pi. Android application on user's smart phone helps in easy user interface making the system, easy to use in real time scenario.***

Keywords: E-ticketing, Vehicle parking system, Raspberry Pi 3, RFID, Firebase.

I. INTRODUCTION

Due to growing concerns for traffic control in amenities housing vehicle parking, a good and efficient parking systems are the need of the hour. The parking system has to be developed in such a way that it enhances customer satisfaction and should increase parking efficiency, so as to reduce or avoid congestion and time delay. Thus, a system which has applications for incorporating automatic e-ticketing system using Internet of Things (IoT) for handling real time data and also notifies customers on vacant parking spaces in a multi-level car parking is essential. The data for these applications can be read directly from customized mobile applications, which can be installed on smartphones [1].

Almost all vehicle parking are operated manually, where cash is collected and receipts are given. This is a slow and hectic process that takes a lot of time, making the users wait for a long time, before their vehicle is parked. Therefore better methods of parking and charge collection are necessary. Radio Frequency Identification (RFID) enabled systems is an interesting choice [5], [13]. RFID is cheap and is the best choice for the development of a low cost and efficient system that can detect the arrival and departure of vehicles. Using RFID systems can not only be very effective, but also very simple in nature [2]. So while using the intelligent parking systems embedded with RFID, the user can reduce the time wasted for entering and finding a parking space [3]. This method is also environment friendly; avoiding usage of pen, ink or paper as everything is done electronically.

The developed prototype has RFID reader, RFID tags, Infrared sensors and Raspberry Pi. Firebase, the real-time database is used to store the vehicle information and user data at run-time. The RFID reader which is limited to its use as a timing tool, by helping to monitor the entry and exit time of the vehicle. It is the Raspberry Pi which acts as the control module that does the major part. This system is built on a simple logic of the infrared sensors detecting the entry of the vehicle into the parking area and the RFID reader reading the vehicle's RFID tag and sending the data to the Raspberry Pi for further processing. The similar process is performed at the exit point of the car parking. The system has to be deployed at the entrance and exit of the vehicle parking space and is tested for its functionality in real-time.

The paper is organized as follows: section 2 describes the system overview and hardware implementation details along with the results are presented in section 3. The paper is concluded in section 4, elucidating the future scope.

II. SYSTEM OVERVIEW

The proposed automatic e-ticketing system has different modules viz., Raspberry Pi, IR sensors, RFID reader, Firebase real-time database and an Android app developed using MIT App Inventor to communicate between the user and the system as shown in the Fig.1.

Revised Manuscript Received on November 30, 2019.
* Correspondence Author
Viknesh M R, Undergraduate students, Department of Electrical and Electronics Engineering, Amrita School of Engineering, Amrita Vishwa Vidyapeetham, Coimbatore, India. E-mail: viknesh2798@gmail.com.
J Swaminathan, Undergraduate students, Department of Electrical and Electronics Engineering, Amrita School of Engineering, Amrita Vishwa Vidyapeetham, Coimbatore, India. E-mail: bharatmsdian@gmail.com.
Mahakaleshwar P, Undergraduate students, Department of Electrical and Electronics Engineering, Amrita School of Engineering, Amrita Vishwa Vidyapeetham, Coimbatore, India. E-mail: kaleshwar1906@gmail.com.
Anju S Pillai, Assistant Professor, Department of Electrical and Electronics Engineering, Amrita School of Engineering, Amrita Vishwa Vidyapeetham, Coimbatore, India. E-mail: s_anju@cb.amrita.edu

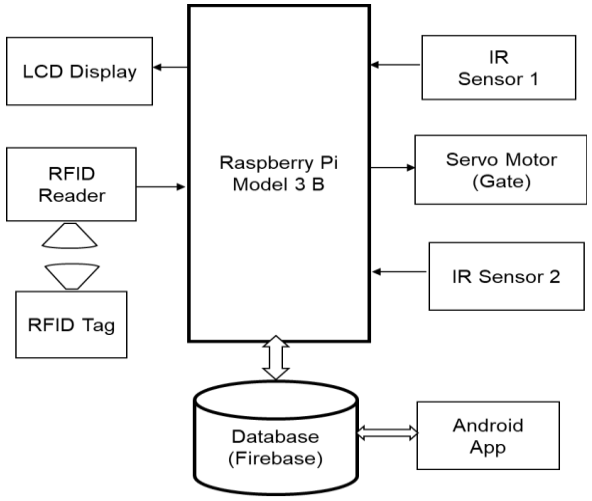

Fig. 1.Overall system design

When the vehicle enters the parking space, one of the IR sensors placed at the entrance detects the vehicle and a signal is sent to the Raspberry Pi, which in turn sends a signal to the servo motor to open the gate. When the vehicle crosses the gate, the RFID reader present in the vicinity reads the unique code from the RFID tag that has been attached to the vehicle. Simultaneously, the time at which the vehicle has entered the parking area is stored in the Firebase, in its respective path. From the Firebase, the user's name is fetched by the Raspberry Pi and is displayed on the LCD display. The gate closes only after the vehicle has passed through the second IR sensor. The check-in process is shown in Fig.2.

