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Implementation of Agent Based Smart Parking System using IoT

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Abstract: *Due to the increasing number of automobiles on the roads worldwide, parking space problems have arisen in many areas, causing people to spend a considerable amount of time searching for a place to park. This study proposes a smart mobile parking booking system utilizing an agent-based model. The algorithm considers the driver's location, speed, desired destination, preferred parking charge, and arrival time, to determine the most suitable and available parking spot for them. The agent-oriented approach is utilized to represent the system, with each agent responsible for addressing a particular issue.*

Keywords: Smart parking system, Agent-based modeling, Agent-based parking systems, Internet of Things, Smart Devices, Raspberry Pi

I. INTRODUCTION

By easing congestion for parking spaces, A smart parking system can enhance the efficiency of the entire transportation system by easing congestion for parking spaces and assisting users in locating the best available spot. Agent technologies have been suggested as a viable alternative for creating parking management systems, as agents are autonomous programmers that can work concurrently and independently in dynamic situations. and run concurrently and independently of one another. Most parking sites offer paid parking that can be accessed using parking vouchers, with different hourly charges for various zones. After finding a parking spot, drivers have a certain amount of time to leave their car there. However, the key issue is that drivers do not have access to real-time information about available spaces, which requires them to travel to the parking lot to check for availability even after finding a spot. This paper outlines the effort made to model an intelligent mobile parking reservation system that analyses the driver's position and speed to provide them with the best and most accessible parking place based on their arrival time, destination, and parking price. The system uses an agent-oriented approach, where each agent solves a specific problem..Real-time information generated from smart parking systems tracks the movement of cars into and out of parking spaces, offering the ideal solution for finding available parking spaces. Planning with balance and the use of surveillance cameras provide security to guarantee the safety of the car and its occupants, as well as the availability of fire extinguishers throughout the parking area. This technique prevents traffic congestion, as drivers are informed of where available parking spaces are located, saving time that would otherwise be wasted searching for a spot in the parking lot. The system uses RFID tag technology to identify and authenticate users, and each time a user signs in, their name, address, date, and time, as well as their parking history, are logged and stored in a central database to prevent duplicative or illegal entries in other parking spaces.

II. RELATED WORK

The following papers present different approaches towards the development of smart parking systems. Paper(1) proposes a connected auto- grounded on- road parking position service system that utilizes a parking space detecting device, a pall garçon, and a mobile operation. The system advises druggies about off- road parking installations close to the stoner's planned destination when it cannot find any free on- road parking locales. Paper(2) presents a practical use of a traditional line- following robot to enhance an inner parking system with several redundant capabilities in addition

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to line- following. Paper(3) suggests a smart parking system that utilizes IoT technology and an automatic cashier machine to find parking spaces and streamline the parking process. The use of IoT technology has surfaced as one of the stylish technologies to round complicated systems with no need for tackle, and it has largely helped to attack parking problems in congested areas using low- cost and easy- to- use tackle. still, there are gaps in the papers that reveal that parking systems are multitudinous, and it isn't always accessible to recreate a system to fit the suggested approaches. Paper(6) focuses on using ultrasonic detectors and the Internet of effects(IoT) to descry parking places and shoot their status to a platform accessible from anywhere in the world. It uses computer vision to member parking areas into blocks and identify available places for motorists. Paper(10) presents a system that uses detectors to descry the vacuity of parking spaces and provides real- time information to motorists through a mobile operation. The pall-grounded network enables effective data processing and storehouse, allowing the system to manage a large quantum of parking data. Paper(9) also provides a brief review of former exploration on smart parking systems grounded on technologies similar as RFID, wireless detector networks, Bluetooth, Wi- Fi, ZigBee, and image processing ways. Paper(7) presents a result for perfecting parking operation inmulti-story parking areas using state- of- the- art Internet of effects(IoT) technology and advanced detectors and regulators. It includes automatically controlled lighting to reduce energy operation and ameliorate the aesthetics of the parking area. Paper(8) describes the design and perpetration of a prototype system called SPIN- V that uses cameras to descry vehicles and give real- time information about available parking spots.

