"USER - CENTRIC PARKING SOLUTIONS USING IOT"

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ABSTRACT: This program streamlines parking slot administration for both commercial and ordinary customers, offering a user-friendly interface for registration, login, and booking procedures. Upon logging in, business customers have the flexibility to choose parking spaces depending on the availability of floors and lanes, which are shown using a color-coded system. Once consumers have selected an open time slot, they continue to finalize the booking, which generates a unique token number for future reference. After registration, regular users often adhere to a standardized procedure. A key component is the administrative interface, which allows the administrator to oversee all reserved time slots, track the length of parking, and release slots after the consumer has made a payment. The system improves user experience via the provision of comprehensive information display, effective slot release procedures, and a faster payment process. This all-encompassing parking management system addresses the requirements of various user roles, guaranteeing a seamless and well-structured parking experience.

INTRODUCTION

The internet is a remarkable phenomenon that provides us with several benefits that were before unattainable. Consider the state of your mobile phone prior to its transformation into a smart phone. Now, you have the ability to access and consume any book, movie, or music from the convenience of your hand. These are just a few examples of the remarkable features of your smartphone. The crux of the matter is that accessing the Internet offers several remarkable benefits. The Internet of Things (IoT) refers to the process of connecting all objects in the world to the internet. The Internet of Things (IoT) is a vast network including many devices that are fitted with sensors to collect data. This data is then communicated throughout the network. The term "things" in IoT encompasses many devices such as sensors found in automobiles, heart monitors worn by individuals, and cameras that capture live footage of animals in forests. These objects are then linked to the internet, meaning they have been given an IP address, and the data gathered by these devices is subsequently sent via the network. These data may be used to accomplish numerous activities. The Internet of Things (IoT) enables remote control of things via network connectivity, resulting in the creation of a smart environment. Currently, it is one of the prevailing subjects of interest in contemporary times. Any object or device that is linked to the Internet may be categorized into three distinct groups:

LITERATURE REVIEW

The IoT, or Internet of Things, is a convergence of several technologies that enhance social services by leveraging intelligent sensors and devices. Smart devices may be remotely accessed and controlled at any time and from any place with IP (Internet Protocol) connectivity[11].IoT is also responsible for the development of

Smart Parking. Various parking systems may be devised, such as assigning a tag to each visitor which will be authenticated prior to granting access to the parking area, hence providing security measures. A visual representation of the number of available parking spaces may be shown at the entrance and departure points. An enhanced system might be implemented where users can pre-book time slots and make payments via a dedicated application. Various methodologies might be used to develop a Smart Parking system that aligns with our specific needs.Due to the continuing expansion of IoT, much study has been conducted in this domain.

In [1], a proposal for an advanced automobile parking system is presented. The primary need of this system is to authenticate the user, which is achieved via the use of an RFID card.At each slot, sensors are fitted to detect when a vehicle enters or departs. This information is promptly updated on the displays located at both the entrance and exit gates.The gates will only open when an approved RFID card is used, regardless of the availability of vacant parking spaces.

The recommended solution in [2] involves using ultrasonic or infrared sensors to identify vehicles or obstacles in a cloud-based system. Users may use an android application to verify the accessibility of parking spaces. Additionally, they have the option to reserve slots and complete payments. The program will record their entrance and leave times. Once the user has parked their car, they must validate their occupancy using the application.A mathematical model has been suggested by them.
In their study, the authors have presented methods for efficient toll revenue collection, effective traffic congestion management, and an advanced parking system.A centralized monitoring system will be implemented to oversee many parking locations across the city.The system would possess information on the availability of various parking places. The end user will use this system to search for available parking spaces at no cost. The system will determine the end user's position using GPS (Global Positioning System) and give the most efficient path to the parking area using Dijkstra's Algorithm.

In [4], a system has been devised including a server, database, user-friendly application, and parking space. They have supplied a mobile application for Android to the user. Users must register using a unique identification document, such as an Aadhaar card. The information and parking spot data are stored in the database.The user has the option to reserve a certain parking place at their preferred location. Once the reservation is made, the server generates a QR code and sends it to the user. Users will use this QR code to access the slot.
Within the context of [5], there exists a comparable system that comprises a mobile application, a cloud server, and an Arduino device. Users may reserve a time slot using the application and make payments directly inside the application.

