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"Fostering a Culture of Innovation and Entrepreneurial Excellence"

23 January 2025
PTDI, UiTM Cawangan Johor
Kampus Pasir Gudang

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A-ST026: REVOLUTIONIZING ACCESSIBILITY: AN IOT-POWERED DOORBELL FOR THE DEAF COMMUNITY

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ABSTRACT

The IoT-Powered Doorbell for the Deaf Community is a groundbreaking assistive technology solution to address communication barriers individuals with hearing impairments face. This system integrates advanced IoT technologies, including the ESP32-CAM, HC-SR04 ultrasonic sensor, LEDs, a vibration motor, and the Blynk application, to deliver a multisensory notification mechanism. Upon detecting a visitor within 100 cm, the system triggers visual alerts through LEDs, tactile feedback via vibration, and real-time smartphone notifications via the Blynk IoT app. Additionally, the ESP32-CAM enables live video monitoring for enhanced security. By prioritizing simplicity, cost-effectiveness, and accessibility, this innovation empowers deaf individuals with greater autonomy while fostering inclusivity and enhancing their quality of life.

Keywords: Assistive Technology, IoT, Accessibility, Deaf Community, ESP32-CAM

1. Product Description

The IoT-Powered Doorbell is a comprehensive system tailored to the unique needs of the deaf community. It incorporates multiple sensory modalities to ensure effective communication and notification. The ESP32-CAM is a real-time surveillance camera that visually monitors visitors and enhances the user's sense of security. The HC-SR04 ultrasonic sensor detects motion within a defined range of 100 cm, which activates three bright LEDs for immediate visual alerts and a mini coin vibration motor for tactile feedback. The Blynk IoT application integrates seamlessly into the system, sending real-time notifications to the user's smartphone, ensuring that they are informed regardless of location. This feature also allows users to communicate with visitors remotely, such as notifying them of their absence. This doorbell redefines assistive technology by combining intuitive usability, low energy consumption, and a cost-effective design, making it accessible to a broader audience.

2. Diagrams

Figure 1 illustrates the block diagram of the IoT-Powered Doorbell for the Deaf Community, showcasing the system's architecture and key components. The input section includes the HR-SR04 ultrasonic sensor, which detects visitors within a 100 cm range, and the ESP32-CAM, which provides real-time video surveillance for enhanced security. These inputs are processed by the ESP32 microcontroller, which serves as the system's core, managing the flow of data and controlling the output components. The output section comprises LEDs for

visual notifications, a vibration motor for tactile feedback, and an LCD for displaying system status. Additionally, the Wi-Fi module facilitates connectivity to the Blynk IoT application, enabling real-time alerts and remote control via a smartphone. This comprehensive setup ensures a user-friendly, multisensory notification system tailored for individuals with hearing impairments.

