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An Internship Report On

**“Smart Mobility- IoT based Smart
Parking System”**

Submitted by

**Ujjwal
1RV18CV118**

Under the Guidance of

**Dr. Anjaneyappa
Associate Professor**

***In partial fulfilment for the award of
BE
in
Civil Engineering***

Civil Engineering Department

2022

RV COLLEGE OF ENGINEERING®

Bengaluru - 560059

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Visvesvaraya Technological University, Belagavi)



CERTIFICATE

Certified that the Internship work titled **“Smart Mobility- IoT based Smart Parking System”** was carried out by **Ujjwal-1RV18CV118** who is a bonafied student of RV College of Engineering, Bengaluru, in partial fulfilment for the award of degree BE in **Civil Engineering** during the year **2021-22**. It is certified that all the corrections indicated during the internal assessment has been incorporated in the report deposited in the departmental library. Internship work report has been approved as it satisfies the academic requirements in respect of the work prescribed by the institution for the said degree.

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EXTERNAL VIVA

Name of the Examiner


(i)

Signature with Date

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Signature with Date

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Internship Certificate


This is to certify that **Mr./Ms. Ujjwal C V**, 1RV18CV118, VI Semester B.E. Civil Engineering of RV College of Engineering®, Bengaluru, has satisfactorily completed Internship on '**Smart Mobility**', during 1-30 September 2021.



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I would like to thank my parents and friends who have always supported me in every path of life.

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Executive Summary

This report contains the overview of the Internship done by me in the 6th sem break under Centre of Competence, Smart Mobility in partnership with IBI Group, Hynetic and IEEE CAS under the guidance of Dr. Anjaneyappa, Associate Professor, Civil Engineering and Dr. Vinay Hegde, Associate Professor, Computer Science Engineering. This internship included research based analysis and online webinars on Smart Mobility domain at the end of which we were asked to do a Assignment project whose topic, I chose to be Smart Parking System.

Internet of thing (IoT) has the ability to transfer data through network without involving human interactions. IoT allows user to use affordable wireless technology and also helps the user to transfer the data into the cloud. IoT helps the user to maintain transparency. The idea of IoT started with the identity of things for connecting various devices. These devices can be controlled or monitored through computers over internet. IoT contains two prominent words “Internet” and “Things”, where Internet is a vast network for connecting servers with devices. Internet enables the information to be sent, receive or even communicate with the devices. The parking problem causes air pollution and traffic congestion. In today’s scenario, parking space is hard to search in a day to day life for the people. According to the recent survey, there will be a rapid increase in the vehicle’s population of over 1.6 billion around 2035. Around one million barrels of world’s oil is being burnt everyday. Thus, smart parking system is the key solution to reduce the waste stage of the fuel. The solution for the problems that is being raised. The smart parking can be a solution to minimise user’s time and efficiency as well as the overall cost of the fuel burnt in search of the parking space. In this, the data is collected from the sensor and through analysing and processing, the output is obtained. This data gets transmitted in the devices which extracts the relevant information and sends it to the Arduino device which gives the command instruction for the data to the particular devices simultaneously. Arduino sends the signal to the servo motor along with GSM module which further gives instructions and notification to the user. When the user enters in the parking area, RFID card allotted to the registered user is scanned by the reader module thus ensuring the security of the user identity. This enables the user to get the information of the available parking space as well as SMS notification to the registered user’s mobile number. It consists of three parts where first part is the parking area which include Arduino devices along with IR Sensor. The user interacts with the parking area with the help of these devices. The second section of the paper includes the cloud web services which act

as a mediator between the user and the car parking area. The cloud is updated according to the availability of parking area. The cloud service is administered by the admin but it can also be viewed by the user to check the availability. The third section of the paper is the user side. The user gets notified for the availability via SMS through GSM module. The user interacts with the cloud as well as parking area. The user gets the notification when the parking availability is full which saves the time for the user.