In addition, they have developed an application for reserving parking spaces and generating bills. However, the distinguishing factor resides in the detecting technology. They have developed their own sensors. Pressure sensors are constructed utilizing a pair of pressure pads fabricated from aluminum foil. There is a foam layer in the center that separates these pads. The pressure pads are linked to the NodeMCU micro-controller.

The authors used passive radio frequency identification (RFID) technology in [7].A novel RPM algorithm is suggested for the purpose of collectively selecting a communication channel between a collection of RFID readers, from the source to the destination, and calculating the minimal transmission energy needed by the RFID reader to guarantee connection of the communication route.

The user who wants to park the automobile is connected to the Wi-Fi network of the particular parking lot with a password in [8]. The IR sensors transmit the status of the information processing to the microcontroller. The microcontroller utilizes Internet of Things (IoT) technology to transmit user information on the state of the slot to the web page. This facilitates the user's ability to locate a parking spot without encountering congestion.

In their study, the authors highlighted the benefits of integrating Cloud technology with the Internet of Things (IoT) and conducted a thorough analysis of public, private, and hybrid cloud solutions. They have used a private cloud.

In their study, the researchers used Raspberry Pi in conjunction with Arduino, Amazon Web Service Elastic Compute Cloud, ultrasonic sensors, RFID, and Mongo DB. The Cloud Application retrieves and saves the data sent to the MongoDB database by the Raspberry Pi application. When a customer requests to locate the nearest available parking space, the system identifies the parking space closest to the user's current location. It then searches the records to determine if this parking space has any vacant spots. This process is repeated until a suitable accessible parking space is found, and the response is sent back to the customer. This program further records the time when a user enters or leaves, as well as their financial details.

The substantial increase in new automobile registrations worldwide, particularly in regional economies like Asia Pacific (APAC), will provide major opportunities for parking management companies. Due to the government's many smart city initiatives, there will be a significant increase in the need for smart parking systems.The worldwide parking management industry is projected to grow at a Compound Annual Growth Rate (CAGR) of 11.4% from 2014 to 2019. The parking management industry is expected to reach a value of $5,025.9 million in 2014[13].

METHODOLOGY

PROBLEM SYSTEM:

In previous works manual and time-consuming, requiring significant manpower and user effort. Users navigate through parking floors, wasting time and energy. These conventional systems are inefficient, consuming excessive power. This paper proposes a Smart Parking Energy Management solution using IoT technology, integrating advanced Honeywell sensors. Unoccupied spaces are indicated with lamps, guiding users to available parking spots. Occupied spaces are stored in the cloud, streamlining the parking process. Automatic light control minimizes energy consumption, enhancing the parking area's aesthetics. This fully automated

system reduces manpower and prioritizes user time and convenience, addressing the shortcomings of traditional parking systems.

