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IoT Based Smart Parking for Metro Cities

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***Abstract*- An emerging technology aiming to connect the surrounding environmental things to the network and making the access to the same in a very easy way is Internet of Things- IOT. The paper focuses on the same technology which is useful for identifying, disseminating the known facts and connect the entire world under a single system. The work here creates an android application for providing a parking solution to smart cities. This literature aims to resolve the parking issues and other related problems as traffic, pollution, over fuel consumption etc. by public involvement. This application holds good for both public and government as well which in turn helps decrease congestions on roads.**

***Keywords*- Internet of Things (IOT), Smart Parking System (SPS) , Parking, Security, Addressability, M-M communication**

I. INTRODUCTION

Parking problem is global issue which is a worry for each and every city whether developing, developed or a smart city. According to the current scenario, the ratio of growing cars seems to be almost inversly propotional to their prices. New models of cars with affordable prices are introduced every now and then. This has resulted in increased demands and sales of the cars as the average class families which constitute a large population of our country are able to afford these cars. This gives birth to the parking issue which is growing healthy every day. Internet of things is in the early stage and there is no common architecture exists till today [1]. The parking issue brings other issues related with it such as pollution, traffic issues, fuel overuse, etc.

The sensors are connected to the physical objects in our surroundings or to any embedded systems and inturn the same are connected to the network either using wired or wireless connections[2], [3]. The nodes in this network are said to be smart devices or smart objects.

A motorist even before reaching his intended destination in the city has the only wish in his mind that he finds a free space and he rejoices at the site of an available parking space or another person unparking his/her vehicle just ahead of him. If the motorists are unable to find a parking space, they park their vehicles on the roads. This makes the road congested and increases the traffic. The increase in traffic in turn again increases the pollution, mainly noise and air pollution. Parking vehicles on roads makes the roads unsafe. Even the cars parked are not safe as the heavy vehicles or other cars passing on the roads can cause damage to the parked cars.

As M-M communication is developing by the various standardization bodies such as Open Mobile Alliance (OMA), European Telecommunication Standards Institute (ETSI), Institute of Electrical and Electronic Engineers (IEEE), 3rd Generation Partnership Project (3GPP) organization have performed some activities on M-M communication [4].

The scenario in every metro city is no different from the other. They are developing industrially, economically and a healthy volume of vehicles are added to its vehicles count every year. However, the parking problem does not only persist but becomes more severe as the time passes in metro cities. Available paid parking lots are far away or inconvenient.

The solution to this problem can be derived by encouraging public involvement for the same. Public involvement in this scheme can be promoted through the “e Parking” application. The user of this application can offer or find parking spaces which are closer to their target area. This research has mainly two aspects, one is to offer parking to the required ones in

their residence when their owned vehicles are not in place and the second aspect is to seek the parking venue.

II. RELATED WORK

Survey on Internet of Things and Design for a Smart Parking Area[5]

In this research paper, the author is highlighting on the concept of a new technology: IoT, as applications of old parking are not so updated towards automation, this technology opens the gate towards automation [5]. So the researchers have given an idea of automation towards the fully automatic parking world. The limitation of this research is it allows only Parking automatically.

Management of Car Parking System Using Wireless Sensor Network [6]

To cope with the ever growing problem of traffic management and parking management this paper proposes an advance solution for managing and monitoring free parking space and gives automated guidance for users to park their cars. It aims at implementing smarter and better parking guidance mechanism which reduces significantly vehicle travel time and parking time [6]. In this system all the Infrared sensor nodes (IR sensor) sense the status of the car space and accordingly transfer the information to the AVR controller. Accordingly, AVR sensor sense the status of car parking space and displays the information on the LED screen for the user, thereby reducing the time for the driver to find vacant empty space and almost reduce the chances of entering into the unusual space which might lead into the traffic jam. The drawback of this work is that it needs extra hardware and parking can be done in a limited area only.

