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INTERNATIONAL TINKER INNOVATION & ENTREPRENEURSHIP CHALLENGE (i-TIEC 2025)

"Fostering a Culture of Innovation and Entrepreneurial Excellence"



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Electrical Engineering Studies, College of Engineering
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Kampus Pasir Gudang
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A-ST045: RFID-ENABLED PARKING SYSTEM FOR ENHANCED ACCESSIBILITY OF DISABLED DRIVERS

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ABSTRACT

In today's fast-paced technological landscape, Radio Frequency Identification (RFID) technology emerges as a transformative solution, utilizing wireless signals to uniquely identify objects, animals, or individuals. However, the persistent challenges faced by disabled individuals in accessing essential services, particularly within parking facilities, underscore the urgent need for innovative solutions. Traditional parking setups often lack accommodations for disabled drivers, creating barriers to their mobility and independence. This proposal advocates the integration of RFID technology into parking infrastructure, establishing dedicated parking spots equipped with RFID sensors. These sensors would enable real-time identification and reservation of accessible spaces, streamlining the parking experience for disabled drivers. Beyond enhancing accessibility, the implementation of an RFID-based parking system holds the potential to optimize parking management efficiency and foster inclusivity in urban environments. Through collaborative efforts between technology developers, policymakers, and disability advocacy groups, this initiative aims to empower disabled individuals, ensuring their equal participation in community life while promoting independence and inclusivity.

Keywords: Energy Theft, Anomaly Detection, Isolation Forest, Smart Meter, Utility Network, Real-Time Detection

1. Product Description

The misuse of designated parking facilities for disabled drivers by non-disabled drivers has become a significant issue in recent years. Despite clear signage indicating that these parking spots are reserved for individuals with disabilities, many normal drivers occupy these spaces, disregarding the needs and rights of disabled drivers. This misuse results in numerous challenges for disabled drivers, who are often left with no choice but to find alternative parking spots located farther from their intended destinations. This increased distance can cause considerable inconvenience and additional physical strain for disabled individuals, particularly those with mobility impairments. To address this pervasive issue, an RFID-based parking system for disabled drivers presents a viable solution.

The implementation of an RFID-based parking system for disabled drivers represents a significant step towards improving accessibility and inclusivity in urban environments. By addressing the specific challenges faced by disabled individuals in parking facilities, this

solution aims to enhance their independence and mobility, thereby promoting greater participation in social, economic, and recreational activities. Moreover, the adoption of such a system aligns with broader societal goals of creating smart, connected cities that utilize technology to improve the quality of life for all residents. As cities continue to grow and evolve, the integration of RFID technology into parking infrastructure can serve as a model for other accessibility initiatives, demonstrating how innovative solutions can make a tangible difference in the lives of people with disabilities.

2. Method Flow Chart and Product Model

The "RFID-Based System for Disabled Driver Convenience" project employed a detailed and methodical strategy to design, develop, and implement an advanced system for managing parking access for disabled drivers. Starting with an in-depth literature review, the project sought to glean insights from existing research on RFID-based parking systems, ensuring a solid foundation of established knowledge. During the system design phase, specific requirements and functionalities were identified, leading to a carefully planned circuit design that incorporated RFID readers, RFID tags, and an automated gate control mechanism as one of the outputs.

Figure 1 presents the block diagram of the RFID-Based System for Disabled Driver Convenience. The Arduino UNO serves as the central component and functions as the project's brain, managing all other components through the implementation of specific code. This comprehensive block diagram illustrates the system's architectural framework, detailing the essential components of the RFID-Based System for Disabled Driver Convenience. The input hardware includes an ultrasonic sensor and an RFID reader. The ultrasonic sensor detects whether a car is correctly positioned in the parking spot by measuring the distance to the car and sending this data to the Arduino UNO. The RFID reader scans RFID cards to identify authorized users; when a driver scans their card, the reader transmits the card's information to the Arduino UNO for authentication. The output hardware consists of an LCD, a buzzer, a servo motor, and two LEDs. The LCD displays the parking status, indicating whether the parking lot is full or has available spaces. The buzzer provides auditory feedback by emitting a sound when a car is correctly parked or when an RFID card is successfully authorized. The servo motor controls the bar gate mechanism, rotating 90 degrees to open or close the gate based on RFID authorization. The LEDs indicate parking availability, with the green LED lighting up when there are available spots and the red LED lighting up when the lot is full. The system ensures that only authorized vehicles can access the parking area while providing drivers with real-time information on parking availability.

