Smart and Secure Door Lock System

Ms. Faazila Ibrahim Mulla[1], Prof. Trima P. Fernandes e Fizardo[2], Ms. Muskaan Kalim Khan[3],

Prof. Selvyn Fernandes[4], Ms. Sarah Sheikh[5]

[1]*Department of Electronics andTelecommunication Don Bosco College of Engineering,Fatorda-Goa, India*
[2]*Department of Electronics andTelecommunication Don Bosco College of Engineering,Fatorda-Goa, India*
[3]*Department of Electronics andTelecommunication Don Bosco College of Engineering,Fatorda-Goa, India*
[4]*Department of Electronics andTelecommunication Don Bosco College of Engineering,Fatorda-Goa, India*

ABSTRACT

our society's theft and crime rates are increasing day by day. Thieves can now simply open ourstandard door locks and go unnoticed. To address this, we presented a security solution for a far more secure environment .The most significant element of any home security system is the ability to detect who enters and exits the premises. Instead of monitoring it with a password or a pin, unique faces can beused as a biometric attribute to prevent a robbery in a protected environment such as a home or any other premise. This project aims to create a smart, user-friendly door lock that permits keyless unlocking while also providing security. Itenables users to enter hands-free by employing face recognition via a camera positioned, both during the day andat night. The system consists of three primary components: a cloud (database) back-end, an onboard logical unit, and theuser interface (intruder alert).When someone tries to enter a house, the camera setup records the person's face and compares it to the pre-stored photographs in the database. If the face matches one of the presets, the door is unlocked; otherwise, an intrusion alert is issued to the owner.The project uses Raspberry Pi for the implementation of facialrecognition using OpenCV, and IoT for further development. The Raspberry Pi camera captures images which then are applied to facial recognition algorithms using OpenCV. The system can recognize authorized users and grant them access to secure areas or buildings while denying access to unauthorized users.

Keywords- *keyless, face recognition, raspberry pi, OpenCV, IoT*

I. INTRODUCTION

A smart and secure door lock system is designed to keep the premises safe. It is a smart device for security purposes both during the day and night. The primary goal of this project is to create a smart monitoring device that monitors the region in which it is installed. This gadget is only put in areas where no one but authorized personnel is permitted to enter. If an unauthorized person tries to enter, this smart device will capture the person's face, and if the person is legal, the person is allowed, otherwise an intruder alert is given.

II. MOTIVATION AND OBJECTIVEMotivation

- Keep intruders out, electronic door locks only allow authorized workers to enter the premises and ensure that no intruders enter specific regions of the house.
- By eliminating the need for keys and replacing them with codes or cards, you eliminate the risk of misplaced keys, which can be a problem in a large office building with many people carrying sets of keys. Installing electronic door locks is one of the finest ways to ensure that no onehas unauthorized access to your confidential items.
- Installing electronic door locks ensures that only certainstaff have access to certain places.
  This lowers the possibility of replication, such as keys and cards, which are easily reproduced.
- It provides a precise record of who enters the building.
- This project offers a broad range of applications in vast areas such as colleges for attendance purposes and can also be expanded for military or criminal security purposes to identify the offender's face in a crowd.

Objective

- To avoid trespassing in places like private residences, businesses like banks and jewelry stores, and government institutions.
- To provide keyless unlocking for all users inside a building without the need for traditional keys.
- Face recognition both throughout the day and at night.
- To monitor who enters a building, and it may also be used for attendance purposes in big spaces like a university campus.

LITERATURE SURVEY

The article published in the International Research Journal of Engineering and Technology in March 2020 presents an IOT- based anti-theft detection and alerting system using Raspberry Pi. The system includes components such as a camera, servo motor,piezo sensor, and Node MCU, all integrated to detect and alert incase of any motion detected in the area under surveillance. The Raspberry Pi microcontroller runs on Raspbian OS, while Python and OpenCV libraries are used to implement motion detection algorithms and image processing techniques. The system's design and development aimed to provide an efficient and convenient motion detection surveillance system to enhance security measures against theft. With the integration of IoT technology, the system can send real-time alerts to the appropriate authorities, enabling quick and appropriate responses to potential threats. Overall, the presented system provides a low-cost, versatile, and easy-to-implement solution for motion detection surveillance using Raspberry Pi and related technologies.

