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A Simple Application: Cloud-Based Vehicle Tracking System

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Abstract - The world has now fully transitioned into the computing era, especially with the emergence of Cloud Computing. Technologies like wireless sensor networks and RFID (Radio Frequency Identification) are prepared to take on new tasks. A significant amount of data is generated, acquired, and stored to take control of our lives and make them more comfortable and secure. The use of various machine learning techniques and large data processing is made possible by cloud computing technologies. The Internet of Things (IoT) system connects various things, objects, and sensors using a cloud-based universal global neural network. Cloud computing and the Internet of Things are quickly developing services with unique characteristics. With the recent growth of cloud computing and IoT-based smart applications, data production, data integrity, confidentiality, authentication, and verification have become more crucial. Nowadays, every business demands that its data be updated in the cloud to be accessed from anywhere. In this regard, people can easily access the internet on their computers and smartphones in most countries, making online information transmission much simpler and more affordable. The author's goal in this project is to develop a smart vehicle tracking system that will help universities, colleges, malls, etc. to monitor incoming and outgoing vehicles, within and out of time, and vehicle owners' details on one website. This project introduces a novel algorithm that delivers real-time information about the vehicles (vehicle in time, out time, current date & owner details) and all the information stored on the cloud so anyone can show all the real-time information.

Key Words: JavaScript, HTML, CSS, RFID, IoT, Cloud Computing, ARDUINO.

1.INTRODUCTION

1.1 Background:

Cloud computing, a recent computing trend, extends computing beyond the desktop to the entire World Wide Web while reducing user responsibility for resource management and maintenance. In terms of cloud computing, the user is only accountable for the pay-as-you-go service(s) cost [1]. Using cloud computing, a smartphone can be turned into a sizable data center. Cloud computing includes distributed computing, parallel computing, and grid computing [2]. With the development of the cloud as a significant paradigm for computing, the Internet now provides open, anytime access to a shared pool of programmable computing resources. This model typically uses infrastructure, IT platforms, and software (applications, databases, or other data) as data storage, administration, and processing services. They have many advantages, including lower IT costs, more adaptability, and simpler spatial and temporal requirements [3-5].

1.2 Purpose of the Paper:

The vehicle Tracking system can be applied to build a variety of new applications, such as automated decision-making, networks, transportation systems, etc. The authors of this paper have shown how data production, data integrity, confidentiality, authentication, and verification have become more essential as cloud computing and IoT-based smart applications have grown latterly.

To benefit from the many promises of cloud computing, several issues, such as architectural solutions, performance optimization, resource virtualization, reliability and security, maintaining privacy, and more, must be addressed [6]. Computing power, database storage, application hosting, and on-demand computing resources are all provided by cloud computing. Consumer computing and infrastructure are now being invaded by cloud computing. Cloud-based machine learning tools are being developed by several Internet behemoths, including Amazon, Alibaba, Google, and Oracle, to offer a range of solutions to businesses worldwide.

Another important technological advancement that is expanding is the Internet of Things (IoT) [7-8]. The Internet of Things' dynamic global network infrastructure connects intelligent, self-configurable embedded devices and sensors, enabling scalability, flexibility, agility, and Large-scale multimedia data processing, storing, accessing, and communication are examples of areas where it is frequently used. IoT is generating a lot of new data that needs to be stored, analyzed, and retrieved, which is why big data is becoming increasingly popular. Due to the need to monitor, analyze, and act on that data, challenges in data security, data verification, authorization, data mining, secure communication, and computation exist. The efficient sharing of resources can be achieved by combining cloud computing and IoT [9-10]. Software, computing, and infrastructure services are examples of cloud resources. Virtual infrastructure for storage, analytical tools, monitoring, visualization, and other needs can be provided by cloud computing [11]. This kind of connection is referred to as "the cloud of things" (CoT). A significant amount of detection data can be stored in the cloud and utilized intelligently for Smart monitoring using various data mining algorithms, machine learning techniques, and artificial intelligence methods [12-13].

1.3 Problem Statement:

To build a dynamic website to manage vehicle tracking and keep track of all incoming & outgoing vehicles and implement using an RFID tag. The data will be tracked on a real-time basis and stored in the cloud.

1.4 Objective:

- When the car is in the parking space, we can check the in-time by reading the RFID card and we can get instantly all the details of the car like the owner's name, and car number.
- Keeping the records of all the registered vehicles within time and out time.
- If the area has more than one number of gates, in that case also we can get all the information within one website.
- We can track the vehicle easily by checking the owner's name on the vehicle.
- As all the information is readily available, anyone can access that information from the website.
- The administrator can maintain track of the driver's attendance, which will make it much easier for him to determine the driver's remuneration. Drivers are not allowed to cheat in any way because the administrator may simply discover it using this approach.

