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IoT BASED SMART DOOR LOCK FOR HANDICAP PEOPLE

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Abstract: Surveillance has proven to be a crucial aspect of home security, ensuring the safety of both property and individuals. In this project, we aim to design an IoT-based Smart Door Lock using Raspberry Pi 4, specifically tailored to cater to the needs of handicapped individuals. The system's primary function is to alert users about the presence of outsiders and provide essential security for their homes. Our proposed system incorporates various components, including a Pi camera for live video streaming, an application for users to view the camera feed, and Wi-Fi connectivity to enable LED and buzzer notifications. By utilizing the Raspberry Pi 4, we not only establish it as the server but also leverage its capabilities as a microprocessor for the entire system. The IoT-based Smart Door Lock for handicapped individuals integrates a Pi Camera to introduce the concept of granting or denying access to outsiders. Through the user's application, the owner can effectively manage access permissions, ensuring enhanced security for their premises.

Index Terms **- IoT, Smart Door Lock, Raspberry Pi 4, Security.**

I. INTRODUCTION

Nowadays, security has become a major concern across various industries, as well as for individuals in their daily lives. In response to this challenge, Internet of Things (IoT) applications have been implemented to enhance security measures. One such application involves the use of Raspberry Pi with a smart lock system.

This proposed system leverages IoT technology to grant authorized users the ability to remotely operate a door, aided by live video streaming through the Pi Cam and an accompanying buzzer. The core component of this approach is the Raspberry Pi 4 microcontroller, which is programmed using Python for live streaming purposes. The Blynk IoT app is employed as an interface for remotely controlling the door.

By utilizing this smart door solution, individuals can conveniently control access to their homes from any remote location. This technology offers significant benefits, particularly for people with physical disabilities and the elderly. Many smart home devices are not designed with the needs of individuals with disabilities or limited mobility in mind. It is widely acknowledged that "disabled persons face numerous challenges in their daily lives, both inside and outside the home, especially when staying alone." Thus, this system, specifically tailored for people with disabilities or handicaps, enables them to operate the door and manage the entry of individuals into their homes through multiple notification channels, such as mobile application alerts and buzzer notifications.

The Raspberry Pi 4 processor serves as the central controlling device for the entire system, boasting an inbuilt Ethernet. The system interfaces with various components, including the Pi Camera, relay, solenoid lock, buzzer, and switch. The Raspberry Pi 4 processor continuously provides live video feed from the Pi Cam. When someone rings the bell, the Raspberry Pi 4 recognizes the event and triggers an alert to the homeowner via the buzzer. Additionally, the live video feed from the Pi Cam can be accessed through the accompanying mobile application. If the homeowner wishes to grant permission, they can do so; otherwise, entry can be denied.

This paper presents the development of a system that enhances home security and provides controlled access to authorized individuals, facilitated by a user-friendly mobile application.

II. Literature Survey

In the study conducted by Iqbal et al. [1], a system was developed using Microsoft Kinect and the X10 protocol to enable people with disabilities to control smart home appliances through gesture recognition. The system architecture involved a Kinect connected to a Central Control Unit (CCU), which in turn was connected to an X10 transceiver module. A database stored the addresses and status of the appliances. Users could simply point to the desired device, and the Kinect sensors would detect the gestures and send commands to the CCU for appliance control. However, the limitation of this system was its dependency on non-verbal communication, rendering it unsuitable for individuals who are unable to speak.

Rashid et al. [2] proposed a home automation system tailored for individuals with physical disabilities. The system architecture comprised IR sensor modules, an ultrasonic sensor (HC-SR04) module, a Bluetooth module, an Arduino Mega2560 microprocessor unit (MU), and a set of relays connected to appliances. The sensors provided data on the appliance states to the MU, which utilized the relays to activate the appliances. Notably, the system incorporated automatic door control, opening and closing doors based on proximity. The system aimed to optimize water usage and power consumption. However, it lacked direct appliance control for individuals with disabilities through the system controls.

Vineeth et al. [3] introduced an e-Home system that enables individuals, including those with physical disabilities, to control appliances using voice commands. The architecture includes a voice recognition module, RF module, Arduino UNO microcontroller, Raspberry Pi Model B+, microphone, and power supply. Users issue commands via the microphone, which are converted by the V3 module and transmitted to the RF receiver connected to the Raspberry Pi. Sensor data is captured, processed, and accessed through the cloud. However, learning specific commands and system complexity pose usability challenges, particularly for individuals with disabilities.

