International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 04 | April - 2024 SJIF Rating: 8.448 ISSN: 2582-3930

AN EFFECTIVE PARKING AND CHARGING FOR E-VEHICLES

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ABSTRACT:

The growing adoption of electric vehicles (EVs) necessitates innovative solutions to address charging infrastructure limitations and enhance user convenience. This paper proposes a novel approach by integrating smart parking technology with wireless charging systems for EVs, facilitated by app-based payment systems. The integration aims to optimize parking space utilization while providing hassle-free charging for EV owners. The system leverages real-time data on parking availability, charging demand, and user preferences to efficiently allocate resources and minimize wait times. Through seamless app-based payments, users can easily access parking and charging services, eliminating the need for physical transactions and enhancing user experience. The proposed solution not only streamlines the EV charging process but also contributes to sustainable urban mobility by promoting EV adoption and reducing carbon emissions.

Keywords- Android App, App Payments, IoT, Sensors, RFID Scanner, Smart Parking System, wireless charging.

I.INTRODUCTION

In cities, it is observed that a majority of the population own vehicles and often find themselves needing to pay increased parking charges due to the inadequate management of parking spaces. Consequently, to address these challenges, people have begun exploring advanced parking techniques, particularly those stemming from smart city initiatives. Drivers seek ways to locate vacant parking spots swiftly, as the prolonged search caused by insufficient parking management directly impacts their mental state. Moreover, the repercussions extend to additional fuel consumption, heightened pollution, and increased traffic congestion in parking areas. Unfortunately, unofficial parking persists despite efforts with the existing manual system. Thus, the introduction of a smart parking system is deemed the most effective solution. This system leverages IoT technology to enhance convenience in our daily lives, facilitating seamless connectivity with smart devices equipped with sensors for data collection. The integration of sensors with programmable hardware enables efficient data processing, storage, and dissemination through network connectivity. This paper outlines the latest advancements in smart parking systems and proposes a systematic approach to implementing a smart car parking system. Additionally, it introduces a novel technique through the implementation of smart devices. This research advocates for the installation of an Android application for monitoring parking slot availability and facilitating automatic payment. The system incorporates RFID technology for unique vehicle identification, requiring the installation of RFID scanners and tags at parking entrances for registered vehicles. Upon entry, vehicles equipped with RFID tags are scanned, and their entry time is recorded by an Arduino device connected to a database via a Wi-Fi module. Consequently, the database is updated automatically to reflect the available parking slots. Users can then monitor parking availability via the Android app. The app also calculates parking charges based on the duration of stay, enabling users to make

payments electronically. Once payment is confirmed, users are permitted to exit the parking area. This method ensures accurate payment for vehicle parking and allows users to track parking charges conveniently. Furthermore, the system offers a charging option for electric vehicles during parking, saving users time and providing added convenience.

II.LITERATURE SURVEY

Smart Parking and Charging System for Electric Vehicles with App payments: This research paper is introducing a new parking toll system that is connected to the user through an app, and all the payments for parking charges can be made through the app. This system is using an RFID reader that scans the RFID tag on the car and allows the user to enter and leave the parking area. This time duration is charged as a parking fee and can be monitored by the user through the app. Also, the no. of parking slots available will be displayed to the user in the app. The user can even charge their e-vehicles during parking time. This amount will also be added to the existing parking charges, which the user must pay through the app.

IOT Based Smart Vehicle parking and Automated Billing System using RFID.

With the exponential increase in the number of vehicles and world population day by day, vehicle availability and usage on the road in recent years, finding a space for parking the bike is becoming more and more difficult with resulting in the number of conflicts such as traffic problems. This is about creating a reliable system that takes over the task of identifying free slots in a parking area and keeping the record of vehicles parked very systematic manner. This paper lessens human effort at the parking area to a great extent such as in case of searching of free slots by the driver and calculating the payment for each vehicle using parking area. The various steps involved in this operation are vehicle identification using RFID tags, free slot detection using IR sensors and payment calculation is done on the basis of period of parking and this is done with the help of real time clock.