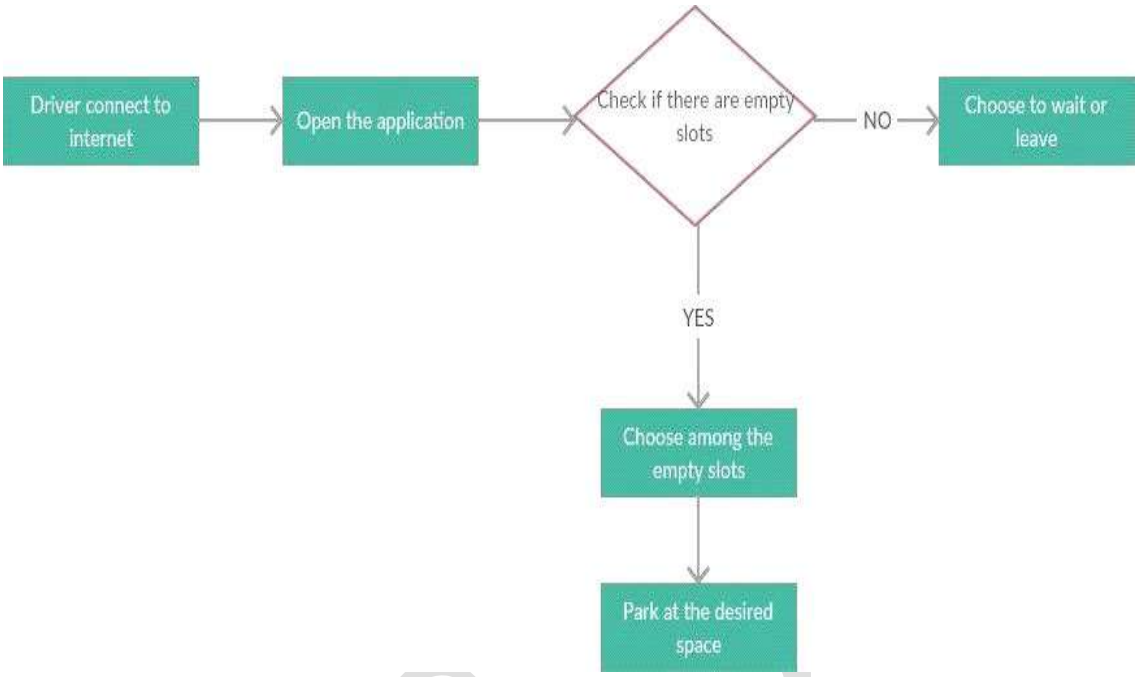


Figure 1: System Flow of Smart Parking.

This will be the scenario at user's end. Now coming to the details, the parking area will be installed with infrared sensors which will sense any object(vehicles in this case) and send this data to the micro-controller. Micro-controller will send this data to the android application or cloud from where user can see the data. Things will become more clear with the following figure 3.2.

This report includes different approaches towards developing a smart parking system using different devices and scenarios which will be discussed in detail in the coming chapters. All the devices used are easily available on the internet, affordable and easy to use. Since obstacle detection is an important technology associated with the proposed solution it has been discussed in detail.