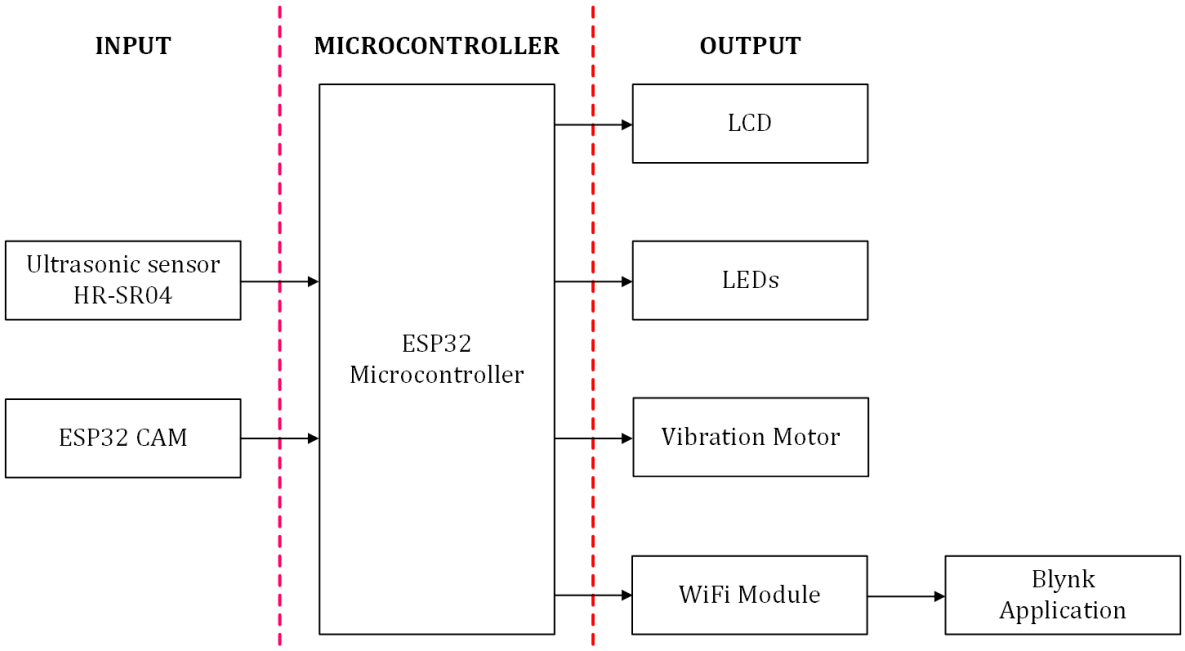

Figure 1. System Architecture Block Diagram

3. Novelty and uniqueness

This project sets itself apart through its innovative use of IoT technology to create a multisensory notification system specifically designed for individuals with hearing impairments. Unlike traditional doorbells limited to auditory notifications, this system integrates visual, tactile, and digital components into a single, user-friendly solution. Its use of the ESP32-CAM for real-time video surveillance adds a layer of security, while the Blynk IoT application enhances functionality by enabling remote monitoring and communication. The affordability, scalability, and advanced features make this system a trailblazer in assistive technology innovation.

4. Benefit to mankind

The IoT-Powered Doorbell addresses critical accessibility challenges by offering a reliable and intuitive communication tool for individuals with hearing impairments. By integrating advanced technologies into an affordable and practical design, the system promotes independence and safety for users. Its broader societal impact includes raising awareness about the importance of inclusive design and fostering a culture of innovation that prioritizes underserved communities. The project highlights the role of technology in improving the quality of life and advancing social equity.

5. Innovation and Entrepreneurial Impact

The project exemplifies the transformative potential of IoT technologies in addressing real-world challenges. The IoT-Powered Doorbell inspires entrepreneurial ventures within the assistive technology sector by introducing an affordable and scalable solution. Its modular design allows for easy customization and adaptation to various user needs, including elderly care and mobility assistance. This scalability opens doors for commercial opportunities in both local and international markets, encouraging startups and businesses to explore similar innovations. Furthermore, the project bridges the gap between academic research and industry application, promoting interdisciplinary collaboration and fostering a culture of innovation.

6. Potential commercialization

The IoT-Powered Doorbell holds significant potential for commercialization due to its affordability, adaptability, and relevance to diverse markets. It can be marketed as a standalone product targeting the deaf community or as an additional feature for existing smart home systems. Its scalability ensures that the product can cater to a wide range of demographics, including the elderly and those with mobility challenges. The IoT integration allows for regular updates and customizations, ensuring long-term marketability. By partnering with home security providers or assistive technology firms, this product could achieve widespread adoption, making a meaningful impact on global accessibility efforts.

7. Acknowledgment

The project team extends their gratitude to the Electrical Engineering Studies, College of Engineering, Universiti Teknologi MARA, Johor Branch, Pasir Gudang Campus, for their support in providing the resources necessary to bring this innovation to fruition.

8. Researchers Biography

Nurul Atina is a final-year student in Electrical Engineering Studies, College of Engineering, Universiti Teknologi MARA (UiTM), Johor Branch, Pasir Gudang Campus. Her research, titled *"Revolutionizing Accessibility: An IoT-Powered Doorbell for the Deaf Community,"* demonstrates her dedication to leveraging IoT technologies to address real-world challenges. With a passion for innovation and inclusivity, Nurul's work focuses on creating affordable, user-friendly solutions that empower individuals with hearing impairments. Her commitment to academic excellence and societal impact underscores her potential as an emerging contributor to the field of assistive technologies.

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