Section II describes some smart applications based on the vehicle tracking system. Section III states the proposed model using a flow control diagram. Section IV gives some complex experimental result and their proofs. Section V describes all the system setups and pin configurations on the circuit. Section VI is the research's conclusion stated.

2. Literature Review

In this paper, nearly ten renowned research papers have been reviewed and deeply analyzed by the authors. By gathering all the precious information regarding real-time intelligent traffic control systems, cloud-based driver monitoring systems, and vehicle parking systems, this table has been prepared.

Table 1: Literature Reviews of some of the previous related studies

Sl. No.	Paper Title	Authors	Year	Objectives
01.	Automated Real-Time Intelligent Traffic Control System for Smart Cities Using Wireless Sensor Networks [14]	Adil Hilmani and et al.	2020	A central server continuously monitors parking availability and traffic density in the city in real time using sophisticated database management techniques. Additionally, another mobile app allows users to locate parking spots near their destination as well as alternative routes to avoid traffic jams.
02.	Cloud-Based Driver Monitoring System Using Smartphone [15]	Alexey Kashevnik and et al.	2020	Using smartphone sensors, the technology recognizes dangerous driving conditions for the driver. We use a smartphone with a front-facing camera tracking the driver's face that is mounted on the windshield of the car.
03.	A Real-Time Cloud-Based Intelligent Car Parking System for Smart Cities [16]	Fazel Mohammadi and et al.	2019	To dynamically test parking availability in different parking areas and address the above-mentioned challenges, this paper integrated on-site data collection using wireless sensors and real-time and continuous data analysis on IoT data.
04.	Intelligent Traffic Control System Based on Cloud Computing and Big Data Mining [17]	Mu Shengdong and et al.	2019	This study is based on intelligent traffic flow data, and a central cloud control management server uses deep learning and artificial intelligence techniques to overtake vehicles, such as traffic flow data forecasting, for training on traffic flow forecasting and short-term congestion on

				urban roads.
05.	Cloud Based Vehicle Parking System for Anonymous Place Using Internet of Things [18]	R.Murugan and et al.	2017	In this paper, the smart shutdown framework and how to use it have been described. The effectiveness of the smart stop framework in solving the travel problem that arises, especially in cities where activity, traffic congestion, and lack of parking spaces are obvious problems in situations Various settings are made.
06.	An IoT-based E-Parking System for Smart Cities [19]	Pampa Sadhukhan and et al.	2017	This paper presents a prototype of an E-Parking system based on the Internet of Things. The proposed E-Parking system includes an integrated part called a parking meter to solve the above problems and provide smart city-wide parking management.
07.	SVPS: Cloud-Based Smart Vehicle Parking System Over Ubiquitous VANETs [20]	Qamas Gul Khan Safi and et al.	2017	In order to offer more dependable parking options, this manifesto suggests a cloud-based smart vehicle parking system (SVPS) that runs across widely used VANETs. By enabling a collaborative environment between vehicles and the cloud, we proposed a new cloud-based smart vehicle parking system (SVPS) that offers vehicles smart parking assistance while delegating processing to the cloud infrastructure.
08.	Internet of Things Approach to Cloud-Based Smart Car Parking [21]	Yacine Atif and et al.	2016	In order to relieve pressure on public agencies, create new revenue streams and attract the participation of new actors in the mid-market, this project utilizes private land funds for parking. It aims to transform parking management from an actual business to a company that treats parking as an IT service.
09.	Smart Parking with Reservation in Cloud-Based Environment [22]	Karthi.M and et al.	2016	This paper includes a useful technique for determining if parking is available and for making a reservation. The only current area of research is the accessibility of parking spaces.
10.	A Vehicular Cloud-Based Framework for the Intelligent	Rodolfo I. Meneguette and et al.	2016	For intelligent urban traffic management, we proposed the cloud-based vehicle

	Transport [23]			architecture called VICTiM. These methods control vehicle movements and the information flows produced while storing data and enabling heterogeneous communication between various devices.

3. Methodology

The Front-end section of our paper is develop by using BOOTSTRAP 4.0 and HTML5. In this paper six main sections are designed like Login page, Admin, Device, Manage Vehicles, All Vehicles, and Vehicles Log. We have added images and links to our website using HTML5 [24]. We located the items in the navigation bar and aligned them with padding and margin. The row and column effect has been used to attach the footer to our website. We are also utilizing the box element. We have added their respective locations to each box, making it simple for users to locate the sites. We have connected our HTML pages by using hyperlinks and made it easy for our users to click on the page they want. We created the Login and Reset Password page using Bootstrap 4.0. We have also used the column attributes to create a form. Text, registration number, name, types of vehicles, date, card UID, gate number, email, and password have all been added to the form. Again using Bootstrap 4.0, we created a variety of boxes for the admin, device page, and manage vehicles pages. We use pop-ups and modals in our admin page, add new device page, change device mode page, manage vehicles page, and filter vehicle page. We designed our owner name, registration number, card UID, gate number, date, time in and time out sections using column division. The design and rendering of our web page's images and elements rely heavily on CSS [25-28]. We have provided the appropriate color, pop-up, modal, hover, shadow, and other effects using CSS. We used PHP, an open-source general-purpose scripting language that works well for our website and is easy to embed in HTML [29]. It helps us design our programs, which are used to create our large applications, and make them scalable. We used JavaScript to provide our customers with a dynamic and interactive experience [30]. We also know that MySQL is the safest and most dependable database management system, so we used it for all our data storage on our website.