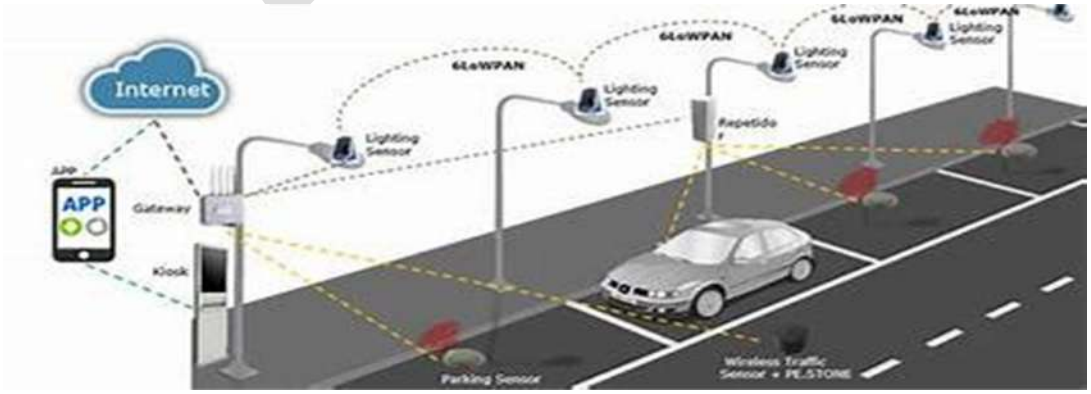
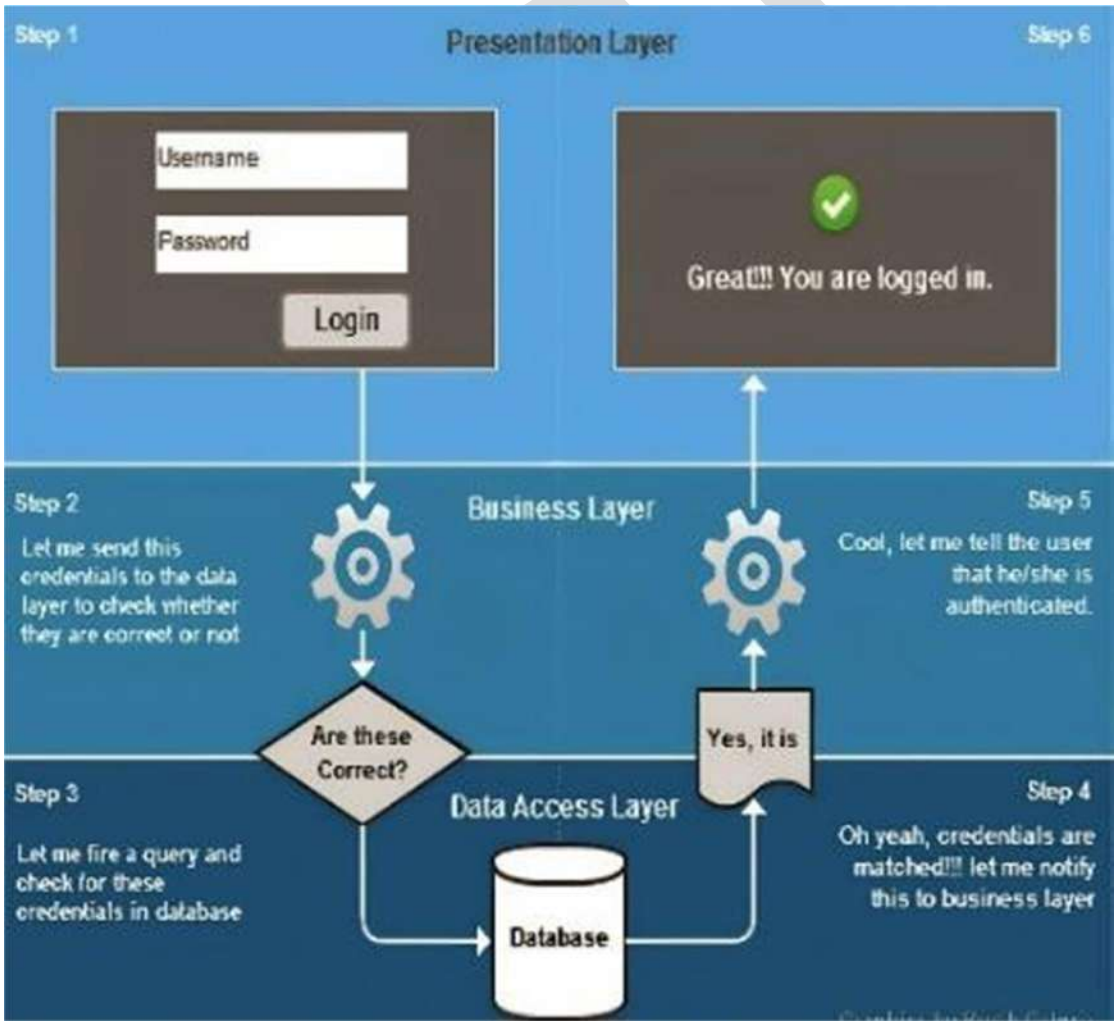