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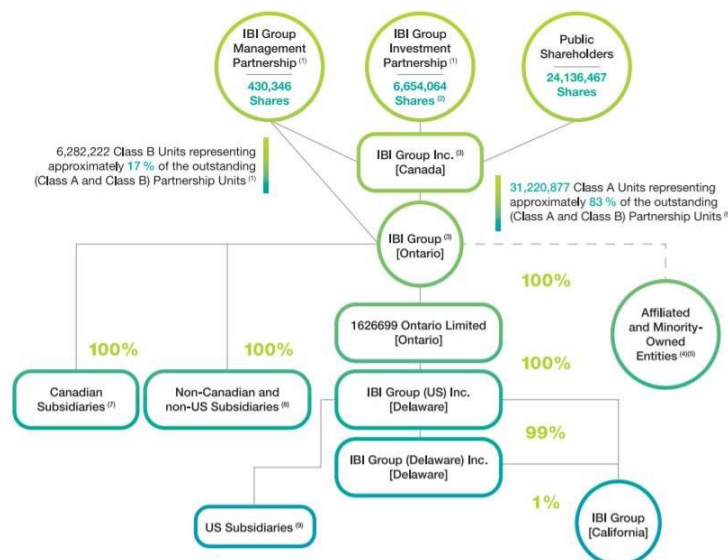
1. Profile of the Organization

1.1 Organization Structure:

Centre of Competence- The CoC is a joint initiative between IBI, IEEE CAS, Hynetic and R V College of Engineering, Bengaluru, to set up an environment that would empower young minds through knowledge and training for enhancing employability, research and innovation in emerging field of Smart City Technologies.

IBI and IEEE CAS have signed up an MOU that promotes collaborative research in Smart Water Management using IoT and Distributed Platforms, Technologies for Smart Buildings, Prototyping Smart Systems for Engineering Applications, Smart Energy Management for Solar PV Systems, Smart Mobility. The key objective of the initiative is to promote research and education in this emerging area leading to end-to-end system development and capacity building.

IBI Group- IBI Group is a general partnership formed under the laws of the Province of Ontario pursuant to the IBI Group Partnership Agreement to carry on the business of the Corporation. IBI Group also provides certain administrative services to the Corporation pursuant to the Administration Agreement. The Corporation holds all of the Class A Units (representing approximately 83% of the outstanding Partnership Units) and the Management Partnership holds all of the Class B Units (representing the remaining 17% of the outstanding Partnership Units). In addition to the Class B Units, the Management Partnership together with its affiliated partnerships hold 7,084,410 Shares. These interests represent an interest of approximately 42.81% of the issued and outstanding shares (approximately 35.64 % on a partially diluted basis, assuming the exchange of the Class B Units for Shares). The principal and head office of IBI Group is 55 St. Clair Avenue West, 7th Floor, Toronto, Ontario, M4V 2Y7.



IEEE CAS- The Different Divisions which comprise of the organization in IEEE are:

- Conference Division: Drive emerging areas and themes in conferences and create more emerging area conferences, promote industry participation and Contribution in conferences to attract industry research as well as enhancement in the key flagship conferences to achieve excellence.

- Publications Division: Leverage the strength of our publication portfolio to address industry participation issue, increase collaboration with sister societies using strength in inter disciplinary and cross disciplinary as well as increase collaboration with sister societies using strength in inter-disciplinary and cross disciplinary
- Regional Activities and membership Division: Design and improve regional technical activities (e.g. seasonal school and workshop), empowering the local chapter governance as well as reach out geographical areas without casso chapters (e.g. Africa)
- Technical Activities Division: Improve and advocate interdisciplinary related to new emerging fields aligned with SDGS, improve and advocate interdisciplinary related to new emerging fields aligned with SDGS as well as better align industrial and academic members on important open questions and research priorities of mutual interest, including knowledge transfer, innovation.