Sunehra and Tejaswi [4] proposed a system consisting of two schemes. The first scheme utilizes the HC-05 Bluetooth module and an Arduino Bluetooth controller mobile app for appliance control. The second scheme employs GSM/GPRS for appliance control. Sensors, Bluetooth module, SIM 900 GSM modem, relays, and webcams are connected to the Raspberry Pi microcontroller. Voice commands are sent via an Arduino Blue Control app on a smartphone. However, the system's complexity and cost may pose challenges for individuals with disabilities.

Basanta et al. [5] proposed a system that combines voice and gesture recognition. Instead of Microsoft Kinect, the system utilizes the MPU6050 accelerometer to capture gestures. Dedicated hardware components like Bluetooth, Arduino boards, smartphones, and an AMR audio codec capture voice command. Appliances are connected to a microcontroller with Bluetooth, allowing users to control them via smartphone. The gesture scheme employs the MPU-6050 accelerometer, Nano microcontroller ATMEGA328P, and Bluetooth HC-06 serial module for gesture data collection. Noise filtration and data verification are required, making our solution simpler and more cost-effective.

III. The Architecture Model

This section describes the architecture model of IoT based Smart Door Lock for Handicap People in detail in Fig. 1.

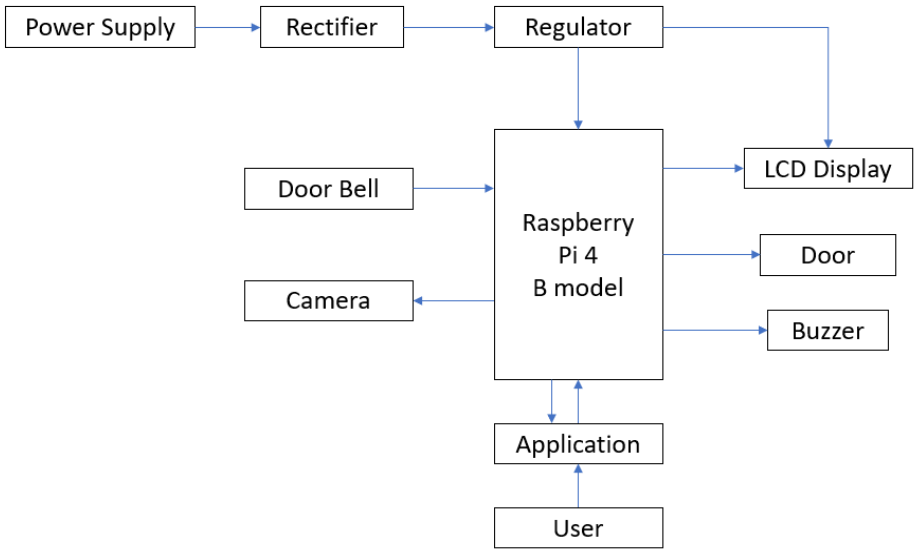

Fig 1 - System Architecture

The core component of this system is the Raspberry Pi 4 controller, responsible for managing and coordinating various elements. It interfaces with the Pi-camera, relay (with a solenoid lock), buzzer, and switch. AC power is converted to regulated DC power to meet the Raspberry Pi's requirements.

Once powered, the Raspberry Pi 4 B+ processor receives a continuous live video stream from the Pi Camera. When someone rings the doorbell, the owner can verify their identity by checking the live video feed through a user application. If permission is granted, the smart lock system transmits the image and opens the door, allowing entry. Conversely, if permission is denied, the door remains locked. All relevant actions, including door opening, door closing, and access denials, are displayed on an LCD screen.

This system is particularly advantageous for individuals with physical disabilities, providing them with a secure and convenient means of controlling access to their homes.

IV. HARDWARE

4.1 Components Used

4.1.1 Raspberry Pi 4

The Raspberry Pi 4 is a compact and affordable single-board computer. It features a quad-core ARM Cortex-A72 processor, up to 8GB of RAM, dual-band Wi-Fi, Bluetooth 5.0, multiple USB ports, HDMI output, and support for running a variety of operating systems.

4.1.2 Liquid Crystal Display

A liquid crystal display (LCD) is a flat-panel display technology that uses liquid crystals to produce images. It consists of a grid of tiny cells filled with liquid crystals that can change their orientation to allow or block light, resulting in the display of text, images, and videos.

4.1.3 Pi Camera

The Pi Camera is a small, high-quality camera module designed for Raspberry Pi boards. It offers a variety of features such as adjustable focus, still image capture up to 12MP, video recording up to 1080p, and supports various functions like time-lapse, motion detection, and streaming capabilities.

4.1.5 Buzzer

A buzzer is an electronic component that produces sound when an electric current is passed through it. It is commonly used in alarms, timers, and notification systems. Buzzer variations include active and passive types, offering different sound outputs and operating voltages to suit specific applications.