Figure 2: System Implementation

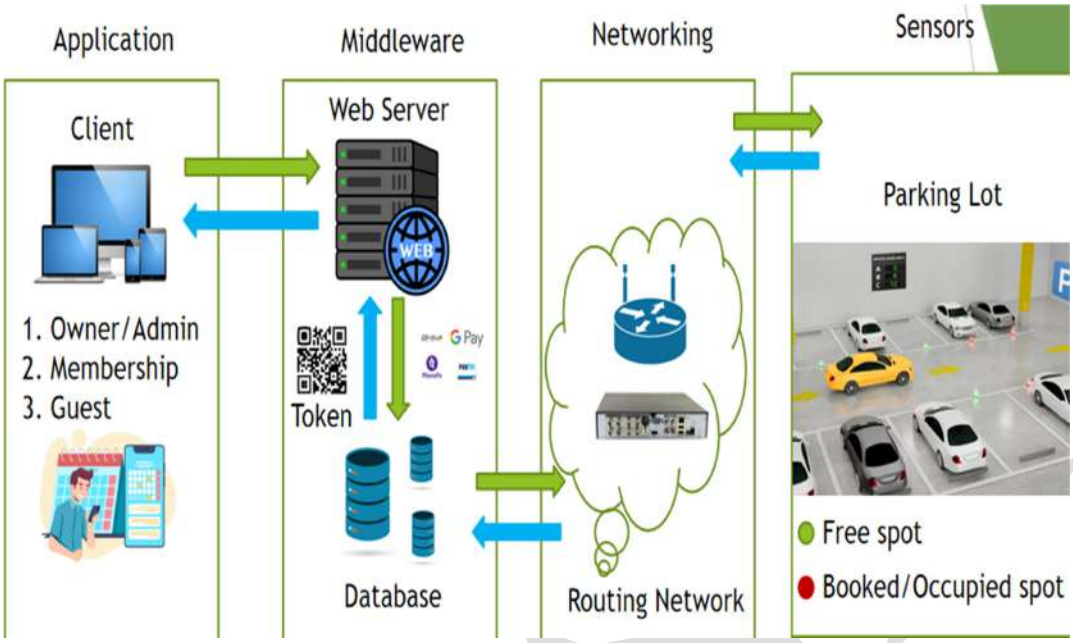
SYSTEM DESIGN

ARCHITECTURE:

A system architecture or systems architecture is the conceptual model that defines the structure, behavior and more views of a system. An architecture description is a formal description and representation of a system, organized in a way that supports reasoning about the structure of the system which comprises system components, the externally visible properties of those components, the relationships (e.g. the behavior) between them, and provides a plan from which products can be procured, and systems developed, that will work together to implement the overall system. The language for architecture description is called the architecture description language. This project consists many forms, each form is used to do particular task, below each form is explained in details



Fegure 3:System Architecture



SYSTEM TESTING

The purpose of testing is to discover errors. Testing is the process of trying to discover every conceivable fault or weakness in a work product. It provides a way to check the functionality of components, sub assemblies, assemblies and/or a finished product It is the process of exercising software with the intent of ensuring that the Software system meets its requirements and user expectations and does not fail in an unacceptable manner. There are various types of test. Each test type addresses a specific testing requirement.

SYSTEM IMPLEMENTATION

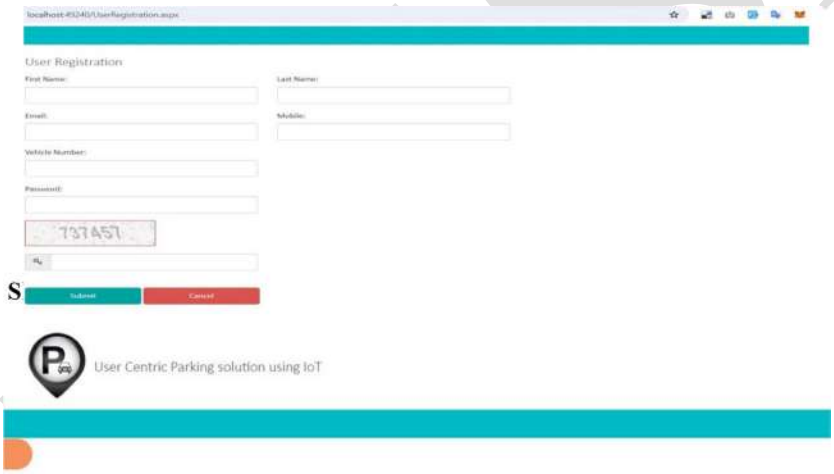
The methodology for developing a smart parking system with 5 slots can be divided into two parts: hardware and software development. For hardware development, the required components such as IR sensors, LEDs, ultrasonic sensors, and an LCD display will be connected to the Arduino micro-controller board. The IR sensors will detect the presence of a car in each slot and the red or green LEDs will indicate if the slot is occupied or vacant. The ultrasonic sensors will detect the car's presence at the entrance and exit and open the barrier accordingly. The LCD display will show the number of available and occupied parking slots.

For software development, a website will be created using HTML, CSS, and JavaScript for users to reserve a parking slot. The website will display the available slots and allow users to select a slot and make a booking. The user's booking information will be stored in a database.The code for Arduino will include programming for reading IR sensor values, controlling the red and green LEDs, and controlling the ultrasonic sensors to open and close the barrier.