3.1 Introduction:

A Vehicle Tracking System is a system that allows tracking and controlling of vehicles via an online computer, smartphone, tablet, etc. This diverse paper includes HTML5, CSS, Bootstrap 4.0, JavaScript, PHP, MySQL, XAMPP, AURDINO, and Visual Studio Code [31-32]. Therefore, it's crucial to recognize each key function in order to become accustomed to the task that needs to be done.

3.1.1 Data Flow Diagram

Login Section:

In the Login Section, the correct mail Id and password have to be put. If the wrong password is given, you have to reset your password and log in again. The option is available here. After successful login, some sections will be visible to the users, including the log-out option [33].

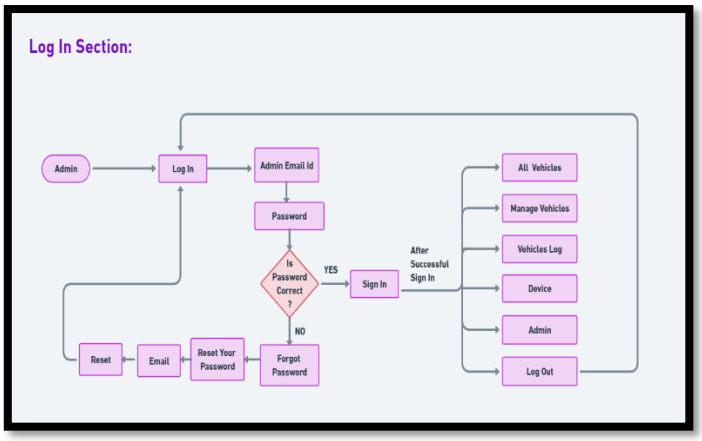

Figure:1: Flow control of Login Section

Admin Section:

In the admin section, some general information is there like the admin name, and email. If the admin wants to set the password, they are free to do so here. So basically, account updating can be done here.

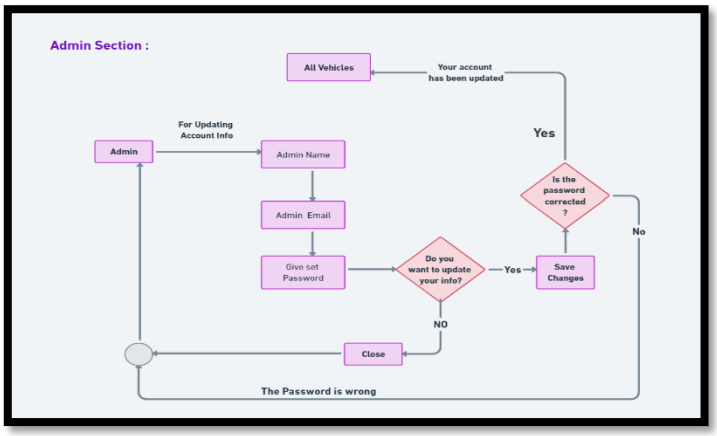

Figure: 2: Flow control of Admin Section

Device Section:

In the device section, new devices can be added; current device information are available there like device name, gate number, device data, and device mode. Here, we can also remove the device record and change the mode [34].

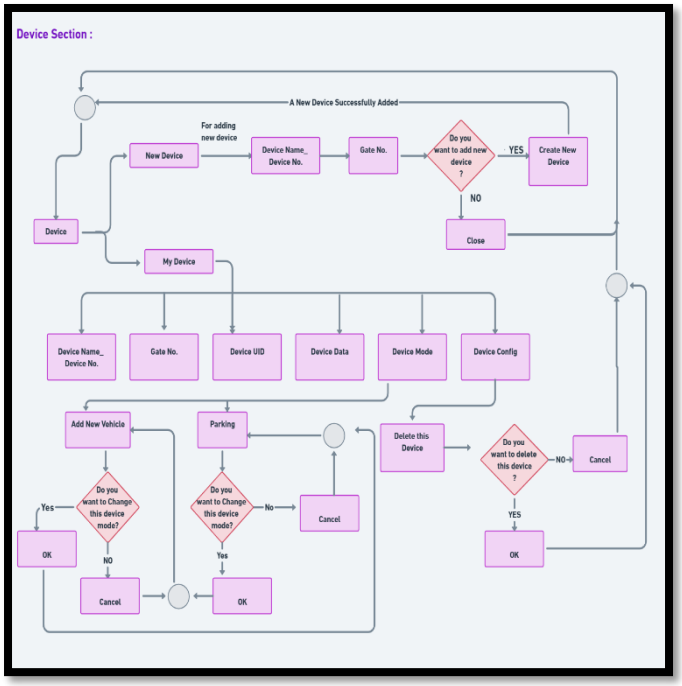

Figure:3: Flow control of Device Section

Manage Vehicles Section:

In manage vehicle section, vehicle information is available like card UID, owner name, vehicle types, registration number. We can here add vehicle also and same for remove vehicle information.