Study on Automated Car Parking System Based on Microcontroller [7]

This paper has shown the concept of an automatic car parking system. Everything in the modern world is going automatic, the system in this work automatically senses the entry and exit of cars through the gate and then displays the number of cars in the parking lot [7]. This automated car parking system reduces the time taken to check the space for vehicles by displaying the available spaces for parking on a LCD displayer by using infra-red (IR) sensors installed at the entrance and exit. This project is developed using 89c52 microcontroller. Limitation: This paper explains the parking available in parking lot only.

Smart Parking Applications Using RFID Technology [8]

There has been a considerable amount of reduction in transaction costs and decrease in stock shortage with the use of Radio Frequency Identification (RFID) technology in automation. Most of the RFID networks include a wide range of automation technologies [8]. These technologies are RFID readers, writers, barcode scanners, smart sensors and controllers. In this study, a solution has been provided for the problems encountered in parking-lot management systems via RFID technology. RFID readers, RFID labels, computers, barriers and software are used as for the main components of the RFID technology. The software has been handled for the management, controlling, transaction reporting and operation tasks for parking lots located on various parts of the city. Check-ins and check-outs of the parking-lots will be under control with RFID readers, labels and barriers. Personnel costs will be reduced considerably using this technology. Limitations: The scope of this study is only up to the parking area.

Wireless Mobile-Based Shopping Mall Car Parking System (WMCPS) [9]

The existing car parking system in Malaysia usually required the car drivers to search an empty space in the car park without providing detail direction toward the available parking space. As the result, drivers may waste a lot of time and unnecessary energy while they turn around in the car park without direction and may cause car traffic congestion in parking space [9]. This paper investigates the problems of car parking system in Malaysia and finally proposed a Wireless Mobile-based Car Parking System using low cost SMS service.

III. PROPOSED SYSTEM

Our system encourages public involvement. Almost all the residents own vehicles and parking space. During the day, they take their vehicle to their offices or business establishments and their parking space becomes available. An outsider visiting their locality can conveniently use the available space for parking his vehicle by paying a nominal parking fee to the owner. Such an arrangement if made available in and around the busy market places and commercial areas will provide a safe secured parking for the vehicle and an income source for space owner. Further it would certainly reduce the parking rush on crowded lanes and ease the congestion. To serve the purpose, we are introducing an Android Application which will help users to rent their available space and find parking as well. In this research, we have used Internet of things. [1], System with IR sensor and AVR controller also LED display. [2], System with 89C52 Microcontroller and LED display. [3], System with Radio Frequency Identification technology, which uses RFID readers, sensors, RFID tags. [4], Wireless Mobile-based Car Parking System using SMS service. [5]

IV. METHODOLOGY

There are few requirements to implement the above proposed system, which are cited below.

Requirements from owner

- Providing available space for parking

- Using parking space for earning some money
- Enabling and disabling parking spaces according to their needs

Requirement from driver

- Finding a parking space within interested premises
- Accessing the parking location and getting information of parking area
- Navigation to parking spot from current location
- Booking the available free space and remunerating the site Authenticated owner.

Workflow of the proposed System

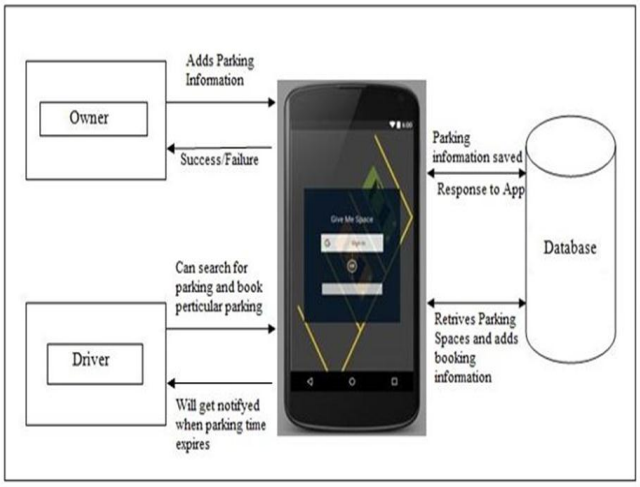

Figure 1: Context Diagram showing the workflow

In the above figure, the mobile the contains the app developed for the work mentioned using android studio. As mentioned in the above requirements, the owner and the driver communicates with the app to offer the parking and find the parking place as well.