RESULTS

HOME PAGE:

SIGNUP PAGE:



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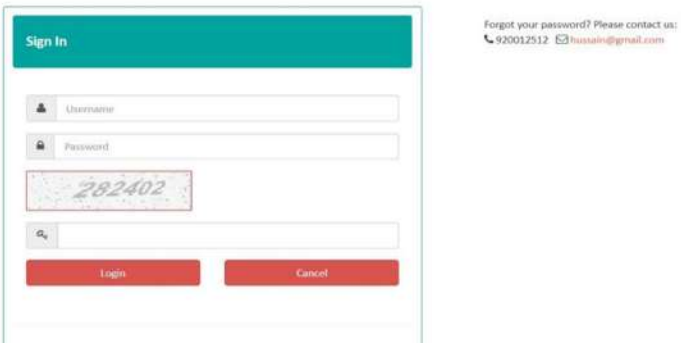
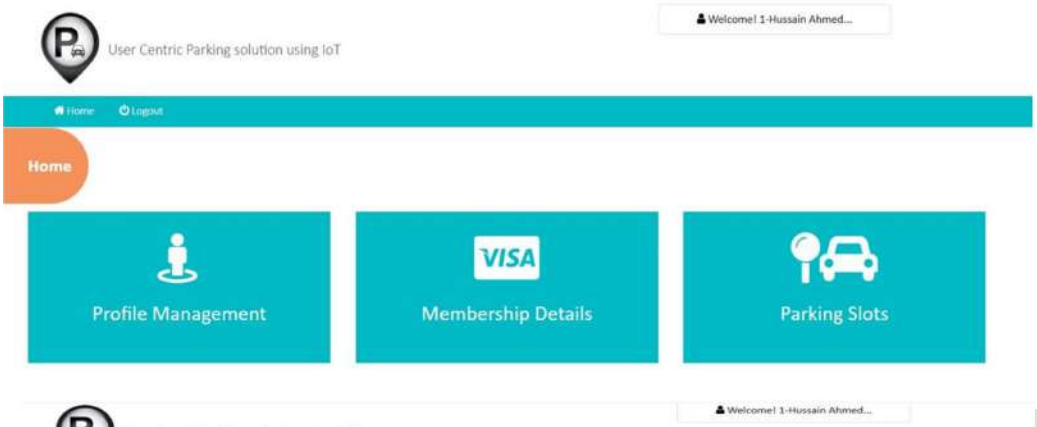
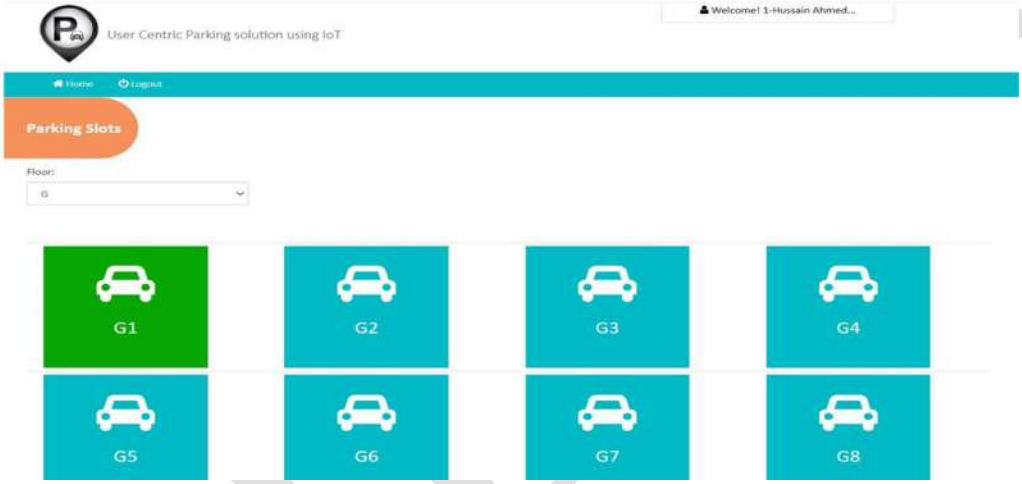
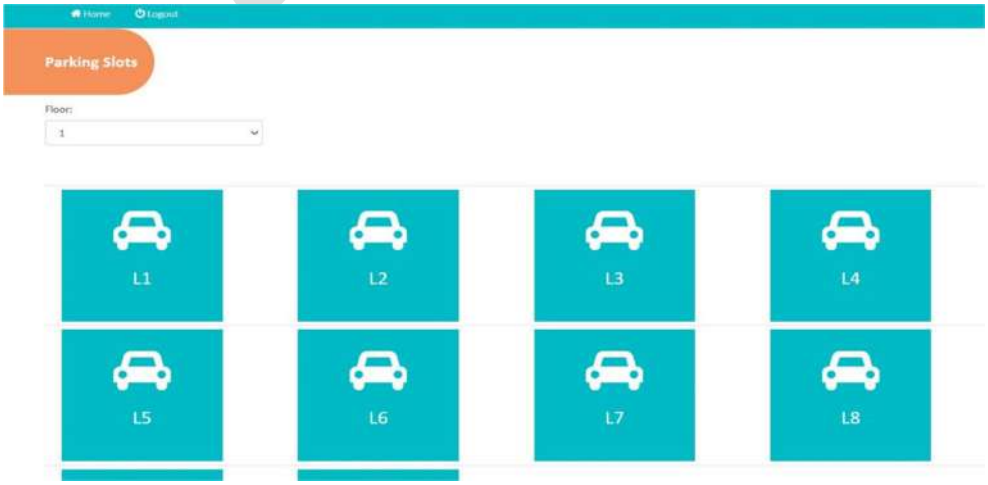