III. PROPOSED METHODOLOGY

3.1 Software and Hardware Specifications

A. Software Specifications

- InFront End: HTML5, CSS
- Back End: Python, SQL Server 2008
- Raspbian OS

B. Hardware Specifications

The following hardware is needed to develop a smart parking system:

Device/Components	Description
Raspberry Pi 3b+	
Ultrasonic Sensor	
Servo Motor SG-90:	4.8V
PWM servo driver	16C 12 bit
Jumper Wires	Male to Male, Female to Male, Female to Female
Power Supply	5 V, 2.5-3.0 A
Laptop	

Table I: Hardware Specification

1. The Raspberry Pi is a credit card-sized computer. It is based on the BCM2837B0 system-on-chip (SoC), which includes a 1.4 GHz quad-core ARMv8 64bit processor and a powerful Video Core IV GPU.
2. An ultrasonic sensor is a piece of technology that uses ultrasonic sound waves to measure the distance to a target item and then converts the sound's reflection into an electrical signal.
3. An extremely small and light servo motor with great output power is called a "e- Micro Servo Motor SG90." The Adafruit PWM/Servo Driver is the perfect solution for any project that requires a lot of servos.

3.2 Proposed System

The multi-level parking lot has hundreds of spots, making it exceedingly difficult to obtain a vacant spot, and there is no available reservation system. Locating a parking spot that is free takes extra time.

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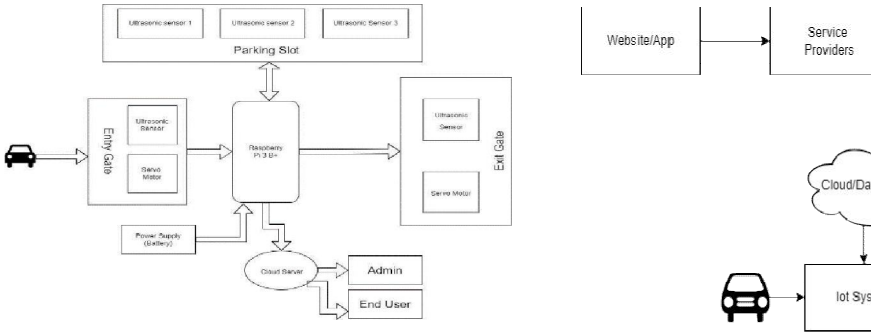

Figure 1: System Block Diagram

3.3 Diagrams

A. Circuit Diagram

A circuit diagram is a simplified representation of the components of an electrical circuit using either the images of the distinct parts or standard symbols.

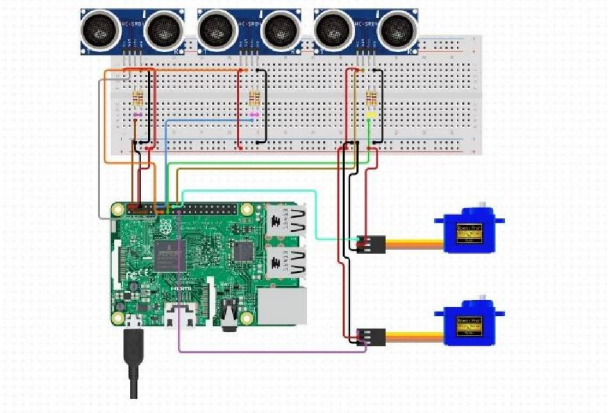

Figure 2 (Circuit Diagram)

B. Data Flow Diagram (DFD)

Graphical diagrams known as data flow diagrams (DFD) are used to define and visualize the model of a system that is being created. It is widely utilized across a variety of fields for system analysis and design.

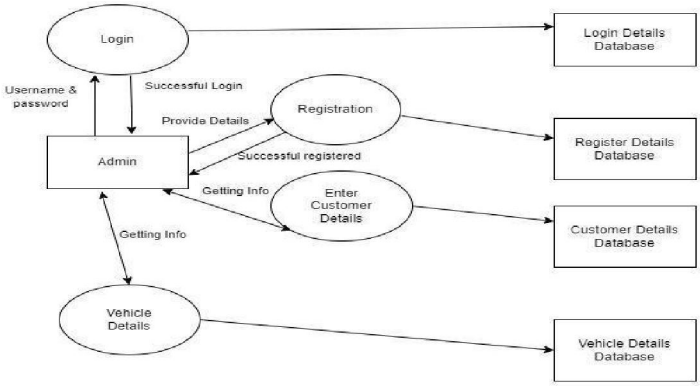

Figure 3 (Data Flow Diagram)

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C. ER Diagram

An entity-relationship model (also known as an ER model) illustrates how various concepts within a given body of information are connected to one another. Entity types (which categorize the objects of interest) and connections between entities are the core building blocks of an ER model (instances of those entity types).

