



ANDROID BASED SMART PARKING SYSTEM

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Abstract:

The number of personal vehicles usage is more than the use of public transportation, so do the parking problems as the usage of vehicles increasing at higher rate. Major problems faced by people in smart community or Major organizations (Such as Universities with large hold) as their most valuable thing time is getting lost in finding the right parking spot. This paper provides a system for a smart community or organisation to monitor the availability of parking places utilising an Android application, sensors, and Radio-Frequency Identification (RFID) gateway entry and exit (RFID). Sensors monitors the parking slot whether they are occupied or empty and update it in android application, users can use their RFID card particular for each user to enter into parking or community and can be used to exit from the parking or community.

Keywords: Android application, IOT, RFID, IR sensors.

Introduction:

The augmentation of availability in actual gadgets is known as Internet of Things IOT is of major help that uses inter network of devices using internet as communication between them. The devices can be controlled or sensed using internet. IOT uses various technologies like mobile application, embedded system, cloud computing and takes a rise in growth of using these technologies. According to a study carried out by Global Data, the IoT market is projected to reach \$318bn new worth by 2023 (in constantly rise compared to the previous years) [1].

It is a high demand technology that can change or involve in a way closer to humans' lifestyle. The main reason that what IOT can offer is that it can make things from daily tooth brush to bed lights as smart involving day to day life things. Countries with high population has seen rise in use of individual vehicles which causes many problems including traffic holdup causes to ultimate loss of fuel and energy of each individual. Due to

the growth difficulty in finding parking slot has increased mainly in smart communities and big organisations such universities and government offices. The current situation in major places is using the manual finding of parking slots where there is a need to find the parking slots themselves using the indicated boards and there are manual labour working to show the direction of parking in multiple levels ex: malls, organisations. This situation can be improved by using smart parking system as this leads to reducing the searching of parking slots, traffic holdup and road accidents avoiding unnecessary searching. In the recent research found that a driver takes nearly 8 minutes to park his vehicle because he spends more time in searching the parking lot. This searching leads to 30 to 40% of traffic congestion [2]. The research studies relevant to the smart car parking development revealed that electronic components and computer and network technology can be applied to develop the smart car parking in many ways [3].

Recent research conducted towards improvement of smart parking systems use various wireless technologies such as Radio Frequency Identification (RFID), Infrared (IR), Zigbee. This study aimed to provide information to the user about nearby available parking spaces [4]. IOT plays an important role for smart systems using devices communicating each other making a chain between physical devices. This paper proposes smart parking system using RFID and android application, the system helps user know the availability of parking spaces on a real time basis [5]. In this system user can see the available parking slots and occupied parking slots and with the use of RFID user can enter and exit the smart parking system. RFID is assigned to each individual user differently and can see each individual how many times they have entered and exit the smart parking on daily basis using the RFID. The main motivation of this project is to reduce traffic holdup where there are long lines of vehicles each one waiting their turn to park the vehicles for example universities has two-way lanes to travel in and around the universities and clock ticks the time where university assigned as start time of university, people clog up the road with their own vehicles to find the parking spot right beside their block in university. In a recent survey, researchers have found that for one year, car cruising for parking created the equivalent of 38 times trips around the world, burning 177914.8 litres of fuel and producing 730 tons of CO₂. To reduce all these factors, we go for the smart parking system [6].

Literature review:

In this, we look at several research of parking systems that use wireless technologies and RFID, among other technologies. Parking space management is rarely addressed in most existing parking systems. To monitor the traffic volume on their premises, most parking companies, particularly those that operate indoor parking lots, employ a simple photodiode and barrier system. Drivers are frequently informed of this information via signs placed at the gateways and neighboring roadways. The section gives an overview of the systems we looked at to give you an insight on the different technologies that others are using. The idea of smart parking [1], which uses an Android Application software to book a parking spot, is one that focuses on a certain type of parking place, such as malls and restaurants, where parking is priced on a time basis and open to any random number of people. [2] The suggested smart parking system requires the user to enter the parking space through Bluetooth and to monitor the available parking spaces via SMS, with money deduction enabled as the vehicles parks for hours. Bluetooth, GSM, and ultrasonic sensors were used in this system. [3] The designed smart parking system includes wireless sensor networks, an embedded web server, a central web server, and a mobile phone app for Android and iPhone. Wireless sensor networks modules are installed in each parking spot, each of which has one sensor node. The condition of the parking spot is sensed by the sensor node and sent to the embedded web server on a regular basis over the established wireless sensor networks. This data is transferred in real-time to a central web server over Wi-Fi networks. [4] The system presented in this study provides users with an overarching parking system utility by giving information about available parking places as well as a reservation facility via an Android application. Our research uses a Raspberry Pi using Cloud MQTT to create a system prototype.

PARKING SYSTEM OVERVIEW:

This research paper proposes system of smart parking using mobile application based on RFID and IOT using microcontroller, Arduino and IR sensors .IR sensors are used to get the information of parking slots whether it is occupied or unoccupied. The development framework is shown in Figure1. Slots are equipped with IR sensors each individually and monitored by Arduino equipped in the system. This approach allows for the low-cost development of a large-scale system. This technique cuts down on the amount of time spent looking for an open parking spot. The sensor monitors the condition of the parking place and determines whether there is or is not a car in the area. If there is no automobile and the parking spot is open, it displays 0 (Empty), and if it is inaccessible or if a vehicle is parked in it, it displays 1 (Unavailable) [7]. The system then changes the database's state. The data is serially transmitted from Arduino to database which acts as a client for Cloud. Parking information is updated in real time and continuous data is stored in cloud. Users can access the parking information data via android application that takes data from cloud. When a user enters a parking area, sensors installed in the area identify the car and provide data to a microcontroller and eventually transfers the data to server in database and updates the status of mobile application [8]. RFID tags are given to each individual user and has unique identity for each tag and can be used in entry and exit of parking system. By placing RFID tags on RFID readers placed Infront of barriers on entry and exit, access will be given to enter into the system and barriers will be open to make a way into the parking for vehicle [9].