1.2 Products & Services:

Hynetic: Some of the products and solutions by Hynetic are listed below:

- Smart Outdoor Lighting
- Smart Building Lighting
- LED Lighting
- Smart Pole
- Smart Lock
- E-Rickshaw charger

IBI: Some of the products and solutions by IBI are listed below:

- Urban software and systems:
 - Nspace- A flexible planning, scheduling, and management solution for the hybrid office.
 - BlueIQ- A proven, innovative approach to reducing system-wide operational energy costs of water distribution assets in real-time.
 - InForm- A cloud-based asset management platform.
 - Smart City Platform- Helping cities and communities make better choices to improve services for, and with, their residents.
- Transportation:
 - Travel-IQ- An internationally-proven, white-label advanced traveller information system (ATIS) that provides real-time, multimodal trip planning to the public.
 - CurblQ- Understand, manage, and optimize your curbside.
 - Transit Data Suite- Inform your customers and improve efficiency with software made especially for transit agencies.
 - Road Permitting System- Manage the road closure permit process from application to issue, improving efficiency and eliminating paper documents.
 - Airport Ground Transportation System- A proven solution for airports to manage their groundside transportation commercial fleet.
 - Advanced Traffic Management- A comprehensive system which gives operators a real-time view of network conditions and incidents, featuring controllable video coverage and message display output.
- Healthcare:
 - BedPod- BedPod is a high-quality prefabricated modular care space that can be quickly installed with minimum disturbance to patients, and no loss of beds.
 - MedBed Head- A flexible in-home bedhead system seamlessly integrates a wide mix of diagnostic equipment, medication, and connected support into domestic settings.
 - Norbury Lounge Chair- This ergonomic design was specifically created for use in mental health units where healing, safety, comfort, and respect for environment are vital to patient recovery.

2. About the Organizations

Hynetic: Hynetic is an Indian-based leading manufacturer of hardware and software solutions provider for IoT applications like Smart Lighting, Energy Management and more. Since inception in 1989, we are constantly innovating to provide state-of-the-art products and future-ready solutions. Our monumental success has been with LED Drivers, Solar Power Plant Monitoring, and Smart Street Lighting. Our innovative approach to providing affordable and quality solutions for Smart City applications enable customers to achieve optimized energy-efficiency and future-proof solutions. With an experienced Research & Development team and Manufacturing facility, we can provide turnkey solutions to customers looking for Smart Solutions. By working closely with our OEM partners and leading system integrators to leverage on Internet of Things for a multitude of Smart Solutions.

Vision: They believe modern cities can grow and utilize resources sustainably while facilitating a comfortable and seamless life for their citizens.

Mission: To constantly innovate and develop affordable and reliable technology for facilitating large scale adoption of IoT connectivity.

IBI: IBI Group™ is a global team of industry leading architects, engineers, planners, designers, and technology professionals united by a common desire: to create livable, sustainable, technologically advanced urban environments. They are a technology-driven design firm. From high-rises to industrial buildings, schools to state-of-the-art hospitals, transit stations to highways, airports to toll systems, bike lanes to parks, they design every aspect of truly integrated cities. Their collaborative approach focuses on future-forward solutions. They're bridging the gap between design and technology, unlocking new potential in data-driven environments. They believe in cities built upon intelligent systems, sustainable buildings, efficient infrastructure, and the human touch.

Vision: They are the global partner to plan, design, build, and sustain the cities of tomorrow and holistically minded, design inspired, environmentally responsible and technology driven.

Mission: Defining the Cities of Tomorrow. They're dedicated to defining how cities look, how cities feel, and how cities work

IEEE CAS: The IEEE Circuits and Systems Society is the leading organization that promotes the advancement of the theory, analysis, design, tools, and implementation of circuits and systems. The field spans their theoretical foundations, applications, and architectures, as well as circuits and systems implementation of algorithms for signal and information processing. The Society brings engineers, researchers, scientists and others involved in circuits and systems applications access to the industry's most essential technical information, networking opportunities, career development tools and many other exclusive benefits. Local members with similar technical interests engage in professional exchange through the Society's 10 regional chapters in the United States, Canada, Europe, the Middle East, Africa, Latin America, Asia, Australia and the Pacific.

Vision: To advance and promote Circuits and Systems knowledge framed in interdisciplinarity to be essential to the global and diverse technical community and be universally recognized for providing and leading solutions to the United Nations' Sustainable Development Goals.