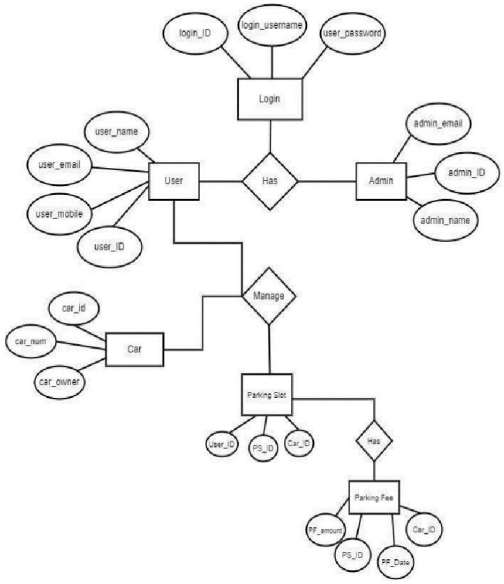

Figure 4: ER diagram

D. UML Diagram

Software blueprints are written in the standard language known as Unified Modeling Language. The artifacts of a software-intensive system may be seen, specified, constructed, and documented using the UML. Although UML is process neutral, it is best applied in use case driven, architecture-centric, iterative and incremental processes.

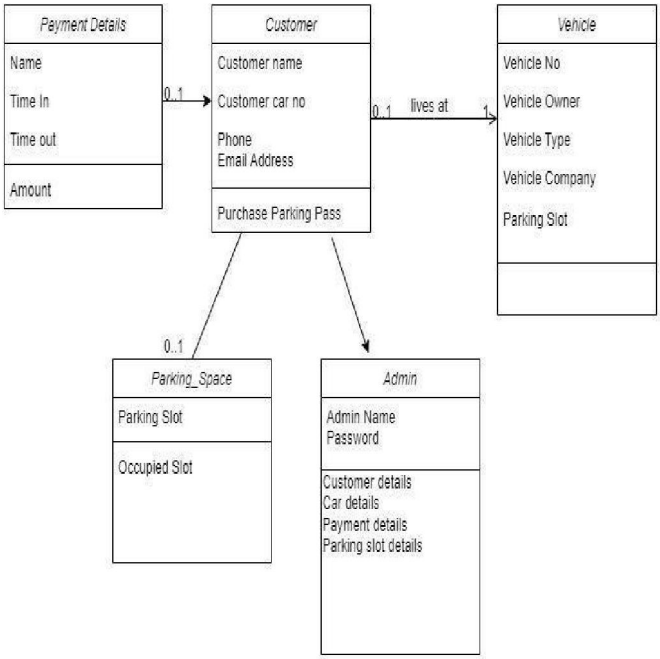

Figure 5: UML diagram

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IV. SIMULATION RESULTS

We have created a admin portal that includes the Dashboard where all users who are now utilizing the site and all service providers who are available will be displayed on this page, which is the admin control page. In the Users page the site's current users information will be shown on this page, which also includes the administrator for security reasons. In the Transaction page user or customer information, as well as the transactions, will be shown on this page together with the date and time. And the service providers that are connected to the service and are active at the moment are shown on this page. As the paradigm in use today is agent-based.

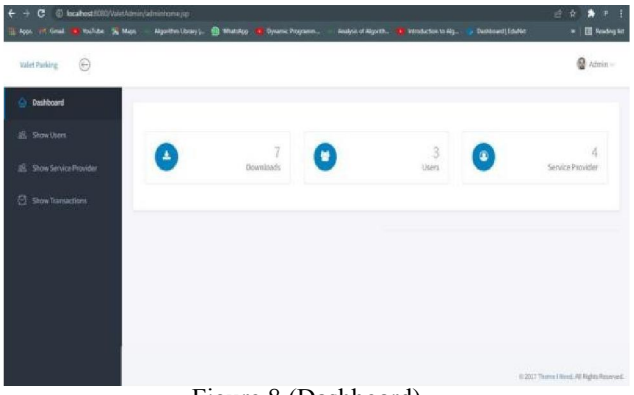

Figure 8 (Dashboard)

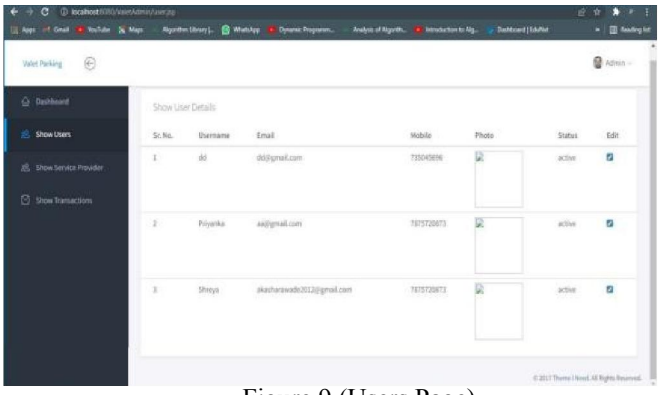

Figure 9 (Users Page)