Smart Parking System with primary Preservation and Reputation management using Block chain: Most of the existing smart parking systems threaten the drivers' privacy by revealing information about their visited locations. Moreover, they are centralized making them vulnerable to a single point of failure and attack, which threatens the availability of the parking service. They also suffer from a lack of transparency, where the centralized service organizer may favor some parking lots by booking their parking slots first. To tackle these concerns, we propose a blockchain-based smart parking system with privacy preservation and reputation management. In our system, a consortium blockchain is created by different parking lots to run the parking system securely and transparently, where the parking offers are recorded on a shared and immutable ledger. We use a commitment technique during the submission of the offers to ensure fair parking rates. Then, we use a private information retrieval technique during the offers retrieval to preserve the drivers' location privacy. Furthermore, to anonymously and efficiently authenticate drivers during the reservation process, we use a short randomizable signature. We also use a time-locked anonymous payment technique to discourage drivers from not committing to their parking reservations and provide a secure and privacy-preserving payment method for parking service. Finally, we integrate a blockchain-based anonymous reputation management scheme into our system, where drivers can anonymously rate the parking service to ensure high quality of service. Our evaluations demonstrate that our smart parking system is secure and capable of preserving drivers' privacy with low communication, computation, and storage overheads.

Remote Monitoring of Electric Vehicles Charging Stations in Smart Campus Parking: Smart parking lots are smart places capable of supporting both parking and charging services for electric vehicles (EVs). In order to manage EV charging, the parking lot local controller (PLLC) requires data exchange with EV charging stations (EVCSs) through communication infrastructures. However, data losses and communication delays are unavoidable and may significantly degrade the system performance. This work aims to investigate the underlying

communication networks for remote monitoring of EVCSs in a smart campus parking lot. The communication network consists of two subnetworks: parking area network (PAN) and campus area network (CAN). PAN covers communication among EVs, charging stations and PLLC, while CAN enables dedicated communication between PLLCs and a global controller of the university. As one of the major obstacles in EV system is the lack of unified communication architecture to integrate EVCS in the power grid, we develop communication models for the in-vehicle system and EVCSs based on logical node concept of IEC 61850 standard. Furthermore, we implement network models for EVCSs using OPNET modeler. Different communication technologies and configurations are considered in modeling and simulations, and end-to-end delay is evaluated and discussed.

III.EXISTING SYSTEM

The research paper introduces a novel parking toll system seamlessly integrated with a user-friendly mobile application. Through this app, all parking charges can be conveniently settled digitally. The system relies on an RFID reader to scan the RFID tag affixed to the user's vehicle, granting access to and from the parking area. The duration of the vehicle's stay incurs parking fees, which users can monitor in real-time via the app. Additionally, the app provides updates on available parking slots. Moreover, users have the option to charge their electric vehicles while parked, with the corresponding fee conveniently added to their parking charges, all managed and paid through the app.

. When the vehicle enters the parking lot, the RFID reader scans the tags and allows it inside to park the vehicle, and Arduino will note the in–time and send it to the database through the Wi–Fi module. Later when the vehicle comes near the exit gate, the RFID reader scans the tag and Arduino sends the out–time to the database through Wi–Fi module. For E – Vehicles, this system has an option in the app for charging in wired. The amount for the charging will get added to the parking amount and the total amount will be displayed in the app for the user to pay.

IV.PROPOSED SYSTEM

The growing adoption of electric vehicles (EVs) necessitates innovative solutions to address charging infrastructure limitations and enhance user convenience. This paper proposes a novel approach by integrating smart parking technology with wireless charging systems for EVs, facilitated by app-based payment systems. The integration aims to optimize parking space utilization while providing hassle-free charging for EV owners. The system leverages real-time data on parking availability, charging demand, and user preferences to efficiently allocate resources and minimize wait times. Through seamless app-based payments, users can easily access parking and charging services, eliminating the need for physical transactions and enhancing user experience. The proposed solution not only streamlines the EV charging process but also contributes to sustainable urban mobility by promoting EV adoption and reducing carbon emissions.