4.1.6 DC Motor

A DC motor is an electric motor that converts direct current (DC) electrical energy into mechanical motion. It consists of a rotating armature and a stationary magnetic field, utilizing the interaction between them to generate rotational movement. DC motors are commonly used in robotics, appliances, and industrial applications.

4.2 Design

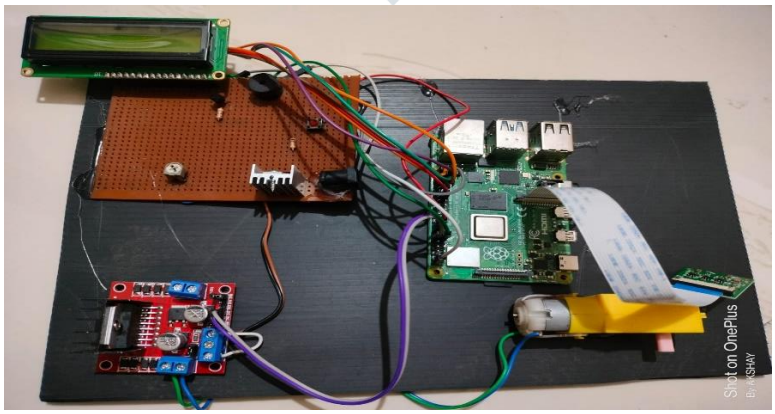

Fig. 2 – Hardware Design

The system incorporates a Raspberry Pi 4 processor as the central control unit, linked to multiple components including an LCD display, buzzer, camera, and DC motor. When the doorbell is pressed, the camera captures live video footage of the area outside the door, which is instantly shared through the user's application. Using the application, the user can observe the live video feed and make a decision to grant or deny access. The door locking mechanism, powered by a DC motor solenoid relay lock, responds accordingly to open or close the door.

