IOT BASED PARKING SYSTEM WITH LPR AND BLOCKCHAIN TECHNOLOGY

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ABSTRACT

Urban life has transformed significantly since the early 2000s due to the professional and personal activities, the surge in data generation raises significant privacy concerns. To address these concerns, innovative solutions leveraging blockchain technology and smart contracts have emerged. However, challenges persist, especially in developing blockchain architectures for IoT environments, with security vulnerabilities in smart contracts being a prevalent concern. widespread adoption of the IoT. Despite the potential for creating novel services to enhance This introduces a block chain based storage framework specifically designed for recognition of license plate (LPR) systems within smart city contexts. The emphasis is placed on ensuring privacy, optimizing performance, and enhancing security measures. This innovative architecture aims to address the unique challenges associated with LPR technologies in urban environments. By prioritizing confidentiality, efficiency, and robust security features, our solution strives to meet the evolving needs of smart city infrastructures, providing a reliable foundation for the implementation of license plate recognition systems

Key Word: **Blockchain technology**, **License Plate Recognition (LPR)**, **Smart cities**, **Privacy**, **Security.**

I INTRODUCTION

To address these challenges, previous studies have focused on utilizing existing parking spaces efficiently and incorporating smart technology into parking management systems. However, little attention has been given to leveraging idle parking spaces owned by individuals and incentivizing their use. The emergence of online-to-offline (O2O) technology, a key component of the Fourth Industrial Revolution, presents an opportunity to develop innovative solutions. O2O technology integrates online platforms with physical services, enabling users to access services such as parking reservations, navigation, and payment via their smartphones.

II LITERATURE REVIEW

Our literature review underscores the pressing need for innovative solutions to effectively address the challenges posed by urban parking. By integrating cutting-edge technologies such as the Internet of Things (IoT), License Plate Recognition (LPR), and blockchain, our project aligns with established research to develop a sophisticated parking management system.

Xiong Li (2019) emphasizes the transformative potential of IoT and LPR technologies in enhancing parking efficiency and accessibility. Our project builds upon these insights by leveraging these

technologies to eliminate traditional tokens or tickets, providing real-time parking availability information, and ensuring secure, frictionless access for users

III EXISTING SYSTEM

The current landscape of smart parking systems encompasses various projects, each presenting unique advantages and drawbacks. Let's delve into a comprehensive examination of three such projects:

1. Arduino UNO-based Smart Parking System:

This project pioneers the use of Arduino and IoT technology to develop a Smart Parking System. It employs an Infrared sensor to detect parking space availability, connected to an ESP12-E (NodeMCU) module programmed for functionality. While effective in its objective, this approach may present a challenge for users less familiar with the intricacies of such technology due to its inherent complexity.

2. Smart Indoor Parking System:

. However, concerns arise regarding the In this innovative project, a database is integrated to store registered license plates during the vehicle registration process. Parking slots are automatically allocated utilizing the First-Come-First-Serve (FCFS) algorithm in corporation of refunded systems, potentially leading to increased costs, which could pose a drawback to widespread adoption.

IV DISADVANTAGES

- **High initial setup costs** for IoT devices, LPR technology, and blockchain infrastructure.
- **Complexity in integrating** with existing parking systems and urban infrastructure.
- **Latency and performance issues** due to blockchain transaction processing delays.
- **Privacy concerns** around storing sensitive vehicle data on a public ledger.
- **Scalability challenges** as the system grows with increasing vehicles and data.
- **Security vulnerabilities** in IoT devices like sensors and cameras.

V PROPOSED METHODOLOGY

A smart parking system built around an Arduino UNO serves as a sophisticated solution to modern parking management challenges, offering automation, IoT connectivity, and real-time monitoring capabilities. At its core, this system integrates various components including IR sensors for slot detection, a servo motor for slot control, an LPR (License Plate Recognition) system for entry/exit management, and an LCD for status display. By harnessing Wi-Fi connectivity, it transmits sensor data to an IoT cloud platform, enabling remote monitoring and management.

VI BLOCK DIAGRAM

Furthermore, the Arduino Uno's transmitter pin establishes a connection with the IoT module's receiver pin. The appointment booking data from the IoT app is transmitted to the Arduino Uno, which cross-references this information with the RFID number to determine and display the token issuance status on the LCD. In the case of the LCD, its data pins (D4-D7) are linked to Arduino pins D8-D11 to effectively transmit the relevant information. The control pins (RS and E) of the LCD are connected to Arduino pins D13 and D12, respectively. Additionally, the RW pin is grounded to manage data flow efficiently. The connections operations in real-time, contributing to the overall efficiency and functionality of the system and interactions between these components are carefully established to facilitate the authentication process, data transmission, and accurate display of token issuance status on the LCD. The power supply unit plays a crucial role in sustaining these.