The article published in the International Journal of Science, Technology, and Engineering in June 2017 presents a theft prevention system using Raspberry Pi and PIR sensor technology. The system includes components such as a PIR sensor, relay, Raspberry Pi camera, buzzer, and GSM, all integrated to provide a cost-effective solution for preventing theft. The proposed system enables the deployment of a number of PIR sensors, making it a versatile and scalable solution for theft prevention. The Raspberry Pi microcontroller runs on raspbian OS, while PHP and python programming languages are used to implement the system's functionalities. The system's design and development aimed to provide an easy-to-implement and effective solution for theft prevention, with the ability to send real-time alerts to the user's mobile phone in case of any security breach. Overall, the proposed system presents a cost-effective and scalable solution for theft prevention, making it a viable option for various security applications.

The International Journal of Advanced Research and Innovative Ideas in Education published an article in 2021, discussing a facial recognition-based door-locking system. The system includes an AVR microcontroller (ATmega8A), a solenoid lock,a buzzer (5V), a camera, and GSM for communication. The system is designed to detect and recognize faces and lock/unlock doors based on the authorized user's face. The system is programmed using MATLAB and tested for its performance, including recognition rate, reliability, memory management, and power management. The face detection and recognition provides reliable and accurate results. The system can efficiently manage memory and power consumption, making it a cost-effective solution for securing homes, offices, and other facilities. The system can also send alerts to the authorized user's mobile phoneusing the GSM module, providing real-time updates on the door's status. Overall, the proposed facial recognition-based door-locking system provides a reliable, efficient, and cost-effective solution for enhancing security measures.

The International Research Journal of Engineering and Technology published an article in May 2020, describing a facialrecognition door lock system based on Raspberry Pi-3, GSM module, webcam, and solenoid door lock.

The system uses OpenCV and python programming languages to implement facial recognition algorithms and a SQL Lite database to store and retrieve user information. The system's design and development aimed to provide a secured door locksystem, preventing unauthorized access and providing reliablesecurity. The integration of a GSM module allows the system to send real-time alerts to the authorized user's mobile phone in case of any unauthorized access attempts or system malfunctions. The solenoid door lock ensures secure locking and unlocking of the door, and the webcam captures the facial images of users for recognition purposes. The system's design and implementation ensure user privacy and data security, making it an effective solution for enhancing security measures. Overall, the proposed facial recognition door lock system provides a reliable and efficient solution for securing homes, offices, and other facilities, using Raspberry Pi-3, GSM module, webcam, and solenoid door lock

III.HARDWARE REQUIREMENTS

• Raspberry Pi zero

A small and adaptable computer board, the Raspberry Pi Zerohas several features in common with the Raspberry Pi 3. It has a Wi-Fi chip integrated inside it, enabling seamless wireless network connectivity without the need for additional hardware. Additionally, it is a great option for Internet of Things (IoT) applications, the built-in Bluetooth Low Energy(BLE) functionality, which enables communication with a variety of low-power devices. A convenient SD card slot on the Pi Zero makes it simple for customers. It is also compatible with a variety of monitors, the tiny HDMI port that it offers for video output. The Pi Zero offers flexibility in terms of powering the device and connecting peripherals, its two microUSB ports, one for power and the other for USB connectivity.The Pi Zero has the same single-core 1 GHz CPU chip as the Pi A+ and B+, 512MB of RAM, thus it has enough processingcapability for a variety of tasks.
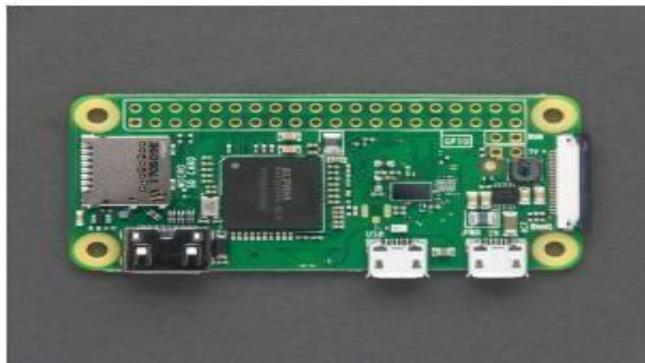

Figure 4.1: Raspberry pi zero

• Camera

The tiny and adaptable Raspberry Pi Infrared (IR) night vision surveillance camera module is made use with the Raspberry Pi. Its infrared (IR) night vision capabilities are one of its primary advantages, allowing you to take quality pictures even when it's dark outside or at night.

In order to enable high-quality video recording and streaming, thecamera module supports a number of video codecs, including 1080p at 30fps, 720p at 60fps, and 640x480p at 60/90fps. It is capable of taking detailed pictures due to its 5 megapixel resolution.

The Raspberry Pi Zero and the camera module are compatible. Due to its compact and lightweight construction, it can be used fora variety of space-constrained surveillance and monitoring applications.

