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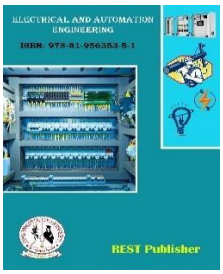


# Wi-Fi Door Lock Using Esp32 Cam and Blynk

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**Abstract:** *this paper describes a smart Wi-Fi door lock system developed using the esp32 cam and BLYNK app. the system aims to enhance home security by providing real-time notifications and visual verification of visitors. When the doorbell rings, the homeowner receives a notification on their smartphone along with a captured image of the person at the door. This allows the homeowner to remotely verify the individual's identity before granting access by unlocking the door through the door security system application. by bridging traditional door locks with advanced technology, this solution offers convenience and control to homeowners, ensuring the safety of their homes even when they are not present.*

## 1. INTRODUCTION

Security In today's society, the security of confidential items, properties, and lives is of paramount importance. To prevent any potential harm, it is crucial to pay close attention to these valuable assets. Among the plethora of security systems available, microcontroller-based door lock systems have emerged as one of the most effective solutions. These systems employ a unique password specified by the programmer, placing the responsibility on the user to maintain its confidentiality. Similar to the use of ATM card PINs, the correct password grants the individual the ability to open the door, ensuring authorized access .One notable aspect of microcontroller-based door lock systems is the incorporation of additional security features. In the event of an erroneous code entry, these systems are designed to sound a buzzer, immediately alerting the owner that incorrect information has been provided. This instant feedback acts as an extra layer of security, discouraging unauthorized access attempts and enhancing the overall effectiveness of the system. The primary characteristics of microcontroller-based door lock systems revolve around the common approach of sending alarm signals to address security breaches. These systems typically rely on microcontrollers and GSM modules to facilitate communication. Additionally, the integration of One-Time Passwords (OTPs) adds an extra layer of security. Unauthorized users or attackers who do not possess the correct password may attempt to input OTPs. However, if an attacker mistypes the OTP multiple times, the system triggers an alarm, immediately notifying the homeowner via their mobile device. This prompt notification ensures that the owner remains aware of potential security threats and can take appropriate action. To further enhance security, microcontroller-based door lock systems also integrate fingerprint-based authentication. This advanced biometric technology offers several advantages, including heightened security and convenience. By combining OTPs with fingerprint verification, these systems provide real-time protection against unauthorized access attempts. This integration addresses the limitations of previous systems, such as digital and mechanical door lock systems, and ensures a more robust and reliable security mechanism. It is worth noting that security systems can be classified based on the technology used for real-time implementation. Two common classifications are biometrics and password-based systems. Microcontroller-based door lock systems fall into the latter category, utilizing passwords as the primary means of authentication. This classification underscores the reliance on the unique password specified by the programmer and underscores its importance in maintaining the security of the system. The microcontroller-based door lock systems play a vital role in safeguarding confidential items, properties, and lives. With a unique password specified by the programmer and the user's responsibility to keep it confidential, these systems provide an effective barrier against unauthorized access. The integration of additional security features, such as alarms and instant notifications, ensures timely awareness of any breach attempts. By incorporating OTPs and fingerprint-

based authentication, these systems address the limitations of previous security mechanisms, providing enhanced security and peace of mind. As security technology continues to evolve, microcontroller-based door lock systems contribute significantly to the ongoing mission of protecting valuable assets and preserving the well-being of individuals and their properties.