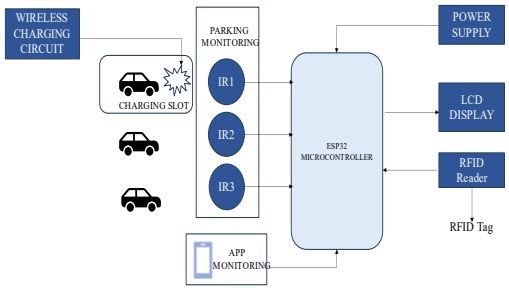

Figure 1.1: Block diagram of proposed system

This proposed system IR sensor signal used for parking station slot will be automatically open/close and also detect the parking slot availability. An RFID tag will be applied to each of the registered vehicles. The controller will note the in-time and send it to the database using the IOT platform as soon as the vehicle enters the parking lot and the RFID reader scans the tags to let it inside to park. The system of parking lots will be automatically updated by the vehicles' entry and exit. The coil transmitter is used transmit the power charging in wireless and relay is used to turn on/off the supply of coil transmitter. Automate the vehicle's charging after parking and when the vehicle was fully charged, the message will

be sends into respected driver or car owner. All details will be display through LCD display. When a car leaves a parking station, the amount will be immediately detected after showing the entire charging amount that includes parking. Incase RFID tag amount will be insufficient compare then parking amount they exist gate not open.

A. PARKING MONITORING

IR sensors are installed at each parking space within the parking facility. These sensors emit infrared light and detect the reflection or absence of this light to determine if a vehicle is present in the parking spot. When a vehicle enters or leaves a parking spot, the IR sensor detects the change in infrared light reflection and sends this information to a central system or gateway. This data transmission occurs in real-time to ensure accurate monitoring of parking space occupancy. The central system processes the data received from the IR sensors and updates the parking availability status in the system's database or cloud server. This allows users to access up-to-date information on available parking spaces through the mobile app or other user interfaces.

Overall, IR sensors enable the smart parking and wireless charging system to efficiently manage parking space occupancy, facilitate user reservations and payments, and provide a seamless experience for e-vehicle owners.

Each vehicle is equipped with an RFID tag or sticker, which contains unique identification information associated with the vehicle and its owner. These RFID tags are affixed to the vehicle in a prominent location for easy detection. RFID readers are installed at entry and exit points of the parking facility, as well as near charging stations. These readers emit radio waves and detect RFID tags within their vicinity. As a vehicle equipped with an RFID tag approaches the entry point of the parking facility, the RFID reader detects the tag's presence and reads the unique identification information stored on it. For parking spaces equipped with wireless charging pads, the RFID reader near the charging station detects the presence of the vehicle as it approaches. The central system verifies the RFID tag associated with the vehicle and initiates the charging session if the user has opted for wireless charging. The RFID mechanism ensures secure access control and payment processing by authenticating the RFID tags associated with authorized vehicles and users.

B. MICROCONTROLLER

The ESP32 microcontroller can serve various functions. The ESP32 can interface with various sensors such as IR sensors for detecting vehicle presence in parking spaces, temperature sensors for monitoring charging pad conditions, and current sensors for measuring power consumption during charging. The ESP32 supports Wi-Fi and Bluetooth connectivity, allowing it to communicate with the central system and mobile applications. It can transmit real-time data about parking space occupancy, charging status, and other relevant information to the system's server or cloud platform. The ESP32 can control the operation of wireless charging pads, managing the initiation and termination of charging sessions based on user commands received through the mobile app or central system. It ensures seamless communication between the charging infrastructure and the user interface. The ESP32 can handle user authentication tasks, verifying user credentials and ensuring secure access to the system's functionalities. It may implement encryption protocols to safeguard sensitive data such as payment information and user profiles. The ESP32 can perform local processing of sensor data and user inputs, making quick decisions regarding parking space allocation, charging session management, and other system operations. This reduces latency and enhances the system's responsiveness.