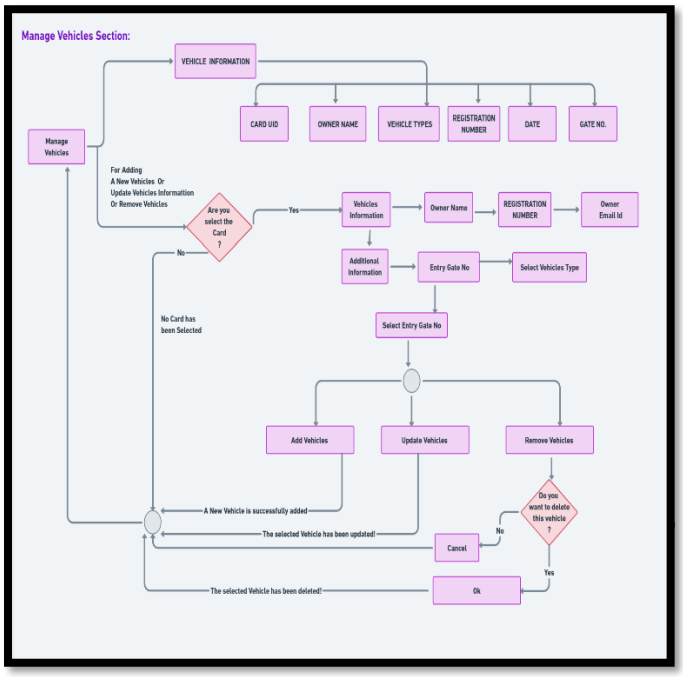

Figure:4: Flow control of Manage Vehicles Section

All Vehicles Section:

In all vehicle section, basic information about vehicles is available. Like owner name, registration number, vehicle type, card UID, Date, and gate number [35-36].

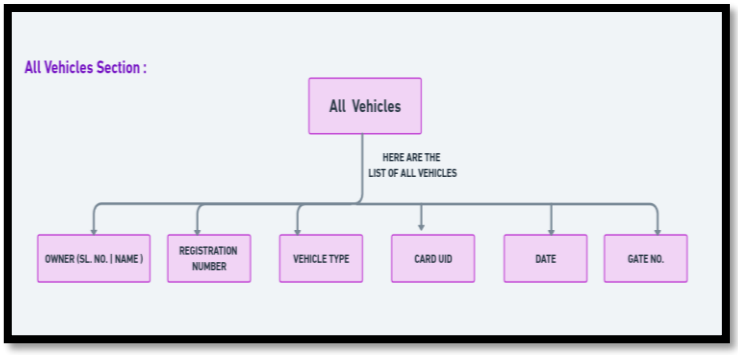

Figure:5: Flow control of All Vehicles Section

Vehicles Log Section:

In the vehicle log section, a filter option is available. We can use a log filter to export the data to excel. It is a kind of report generation. We can select the date range or filter by in/out time or we can filter by owner name or by entry gate number. Thus, we can export the data.

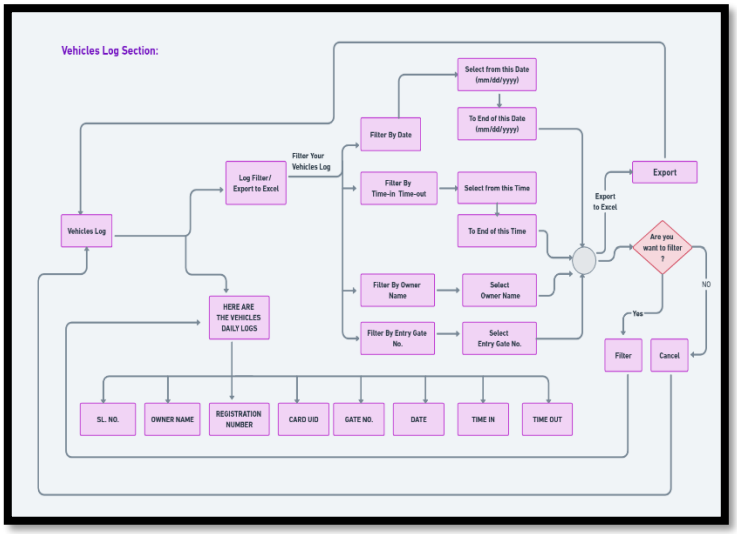

Figure:6: Flow control of Vehicles Log Section

3.2 Technologies used:

PHP: PHP is a well-suited general-purpose, open-source scripting language for web development that can be embedded in HTML. PHP is highly adaptable, no matter where you are in the project—in the middle or at the end [37]. PHP is a programming language that can be useful. It can create many applications and is scalable for program design. PHP is used for this reason [38].

