IOT BASED SMART DOOR LOCK SYSTEM

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ABSTRACT

Doors are designed for safety, protection of people, places and properties which should be kept locked when not in use to have a secured home, but there has been high level of concern with issues of security and safety with doors and its structure. At present, most doors are under mechanical lock and key which are not adequately secured from authorized individual. This smart door lock system with embedded spy camera as security solution used to view video of a persons who tries to accessor gain entrance to home and to ensure that guest is not under attack while granting access to the door. The method of implementation involves the use of ESP-32 enabled interfaced with Arduino Uno microcontroller-ATMEGA328P to control the locking and unlocking process of the door. Designing and implementing a security system for door locking purpose based on monitoring camera, alarm system and web app. The system uses a camera for video surveillance and it remotely transmits video images to the phone/computer using Wi-Fi as medium and allow door control from any location. This system is enabled when a command is received from its mobile app, the door is opened and authorized user is allowed access to the house. The entrance door is closed after few microseconds to prevent unauthorized users gaining entrance.

Keywords: Embedded Spy Camera, ESP32 CAM, Arduino Uno Microcontroller-ATMEGA328P, Alarm System And Web App (Blynk App).

I.   INTRODUCTION

In terms of house security, the door is crucial. To keep the residence secure, the owner will keep the door always locked. However, owing to a rush when leaving the house, the house owner may forget to lock the door, or they may be unsure if they have closed the door or not. In this paper, we have presented a smart Wi-Fi Door Lock using the ESP32 CAM and the Blynk App. The owner can also unlock the door from a mobile phone after checking the photo. The proposed Door Security System application uses Wi-Fi Door Lock with ESP32 CAM and Internet of Things (IoT) technology to monitor the status of the door, manage the door, and increase security in a home. Blynk is a communication protocol that connects a smartphone to a door lock system and is used to increase the security of a home. Keywords-IoT based door lock, Wi-Fi lock system, House security, ESP32 Camera, Blynk, TCP/IP. Digital door locks have grown quite prevalent in recent years as technology has advanced and the use of IoT has increased.

A digital lock does not require a physical key to operate, instead relying on Radio-Frequency Identification (RFID), fingerprint, Face ID, pins, passwords, and other methods to do so. Using these diverse technologies, we have previously built a number of digital door lock applications. In our project, we are using (ESP32 CAM) to create an IoT-based Wi-Fi Door Lock system. The AI-Thinker ESP32-CAM module is a low-cost development board with a micro-SD card port and a small (Omni Vision's) OV2640 camera. It has a built-in Wi-Fi ESP32 S processor with two high-performance 32-bit LX6 CPUs and a 7-stage pipeline architecture. Door Security System application uses ESP32 CAM and Internet of Things (IoT) technology to monitor the status of the door. Blynk is a communication protocol that is used between a smart phone and a door lock system.

II.   LITERATURE REVIEW

Since past few years most of the industries are working in the fields of machine learning, artificial intelligence, big data analytics, IoT based project the major moto of all these is to make things easy and smart. These became need for digitalizing with lot security tools by these our daily life locks become smart and also introduced the locks movable with stepper motor and need to digital number pad to get input from user, and it need to add

infrared or any Bluetooth module to operate all these devices. A major difference in face recognition door lock is that no need to use stepper motor and the application detects the face with stored images in the application program in our application. We have eliminated unwanted components of stepper motor and drivers which are in existing models. We have added newer and unparalleled features of facial detection as an access point to open or close the door. Where it is the combination of relay module and solenoid lock for opening the door and it is unique and user friendly. Here have been used USB attachable with HD WebCam to do efficient and dependable facial detection and it can be stored by using cloud computing for future need.

This facial recognition door model allowing people to get more interested in because of its features and advantages and also due to its functionality. There are some of drawbacks in that based on that the industries working in this field and improving the security models day by day.