Mission: To foster technological innovation and excellence in fundamentals, emerging directions and application of circuits and systems for the benefit of humanity through an interdisciplinary community.

3. Tasks Performed

3.1 Project assignment on IoT based Smart Parking System:

3.1.1 Introduction: Internet of thing (IoT) has the ability to transfer data through network without involving human interactions. IoT allows user to use affordable wireless technology and also helps the user to transfer the data into the cloud. IoT helps the user to maintain transparency. The idea of IoT started with the identity of things for connecting various devices. These devices can be controlled or monitored through computers over internet. IoT contains two prominent words “Internet” and “Things”, where Internet is a vast network for connecting servers with devices.

- According to the recent survey, there will be a rapid increase in the vehicle’s population of over 1.6 billion around 2035. Around one million barrels of world’s oil is being burnt everyday. Thus, smart parking system is the key solution to reduce the waste stage of the fuel.
- In this, the data is collected from the sensor and through analysing and processing, the output is obtained. This data gets transmitted in the devices which extracts the relevant information and sends it to the Arduino device which gives the command instruction for the data to the particular devices simultaneously. Arduino sends the signal to the servo motor along with GSM module which further gives instructions and notification to the user. When the user enters in the parking area, RFID card allotted to the registered user is scanned by the reader module thus ensuring the security of the user identity.
- It consists of three parts where first part is the parking area which include Arduino devices along with IR Sensor. The user interacts with the parking area with the help of these devices. The second section of the paper includes the cloud web services which act as a mediator between the user and the car parking area. The cloud is updated according to the availability of parking area. The cloud service is administered by the admin but it can also be viewed by the user to check the availability. The third section of the paper is the user side. The user gets notified for the availability via SMS through GSM module. The user interacts with the cloud as well as parking area. The user gets the notification when the parking availability is full which saves the time for the user.

3.1.2 Working of the system: The sensors used in IoT based smart parking system stores and accesses data from remote locations with the help of the cloud these factors give rise to cloud of things (COT). The nodes could be monitored and controlled from any location the system that we propose provides information regarding the availability of the parking slots with the help of the mobile application the users from the remote location can book the parking slots. An algorithm is used to increase efficiency of cloud-based parking system and network architecture technology is used. This algorithm is used to find the lowest cost parking space. Considering the number of parking space available and also considering the distance of the parking space from the user. The user can directly access the cloud-based server and find the information on the parking space. The user can also install an application in their mobile phones to access this information. With the help of this algorithm, waiting time of the user to find a parking space can be minimised. Security aspects are not included in this paper. A wireless sensor node along with smart phone application is being used to find the parking space. Since, wireless technology is used here the system has high accuracy and efficiency. In this system, onboard units are used to communicate with other vehicles. The user parks his vehicle in any one of the several bays available a mechanical lift lifts the vehicle out. A ticket key and id are given to the user and it is only known to the user which is used to retrieve the vehicle. The user need not carry any paper ticket since an RFID card is given to the user. The technology used here is economical. Security features must be improved to protect the user's privacy. The author of smart parking system the survey has divided detector system and vehicle sensors into two math categories as intrusive sensors and non - intrusive sensors. Intrusive sensors are installed in holes on the road surface by tunnelling under the road. Non-intrusive sensors do not affect the surface of the road and it can be easily installed and maintained. Smart parking system helps us to resolve the grounding problems of the traffic congestion and it also