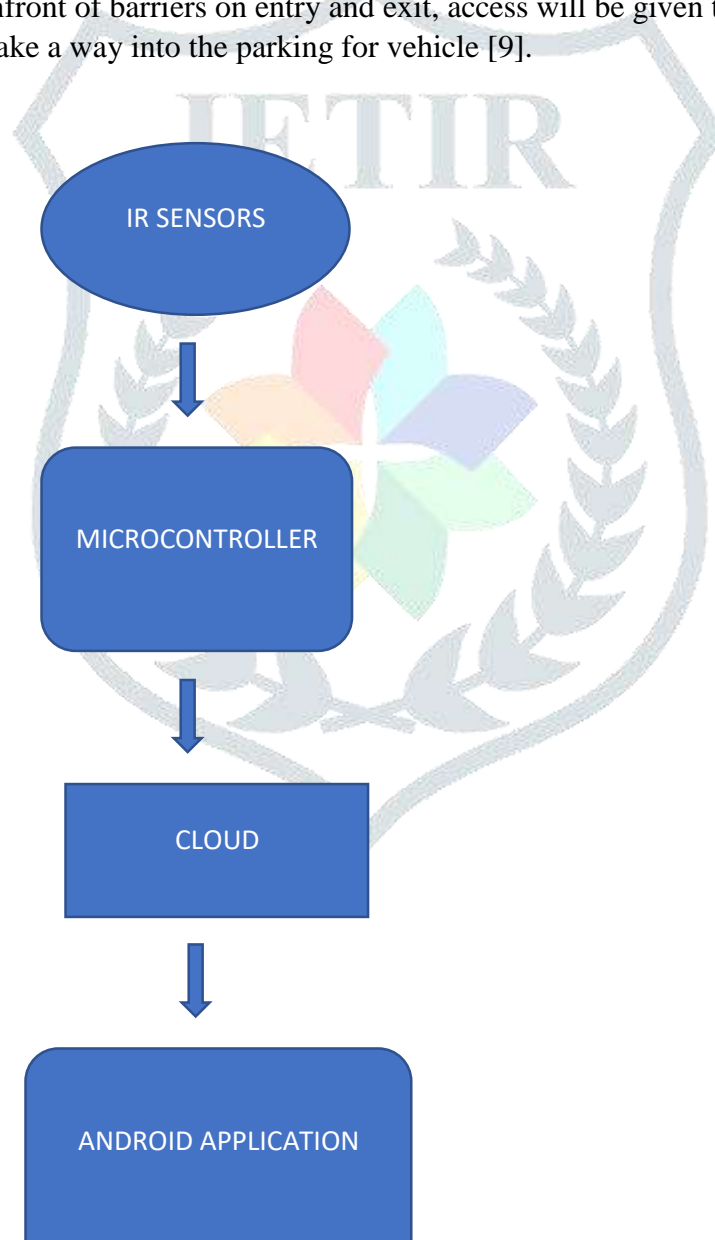


Figure 1 System Overview

The interfacing of physical objects is done by using plc board and can be connected with Wi-Fi module which will auto connect to Wi-Fi and update the system server. This research paper designed a mobile application with support of all sizes of android smartphone. Design would be same to all smartphones. There are several

development tools that were used in developing mobile application, some of them are JavaScript, PHP, Bootstrap Android studio etc [10].

These are number of features that were proposed in this paper to enhance the system they are

1. Status of parking slot: when car enters the parking system, sensors detect the car and update the database and otherwise if the parking slot is empty.
2. Updating the mobile application: sensors recorded data will be used to update the mobile application of parking slots with particular indication.
3. Parking slot edit: parking slot can be edited by administer if there is work or reconstruction is happening with parking slot.
4. Virtual money adds: There is virtual money pocket for each individual user with RFID tag which uses a dummy number of money as it can deducted each time when RFID tag reads in READER. administrator can add the money as he likes, for example scenario when the user is not allowed to parking system the administrator can simply put '0' in virtual money packet so that barrier won't open when user reads the RFID tag [11].

Table 1 Hardware and software

	Clients
HARDWARE COMPONENTS	<ol style="list-style-type: none"> 1. Microcontroller 2. IR sensors
SOFTWARE	<ol style="list-style-type: none"> 1. Android studio 2. ARDUINO IDE

The hardware and software used in the system is shown in Table 1.

This system is proposed created considering the two groups of people: users and administrators. Administrant can add the data of parking slots whether the extra or reconstructing ones and can add virtual money into each individual user [12].

3. PARKING SYSTEM ARCHITECTURE:

Architecture description: mainly consists of

- a) Parking sensors
- b) ATmega328P Microcontroller
- c) CLOUD
- d) EM-18 RFID reader module:
- e) Mobile application
- f) Arduino IDE



Figure II IR Sensor

a) IR sensors (Parking sensors):

The emission from a Transmitter is detected by infrared receivers or ir sensor. Photodiodes and phototransistors are two types of infrared receivers. Infrared Photodiodes vary from regular photodiodes in that they only sense infrared energy [13]. An IR receiver, also known as a photodiode, is seen in the figure below. Various types of IR sensors exist depending on wavelength, voltage, packaging, and other factors. The wavelength of the receiver should equal that of the transmitter when utilized in an infrared emitter – receiver combo. An IR LED serves as the emitter, while an IR photodiode serves as the detector [14]. An IR LED emits infrared light, which is detected by the IR photodiode. The resistance and output voltage of the photodiode

alter in response to the amount of infrared light received. This system can also use other sensors to determine the parking slot activity such as ultrasonic sensor which measure distance Infront object. These sensors are connected with 5v from Arduino [15].