The camera module connects to the Raspberry Pi using the Camera Serial Interface (CSI), ensuring a dependable and quick data transfer. It has a fixed-focus lens with a broad field of visionthat has an aperture of 1.8 and a focal length of 3.6mm.

Overall, the Raspberry Pi Infrared IR night vision surveillance camera module is a good option for security and monitoring applications since it provides a practical and effective solution forrecording surveillance footage, especially in low-light situations.

Figure 4.2: Raspberry pi camera

- **Buzzer**

It's great to add an alarm to electronic devices.
It operates on 5V supply uses and a coil element to generate tone.

Figure 4.5: Buzzer

- **ESP 32**

The ESP32 family of system on a chip microcontrollers that features integrated Wi-Fi and dual-mode Bluetooth and is inexpensive and low power. The Tensilica Xtensa LX6 dual-core or single-core microprocessor, Tensilica Xtensa LX7 dual-core, or a single-core RISC-V microprocessor are used in the ESP32 series, which also has integrated antenna switches, RF baluns, power amplifiers, low-noise receive amplifiers, filters, and power-management modules. Espressif Systems invented and developed the ESP32.

- **Lock**

DC 12V solenoid Electromagnetic cabinet Door lock

Figure 4.3: Solenoid Lock

- **Ultrasonic Sensor**

An ultrasonic sensor is a gadget that measures distance or finds things by using sound waves at frequencies higher than those heard by humans. Both a transmitter and a receiver are part of it. Ultrasonic waves from the transmitter bounce off nearby objects before reaching the sensor. The receiver determines the time it takes for the waves to return by identifying the reflected waves. The sensor can calculate the distance to the item based on this time.

Figure 4.4: Ultrasonic Sensor

Figure 4.6: ESP 32

III.   SOFTWARE REQUIREMENTS

- **Programming language: Python**

Python supports several programming paradigms, including structured, object-oriented, functional programming, and it has dynamic typing. One of Python's most notable advantages is its extensive standard library, which offers tools suitable for a wide range of jobs. It has modules for building graphical user interfaces, establishing connections with relational databases, performing arithmetic with arbitrary precision decimals, working with regular expressions, and performing unit tests.

- **Arduino IoT Cloud**

Users can securely connect to and manage their IoT (Internet of Things) devices and projects using the platform offered by Arduino called the Arduino IoT Cloud. By providing a user- friendly interface and easy interaction with Arduino boards, it streamlines the process of developing Internet of Things applications.

Using a web browser or mobile app, you can quickly connect your Arduino devices to the Arduino IoT Cloud and remotely monitor and control them from any location. It offers capabilities including real-time data visualization, remote device management, and simple cloud service integration.
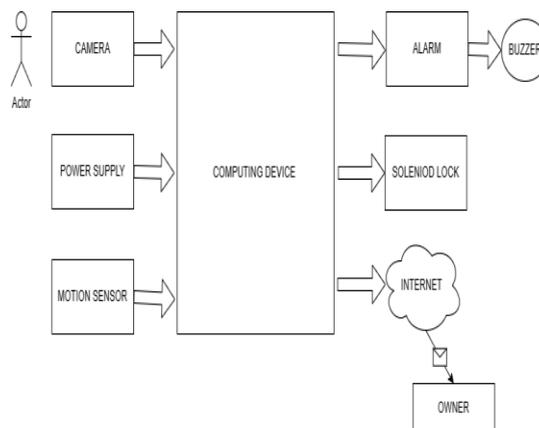
IV.   METHODOLOGY

Figure 6: Block Diagram

V. CONCLUSIONS AND FUTURE SCOPE

In conclusion, the project "Smart and Secure Door Lock System" is an innovative and efficient solution for securing homes, offices, and other facilities. By using an IR camera connected to a Raspberry Pi, the system can capture images, perform face recognition, and unlock the door in real time.

Furthermore, the project can be extended by using cloud computing and IoT capabilities to enhance scalability, reliability, and monitoring. By integrating the Raspberry Pi with cloud-based face recognition APIs and IoT modules such as Wi-Fi, Bluetooth, or GSM, users can monitor the door remotely and receive alerts or notifications whenever someone enters or exits through the door. Additionally, the passcode module can be used as an alternative means of unlocking the door, providing users with more options and flexibility.

Overall, the project is a cost-effective and reliable solution that combines modern technologies such as face recognition, cloud computing, and IoT to provide enhanced security and monitoring capabilities. With further development and improvements, the system can be deployed in various applications such as homes, offices, hotels, and other facilities to ensure the safety and security of individuals and their belongings.

VI. REFRENCES

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