reduces the emission from a car. A paper proposes efficient way to unfold the issue of parking availability in the real time scenario and to reduce the time consumption. In this, the data is sent locally with devices which filters the data. This signal is transmitted over the cloud for the process as well as for evaluation which uses machine learning algorithms. This paper uses mobile phone application that connects the user with the real time traffic status via Google API. Thus, avoiding traffic congestion. This paper does not provide the reservation facility for the car parking. Smart parking using IoT technology helps to designs and develops a real smart parking system which provides information for vacant spaces and also helps the user to locate the nearest availability. This paper uses a computer vision to detect vehicle number plate in order to enhance the security. The user can pay for the parking space prior to the entry of the car through mobile payment. Thus, insuring the reservation of the parking. The user is notified about the parking location, number of slots available and all other relevant information. The paper uses efficient algorithms and techniques for extracting license plate text. An algorithm operates on the ultrasonic sensor detection of the vehicle entering into the parking slot and calculates the minimum cost for the user. Smart parking system based on reservation allows the reservation of a vacant space which involves smart parking system based on reservation (SPSR). This consists of host parking database management which collects and stores data about the driver's identity and parking location. When the parking reservation time is about to expire a notification will be sent to the user through the web service that has been provided to the user by the admin. The main drawback is that some other user can occupy a reserved parking space to avoid this QR scanners are used to identify the user. It helps us to propose a way in which the user can reserve his parking space by mentioning the

destination and the vehicle type with the help of mobile applications .The booking details will be stored in the cloud which finds the shortest path from the user to the parking space , the location of the user is updated regularly in the cloud with the help of GPS . When the user reaches the car parking the Rfid is scanned and the user is allowed into the parking space.The billing is done by the cloud server. The main disadvantage is that the car parking space must be registered in the smart parking system for the user to use it. This paper describes the implementation of wireless sensor networks (WSN) used in a car parking system with the help of a server. The car parking system can detect the car which is parked in the parking slot. The aim of this project is to make it cost effective and user friendly. Car parking system helps the user to sustain the data with 90% of accuracy.Smart car parking system provides a comprehensive parking solution for the user as well as admin of the parking area. It provides the feature for a reserved parking slot and identify reserved user. In this, user can navigate to the nearest parking area depending upon the size of the vehicle. The user can reserve parking slot based on hourly, daily, weekly or monthly basis. An algorithm is designed to identify the nearest parking according to the size. The mobile application provided to the user is used to reserve and pay-as-you go service

Proposed System



Figure 3.1

Hardware

The three main hardware components used are GSM module, RFID card, IR sensors. A user is allowed inside a parking space only if the user has a RFID card. RFID card contains the information of the registered user. As the car enters the parking slot, reader module scans the registered user's RFID tag. The data is sent to the arduino for checking the availability of the car parking and simultaneously, the user is notified through SMS about the status of the parking area. The GSM module sends the message according to the availability. IR sensor sends the signals according to the presence of the vehicle.

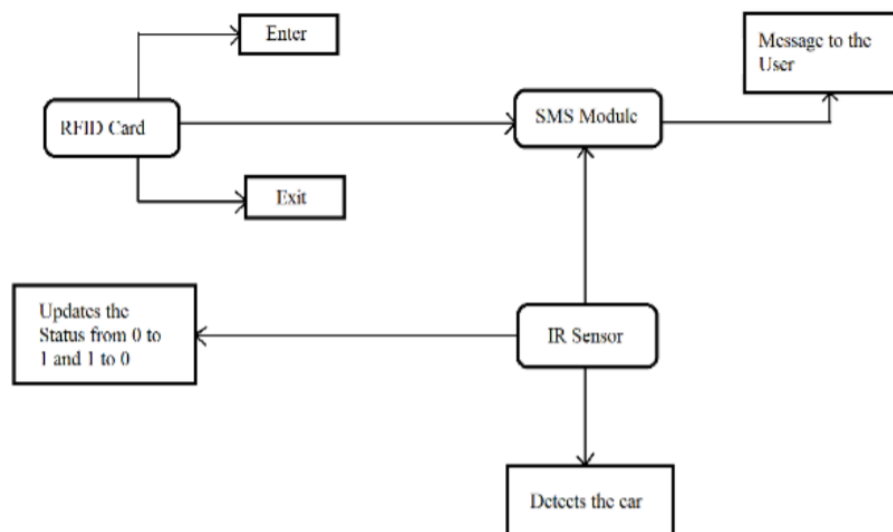


Figure 3.2

Software

The cloud server acts as a mediator between the modules. The cloud server is connected to the Wi-Fi module. The user receives messages through the SMS module while the car enters and exits the parking area using RFID card. The messages sent by the SMS module are managed by the cloud. As soon as the IR sensor detects the car, the status of the cloud will be updated from 0 to 1 and when the car leaves the parking area the status of the car will be updated from 0 to 1.