IR sensor Module consists of two parts which are

- i. LED
- ii. Receiver

The infrared light from the LED reflects off the object and is detected by the receiver.

b)

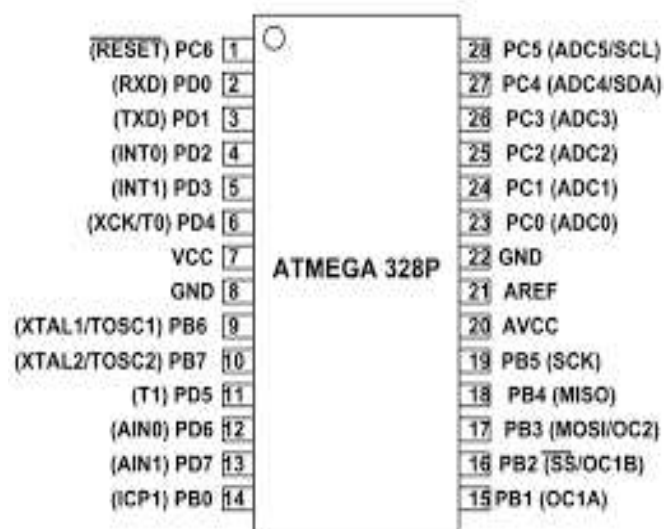


Figure III ATMEGA328 pin diagram

- c) **Microcontroller:** The Atmel ATmega328P is an AVR-based 32K 8-bit microcontroller by Atmel. At 20MHz, several instructions are completed in a single clock cycle, resulting in a throughput of about 20 MIPS.



Figure IV ATMEGA328P Microcontroller

The ATMEGA328-PU comes in an PDIP 28 pin package and is suitable for use on 28 pin AVR Development board [16]. On the one hand, a computer is designed to perform all general-purpose tasks on a single machine, such as running software to perform calculations, storing multimedia files, or accessing the internet through a browser, whereas microcontrollers are designed to perform only specific tasks, such as switching the AC off automatically when the room temperature drops below a certain defined limit and turning it back on when the

temperature rises above that limit. The most prevalent microcontroller families are the 8051, AVR, and PIC microcontrollers, which are utilized in a variety of applications based on their competence and practicality to do the necessary task. This article will introduce you to the AVR microcontroller family. [18].

d) Cloud:

Cloud is a database that stores or acts as a database for parking area data and users that have access to the system. It keeps a record of every user that is linked to the service and stores data such as the parking spot where the automobile was parked., time duration for parking a car, Daily hits to the parking (entering and exiting the parking area using the RFID tag) [19]. It's because of the cloud's adaptability, which allows the system to add any number of users at any time of day. Data saved in the cloud is backed up on a regular basis to enable easy and speedy recovery in the event of a system breakdown. One can use the IBM MQTT server as host of cloud or Cloud MQTT. Cloud MQTT are overseen Mosquitto servers in the cloud. Mosquitto executes the MQ Telemetry Transport Protocol, MQTT, which gives lightweight techniques for doing informing utilizing a distribute/buy in message queueing model. MQTT is the machine-to machine convention without bounds. It is perfect for the "Internet of Things" universe of associated gadgets [20].

e) EM-18 RFID reader module:



Figure V RFID reader module

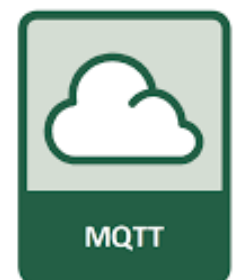
The EM18 is a RFID peruser that peruses RFID labels at a recurrence of 125 kHz. It conveys the extraordinary ID consecutively to the PC or microcontroller by means of UART correspondence or Wiegand design on the proper pins in the wake of understanding labels. The EM18 Reader can read data from Radio frequency identification that have a stored ID of 12 bytes. Information is sent from the tag to the peruser through radio waves. RFID technology uses that, in principle, is analogous to bar codes. The RFID is a network associated innovation that can be either compact or fixed. It communicates driving forces that trigger the tag by means of radio waves. When the tag is turned on, it transmits a signal back to the antenna, which is converted into data. The transponder is in RFID tag itself.