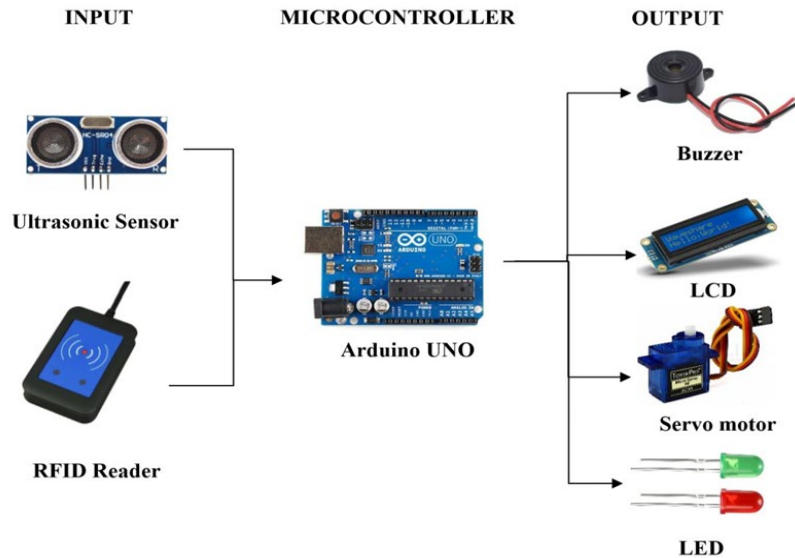


Figure 1. Block Diagram of RFID-Based System for Disabled Driver Convenience

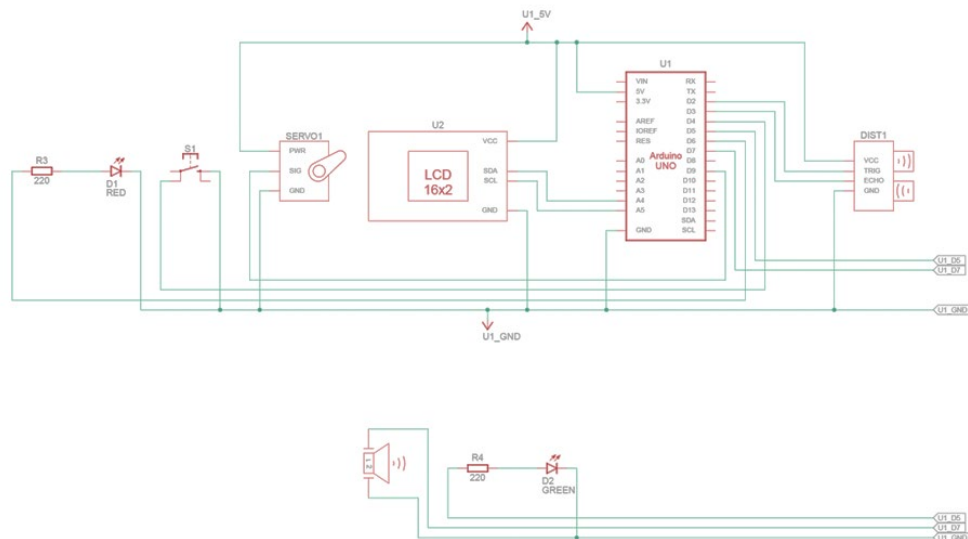


Figure 2. Schematic Diagram of the RFID-Based System for Disabled Driver Convenience