Currently, there are lots of fraud things and thefts are going on, became significant issues for all. Even if we have locks to the door, others can enter inside by getting key but if we have password lock also they can get and access it by these modern technology. By these the facial recognition doors become more secure in these field, here we can use biometric for face recognition, so others cannot enter inside. In this new era face recognition plays important role for security and privacy purpose. These face recognition identify the people, who the person is, if the face is matched with stored database then it will automatically open the door otherwise it will be sent an alert message to the owner.

RELATED WORK

The most commonly used system for locking and unlocking the door is a lock and a physical key. The entire process is a mechanical one. If the key is lost, misplaced or stolen, then the entire locking mechanism has to be replaced. This problem with the physical keys intensifies when it comes to big companies where employees are needed to carry several keys for different doors. Apart from the extra burden, all the keys add to become vulnerable to getting lost. An alternative used for physical keys currently is RFID (Radio-Frequency Identification). There are RFID cards being used as pass keys. The RFID card reader unit is installed near the door. When the card is brought near the reader, it identifies the radio frequency of the card and thus verifies the key. Multiple cards can be paired with the device. But again they are vulnerable to theft or getting lost. It also does not solve the purpose of not carrying a key.

Just like traditional keys, you can forget your keycard. It is possible the system can be hacked or bypassed by someone who is tech-savvy, so they aren't foolproof. One major problem is that electric RFID systems may malfunction during power outages.

III.   THE HARDWARE

ARDUINO UNO

The Arduino UNO SMD is frequently used microcontroller board in the family of an Arduino. This is the latest third version of an Arduino board and released in the year 2011. The main advantage of this board is if we make a mistake, we can change the microcontroller on the board. The main features of this board mainly include, it is available in DIP (dual-inline-package), detachable and ATmega328 microcontroller. The programming of this board can easily be loaded by using an Arduino computer program. This board has huge support from the Arduino community, which will make a very simple way to start working in embedded electronics, and many more applications

Fig 1: ARDUINO UNO

ESP32 CAM MODULE

The ESP32-CAM may be a small size, low power consumption camera module supported ESP32. It has an OV2640 camera and provides onboard TF card slot. The ESP32-CAM are often widely utilized in intelligent IOT applications like wireless video monitoring, Wi-Fi image upload, QR identification, and so on. The ESP32 CAM Wi-Fi Module Bluetooth with OV2640 Camera Module 2MP For Face Recognition features a very competitive small-size camera module which may operate independently as a minimum system with a footprint of only 40 x 27 mm.

Fig 2: ESP32 CAM MODULE

FTDI CHIP

Original FT232R chips are one of the newer chips manufactured by FTDI (Future Technology Devices International). Apart from being an USB to serial UART, it has an integrated EEPROM and optional clock generator output. The chip also incorporates FTDI Chip-ID functionality (giving each chip a unique identifier for security) and USB termination resistors. Cloned boards (with a cloned chip) will likely exclude the unique ID functionality and does not include an EEPROM, meaning that signals cannot be inverted.

Fig 3: FTDI CHIP

SERVO MOTOR

SG90 servo motor is the cheapest servo motor available on the market. If you have an SG90 servo motor and you don't know what to do, this article is for you. In this article we will introduce sg90 servo motor. We'll share the sg90 pinout scheme. At the end of our article, we will share best 10 sg90 servo motor projects.

Fig 4: SERVO MOTOR

IR SENSORS

An infrared (IR) sensor is an electronic device that measures and detects infrared radiation in its surrounding environment. Infrared radiation was accidentally discovered by an astronomer named William Herchel in 1800. While measuring the temperature of each color of light (separated by a prism), he noticed that the temperature just beyond the red light was highest. IR is invisible to the human eye, as its wavelength is longer than that of visible light (though it is still on the same electromagnetic spectrum). Anything that emits heat (everything that has a temperature above around five degrees Kelvin) gives off infrared radiation.
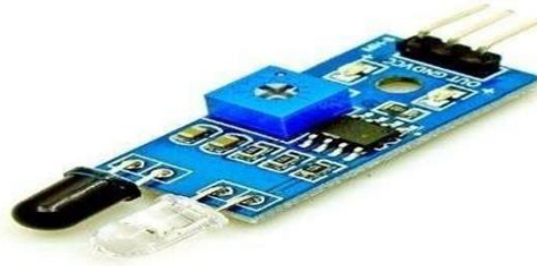
Fig 5: IR SENSORS