## 2. RELATED WORKS

This research focuses on the importance of security in modern society and presents a system utilizing a fingerprint sensor, GSM module, and Arduino microcontroller. Authorized individuals' fingerprints are stored in the microcontroller, and a matching algorithm verifies their identity. Upon successful authentication, an OTP (One Time Password) is sent to their registered mobile number through the GSM module. However, if an unauthorized person attempts access, their fingerprint will not match, triggering a buzzer to indicate an unauthorized access attempt. This system provides a cost-effective solution for enhancing security in sectors like banks and offices. By combining biometric authentication and mobile communication, it ensures robust security measures while keeping costs low. This research contributes to the ongoing demand for reliable and affordable security solutions in various domains, where security is a paramount concern. AdiShankara Institute of Engineering and Technology, Kalady. Kerala, India. To enhance house security, we have introduced a Smart Door Bell system that integrates the ESP32 CAM and an accompanying mobile app. The door plays a crucial role in ensuring safety, but homeowners may sometimes forget to lock it or be uncertain about its status. With our innovative solution, homeowners can address these concerns effectively. The Smart Door Bell system incorporates IoT technology and a Wi-Fi Door Lock, allowing users to monitor and manage their doors conveniently. By utilizing the ESP32 CAM and the accompanying app, homeowners gain the ability to monitor their doors in real-time and remotely control their locking status. Mudhoji College, Phaltan. This paper titled "Smart Door Locking System using Wireless Communication Technology" presents a research study conducted by N. N. Kumbhar and P. V. Mane Deshmukh. The study focuses on developing a smart door locking system that utilizes wireless communication technology. The methodology involves designing and implementing a system that integrates wireless communication modules with a door locking mechanism. The system allows users to remotely control the door lock using a smartphone or a designated device. The research explores the effectiveness and practicality of the proposed smart door locking system, highlighting its potential applications in enhancing security and convenience in residential and commercial settings. This paper focuses on the development of a door lock system using facial recognition in conjunction with the ESP32 CAM for improved face detection accuracy. The ESP32 CAM serves as the backbone of the system, powered by a battery, and controls the locking and unlocking mechanisms of the door. The proposed system operates based on facial recognition, where access to the door is granted based on the recognition of an authorized individual's face. The door serves as a critical defense feature to ensure the physical security of a house. Easy access to an unlocked door can pose a risk of theft and compromise the contents of the house. While traditional doors required a physical key for locking and unlocking, technological advancements have led to the innovation of digital doors that operate without the need for physical keys. This paper introduces an application called "Face Detection Door Lock" based on Arduino and utilizing Internet of Things (IoT) technology to monitor the door's status, control its operation, and enhance security. With the integration of the ESP32 CAM, the door can automatically lock or unlock based on facial recognition, offering convenience and improved security measures. The Door Security System is an Android-based application utilizing IoT technology to enhance home security. By integrating the ESP32 cam, the system can automatically lock or unlock the door. Communication between the smartphone and the door lock system is established using the Blynk software. Additionally, the system enables live streaming to monitor the outdoor surroundings, ensuring early threat detection. To further enhance user comfort, the DHT-11 sensor measures room temperature, allowing the microcontroller (MCU) to control heating or cooling based on the owner's proximity to the house. Due to the limited input/output pins on the MCU, the project includes the use of shift registers to significantly increase the inputs available on the ESP32, expanding its capabilities. Overall, this system provides convenience and increased security by automating door locking, monitoring, and temperature control. The Door Security System is an Android-based application that utilizes IoT technology to enhance home security by monitoring and controlling the door. By implementing MQTT cloud as the communication protocol, the system establishes a secure connection between the smartphone and the door lock. The system incorporates a PIR sensor in the door lock, which accurately detects any movement near the door, while a touch sensor on the door handle recognizes human interaction. In the event of forced entry, an alarm is triggered, and a notification is sent to the house occupant, alerting them to the presence of an intruder. The evaluation results indicate that the motion detection sensor can accurately detect movement up to a distance of 1.6 meters. Furthermore, the messaging system between the smartphone and door lock is encrypted, ensuring the secure transmission of messages. This comprehensive system provides reliable and convenient door security, enhancing the overall safety of the house.

This paper titled "Door Security for Home Monitoring Based on ESP32" introduces an innovative door lock system that incorporates face recognition technology using the ESP32 cam module for accurate detection. The system aims to enhance security and convenience by providing secure access control through facial recognition while promptly notifying the owner of any unauthorized attempts. The core of the system is an ESP32 microcontroller, which acts as the control center for the door lock mechanism. It is powered by a battery, ensuring continuous operation even in the event of a power outage. The ESP32 microcontroller is responsible for managing the locked and unlocked states of the door based on the authentication results. To grant access, authorized individuals are required to undergo face detection using the ESP32 cam module. The face recognition algorithm analyzes the captured image and compares it against a pre-registered database of authorized users. If the face is successfully recognized, the door is unlocked, allowing entry. This provides a convenient and secure way for authorized individuals to enter without the need for physical keys or passwords. In the case of unauthorized access attempts, the system responds by triggering the ESP32 cam module to capture an image of the intruder. This image is then sent as a notification to the homeowner, alerting them to the unauthorized activity. The cloud integration plays a crucial role in enabling this functionality, as all processing and control functions are performed remotely, providing real-time notifications and access logs. Overall, the introduced door lock system based on ESP32 with face recognition technology offers a reliable and convenient solution for secure access control. By combining advanced facial recognition capabilities, cloud integration, and real-time notifications, the system provides enhanced security and peace of mind for homeowners. The paper's findings and implementation details likely highlight the system's performance, effectiveness, and potential for further improvements, solidifying its contribution to the field of door security and home monitoring.