f) Android Application:

The mobile application is built utilizing the Apache Cordova network, and the main programming language is JavaScript. The application communicates with the cloud server through a secure connection with two-factor authentication. The goal of the mobile application is to deliver parking information., map of parking area with parking slots indicating whether they are occupied or empty. Data is sent between the cloud server and the mobile application in JSON format. The mobile application acts like an interface for the end users to interact with the system [21].

g) Arduino IDE:

The Arduino IDE stands for Arduino integrated development environment, and it is an open-source platform for writing function code. This programme allows you to create code, compile it, and upload it to an Arduino development board, as well as connect with it. Arduino board are distinguished and less cost open-source platform which can be programmed by using Arduino IDE. This software consists of all type of boards and have few examples for each board and protocol to upload and check. It is very easy to use for even beginners as it only needs to learn the ins of Arduino write the code of functions [22].



4. Result:

The final prototype consists of IR sensors connected with plc and has Wi-Fi module and exchanges data with cloud to update the android application.

System which we have followed are

1. Entry and exit into parking area with RFID reader and RFID tag
2. Sensors pickup information from parking area
3. Checking the android application for parking slots
4. After logging in dashboard shows the information of how many times user entered and exited the parking area on daily basis
5. Four spaces naming x1, x2, x3, x4 are available
6. Android application shows the empty slots as red and occupied slots as green

IR sensors can be connected using three pins on IR module consists of GND(-Ve), Vcc and signal pin. Vcc is the force of the module and can be associated with GPIO pins of Arduino.

Users can access the parking area by reading RFID tag on EM-18 RFID reader module and the process flows to android application. Android application directly takes to the user login page where user need to put in the email id and password given by administrator. clients will actually have to get to the framework by entering the email id and secret password. The next part after logging in is dashboard which shows the user statistics of entering and exiting on daily basis. User can choose parking area option which is available and can access the parking area information as shown in below figure (5,6).

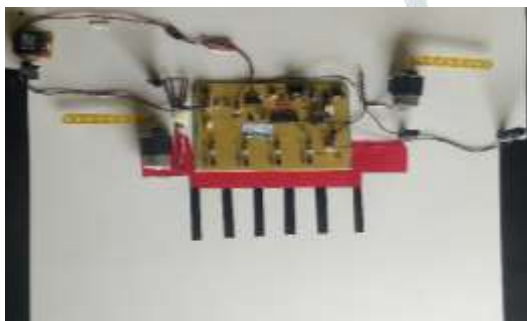


Figure VI IR sensors and other electronic connections on PCB

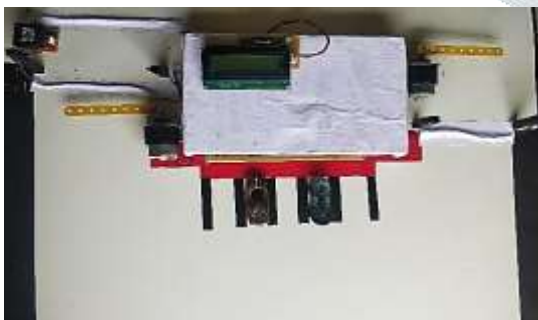


Figure VII Prototype of parking System

Parking system containing barriers and can be lifted by reading the RFID tag on reader



