



## IoT Based Smart Parking System

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### ABSTRACT

The present day population and its effects on traffic are on a greater hike. This has extended towards increase in pollution which emerged as an outspoken issue thorough out the world. This project is a solution to avoid traffic issues and pollution at a particular place. In order to have an efficient monitoring system that allows for accurate vehicle tracking as well as easy in-and out access for drivers, this project forecasts all the possible ways to reduce traffic. The existing methodology aims at implementing RFID concept .This uses a card to park the car based on the hour basis and deduces the amount based on the in and out time. The proposed methodology aims at interfacing RFID concept with Internet Of Things (IOT) to establish a client server communication and in order to enhance a mobile friendly environment an android app is being developed that gives prior information to the user about the availability of parking slot and thereby enabling them to book the slot for parking which ensures minimization of traffic issues and reduces pollution to a greater extent.

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### 1. Introduction

The present day metropolitan areas have seen a burgeoning growth in human population as well as vehicles. With shrinking spaces, operating a busy & expensive parking lot having multiple gate scan pose a significant challenge. The parking area has to be secure, with barrier-enforced entrance and exit. It also has to have an efficient monitoring system that allows for accurate vehicle tracking as well as easy in-and out access for drivers. With larger number of families exceeding the total number of vehicles, the parking scenario is woefully falling short of the current requirements in the country.

India's urban population is currently around 30% of its total population, India's six major metropolises increased by about 1.9 times during 2000 to 2016. In context to urban transport system, as number of motor vehicles went up, parking is one of the major concerns in terms of space occupation. In United States rising traffic issue is an irresistible one, so that they have planned to reduce traffic to automate parking system by delivering prior information to the user using an app.

Hence this paper ensures to provide transparency about the traffic issues and discusses the existing methodology along with its associated drawbacks and extends towards providing a solution for the enlisted drawbacks thereby providing a permanent solution for the traffic issues and pollution.

### 2. Existing Methodology

The existing methodology aims to use Radio Frequency Identification (RFID) technology of vehicle parking system in mall/building. One of the challenging problems for many vehicle owners in big cities is where to park their vehicles. If the parking slot is known in advance one can save precious time and fuel wastage. This powerful RFID card functions as an in vehicle parking meter, eliminating the need to search for coins when finding a parking place. This project also provides an efficient alternative to coin operated meters and pay and display ticketing systems. Simple and cost effective to implement, this project operates as a standalone system or alongside traditional parking payment systems to eliminate fraud and reduce cash handling.

With this RFID vehicle tracking system, vehicle information can be automatically gathered to enable vehicle management to be more efficient and safe. With RFID vehicle tracking system with high identification accuracy, parking areas or gated communities can manage their vehicles efficiently without human intervention as well as easy in-and-out access for drivers and with low deployment and operation cost. RFID's also offers a turnkey solution for parking operators that require the ability to monitor and record not only access and exit to parking facilities but also log and bill back parking charges by customer.

### 3. Drawbacks of Existing Methodology

- It lacks in developing a client server communication.
- Pre-booking of slots which minimizes the traffic cannot be established with the help of only RFID concept.

- User friendly application that helps the user to find the availability of slots from a distance is a major drawback.

#### 4. Proposed Methodology

The proposed methodology aims at interfacing RFID technology with IOT so that a client server communication can be enhanced and in order to develop a user friendly environment an android app is being developed. Internet of Things (IOT) plays a vital role in connecting the surrounding environmental things to the network and made easy to access those un-internet things from any remote location. It's inevitable for the people to update with the growing technology. And generally people are facing problems on parking vehicles in parking slots in a city. We design a Smart Parking System (SPS) which enables the user to find the nearest parking area and gives availability of parking slots in that respective parking area. And it mainly focus on reducing the time in finding the parking lots and also it avoids the unnecessary travelling through filled parking lots in a parking area. Thus it reduces the fuel consumption which in turn reduces carbon footprints in an atmosphere.

Developing an android app enables to create a mobile friendly environment so that allocated and remaining parking lots can be easily viewed from distances so that accumulation of the traffic in a particular area can be avoided. The idea behind this Android Application is to help the user analyze areas where parking is available and number of slots free in that area and enables them to prebook the slot.

#### 5. Block Diagram of the Proposed System

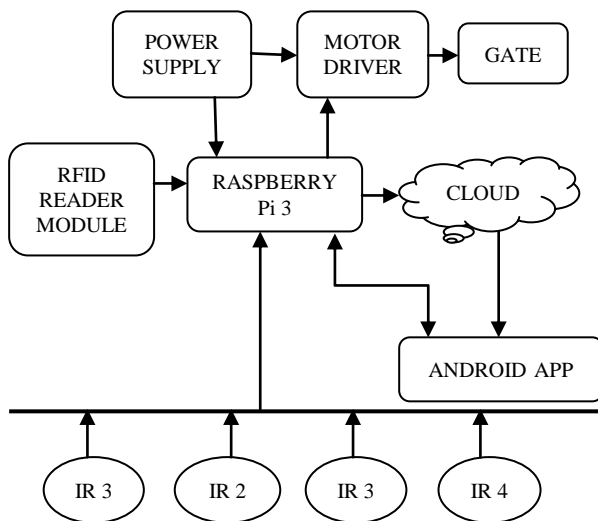


Fig 1. Block diagram of proposed system

#### 6. Implementation of the Proposed System

The project is implemented in five stages:

*Step 1:* User needs to login their details into the android app in their mobile phones developed with the help of ANDROID STUDIO.