## 3. METHODOLOGY

Block diagram for implementing the smart robotic vacuum cleaner is shown in the figure. The block diagram depicts how the complete system works as well as the input and output phases. In this particular project, an ESP32 CAM module was utilized to construct a Wi-Fi door lock system. The ESP32 CAM module is an affordable development board that incorporates a mini SD card slot and a compact OV2640 camera. It boasts impressive features, including a 7-stage pipeline architecture, two high-performance 32-bit LX6 CPUs, and integrated Bluetooth and Wi-Fi capabilities. By leveraging the capabilities of the ESP32 CAM module, a Face Recognition-based Door Lock System was developed. The system integrates a Transfer module, which is responsible for capturing and processing facial images, and a Solenoid Lock, which controls the physical locking mechanism. The system utilizes the built-in Wi-Fi capabilities of the ESP32 CAM module to connect to the local network, enabling remote access and control of the door lock.

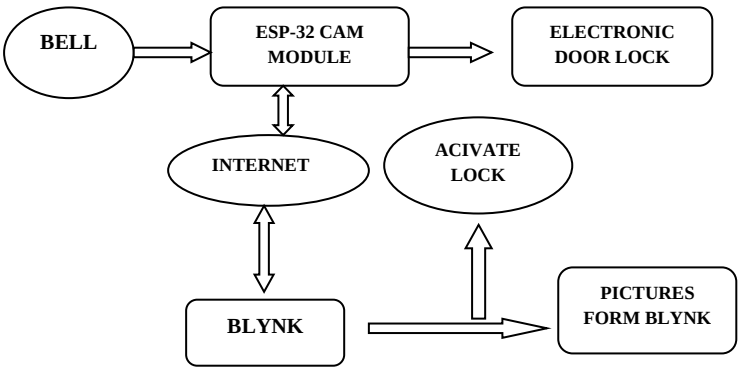


**FIGURE1.** Block Diagram

The Face Recognition-based Door Lock System offers several advantages over traditional lock systems. Firstly, it eliminates the need for physical keys, which can be lost or stolen. Instead, users can gain access by simply presenting their face to the camera for authentication. This not only enhances security but also adds convenience to the user experience. Additionally, the integration of Wi-Fi connectivity enables advanced features such as remote monitoring and control. Users can receive real-time notifications on their smartphones when the door is accessed or attempted unauthorized access is detected. They can also remotely grant or revoke access permissions to individuals, providing a flexible and customizable security solution. the development of a Wi-Fi door lock system using the ESP32 CAM module demonstrates the continuous advancements in the field of home appliances and personal security. The integration of face recognition technology and Wi-Fi connectivity adds an extra layer of convenience and control to traditional door lock systems. As technology continues to

evolve, we can expect further enhancements in the field of digital door locks, offering improved security and seamless integration into our daily lives.