Figure VIII Login interface of Application

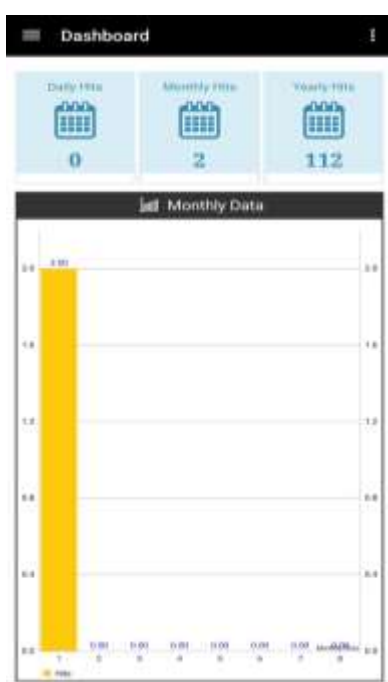


Figure X Dashboard

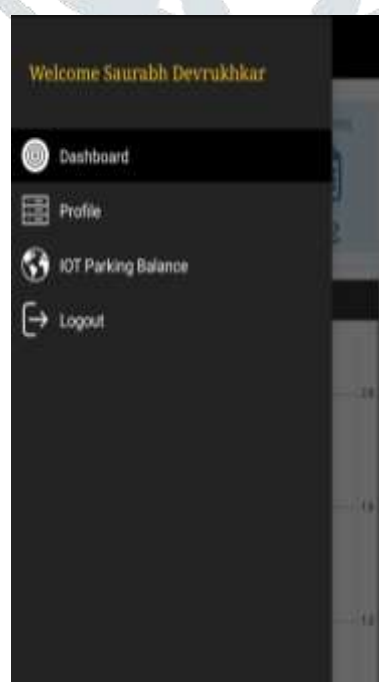


Figure IX Application layout



Figure XI View of slots availability and user information

5. Conclusion:

Smart communities and Smart cities can use the conventional method as to practice the smart systems in large advancements to make smart cities a reality. The cloud technology and IOT has given more rise to advance into use of new technology and takes reality of smart cities. In this study, we examine the issue of parking systems and present a smart parking system based on IoT. This system delivers real-time parking spot information and data through an Android application. The efforts made in this paper is to enhance the system as smart and reduce time wastage [23]. Manual parking system can be turned into smart parking system and reduce the manual labor and indicator boards that show the way to park the vehicle. This system can reduce parking waiting time and reduces the long traffic holdups and mainly very useful to the particular big organizations such as universities and government offices where the users are employees or frequently come by users where there can be need to use android application to park their vehicle. This system reduces the need for man power where they are used to show the directions to park which is cost effective as it reduces the cost. The mobile application can be extended into IOS and windows server to made easy for all users [24].

REFERENCES

1. Kamble, P., Chandgude, S., Deshpande, K., Kumari, C. and Gaikwad, K.M., 2018. Smart parking system. *Int J Adv Res Dev*, 3(4), pp.183-186.
2. Sabbea, M.O.B., Irfan, M., ALtamimi, S.K., Saeed, S.M., Almawgani, A.H.M. and Alghamdi, H., 2018. Design and development of a smart parking system. *Journal of Automation and Control Engineering Vol*, 6.
3. Yang, Jihoon, Jorge Portilla, and Teresa Riesgo. "Smart parking service based on wireless sensor networks." In *IECON 2012-38th Annual Conference on IEEE Industrial Electronics Society*, pp. 6029-6034. IEEE, 2012.
4. Gupta, Rishi, Sharvil Pradhan, Abhijit Haridas, and D. C. Karia. "Cloud based smart parking system." In *2018 Second International Conference on Inventive Communication and Computational Technologies (ICICCT)*, pp. 341-345. IEEE, 2018.
5. Cynthia, J., C. Bharathi Priya, and P. A. Gopinath. "IOT based smart parking management system." *Int. J. Recent Technol. Eng.(IJRTE)* 7, no. 4 (2018).
6. Chippalkatti, P., Kadam, G. and Ichake, V., 2018, February. I-SPARK: IoT based smart parking system. In *2018 International Conference On Advances in Communication and Computing Technology (ICACCT)* (pp. 473-477). IEEE.
7. Kaur, Harkiran, and Jyoteesh Malhotra. "A review of smart parking system based on internet of things." *International Journal of Intelligent Systems and Applications in Engineering* 6, no. 4 (2018): 248-250
8. Ji, Z., Ganchev, I., O'Droma, M. and Zhang, X., 2014, August. A cloud-based intelligent car parking services for smart cities. In *2014 XXXIth URSI General Assembly and Scientific Symposium (URSI GASS)* (pp. 1-4). IEEE.
9. Thorat, S. S., et al. "IoT based smart parking system using rfid." *International Journal of Computer Engineering In Research Trends* 4.1 (2017): 9-12.
10. Pham, T.N., Tsai, M.F., Nguyen, D.B., Dow, C.R. and Deng, D.J., 2015. A cloud-based smart-parking system based on Internet-of-Things technologies. *IEEE access*, 3, pp.1581-1591.
11. Malaiya, A. R., Kumar, N., Kansagara, A., & Kadam, A. (2018). Smart parking system based on cloud computing using android and IoT. *International Journal of Innovative Science and Research Technology*, 3(3), 233-235.
12. Pham, Thanh Nam, Ming-Fong Tsai, Duc Binh Nguyen, Chyi-Ren Dow, and Der-Jiunn Deng. "A cloud-based smart-parking system based on Internet-of-Things technologies." *IEEE access* 3 (2015): 1581-1591.