JavaScript: JavaScript is a programming language used mainly by Web browsers to provide an interactive and

dynamic user experience. JavaScript is used to write most applications and services that make the Internet essential to modern life. Mainly, JavaScript is compatible with numerous programming languages. Additionally, it can create both back-end and front-end applications [39-40].

CSS: CSS is a language that describes how colours, layout, and fonts are displayed on Web pages. It makes it possible to adapt the presentation to fit a variety of devices, including printers and large screens [41]. CSS is independent of HTML in today's environment and compatible with any XML-based markup language; A typical webpage load time is just a few seconds for users. In this instance, we employ CSS as a result. CSS speeds up the loading time of a page [42].

Bootstrap: Modern web applications and pages can be built using a robust front-end framework. It is open-source, accessible, and includes numerous HTML and CSS templates for UI elements like forms and buttons [43]. JavaScript extensions are supported by Bootstrap as well. It is primarily portable and lightweight. Several JavaScript plugins use jQuery. Anyone can create a landing page that is visually appealing using Bootstrap. Because of this, we use it.

MySQL: MySQL is one of the most well-known technologies in the vast data ecosystem. MySQL is used in popular online applications like Facebook and Twitter and is widely acknowledged as the safest and most dependable database management system. MySQL is guaranteed to be available 24 hours a day, seven days a week and offers a wide range of high-availability options, such as customized cluster servers [44].

3.2 Software Requirements

Vs code: Visual Studio Code is a lightweight code editor with version management, task execution, and debugging capabilities. It aims to give developers only the tools they need for a quick cycle of code, build, and debugging, leaving more complicated workflows for full-featured IDEs like Visual Studio IDE [45]. Vs code is compatible with numerous programming languages. It can determine if any code fragments are missing. It has Web application functionality built in [46]. Web applications can therefore be developed and maintained in VSC. It is possible to open multiple projects at the same time that contain multiple directories and files. It's possible that these folders and projects are related or not [47].

XAMPP: Web pages can be served over the Internet with XAMPP. Using a specific tool, the product's most important sections are password-protected. In addition, MariaDB and SQLite databases can be created and manipulated with XAMPP [48]. Setting up a setup for development, testing, and deployment is easy and quick. It handles numerous administrative tasks, such as status and security checks [49-50].

ARDUINO: A single circuit board houses multiple components and interfaces in an Arduino. The 5V regulator, a burner, an oscillator, a microcontroller, a serial communication interface, an LED, and headers for the connections are all included in the package with Arduino [51-52]. The ability of Arduino to automatically convert units

3.4 Hardware Requirements:

RFID reader and RFID tag: The RFID reader is a device that connects to the network and can be fixed or mobile. Impulses are transmitted using radio waves. When activated, the tag generates data by sending a wave back to the antenna. The transponder is contained in the RFID tag [53-55].

Breadboard: A breadboard is a plastic rectangle with numerous tiny holes. Electronic circuit prototyping is made simple by these holes, which include a battery, switch, resistor, and LED (create and test an early version).

D1 Mini: The D1 Mini is a wireless 802.11 (WiFi) development board for microcontrollers. It makes a complete development board out of the widely used ESP8266 wireless microcontroller [56-58].

Cable USB: USB ports enable the connection of USB devices and transfer digital data via USB cables. They can also use the cable to supply electric power to devices that need it. The wired version of the USB standard requires USB ports and connections, while the wireless version is available [59].

Connector: Devices that use electricity to connect or disconnect circuits are called connectors. They don't require special tools or processes like soldering to connect or disconnect them. All that is needed is simple tools and one's hands.