Overall, the ESP32 microcontroller serves as a versatile and capable component within the smart parking and wireless charging system, facilitating data acquisition, communication, control, and security functionalities to deliver a seamless and efficient user experience.

C. CHARGING INFRASTRUCTURE

The primary role of the wireless charging infrastructure is to provide a means for electric vehicles to wirelessly charge their batteries. This infrastructure typically consists of charging pads installed in designated parking spaces. When an electric vehicle equipped with wireless charging capability parks over these pads, the charging process

begins automatically, eliminating the need for physical cables or connectors.

Wireless charging infrastructure enhances the convenience of charging for electric vehicle owners. Instead of manually plugging in their vehicles, users can simply park over the charging pad, reducing the effort and time required for charging. This convenience encourages more frequent and regular charging, promoting the adoption of electric vehicles.

The wireless charging infrastructure integrates seamlessly with the overall parking management system. It communicates with the system's central controller or microcontroller to monitor charging sessions, manage charging power, and coordinate with other system components such as user authentication and payment processing. It adheres to industry standards for wireless charging protocols and safety features to prevent overcharging, overheating, and other potential hazards.

Users may be charged based on the duration of the charging session, the amount of energy consumed, or a flat fee determined by the system. It may incorporate smart charging algorithms to adjust charging power dynamically based on factors such as battery state of charge, charging demand, and grid conditions, optimizing energy usage and reducing overall charging time.

D. APP MONITORING

App monitoring involves tracking and managing various aspects of the system through a mobile application. The mobile app continuously monitors parking space availability in real-time. It retrieves data from the system's central controller or cloud server, which collects information from sensors installed in parking spaces. Users can view the availability of parking spots nearby and make informed decisions about where to park. Users can reserve parking spots in advance through the mobile app. The app communicates with the central system to check the availability of desired parking spaces and facilitate the reservation process. Once a reservation is confirmed, the app provides the user with details such as the parking location and reservation duration.

The app ensures that payment transactions are processed securely and provides users with payment confirmation receipts. The app sends notifications and alerts to users to keep them informed about important events and updates related to their parking and charging activities. This includes notifications about parking reservation confirmations, charging session status, payment receipts, and reminders about upcoming reservation expirations.

Overall, app monitoring in a smart parking and wireless charging system enhances user experience by providing real-time information, facilitating convenient reservation and payment processes, and enabling seamless communication with the system's central controller and customer support services.

VI. CONCLUSION

In conclusion, implementing a smart parking and charging system for e-vehicles with app payments offers numerous benefits, including convenience, efficiency, and sustainability. By integrating advanced technology, such as IoT sensors and mobile applications, users can easily locate available parking spots, access charging stations, and make payments seamlessly. This not only enhances the user experience but also promotes the widespread adoption of electric vehicles, contributing to a greener and more sustainable future. Additionally, the data collected from such systems can be leveraged to optimize parking and charging infrastructure, further improving efficiency and reducing environmental impact. Overall, the integration of smart technology in parking and charging systems represents a crucial step towards building smarter and more sustainable cities.

VII. FUTURE SCOPE

Future developments may focus on optimizing energy management within the wireless charging infrastructure. This could involve the implementation of smart grid technologies, energy storage solutions, and dynamic charging algorithms to balance energy demand, reduce grid strain, and maximize the use of renewable energy sources.

The integration of blockchain technology can enhance the security and transparency of payment transactions within an effective parking and charging

systems. Blockchain-based payment platforms can provide secure, tamper-proof records of transactions, streamline cross-border payments, and enable peer-to-peer energy trading between EV owners.

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