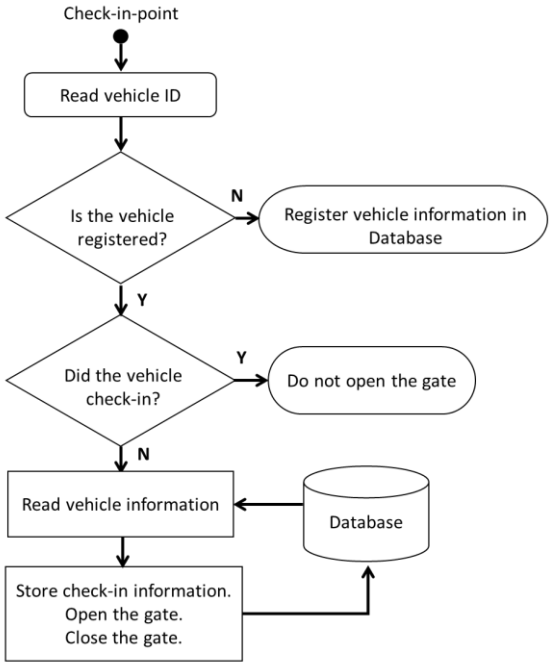

Fig. 2. Parking lot check-in process

As soon as the vehicle enters the parking area, driver tries to find a vacant parking spot. But in multi-level parking it becomes difficult for the driver to locate a vacant spot due to the enormous time required. Thus, in the proposed system this issue is addressed by the developed mobile app. The app provides the location of vacant spaces by assessing the vacancy of the slot using Infrared (IR) sensor.

When the vehicle leaves the parking space, the IR sensor placed at the exit point detects the vehicle and the RFID reader present in the vicinity reads the unique code from the RFID tag which is attached to the vehicle and sends it to the Raspberry Pi. In the Raspberry Pi, the exit time is recorded and is stored in the Firebase. The time at which the vehicle had entered, which had already been recorded when the vehicle had entered the parking space is also fetched from the database. Using this entry and exit time, the duration for which the vehicle was parked in the parking space is calculated. Based on the pre-determined parking tariff, the amount to be paid will be calculated and is displayed on the LCD display. At the same time, the amount to be paid is debited automatically from the user's e-wallet. After the amount is debited, a control signal from the Raspberry Pi is sent to the servo motor to open the gate. If the user has insufficient balance in his/her e-wallet, the gate will not open and will ask the user to recharge his/her e-wallet immediately and also notifies the user through the LCD display. The gate will close when the IR sensor detects the vehicle leaving the parking area.

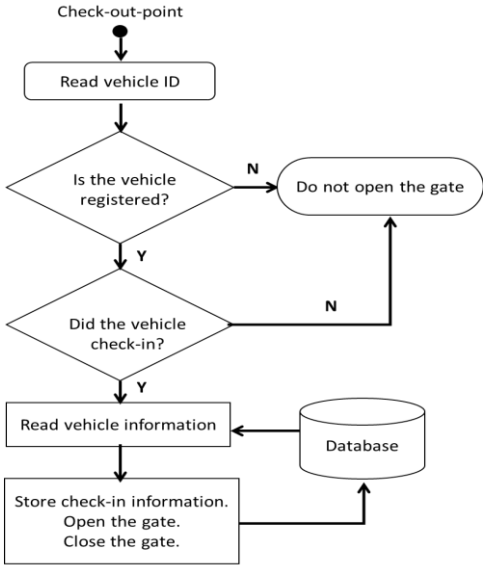

Fig. 3.Parking lot check-out process

App development

The app serves as an interface between both the Raspberry Pi and Firebase database and has been developed using MIT App Inventor 2, where Firebase is a real-time database for storing the data and the Pi helps in calculation and reading of real-time data that is sent to the Firebase. The app uses a concept similar to Scratch, developed by MIT. The coding of the app has to be done by drawing and placing blocks, whereas the designing of the app is done in the Designer tab of the App Inventor.