Fig 2. Login details

*Step 2:* After login process is done a display asking the user to select the location will be shown. The user needs to select the location as well as the user should specify the name of the destination (eg : hospital/ mall) that he/she desires to go.

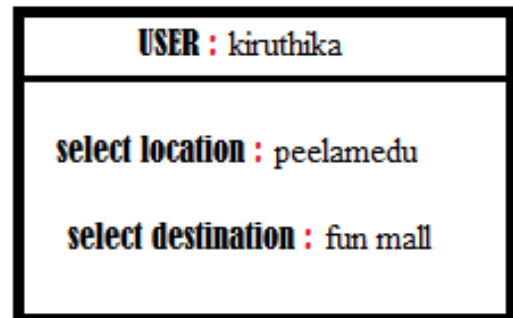


Fig 3. Client location selection process

*Step 3:* After selecting the location the raspberry pi 3 sends the availability of slots to the app from the distance of 1 km through which the user can book the slot if available indicated by green color if slot is available else indicated by red color if there is no slot available in that selected destination.

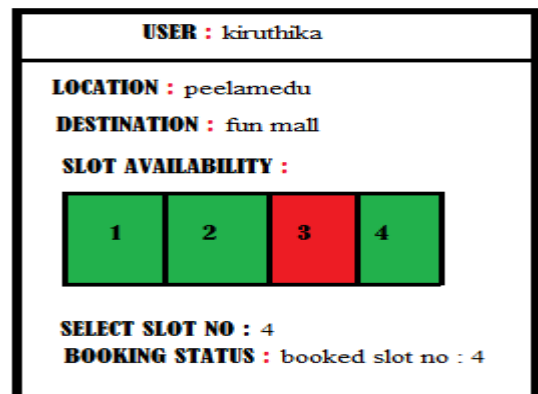


Fig 4. Slot booking by the client

*Step 4:* Once the slot number is being booked by the user the microcontroller obtains the information from the app about the slot booking and then books the slot for the user in the corresponding specified destination (parking area). Then

the stop watch starts from the time of booking and waits till 1hr 30 min for the user to arrive the destination to fill the slot, if the time exceeds than specified then the slot will be declared open, then again the user needs to follow from step 1 to book the slot.

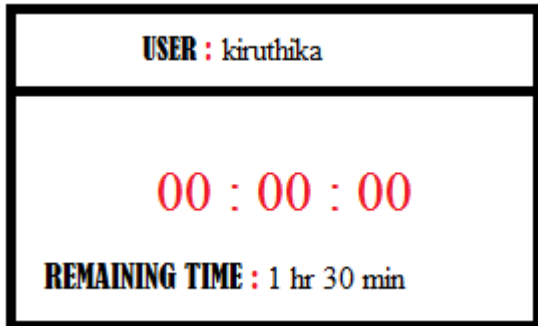


Fig 5. Timer displayed on the app of the user

Step 5: After the arrival of the vehicle in the parking area the user has to show their own possessed RFID tag that acts as a gate pass for the entry into the slot to park the vehicle. The raspberry pi 3 checks for the availability of balance in the tag. If yes the gate driven by the motor opens and then the slot booked by the user will be correspondingly occupied. If no then the gate will not be opened then the user needs to recharge to park the vehicle in the slot.

7. Basic IoT Architecture

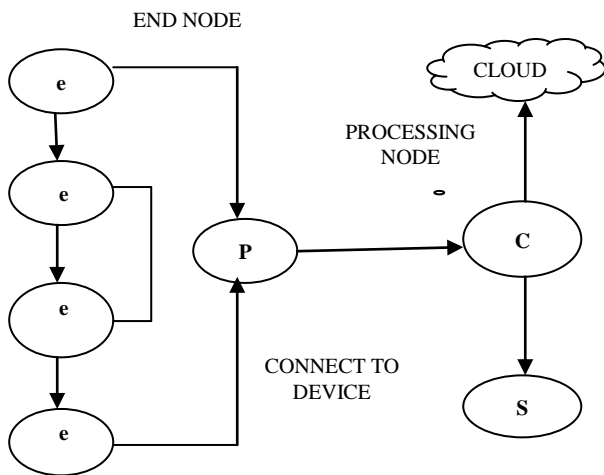


Fig 6. IOT architecture

**e-End Node:** end-node is the first node of any IoT system, without this node the “T” part of IoT i.e. Things is not achieved, these end nodes are sometimes also called as objects and they mostly work as sensing nodes starting from the front node. These nodes usually have dual nature. Examples of end-users are all types of sensors but normally these sensors are basic and it can be converted into active device by a designer. In our proposed system we have used IR sensors as end nodes.