Initially the owner has to register his/her parking lot with the app. The app in turn redirects the registered details to the database. The database notifies the app about the free space location which is now available to the visitors.

The visitors/driver seeking for the space also communicates with the app by sending his required location for vehicle parking. The app responds to the driver by searching the database and retrieving the nearest surrounding with respect to the searched location by the driver. There exist few functional requirements which adds on this literature mentioned below:

Gmail account: User should have a Google mail account as it is the most basic need for an android user to have a Gmail account which will help him to use all his mobile application and will allow him to download applications from play store and this Gmail acts as an authentication factor.

Facebook account: In case user doesn't have a above mentioned account he can use Facebook id as an alternative for logging in application for authentication purpose.

Offer a parking: User once authenticated can offer a parking for driver through which he can earn some amount and make use of his available space.

Find a parking: Driver once authenticated can login in application and find a parking near to his intended place book and use his parking.

Google maps: Use of Google maps is must as android phones support Google maps for navigation and owner can add a parking on map by long pressing and driver can book a parking using maps.

The above mentioned communication for parking can also be done using the social networking like Facebook and Gmail applications. The working of the same is as shown below flowchart.

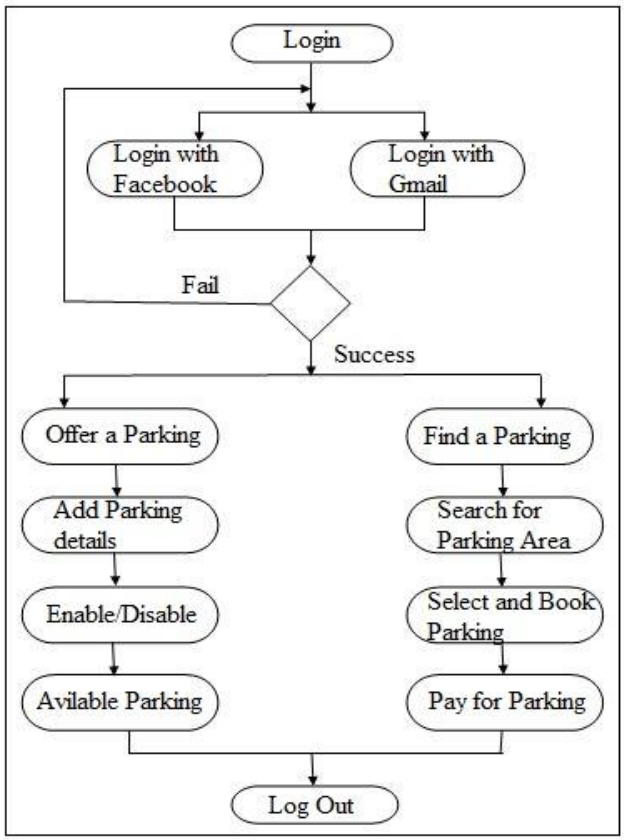

Figure 2: Flowchart showing the workflow using social networking

V. CONCLUSION

This research develops an application to obtain the key solution to the most faced problem by the public. This application is more efficient in terms of speed, time and accuracy. This application is also user friendly in operation for registering the resident free parking space, and in locating parking space in the nearby locality convenient to the driver as well.

V. FUTURE WORK

There are few enhancements in the proposed system. The owner of the resident free space and the motorist may use online payment mode. The e-wallet/ payment gateways are the other options for the payment. The location based service can be integrated to give the driver an option to find parking space in his/her intended area from his current location and also to track his/her vehicle where he/she has parked. This research can be uploaded on Play store and make it available using a Smartphone.

Another enhancement is to adopt this automatic Smart Parking System so that availability of spaces could be displayed on a smart phone application or even to satellite navigation device hence provide the drivers with the details of the free spaces. Improvisation could be made to send some notifications to user's smart phone when vehicle enters to particular shopping places and some streets in a city etc.

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