III. HARDWARE IMPLEMENTATION

A prototype of automatic e-ticketing system for vehicle parking is implemented using Raspberry Pi with major features to identify the vacant parking slots and generate automatic e-ticket. The developed system is shown in Fig.4.

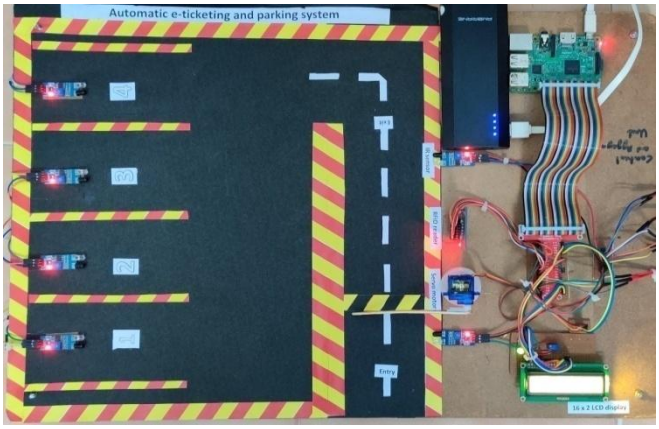

Fig. 4.Overall setup

Features of the mobile app developed are shown in Fig.5 and Fig.6 explains the parking information about entry and exit with time stamps. Vacant parking slots information can be seen in the mobile app as in Fig.7.

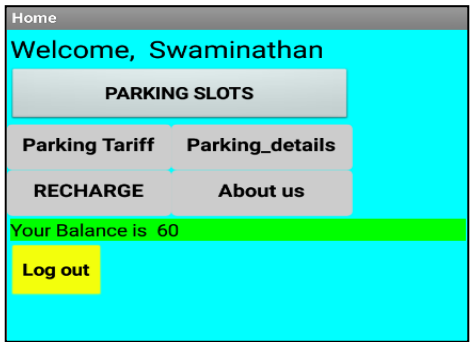

Fig. 5.Home screen

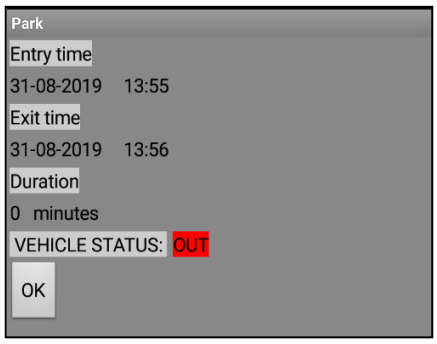

Fig. 6.Parking details of vehicle

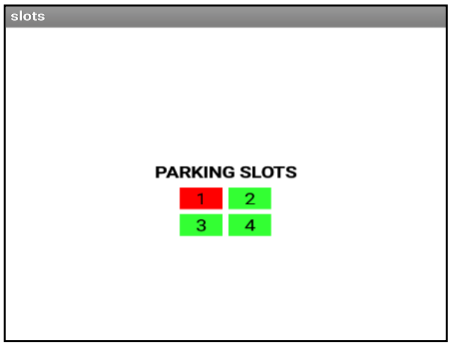

Fig. 7.Available slots

The parking history and the user's information can be viewed by the concerned personnel in the Firebase real time database by login with admin credentials as in Fig.8 and the results from the hardware and the mobile app is shown in Table I.

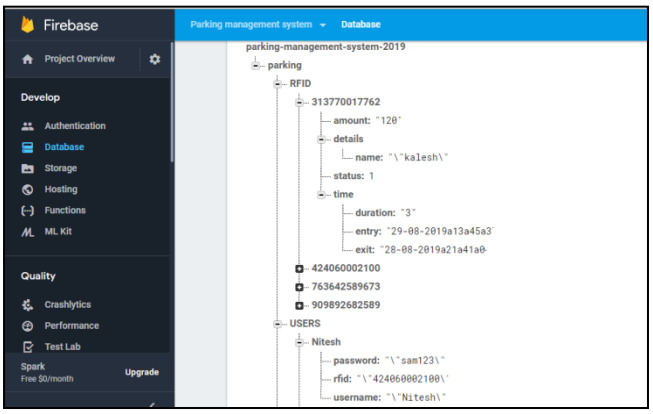

Fig. 8.Data stored in firebase

Table I Results from hardware and mobile app

In the hardware		In the android app	
Parking slot no.	*Vehicle (parked / vacant)*	*Vehicle status (In / Out)*	*Indication*
1	parked	In	Red
2	vacant	Out	Green
3	parked	In	Red
4	vacant	Out	Green

IV. CONCLUSION

The concept of automatic e-ticketing for a vehicle parking system has been implemented in the proposed work. The implemented system has features to identify the vacant parking slots and generate automatic e-ticket. The parking information about entry and exit with time stamps can be seen in the mobile app. Raspberry Pi and the Android application on the user's smartphone helps in easy user interface making the system, easy to use in real time scenario. Through this approach, the user will be able to use the vehicle parking systems efficiently and easily. The implementation of this work helps to save time and man power when integrated with smart city concepts. In future, e-wallet can be linked to the bank accounts with authenticity for ease of payments. Username can be provided with Google authentication to access the mobile app easier. The number of vacant slots in the vehicle parking can also be counted using digital image processing techniques.