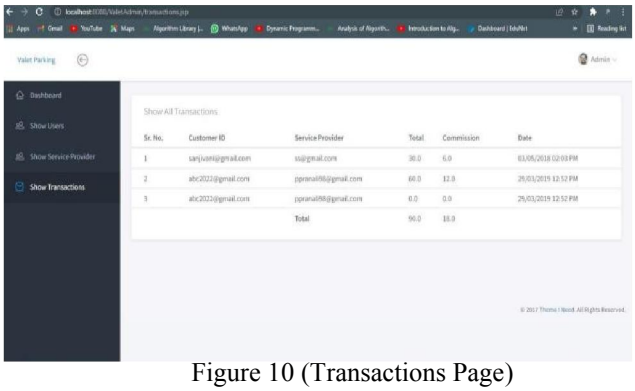

Figure 10 (Transactions Page)

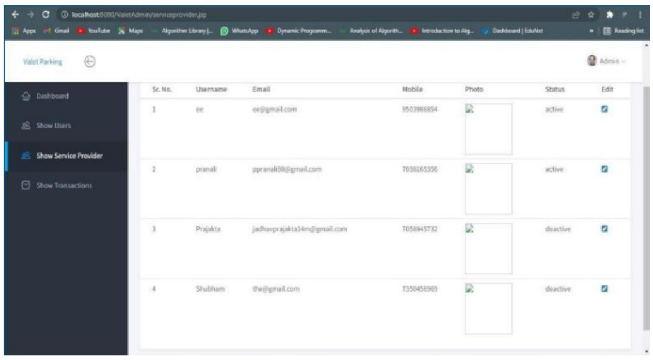

Figure 11 (Service Provider Page)

Also, we have created a user/client portal that includes the Availability Page where Users can check the sites where parking is accessible as desired on this website, which is available to them. In the Selection Spot Page the user may check which slots are available for booking on this website, and the agents will update this page with accurate information. As a result, the user may select the desired parking space. Moreover, information on the booked and open slots will be shown. And if you clicked the reservation location, this page will appear. Your complete information, including your car number, customer name, mobile number, etc., will be collected for registration and safety purposes.

Figure 12 (Availability Page)

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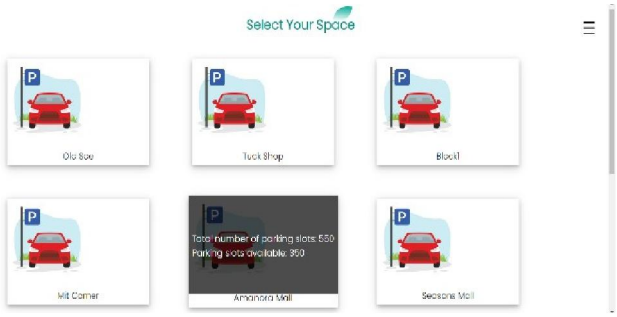


Figure 13 (Selection Page)

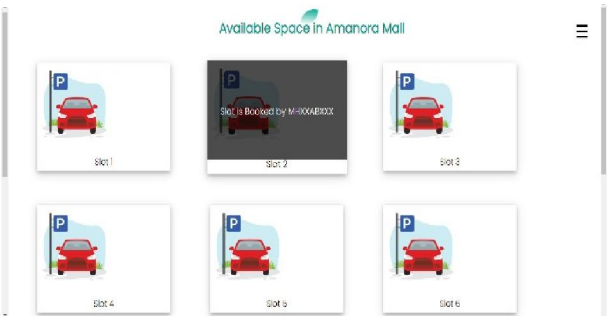


Figure 14 (Selection Page)