4.1 Result and Output

4.1

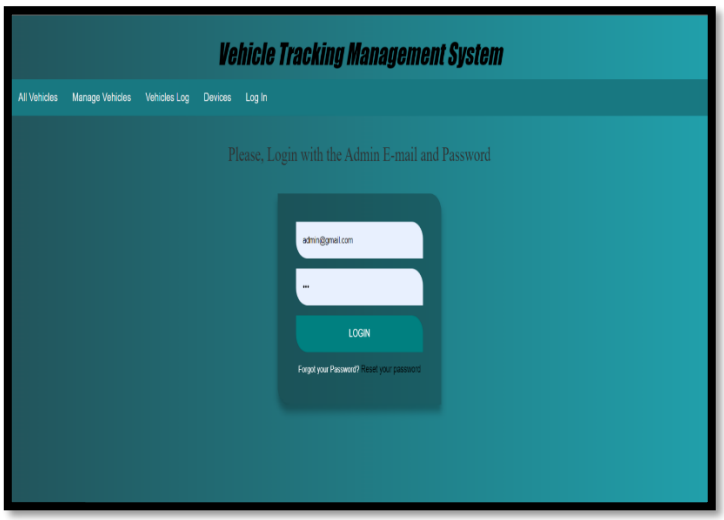

Figure: 9: Log-in Page

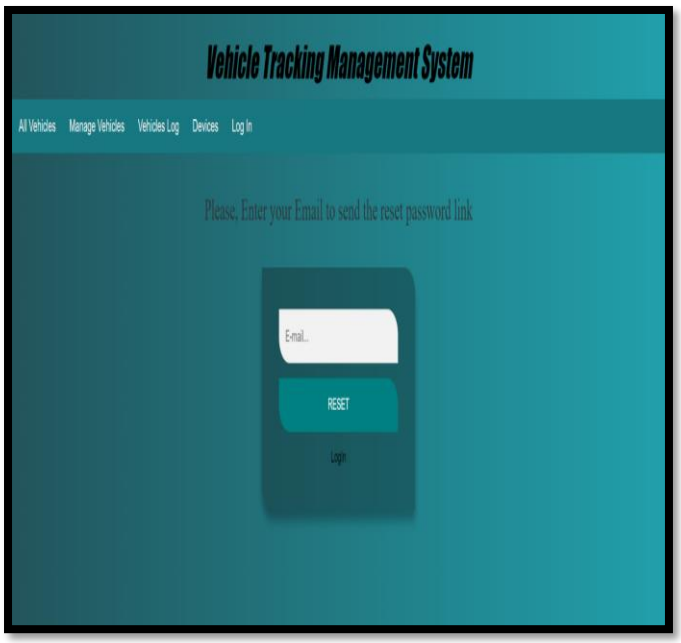

Figure:10: Reset password page

This is the log-in page. At first, Admin needs to put in his/her mail id and password then the admin can log in to this site. In any case, if the admin forgets the password, then it has a forget password option also. Admin can reset the password.

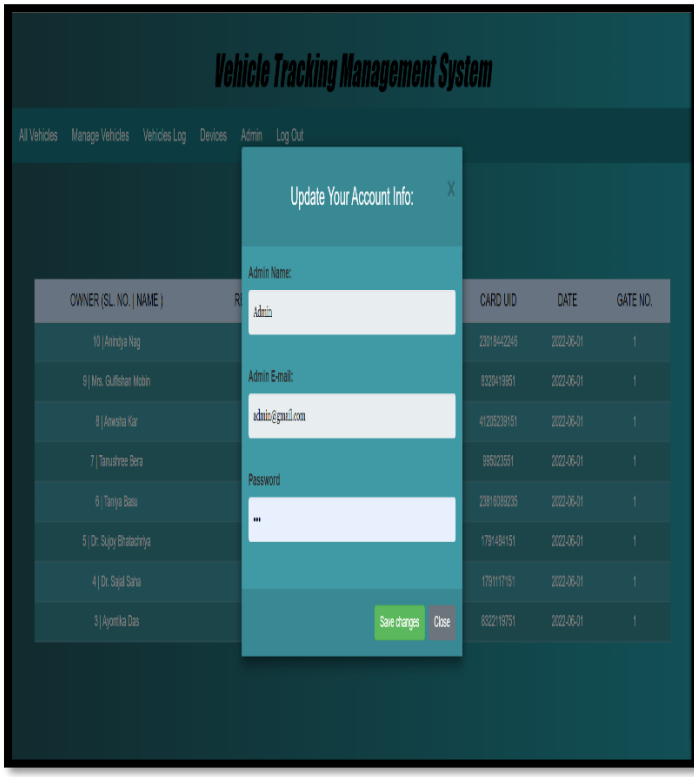

Figure: 11: Admin page

On this page, the admin can change the email id and password. Mainly admin can update the details.