REFERENCES

1. Khanna, Abhirup, and Rishi Anand. "IoT based smart parking system." International Conference on Internet of Things and Applications (IOTA), pp. 266-270. IEEE, 2016.
2. P. Šolić, I. Marasović, M. L. Stefanizzi, L. Patrono and L. Mainetti, "RFID-based efficient method for parking slot car detection," 2015 23rd International Conference on Software, Telecommunications and Computer Networks (SoftCOM), Split, 2015, pp. 108-112.
3. Y. Chang and T. K. Shih, "RFID-Based intelligent parking management system with indoor positioning and dynamic tracking," 2017 10th International Conference on Ubi-media Computing and Workshops (Ubi-Media), Pattaya, 2017, pp. 1-8.

4. A. A. Khan, A. I. E. Yakzan and M. Ali, "Radio Frequency Identification (RFID) Based Toll Collection System," 2011 Third International Conference on Computational Intelligence, Communication Systems and Networks, Bali, 2011, pp. 103-107.
5. S. S. Al-Ghawi, S. A. Hussain, M. A. A. Rahbi and S. Z. Hussain, "Automatic toll e-ticketing system for transportation systems," 2016 3rd MEC International Conference on Big Data and Smart City (ICBDSC), Muscat, 2016, pp. 1-5.
6. W.A. Syafei, A. F. Listyono and Darjat, "Hardware design of queuing free environmental friendly automatic toll gate using RFID," 4th International Conference on Information Technology, Computer, and Electrical Engineering (ICITACEE), Semarang, 2017, pp. 142-146.
7. Balamurugan, K., S. Elangovan, R. Mahalakshmi, and R. Pavithra. "Automatic check-post and fast track toll system using RFID and GSM module with security system." International Conference on Advances in Electrical Technology for Green Energy (ICAETGT), pp. 83-87. IEEE, 2017.
8. Chandra, Hans, Kenny RizkyHadisaputra, HandriSantoso, and Erwin Anggadjaja. "Smart Parking Management System: An integration of RFID, ALPR, and WSN." IEEE 3rd International Conference on Engineering Technologies and Social Sciences (ICETSS), pp. 1-6. IEEE, 2017.
9. Pala, Zeydin, and NihatInanc. "Smart parking applications using RFID technology." 1st Annual RFID Eurasia, pp. 1-3. IEEE, 2007.
10. Wei, Lanxin, Qisheng Wu, Mei Yang, Wei Ding, Bo Li, and RongGao. "Design and implementation of smart parking management system based on rfid and internet." International Conference on Control Engineering and Communication Technology, pp. 17-20. IEEE, 2012.
11. Joshi, Yadnesh, Pratik Gharate, Chetan Ahire, Nikhil Alai, and SamadhanSonavane. "Smart parking management system using RFID and OCR." International Conference on Energy Systems and Applications, pp. 729-734. IEEE, 2015.
12. Mahendra, B. M., Savita Sonoli, Nagaraj Bhat, and T. Raghu. "IoT based sensor enabled smart car parking for advanced driver assistance system." 2nd IEEE International Conference on Recent Trends in Electronics, Information & Communication Technology (RTEICT), pp. 2188-2193. IEEE, 2017.
13. M. Priya B.K., Sandeep, M. T., Chandra, M. D. Vineela, and Swarna, M. V., “Energy Efficient and Secured Smart Car Parking System”, The International Journal Of Science &Technoledge (IJST), vol. III, no. VI, 2015.

AUTHORS PROFILE

Viknesh M R is currently an undergraduate student at Department of Electrical and Electronics Engineering at Amrita School of Engineering, Coimbatore, Tamil Nadu. His area of interest is Embedded Systems.

J Swaminathan is currently an undergraduate student at Department of Electrical and Electronics Engineering at Amrita School of Engineering, Coimbatore, Tamil Nadu.

Mahakaleshwar P is currently an undergraduate student at Department of Electrical and Electronics Engineering at Amrita School of Engineering, Coimbatore, Tamil Nadu.