**p- Processing Node:** It’s the central important block because it provides an artificial intelligence to the whole circuitry. It processes the data and information received from end-nodes and transfers it to further link for next action

which may be software application or cloud based service and data received from application to the previous nodes i.e. End-nodes. Usually this node involves one or more microcontrollers, microprocessors, etc. and may be relatively bigger in size as compared to end-nodes. In our system we have used raspberry pi 3as the processing node.

**c- Connectivity:** Connectivity is must in any system to establish a connection, which may be wired or wireless. The main task of this node /link is to transfer the data gathered after processing of data sent by the end node to the application software or to cloud. Connectivity allows data transfer in duplex form. In this desired system we have used Ethernet shield to send data over the cloud.

8. Flow Model of the Smart Parking System

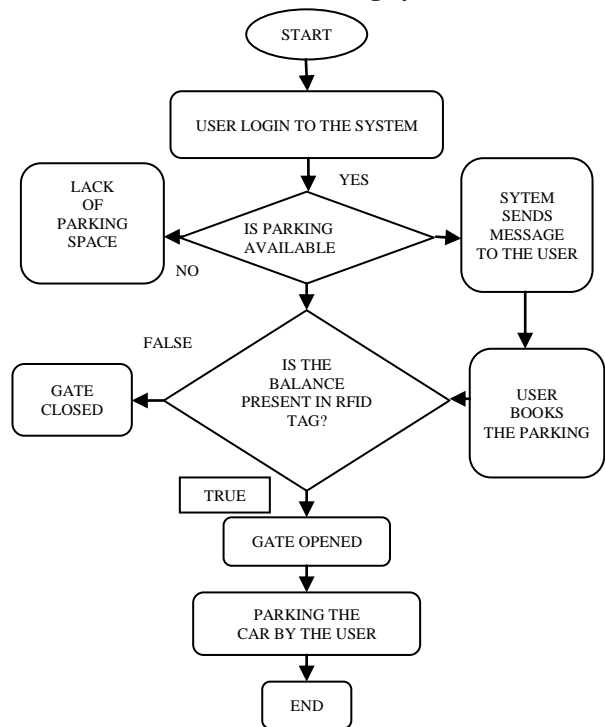


Fig 7 flow chart of smart parking system

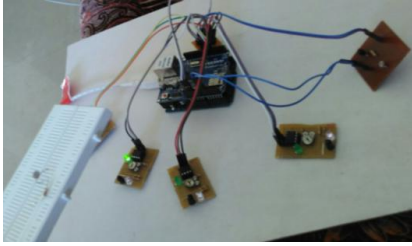
The above shown flow model exactly replicates the proposed system. IOT concept interfaced establishes a client server communication that ensures long distance communication from remote location and additional features of it along with android app creates a mobile friendly environment creating less tension environment by the method of pre-booking the available slots.

9. Results and Discussion

Parking slot allotment implementation using IOT concept for smart car parking are as follows:



Fig 8 Final model of project



**Fig 9. Filled parking slots**

## 10. Applications

- It is an efficient system for car parking which prevents traffic congestion.
- Easy booking of the slot from distance
- Can be implemented in mall, hospitals and multi store building.
- Avoids tension and creates pollution free environment.
- Provides large scale parking system.

## 11. Conclusion

This paper aims at implementing an automated vehicle management system using radio frequency identification (RFID) technology to check the balance amount in the card allocated for parking along with it has suggested implementing an IOT based car parking system and in order to enhance an user friendly application an mobile app is being developed. This designed smart parking system which is simple, economic and provides effective solution to reduce carbon footprints in the atmosphere. It is well managed to access and map the status of parking slots from any remote location through web browser. Thus it reduces the risk of finding the parking slots in any parking area and also it eliminates unnecessary travelling of vehicles across the filled parking slots in a city. So it reduces time and it is cost effective also. The development of reservation for parking slots commanded by android application is implemented. The proposed system reduces the driver's effort and time to search parking space. Also the payment transaction is handled online which makes the system less human dependent. It helps the administration to allocate the vacant slot to the next person in queue. A well thought parking plan saves the time of visitors in booking a parking slot in advance and the administration to allocate the vacant slot in a methodical and organized manner.

## 12. Future Work

### An IOT intelligent car parking system for a Smart City

1. Our future work is to create car parking system to work as an operational platform in a **smart city**.
2. The relevant management and control entities, including a highway Centre, emergency Centre, traffic control Centre, and police can get access to the information managed by the car parking information Centre with high authority.
3. The sensors deployed in the car parking area periodically send updated information as regards occupancy of the car parking lots to the car parking meters, which push this data to the information Centre.

Users can interact with the system by installing the corresponding car parking application on their mobile devices.

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