3.1.4 Details of module:

GSM module: The GSM module is a circuit which is used to setup communication between mobile phones and microcontroller. It is used to send SMS, MMS and voice messages through mobile network. GPRS extension in GSM allows high data transmission. GSM uses time division multiple access approach for transmission.



Figure 3.3

IR Sensor: An infrared sensor is basically an electronic device which is used to detect the presence of objects. Infrared light is emitted by this device. If this device does not detect any IR light reflected back that means there is no object present. If the light is detected by the sensor there is an object present.

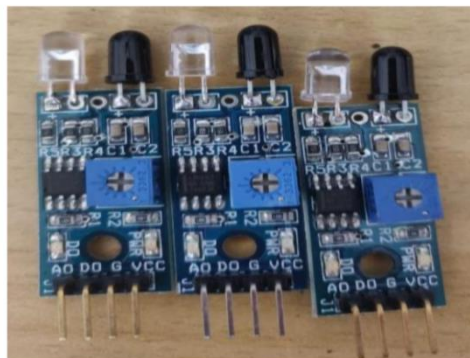


Figure 3.4

RFID Card: RFID tags are made up of integrated circuit (IC), an antenna, and a substrate. It is an identification badge or credit card that transfers its contents about an object to the reader module. RFID tag transfers data about an object through radio waves. When RFID tags are attached to devices they can also be used for tracking.



Figure 3.5

Reader Module: This module is a device which scans and gathers the information from the RFID Card. This card can be used to track objects. As the car enters the parking area, the user scans the RFID card and all the information stored in card is transferred to the admin through this module.

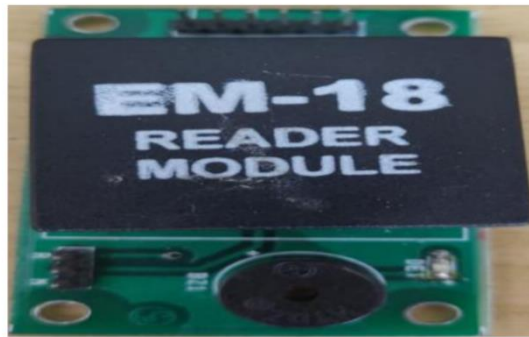


Figure 3.6

Servo Motor: It is a rotator device that allows the control of angular as well as linear motion. A servo motor is used for the opening and closing of the gate. Servo driver transmits electrical signals to the servo motor for producing motion.



Figure 3.7

Arduino Nano: It is a compact board which can be used in various devices and various field. It has overall 22 input/output pins out of which 14 pins are digital pins. It has a flash memory of about 32 kb. These pins can control the operations of digital pins as well as analogy pins. This module is a breadboard friendly board which can be easily used anywhere.



Figure 3.8

WiFi Module: It is used to send data from embedded system to the internet using URL by HTTP POST method using TCP/IP protocol. It is developed by express if systems. It is a 32 bit microcontroller with 80kb user data. It contains 16 gpio pins.

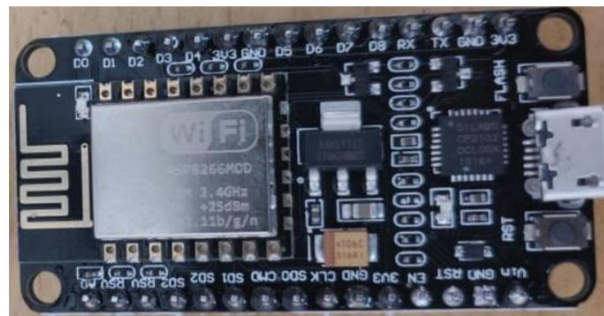


Figure 3.9

3.1.5 Implementation: This section contains the implementation of the proposed system. Every user who enters the parking slot contains a RFID card which contains the details of the user. When the RFID card is scanned by the reader module, the details of the user are transferred into the module. Now the IR sensor checks whether the parking space is free. If, there is no space available the parking barrier gate will not open. A message is sent to the user with the help of a GSM module which sends a registered message depending upon the availability and unavailability of the parking space. The WIFI module supports the system by storing all the data in the cloud. It connects the devices with the cloud server.