RELAY MODULE

A Relay is a device that opens or closes an auxiliary circuit under some pre-determined condition in the Main circuit. The object of a Relay is generally to act as a sort of electric magnifier, that is to say, it enables a comparatively week current to bring in to operation on a much stronger current. It also provides complete electrical isolation between the controlling circuit and the controlled circuit. Relays are the switches which aim at closing and opening the circuits electromechanically.

Fig 6: RELAY MODULE

PUSH BUTTONS

A Push Button is a type of switch work on a simple mechanism called "Push-to-make". Initially, it remains in off state or normally open state but when it is pressed, it allows the current to pass through it or we can say it makes the circuit when pressed. Normally their body is made up of plastic or metal in some types.
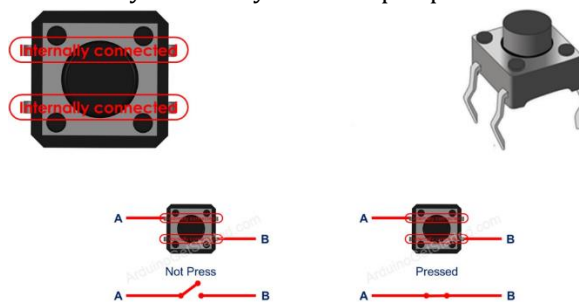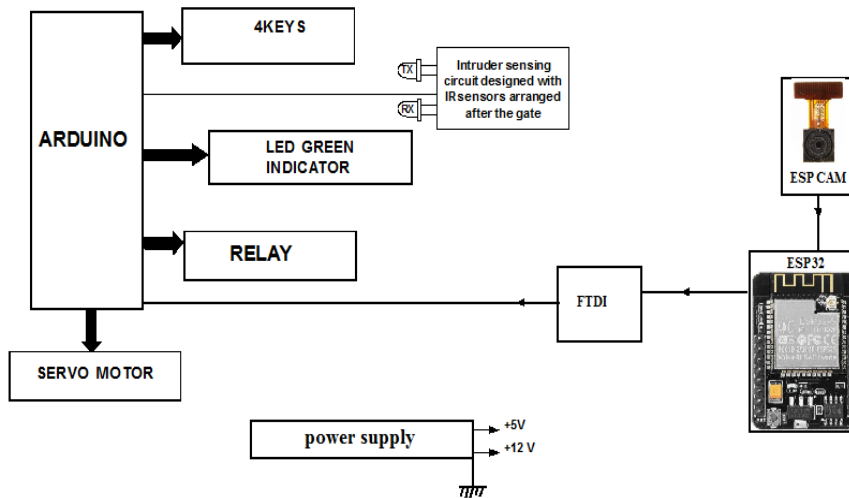

Fig 7: PUSH BUTTONS

DC PUMPING MOTOR

DC powered pumps use direct current from motor, battery, or solar power to move fluid in a variety of ways. Motorized pumps typically operate on 6, 12, 24, or 32 volts of DC power.