## 4. FLOWCHART

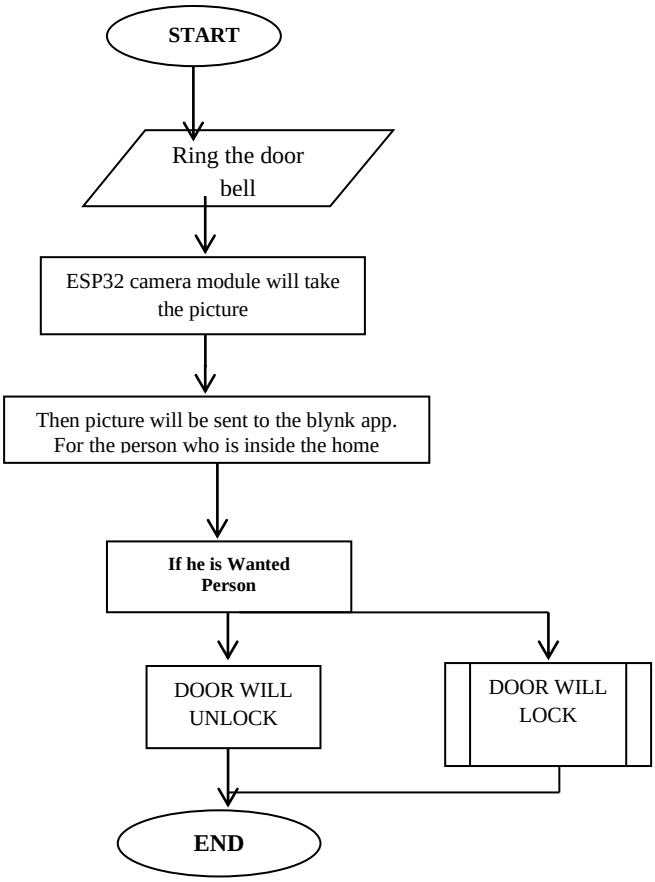


**FIGURE 2.** Flowchart for the proposed method

The below flowchart, the WiFi door lock system operates with a simple yet efficient flow chart. Using the Blynk app, the homeowner can monitor the door's state, enabling them to lock or unlock it conveniently. The authentication procedure, which requires a smartphone, ensures that only authorized individuals can enter the home. Once the authentication is successful, the control device receives this information and promptly opens the door as needed. With the installation of a smart door lock system, traditional keys become unnecessary, allowing homeowners to enter their homes effortlessly. This innovative solution not only provides convenience but also enhances home security through smart door locks.

Esp-32 Camera Module: The ESP32 camera is a small, low-power microcontroller board equipped with a camera module, based on the popular ESP32 system-on-a-chip (SoC). The ESP32 itself is a powerful Wi-Fi and Bluetooth-enabled microcontroller with dual-core processors, making it an ideal platform for IoT (Internet of Things) projects. The addition of a camera module makes it capable of capturing images and videos, opening up a wide range of applications. The ESP32 camera module typically features a 2-megapixel sensor and supports image resolutions up to 1600x1200 pixels. It can also capture video at resolutions up to 640x480 pixels. The module interfaces with the ESP32 through the Serial Peripheral Interface (SPI) and comes with a built-in lens. Additionally, it has GPIO pins that allow for connecting external components or sensors, increasing its versatility. The ESP32 camera module can be programmed using the Arduino IDE or the ESP-IDF framework, which provides a set of libraries and tools for developing applications specifically for the ESP32 platform. This makes it accessible to both beginners and experienced developers. The ESP32 camera's capabilities make it suitable for various applications such as surveillance systems, home automation, robotics, and image recognition. For example, it can be used to create a smart doorbell that captures images or videos of visitors, or a security camera that streams footage over Wi-Fi. Its low power consumption makes it suitable for battery-powered applications as well.

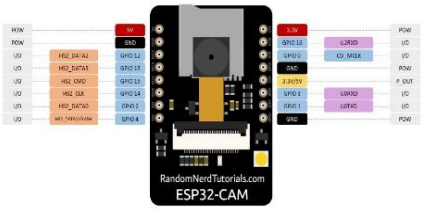


**FIGURE 3.** Pin Configurations forEsp-32 camera Module

Electonic Door Lock: An electronic door lock is a modern security device that replaces traditional mechanical locks with an electronic mechanism for controlling access to a door. It offers enhanced convenience, flexibility, and security compared to traditional key-based locks. Electronic door locks come in various forms, such as keypad locks, card-based locks, fingerprint scanners, and smart locks.Keypad locks require users to input a predefined code on a numeric keypad to unlock the door. This eliminates the need for physical keys and allows for easy code changes, granting access to multiple users without distributing physical keys.Card-based locks use RFID (Radio Frequency Identification) technology to unlock doors. Users are provided with RFID cards or key fobs, and when presented to the lock, it reads the card's information and grants access if authorized.Fingerprint scanners utilize biometric technology to authenticate users based on their unique fingerprints. By scanning and matching the fingerprint pattern, the lock grants access to authorized individuals, eliminating the need for keys or codes.Smart locks are the most advanced form of electronic door locks, as they integrate with smart home. systems and offer remote control and monitoring capabilities. Smart locks can be operated through mobile apps, allowing users to lock or unlock the door remotely, receive notifications about access events,and grant temporary access toguests or service providers.Electronic door locks provide several advantages over traditional locks. They offer convenience by eliminating the need for physical keys and the hassle of carrying them around. They also enhance security by offering features like anti-tampering mechanisms, alarm systems, and audit trails that track access events. In addition, electronic locks can be easily integrated into existing security systems, enabling centralized control and monitoring.Overall, electronic door locks provide a modern, efficient, and secure solution for controlling access to doors in residential, commercial, and institutional settings. Their flexibility, convenience, and advanced features make them a popular choice for enhancing security and streamlining access control.