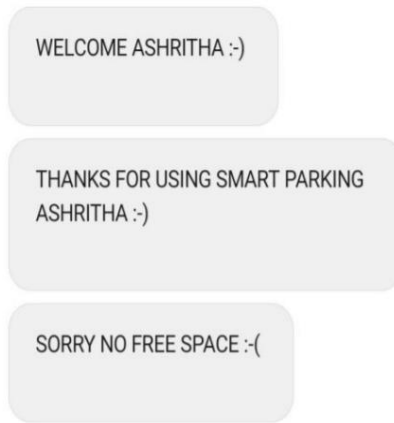


Figure 3.10

Here, the user scans the RFID card provided to the user. If space is available, the user receives a message “Welcome username” the barrier gate will open and the user can park the car. When the user exits the parking space the user again has to scan the RFID and a message will be received by the user “thanks for using smart parking username”. The database about the user’s activity in the parking space will be stored in cloud database.

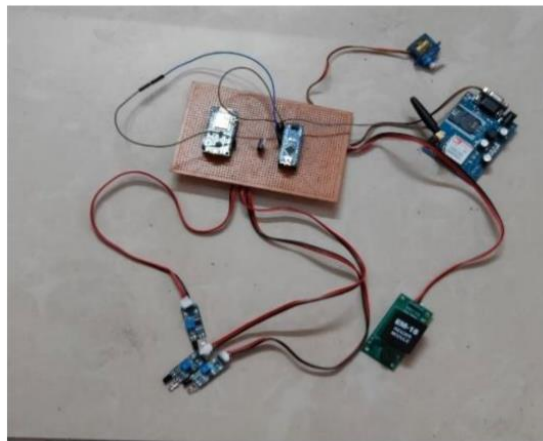


Figure 3.11

The user will know that a particular space is available with the help of the cloud status. When the car is parked the IR sensor detects the presence of an object and updates the cloud status from 0 to 1 and when the car leaves, the cloud status is updated from 1 to 0. So, the user can park his car where the cloud status is 0. The cloud status is updated every 2 minutes.

3.1.6 Result and Discussion: The demand of smart parking system is increasing significantly. This allows user to involve real time access of the availability of the parking space. The existing system in today’s world doesn’t contains the facilities of parking reservation and parking slot availability checker. The existing system was vision-based monitoring system which estimates the number of the parking slots available in the area by counting the number of incoming and outing cars which consumes lot of time and efforts. The next existing system was sensor-based system which uses ultrasonic sound waves for detecting the presence of vehicles and then two-tier parking came into existence which used the concept of parking cars one above another. The result of the paper is to make the parking area connected with the world as well as reduces time and can be cost effective for the user. The result of this paper is to reduce car theft. This paper reduces overall fuel energy of the vehicle which is consumed in the search of the car.

3.1.7 Conclusion:-

The concepts of smart cities have always been a dream. There have been advancements made from the past couple of years to make smart city dream to reality. The advancement of internet of things and cloud technologies has given rise to the new possibilities in terms of smart cities. Smart parking facilities have always been the core of constructing smart cities. The system provides a real time process and information of the parking slots. This paper enhances the performance of saving users time to locate an appropriate parking space. It helps to resolve the growing problem of traffic congestion.

4. Reflections

4.1 Technical Knowledge Acquired:

1. Hands-on experience with a wide range of machine learning algorithms.
2. Understanding of Intelligent Transportation Systems in-depth.
3. Understanding Smart Mobility System in-depth.
4. Understanding integration and working of IOT in mobility systems.

4.2 Soft skills Gained:

1. Self-motivation: Most of the machine learning enthusiasts are self-taught.
2. Multi-tasking
3. Teamwork

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