Fig 8: DC PUMPING MOTOR

BLOCK DIAGRAM

Fig 9: BLOCK DIAGRAM

IV.   METHODOLOGY

For developing face recognition door we need set of electromagnetics like ESP32 CAM (for capturing face), UART TTL programmer, Relay module, Solenoid lock, LED(red and green), Breadboard (for connections) , 12v power supply or battery also we can use , 7805 regulator (it gives 5 volt), 100uf 16v Capacitor and wires for connecting. Now lets see the connections are made for face detection automatic door lock system with ESP32 cam board. First 3volt power module (if we have any error with 3v we can shift to 5v also) and ESP32 cam should be connected to breadboard in the breadboard holes and then wires should be connected in bread board, where red wires indicates -ve and green wires indicates +ve. Then we need a code (mostly c# will be used) for developing these in that code we should add Wi-Fi name(Wi-Fi SSID) and Wi-Fi password ,before moving to further steps we need to select few options from tools tab. Then we have to upload breadboard details and code to it by jumper cap which is from IO 0 and ground. We have to select baurd rate and need to restart to get IP address for further process, then we will get IP address that we need to copy the address and open it in our browser. After that we need to connect all the components of the project to breadboard where we have 7/8 0-5 regulator to get 5 volts from 12 volts because the ESP32 cam will work on 5volts and also our relay module works on 5volts. The reason for using 12 volt or a 9volt battery is that our solenoid lock works on 12 or 9 volts, if we are separately using 5volt then we no need to use regulator. After completion of all connections, we can see red LED light turns on that indicate the power.

The following flow charts depicts how the system works
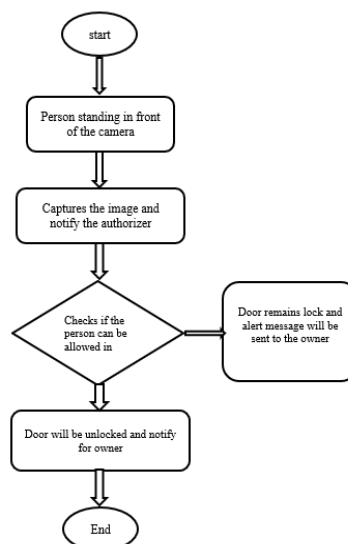
Fig 10: Flow chart

V.   SOFTWARE

ARDUINO IDE SOFTWARE

It's free software that allows us to develop and upload code to Arduino devices. This software can be run on many operating systems or platforms such as windows, Linux, and Mac OS. C and C++ have supported programming languages. This software combines standard inventor tools into a single user interface for creating apps for several operating systems. It is very similar to C Language and it is based on a hardware programming language named processing. An Arduino IDE is required for uploading the sketch on the board.

SOFTWARE SERIAL

The Arduino hardware has built-in support for serial communication on pins 0 and 1 (which also goes to the computer via the USB connection). The native serial support happens via a piece of hardware (built into the chip) called a UART. This hardware allows the Atmega chip to receive serial communication even while working on other tasks, as long as there room in the 64 byte serial buffer.

The SoftwareSerial library has been developed to allow serial communication on other digital pins of the Arduino, using software to replicate the functionality (hence the name "SoftwareSerial"). It is possible to have multiple software serial ports with speeds up to 115200 bps. A parameter enables inverted signaling for devices which require that protocol.

VI.   RESULTS AND DISCUSSION

In this IOT based working model, we have made a Smart door lock using ESP32-CAM and the Blynk App. In this model, when someone comes in front of the door, the house owner will get a notification on the mobile with a photo of the visitor. After checking the photo, owner can unlock the door from an authenticated mobile phone.