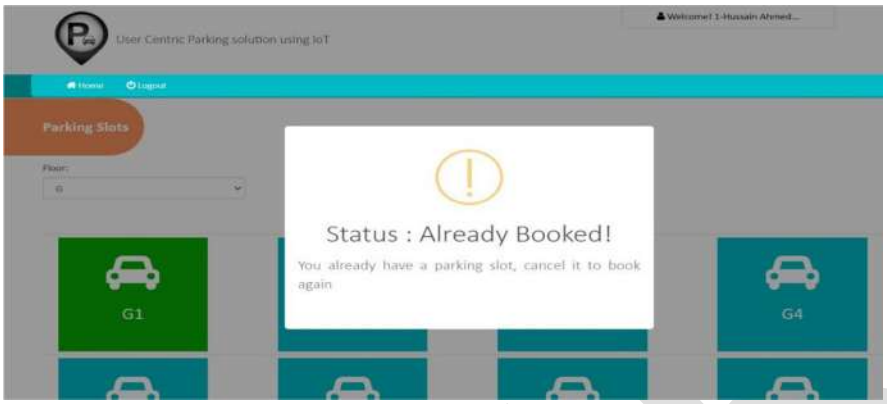
HOME PAGE AFTER LOGIN:

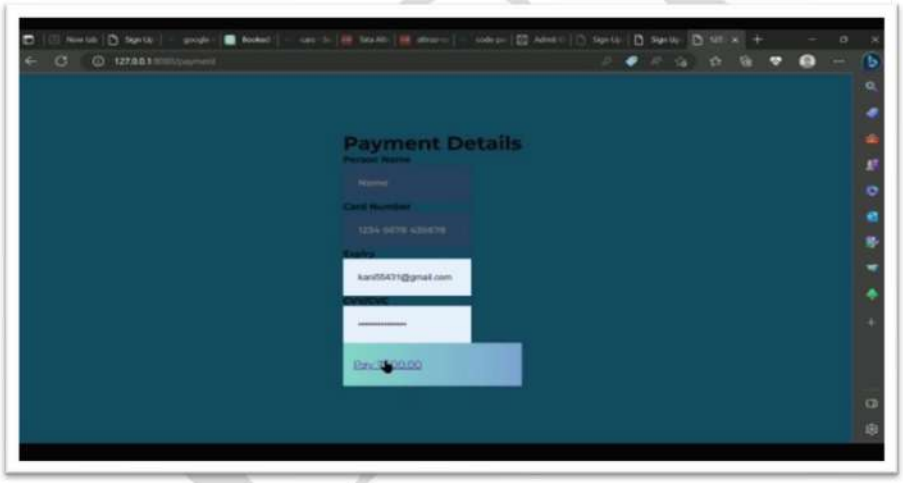


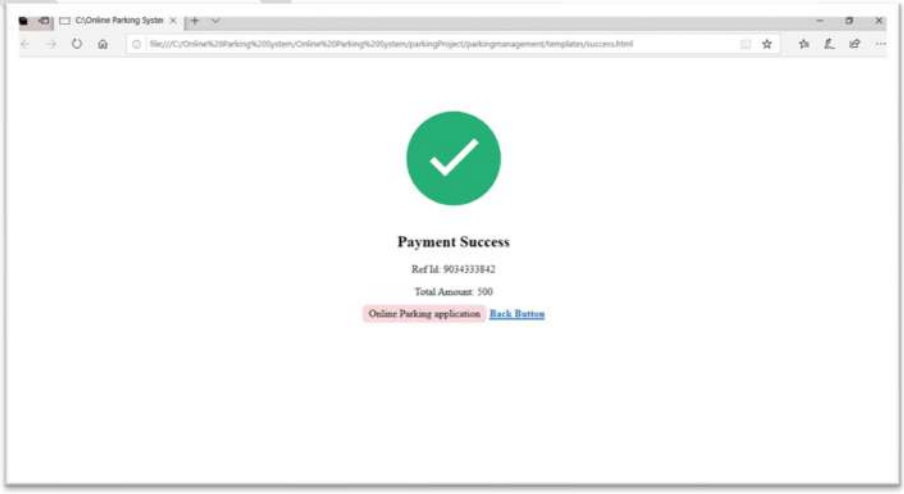




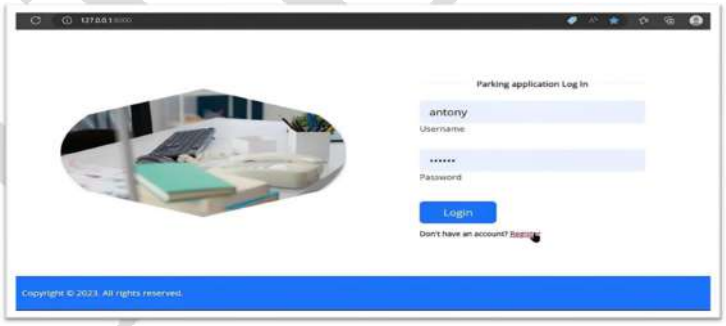
PARKING STATUS:







Admin side output:



CONCLUSION AND FUTURE ENHANCEMENTS

In conclusion, our cutting-edge parking management application marks a transformative leap in addressing the perennial challenges of parking for both businesses and individual users. With a focus on user-friendly interfaces, seamless registration, login, and booking processes, our platform ensures accessibility for all. Business users benefit from a sophisticated yet intuitive system, employing a visual representation with color-coded indicators for efficient decision-making. The generation of unique token numbers further streamlines the booking process. The pivotal admin interface empowers administrators to monitor, analyze, and release parking slots with ease, enhancing overall user experience. Our commitment to diverse user roles is reflected in a comprehensive solution that promises a smooth and organized parking experience. Bid farewell to parking hassles as our application heralds a new era of efficiency and user-centricity, providing a revolutionary solution for businesses and individuals seeking a hassle-free parking experience. Embrace the future of parking with our innovative and comprehensive management solution.

Future work for the parking system could include the addition of advanced features such as automated billing, integration with mobile payment systems, and integration with navigation apps to guide drivers to available parking spots. The system could also incorporate real-time data analysis to identify patterns in parking usage and optimize parking availability and pricing. Additionally, the system could be scaled up to accommodate larger parking lots and multiple parking facilities. Finally, the system could also be adapted for use in other industries beyond parking, such as logistics and transportation, to optimize vehicle flow and reduce congestion. These potential future developments could make the parking system more efficient, convenient, and user-friendly for both drivers and parking lot operators.

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