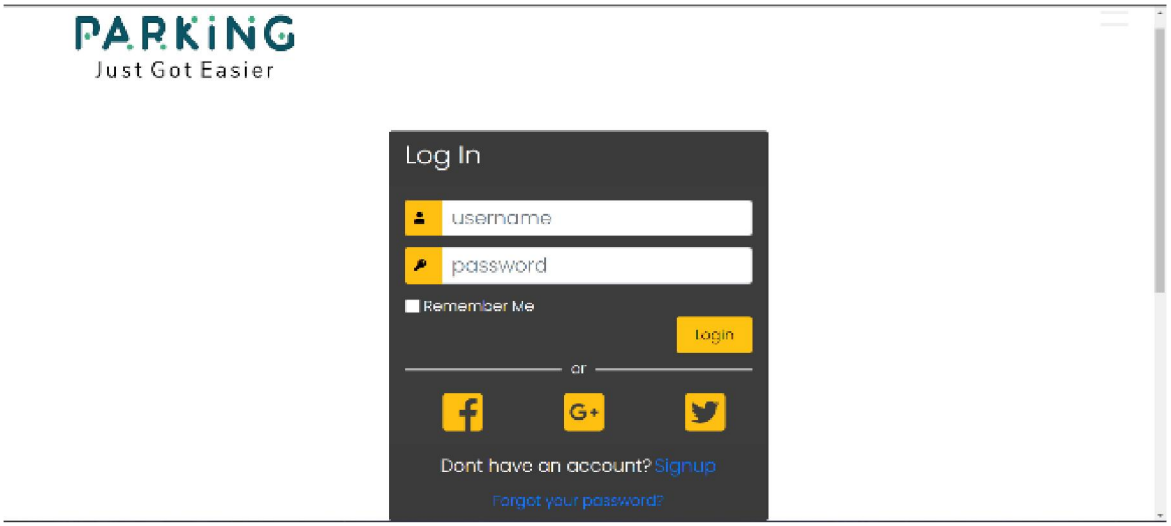
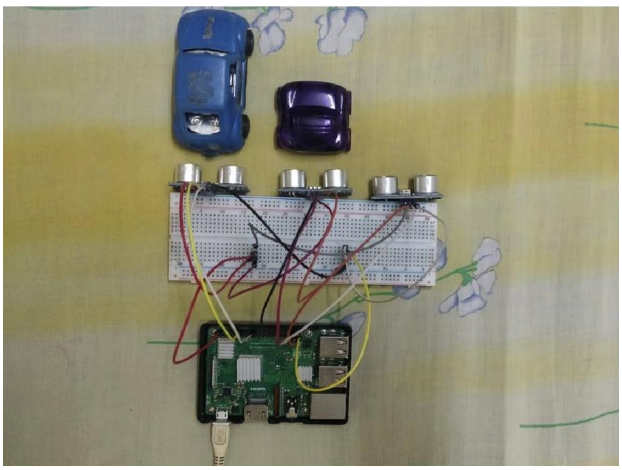
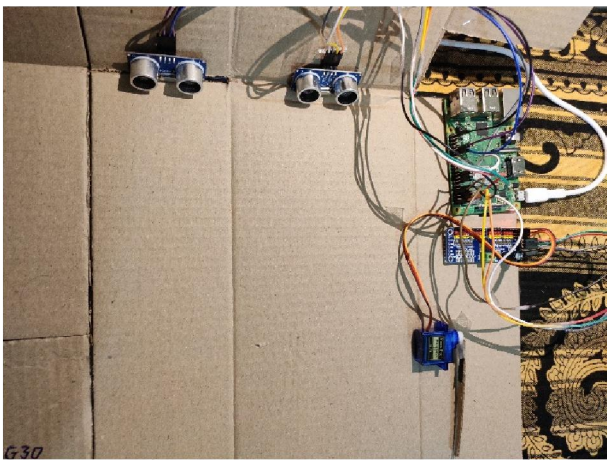


Figure 15 (Login Page)

4.1 Prototype

This is a prototype of the project we developed.





V. CONCLUSION AND FUTURE WORK

5.1 Future Work

The modern era has made car ownership a necessity for many individuals. Urbanization has led to the construction of several business buildings, shopping malls, and recreational areas, all of which require parking areas for visitors to park their cars conveniently and safely. To provide such facilities, a system that keeps track of vehicle information is

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necessary in every parking area. With the aid of a computerized system, exceptional service can be provided to consumers who wish to park their car within any organization's premises.

To further improve the system, the following enhancements could be made:

1. In the future, a single sensor could be used by the user to quickly determine from the outside if the parking lot is full, vacant, or if a place has been designated.
2. Machines could be developed to park the car in the future.
3. A website could be created where a person can register to check for parking availability at or near their location.
4. If a car is parked somewhere and appears in our database, the database could assist security regulating organizations in indirectly locating the vehicle.

5.2 Conclusion

By paying and providing information on the client and the vehicle, this project seeks to reduce the burden of parking a car while preserving data. The car is parked in this in a safe and secure manner. This project is planned as effectively as feasible.

Hereby, we, the BE(IT) students, draw the conclusion that project planning is complete and that we will be developing the project gradually. Using example inputs and outputs collected in accordance with the requirement, the application that was constructed will be tested

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