Table 1. Door operations by using Blynk app Authentication

SN.	Model Type	Seismic Zone
1	If the image of person received through blynk app notification is known	Door will unlock
2	If the image of person received through blynk app notification is unknown	Door will be locked and the owner can take action using the pepperspray.
3	If the owner is unavailable to authorize a known person being busy	Door will unlock will the person uses the unique number key unlock system.
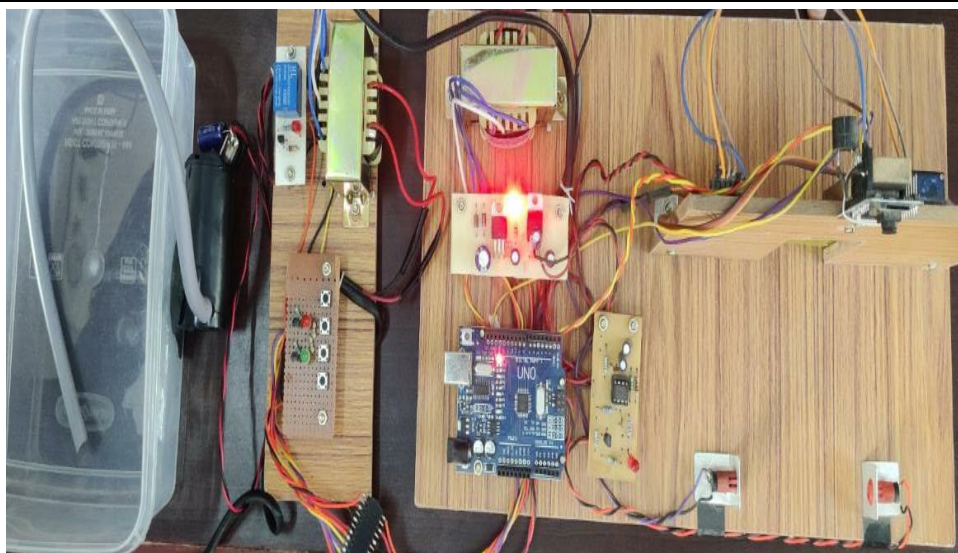
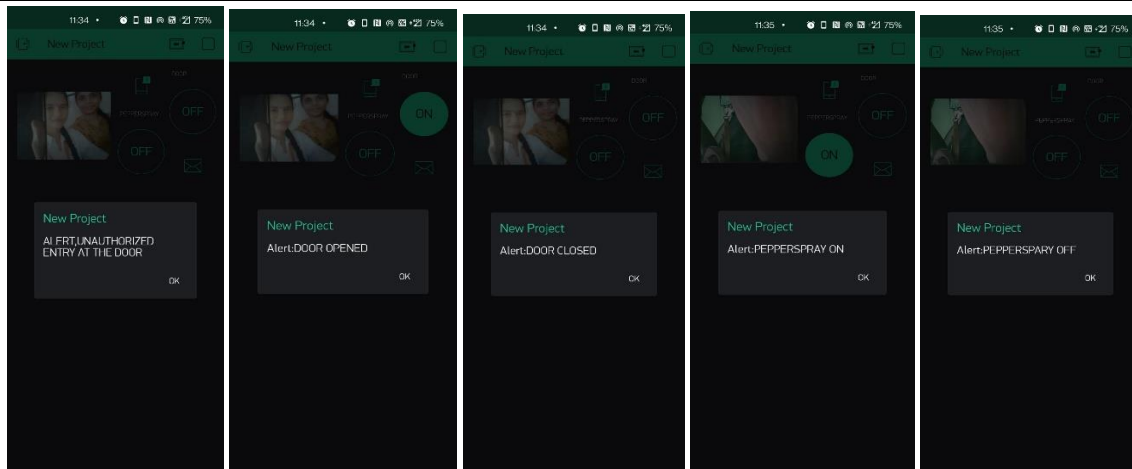**Fig 11:** IMAGE OF SMART DOOR LOCK SYSTEM

Fig 12: SCREENSHOTS ON BLYNK APP

VII.   CONCLUSION

The major goal of this project is to develop a system that provides a robust security system to the user that the user can trust easily. This system is inexpensive and simple to set up. It is a durable and multiple mode device that can be operated by a single tap on the app. The door will close automatically 15 seconds after opening. It has many features like notification alert, multiuser function, activity monitor, only admin access, etc. It is designed keeping in mind the safety of the user

VIII.   FUTURE SCOPE

- New emergency call feature to directly call the police.
- New feature for two-way communication between the owner of the door and the guess.
- The android application should be able to manage more doors, windows, and basic home electronic equipment in the future.
- To assure the system's completeness, a battery backup system should be considered.
- By using AI we can control door locks using face detection and for registered faces.

IX.   REFERENCES

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