Based on **Figure 2**, the schematic diagram for the RFID-Based System for Disabled Driver Convenience depicts an electronic system controlled by an Arduino UNO microcontroller. The system includes several key components: a 16x2 LCD display for visual output, an ultrasonic distance sensor for measuring distance, and a servo motor for mechanical movement. It also incorporates a red LED and a green LED, each with a 220-ohm resistor, and a buzzer for audio feedback. A push button switch provides user input. The LCD is connected to the Arduino via I2C communication (SDA and SCL pins), while the ultrasonic sensor's Trig and Echo pins are connected to digital pins D2 and D3, respectively. The servo motor is controlled via pin D6, the red LED is connected to pin D5, and the green LED to pin D7. Power is supplied through the 5V line, and ground connections are shared across

components. This setup allows the Arduino to interact with the distance sensor, display information on the LCD, control the servo motor, and provide status indicators via the LEDs and buzzer, with user interaction facilitated through the push button.

Figures 3 (a) and (b) show the simulation results of automated gate movement. While making this simulation, the RFID reader was represented by a push button because the Tinkercad software did not have the RFID reader component. **Figure 3 (a)** shows the servo motor didn't move when the push button was not pushed. This indicates that the RFID reader didn't read any RFID tag or card from the driver. While **Figure 3 (b)** shows the availability of the parking lot on the LCD screen.

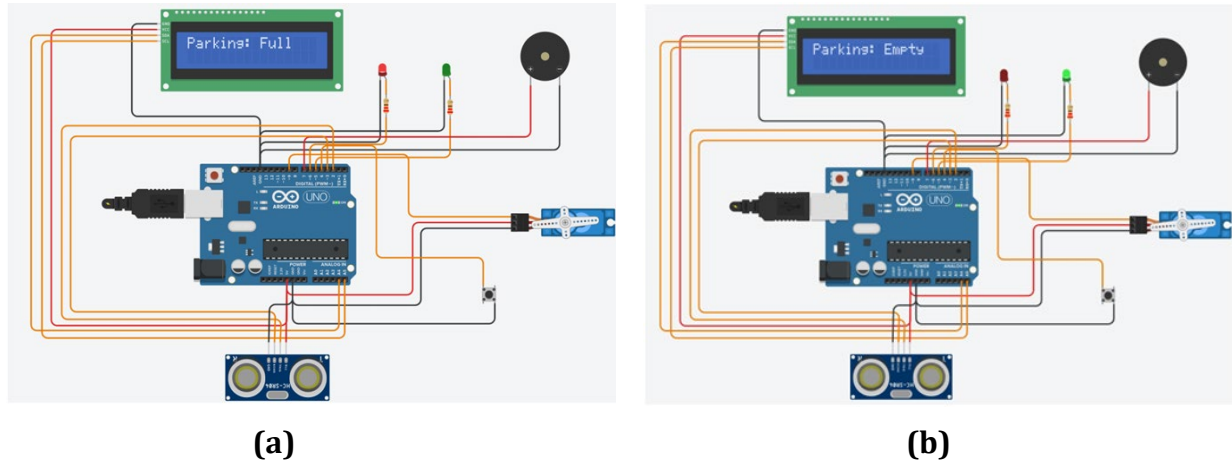


Figure 3 (a) Simulation Result Before Push Button was pushed **(b)** Simulation Result shows the availability of the parking lot