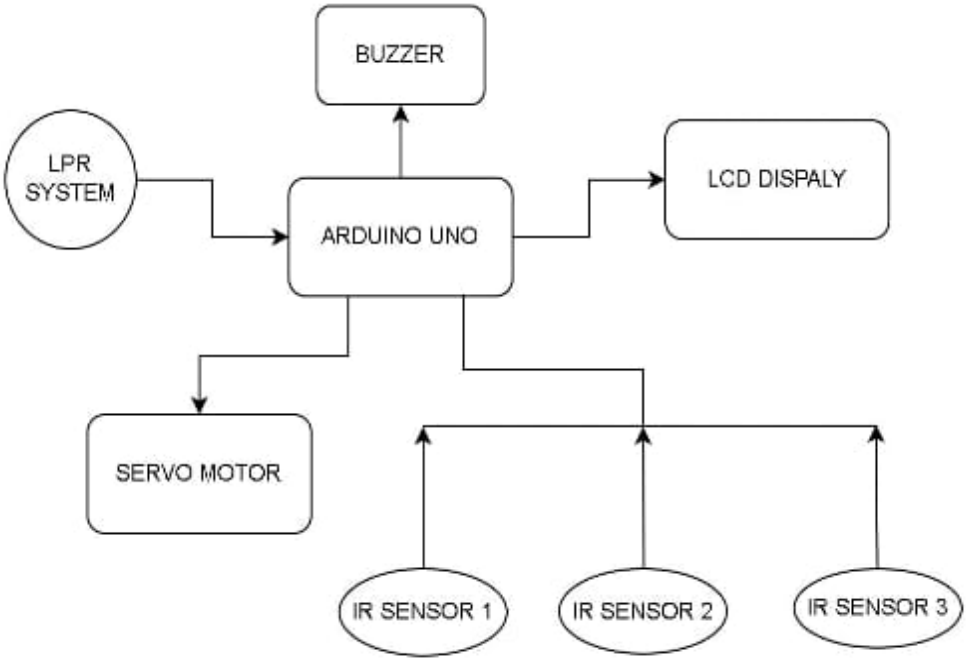

Fig 1: Basic Block Diagram.

VII APPLICATION

1. **Smart Parking**: Real-time availability updates and dynamic pricing based on demand, secured by blockchain for transparent transactions.
2. **Automated Access**: LPR enables automatic entry/exit for vehicles, with blockchain storing parking records securely.
3. **Secure Payments**: Blockchain facilitates secure, transparent transactions for parking fees via smart contracts.
4. **Enhanced Security**: Anti-theft features and secure data exchanges between IoT devices and users.
5.**Parking Reservation**: Blockchain ensures secure, immutable reservation data, and smart contracts process payments.
6.**Traffic and Urban Planning**: IoT data helps optimize traffic flow and predict parking demand for better city planning.

VIII RESULTS AND CONCLUSION

The implementation and evaluation of smart parking management systems have revealed several key insights into their effectiveness and potential for further enhancement. One notable aspect is the utilization of Infrared (IR) sensors for real-time detection of parking space occupancy, providing timely updates on availability. Additionally, the user interface, facilitated by Liquid Crystal Display (LCD) technology, offers clear and user-friendly information by displaying "Occupied" and "Vacant" statuses

based on sensor readings. The incorporation of a buzzer further enhances the user experience by providing auditory feedback synchronized with occupancy status changes.

Furthermore, the License Plate Recognition (LPR) car parking system contributes to broader urban efficiency by addressing several key challenges. The integration of realtime data analytics capabilities enhances the system's adaptability to dynamic parking demands, allowing for proactive adjustments in parking space allocations based on usage patterns. This not only reduces congestion but also promotes a more dynamic and responsive urban parking infrastructure. Moreover, the implementation of machine learning algorithms within the LPR system opens avenues for continuous improvement. The system can evolve its recognition capabilities over time, adapting to new license plate formats or changes in vehicle registration systems. This adaptability ensures a future-proof solution that can keep pace with evolving technologies and regulatory requirements.

IX FUTURE SCOPE

1. **Enhanced Security and Transparency**: Integrating blockchain technology into the parking system can greatly enhance security and transparency. Each transaction or event related to parking, such as entry and exit of vehicles, could be recorded as immutable blocks on the blockchain. This ensures that the data related to parking activities cannot be tampered with, providing a high level of security and transparency.
2. **Decentralized Parking Management**: Blockchain technology enables decentralized parking management systems, where data is stored and managed across a network of nodes rather than in a centralized database. This decentralization reduces the risk of a single point of failure and enhances the resilience of the parking system.
3. **Smart Contracts for Automated Transactions**: Smart contracts, which are self-executing contracts with the terms of the agreement directly written into code, can be utilized in the parking system. For example, smart contracts could automatically execute payments for parking fees when a vehicle enters or exits the parking facility, eliminating the need for manual intervention.

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