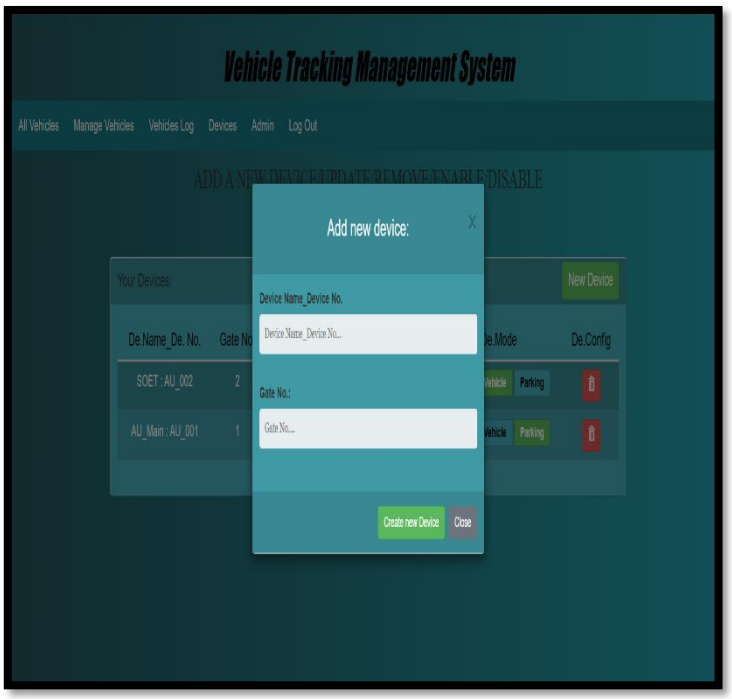

Figure: 12: Add new device page

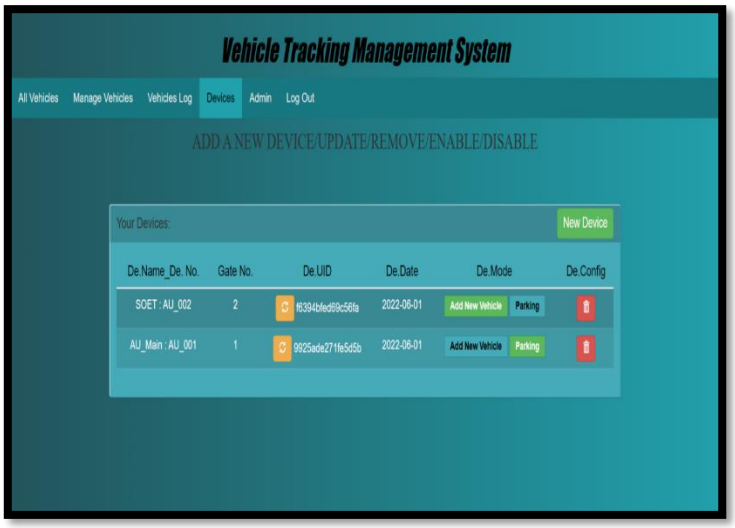

Figure: 13: Device page

On the Device page when any new device connects to the server at first, we need to put the device name or device number and gate number to create a new device. There are two device modes first one is **Add New Vehicle** and the second one is **Parking**.

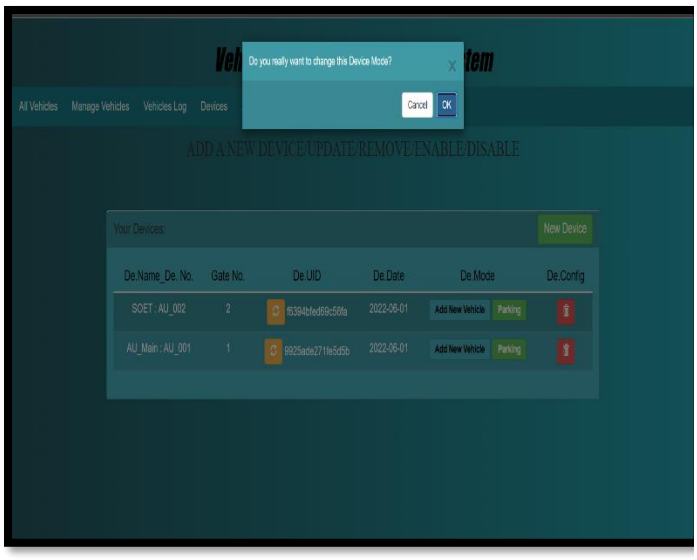

Figure:14: Change device mode page

Suppose we want to add any new vehicle in device number 1 gate 2 then we need to put the device in **Add New Vehicle** mood. After that when we scan the card in the RFID reader then the new vehicle is going to the **Manage Vehicle** part.

And when the previously registered vehicle is coming then the device is in **Parking Mood** for the in time and out time.