V. SOFTWARE DESIGN

5.1 Flowchart

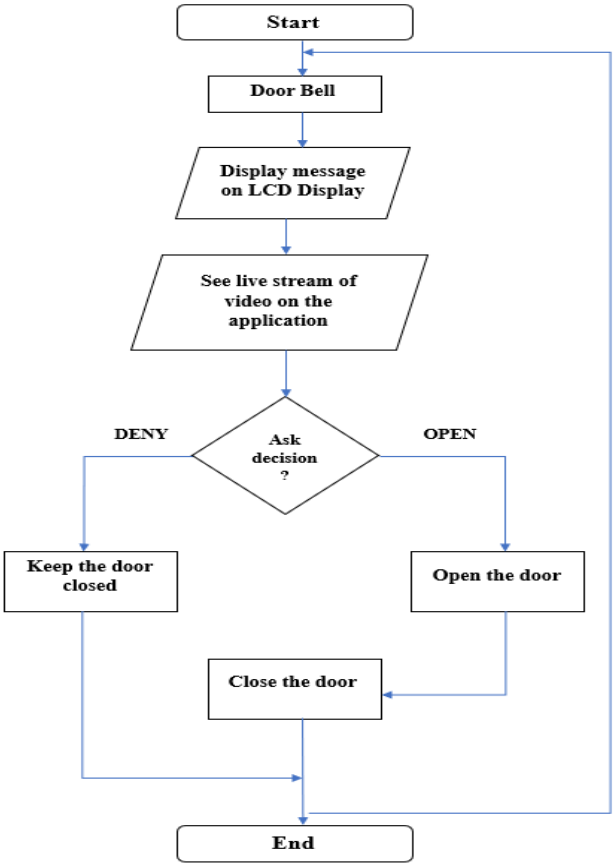

Fig 3 – Flowchart

5.2 Circuit Diagram

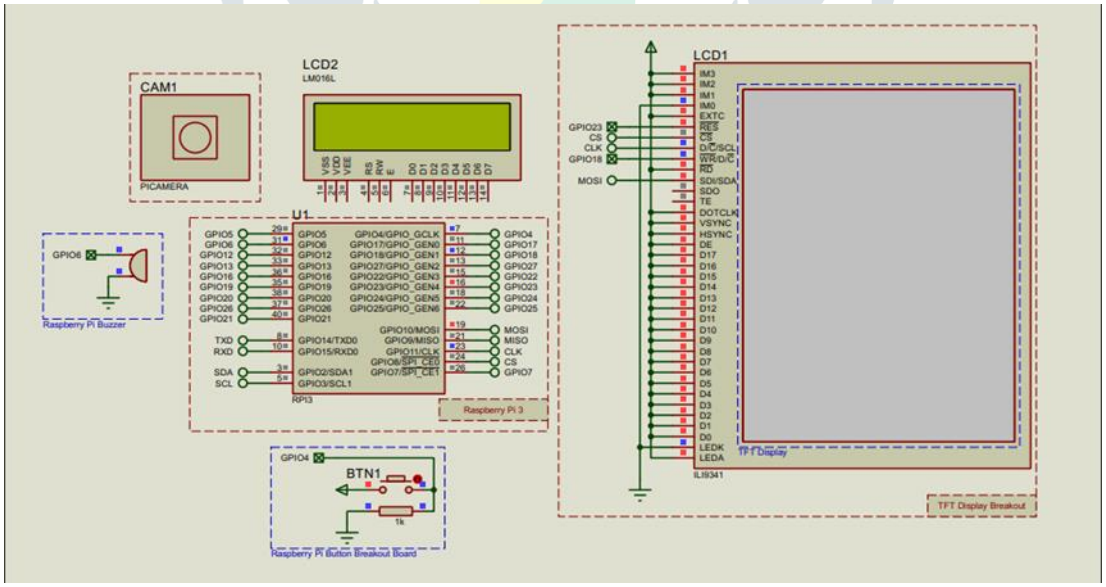

Fig 4 – Circuit Diagram

5.3 Blynk IoT Application

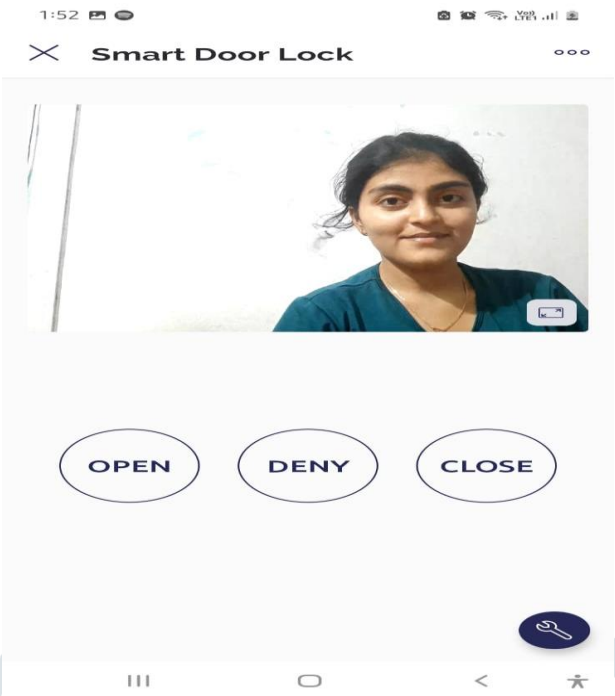

Fig 5 – Blynk IoT Application

Blynk is an IoT (Internet of Things) application that allows users to control and monitor their connected devices remotely. With a user-friendly interface and drag-and-drop functionality, Blynk enables the creation of custom dashboards and mobile apps for seamless device management. It supports a wide range of hardware platforms and offers secure cloud connectivity, making it a popular choice for IoT projects worldwide.

VI. RESULTS

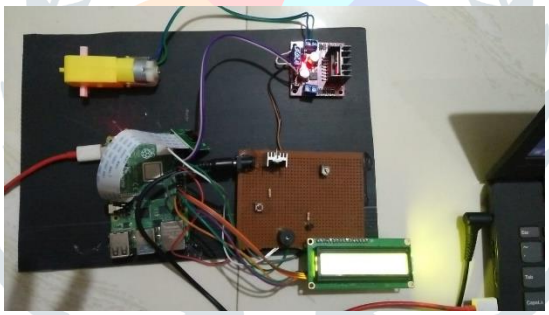

Fig 6 – Final working

The IoT-based smart door lock for handicap people is designed to improve accessibility and convenience. It features a smartphone-controlled unlocking mechanism, allowing individuals to unlock the door remotely through a mobile app. The smart lock can be customized to accommodate specific accessibility needs, such as larger buttons or tactile feedback. This technology promotes independence and inclusivity for handicap individuals by eliminating physical exertion and providing a user-friendly solution for securing their homes.

VII. CONCLUSION

We have developed a system that leverages the power of Raspberry Pi and IoT and provides an efficient solution for granting access to unknown visitors, particularly benefiting physically disabled individuals. By enabling the owner to make informed decisions remotely, the system minimizes unwanted visits and potential confrontations. This innovative technology empowers users with the ability to monitor and control access to their premises through live video streaming and real-time interaction via a user-friendly application. Ultimately, this system not only enhances security but also promotes convenience and peace of mind, offering a safer and more inclusive environment for all.

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