13. Ismail, R., Z. Omar, and S. Suaibun. "Obstacle-avoiding robot with IR and PIR motion sensors." In *IOP Conference Series: Materials Science and Engineering*, vol. 152, no. 1, p. 012064. IOP Publishing, 2016.
14. Ramya, V., Palaniappan, B. and Karthick, K., 2012. Embedded controller for vehicle In-Front obstacle detection and cabin safety alert system. *AIRCC's International Journal of Computer Science and Information Technology*, 4(2), pp.117-131.
15. Hanumante, V., Roy, S. and Maity, S., 2013. Low cost obstacle avoidance robot. *International Journal of Soft Computing and Engineering*, 3(4), pp.52-55.
16. ATmega328P, Microcontroller. "3.1. Microcontroller ATmega328P."
17. Abdullah, R., Rizman, Z.I., Dzulkefli, N.N., Ismail, S., Shafie, R. and Jusoh, M.H., 2016. Design an automatic temperature control system for smart tudungsaji using Arduino microcontroller. *ARNP Journal of Engineering and Applied Sciences*, 11(16), pp.9578-9581.
18. Edozie, E., Janat, W. and Kalyankolo, Z., 2020. Design and Implementation of a Smart Hand Sanitizer Dispenser with Door Controller using ATMEGA328P. *International Journal of Engineering and Information Systems (IJEAIS)*, 4(6).
19. Gupta, R., Pradhan, S., Haridas, A. and Karia, D.C., 2018, April. Cloud based smart parking system. In *2018 Second International Conference on Inventive Communication and Computational Technologies (ICICCT)* (pp. 341-345). IEEE. (19)
20. Collina, Matteo, Marco Bartolucci, Alessandro Vanelli-Coralli, and Giovanni Emanuele Corazza. "Internet of Things application layer protocol analysis over error and delay prone links." In *2014 7th advanced satellite multimedia systems conference and the 13th signal processing for space communications workshop (ASMS/SPSC)*, pp. 398-404. IEEE, 2014
21. Khanna, A. and Anand, R., 2016, January. IoT based smart parking system. In *2016 International Conference on Internet of Things and Applications (IOTA)* (pp. 266-270). IEEE.
22. Patil, M. and Sakore, R., 2014. Smart parking system based on reservation. *International Journal of Scientific Engineering and Research (IJSER)*, 2(6), pp.21-6.
23. Anusooya, G., Jackson, J.C., Sathyarajasekaran, K. and Kannan, K., 2017. RFID based smart car parking system. *International Journal of Applied Engineering Research*, 12(17), pp.6559-6563.
24. Geng, Y. and Cassandras, C.G., 2013. New "smart parking" system based on resource allocation and reservations. *IEEE Transactions on intelligent transportation systems*, 14(3), pp.1129-1139.