**FIGURE 4.** Electronic Lock

7805 Voltage Regulator: The 7805-voltage regulator is a popular and widely used integrated circuit (IC) that provides a constant output voltage of +5 volts. It is part of the 78xx series of voltage regulators, which are designed to regulate and stabilize voltage in electronic circuits. The "78" in the name represents the voltage output, and the "05" indicates that the output voltage is +5 volts. The 7805 voltage regulator is a three-terminal device with an input terminal, an output terminal, and a common ground terminal. It operates by taking in an unregulated DC input voltage, typically between 7 volts to 35 volts, and providing a stable +5 volts output voltage. This makes it suitable for a wide range of applications where a constant and reliable power supply is required. One of the key features of the 7805 voltage regulator is its ability to handle a significant amount of current. The typical output current rating of the 7805 is around 1 ampere, which means it can supply up to 1 ampere of current to the load while maintaining a stable +5 volts output. This makes it suitable for powering various electronic components and low-power devices. The 7805-voltage regulator also includes built-in

protection features, such as thermal overload protection and short-circuit protection. These safeguards help prevent the IC from overheating or getting damaged in case of a fault or excessive current flow. To use the 7805-voltage regulator, it is necessary to connect appropriate input and output capacitors to stabilize the voltage and reduce noise. The input capacitor helps smooth out any voltage fluctuations or spikes, while the output capacitor helps to further stabilize the output voltage. In summary, the 7805-voltage regulator is a widely used IC that provides a constant +5 volts output voltage, making it an essential component in numerous electronic circuits and devices.


**FIGURE 5.** 7805 Voltage regulator

FTDI FT232: The FTDI FT232 is a popular USB-to-serial bridge controller developed by Future Technology Devices International (FTDI). It provides a simple and efficient way to connect peripheral devices that use a serial interface, such as microcontrollers, to a computer or other USB-enabled devices. The FT232 chip integrates a USB 2.0 full-speed controller and a UART interface, allowing bidirectional data transfer between USB and serial interfaces. It supports multiple baud rates and data formats, making it versatile for various applications. The FT232 also includes a built-in EEPROM for storing device-specific information and configuration settings, which can be accessed and modified through the USB interface. One of the key features of the FT232 is its driver support. FTDI provides robust and reliable drivers for various operating systems, including Windows, macOS, and Linux, ensuring broad compatibility and easy integration into different platforms. The drivers create a virtual COM port on the host system, enabling seamless communication with the connected serial device using standard serial APIs. The FT232 has gained significant popularity in the electronics and embedded systems community due to its simplicity, reliability, and widespread availability. It has been widely adopted in numerous applications, ranging from industrial automation and robotics to hobbyist projects and educational purposes. In addition to the standard FT232 chip, FTDI also offers variations and improved versions, such as the FT232R, FT232H, and FT232RL. These variants provide additional features like enhanced baud rates, GPIO capabilities, and expanded functionality beyond serial communication. Overall, the FTDI FT232 has become a go-to solution for developers and hobbyists seeking a reliable and straightforward USB-to-serial interface. Their wide ranges of applications and strong driver support have made it a popular choice for connecting serial devices to modern computers and other USB-enabled devices.

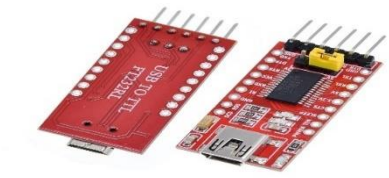

**FIGURE 6.** FTDI FT232

Arduinoide: The Arduino Software (IDE), commonly known as the Arduino Integrated Development Environment (IDE), consists of a menu development, a message locale, a message terminal, a toolbar with buttons for common cutoff factors, and a content leader for writing code. To transmit and receive tasks, it connects with the Arduino device. Drawings are programs created with the Arduino Software (IDE). These representations are stored in the record improvement ino and documented in the substance mechanical meeting. The head comprises highlights for cutting/staying and looking/dislodging text. The message area offers entry at the same time as saving, purchasing, and selling, and it also shows blunders. The manage neighborhood vicinity displays message yield using the Arduino Software (IDE), which contains full scale erroneous messages and distinctive data.