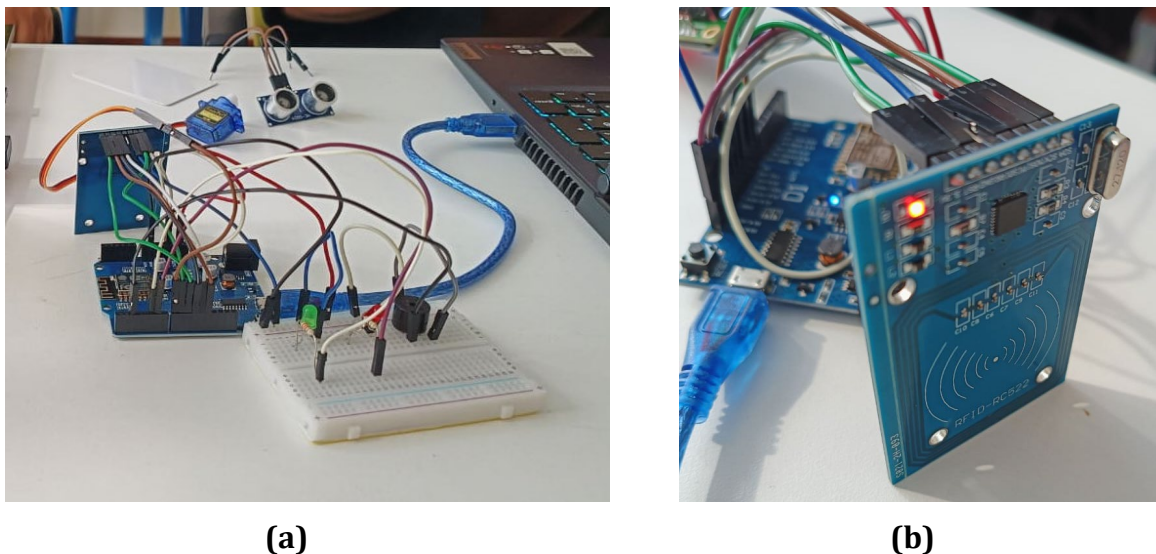


Figure 4 (a) Project design testing and **(b)** RFID reader is functioning

Figures 4 (a) and (b) show the testing phase of the hardware of the project. All hardware used in this project such as ultrasonic sensor, LED, motor and RFID module have been successfully connected to the microprocessor by referring to the design. RFID reader has

also successfully functioned. This is indicated by green light on the reader and reading of the card shows on the LCD screen.

3. Novelty and uniqueness

The development of the RFID-Based System for Disabled Driver Convenience represents a significant advancement in optimizing parking accessibility for disabled drivers. Through the utilization of RFID readers and cards, the system effectively controls access to designated parking spaces, ensuring that these spaces are used appropriately by those who need them. The integration of automated gate control mechanisms further enhances the system's functionality, allowing for seamless entry and exit based on real-time user identification. This feature not only enhances user convenience but also improves the overall efficiency of parking space utilization.

4. Benefit to mankind

The successful implementation of this system highlights its potential to address common challenges faced by disabled drivers in finding and accessing suitable parking spaces. By automating the access control process, the system reduces the likelihood of unauthorized use of designated parking spots, thereby ensuring that these spaces remain available for those who genuinely need them. This contributes to a more equitable and user-friendly parking environment.

5. Innovation and Entrepreneurial Impact

Conducting field trials of this product and gathering feedback from users would be invaluable in refining the system and ensuring its practical utility in real-world applications. Real-world testing would provide critical insights into user preferences and potential areas for improvement, allowing for iterative enhancements that align the system more closely with user needs. By leveraging advanced technologies and user-centric design principles, this system has the potential to significantly improve the quality of life for disabled drivers, making parking more accessible, convenient, and equitable.

6. Potential commercialization

The proposed RFID-Based System for Disabled Driver Convenience holds significant potential for commercialization within the commercial sector. By partnering with mall or business parking management companies, this solution can be marketed as an add-on feature or integrated service for smart parking systems. Commercial area would benefit from reduced revenue losses and enhanced parking management, making them ideal clients for the solution.

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8. Authors' Biography



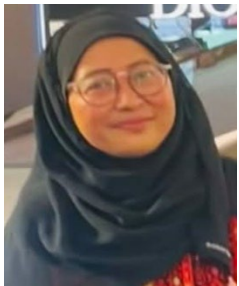
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