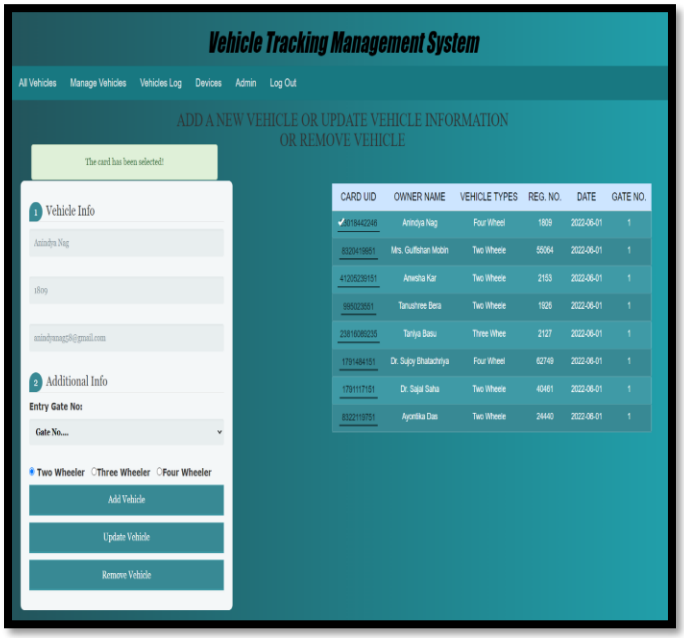

Figure: 15: Manage Vehicles page

On this page, if we click any Card UID, we can see all the details of the car owner. In this part we can also add a new vehicle and vehicle details, we can also update vehicle details and we can remove any vehicle.

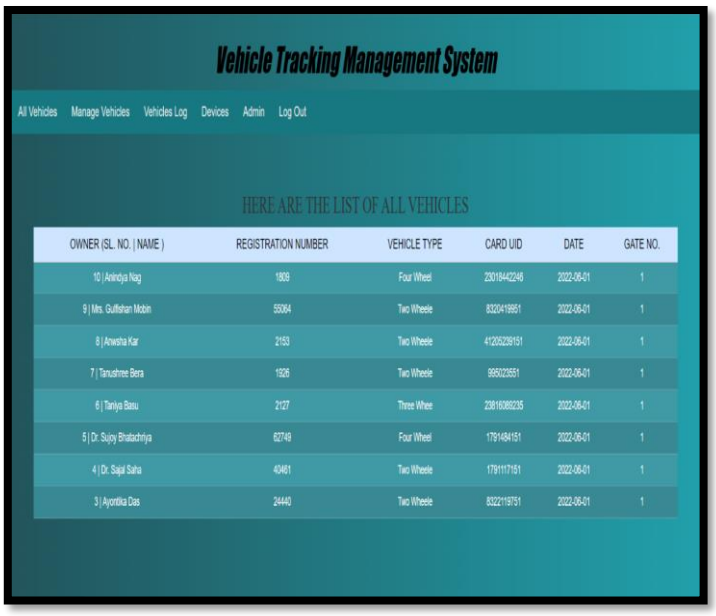

Figure: 16: All Vehicle page

On this page, we can see all the registered vehicle details such as owner name, registration no, vehicle type, Card UID, Date, and gate number.

Figure: 17: Vehicle logs page

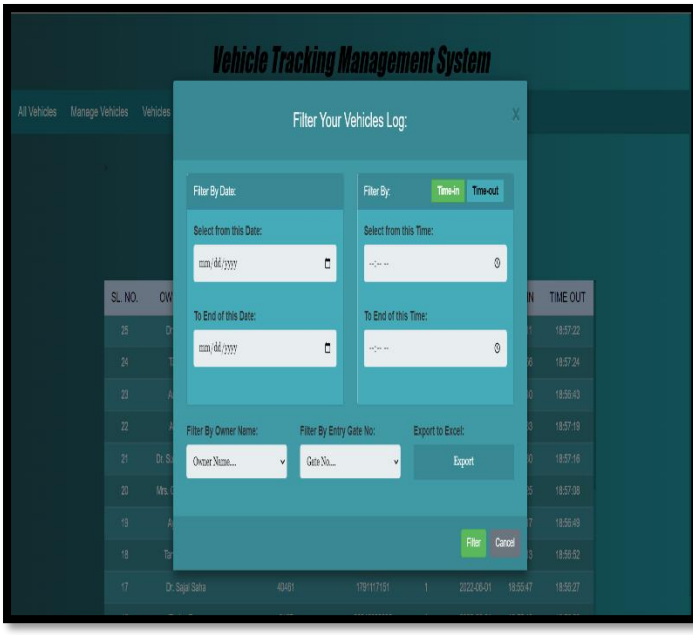

Figure: 18: Filter Vehicle page

On this page, we can filter the vehicles with the help of the incoming and outgoing times and dates of the car. we can also filter by scrolling the owner's name and entry gate number. If we want to check any date, we can also see all the vehicles which are incoming and outgoing on that particular date.

6. Conclusion & Future Work

A smart tracking system is one of the most important components for realizing the smart city concept. Our project's goal is to develop a smart car tracking management system that will help smart cities and malls identify parking spaces that are appropriate for their specific needs and automobiles. This project delivers real-time data based on vehicle category, vehicle in time, out time, and current date. To track the availability of Vehicles based on vehicle type, data storage using cloud servers and data collecting using wireless sensors, as well as real-time with IoT sensors, are examined.

The future scope of the work is to increase the RFID range so that we will be able to track vehicles on a large scale. In future work, we aim to extend this research specifically for designing the algorithm to convert our tracking system into a parking system so that it monitors the availability of parking spaces in different parking lots, and parking prices in order to maximize the use of existing parking spaces and implements it in a simulated environment.

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