BLYNK APPL: Blynk is a popular mobile application that enables users to easily build and control Internet of Things (IoT) projects using their smartphones or tablets. It provides a user-friendly interface for connecting

various hardware components and creating interactive applications without the need for extensive programming knowledge. With Blynk, users can connect their devices to the app via Wi-Fi, Bluetooth, or even the internet, allowing them to remotely monitor and control their IoT projects from anywhere in the world. The app supports a wide range of hardware platforms, including Arduino, Raspberry Pi, ESP8266, and many others, making it versatile and compatible with various IoT devices. One of the key features of Blynk is its drag-and-drop interface, which allows users to quickly and easily create custom dashboards for their IoT projects. Users can add buttons, sliders, graphs, and other widgets to the dashboard and configure them to control or display data from their connected devices. Blynk also provides a library of pre-built widgets that can be easily customized to suit the project's requirements. Another important aspect of Blynk is its cloud-based infrastructure. The app communicates with the user's hardware devices through the Blynk Cloud, which ensures secure and reliable connectivity. The cloud also provides data logging and push notification services, allowing users to receive alerts and monitor their IoT projects' performance. Blynk supports both iOS and Android devices, making it accessible to a wide range of users.

## 5. EXPERIMENT OUTPUT

Solid- The image provided showcases the outcome of an IoT-based project focused on enhancing home security. The project involved the creation of a Smart door lock with camera surveillance using the ESP32-CAM and Blynk app. The objective was to allow homeowners to identify individuals at their doorstep when the doorbell is pressed, by accessing the ESP32 camera. Once verified, the homeowner could conveniently unlock the electric door lock from their authenticated mobile phone through the Blynk application, utilizing touch methods. The implementation of this IoT-based smart door lock with camera surveillance using the ESP32-CAM significantly

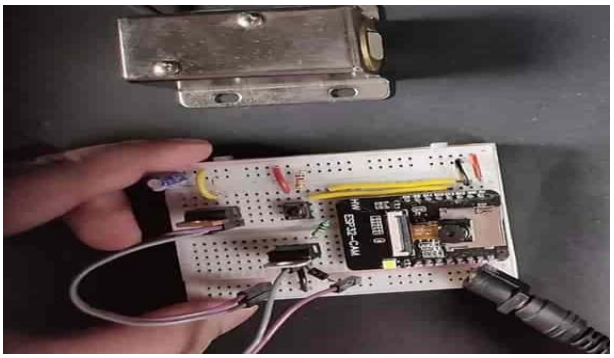

**FIGURE 7.** Experiment Output

elevates home security. By incorporating the Blynk app as the communication protocol between the smartphone and the electric door lock, seamless interaction is achieved. This approach proves particularly relevant in the current COVID situation, as it minimizes physical contact with the door while allowing the homeowner to assess whether the visitor is wearing a mask or not. Overall, this IoT solution effectively combines the convenience of remote control and monitoring with heightened security measures. By leveraging the capabilities of the ESP32-CAM and Blynk app, homeowners can ensure the safety of their premises, make informed decisions about granting access, and maintain a touch less operation of the door lock. This innovative integration of IoT and surveillance technologies contributes to a more secure and contactless living environment.

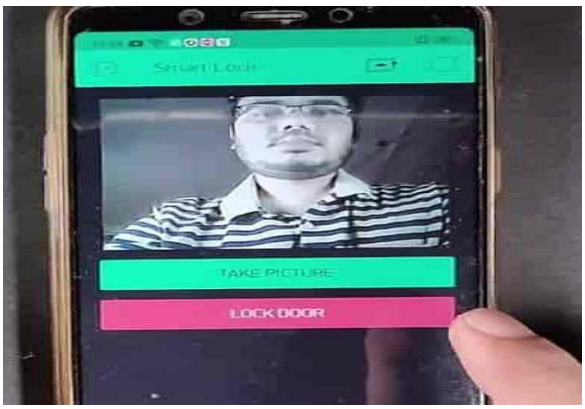


**FIGURE 8.** Output image

## 6. CONCLUSION

In conclusion, the integration of a door lock mechanism with visual monitoring in an ESP32 camera door lock project holds tremendous potential in enhancing security and convenience for users. By enabling remote access and control of the door lock system through smartphones or computers, this project offers the convenience of managing access to premises from anywhere, adding flexibility to users' lifestyles. The inclusion of a camera module further elevates the system's functionality, allowing for real-time visual monitoring, motion detection alerts, and the ability to review captured images or videos. However, it is crucial to acknowledge and address potential limitations and challenges, such as ensuring stable connectivity and meeting power requirements, to ensure the system's reliability and effectiveness. Overcoming these obstacles will be vital for the successful implementation and widespread adoption of this project. Overall, the ESP32 camera door lock project presents an innovative solution that seamlessly combines security and convenience, empowering users with advanced access control and monitoring capabilities for enhanced peace of mind.

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