Face Recognition Door Lock Security System Using ESP-32 CAM

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Abstract— in today's era of automation and smart devices, there is crucial need to alter the security measures of system as privacy and security are notable issues in the information system. It is difficult to trust blindly on traditional and simple security measures of the system. In traditional system many of the doors are having mechanical lock which was restricted on the number of keys. This article proposes Smart Door Unlock System based on Face Recognition to enhance the security. In this system camera sensor is used to capture the face and image matching algorithm will be used to detect the authenticated faces. Only the person whose face is matched can be able to unlock the door. So, limitation of managing keys will be resolved. Only the person whose face is matched can be able to unlock the door. So, limitation of managing keys will be resolved. The security system is also made by means of maintaining into the eye of old age humans for whom it is hard to open the door manually. This system will not only enhance the security but also make the system keyless. Proposed system will be robust from hacking attacks as we are proposing machine learning based approach. [1]

Keywords— IOT, Face Recognition, Machine Learning, Smart Door Security. [1]

1. INTRODUCTION

In order to keep the house safe from outside threats, a door is an important first line of defense. Thieves will have an easier time stealing from a residence if the door is easy to access. In the beginning, a door would only have a physical key to lock or unlock it. However, as technology progressed, a new kind of door emerged— the digital door—that could lock or unlock itself. But it's also possible for the digital door to be damaged or destroyed when the property is unoccupied, and the inhabitants won't know about it until they go home.

The residents will never leave the door unlocked, whether they are leaving the house or just sleeping inside, in order to keep the residence secure. But as a result of being in a rush to leave the house or just not sure if they have secured the door, people sometimes fail to do so. One thing that might compromise home security is this. The Internet of Things (IoT) is a system that allows everyday things and people to have unique identifiers and transfer d a t a a c r o s s n e t w o r k s without the need for human- to-human or human- to computer handshakes. IoT makes advantage of sensors' capabilities, such as infrared (IR) sensors' capacity to detect motion, magnetic (MM) sensors' ability to determine if a door is open or closed, and internal touch sensors' ability to determine if the sensor is being touched or not. Smartphones have begun to use face detection in recent years. This is a fantastic piece of technology that will allow us to open locked phones or any app with stringent security requirements. Here we will attempt to build a simple project using ESP-8266 that uses our face as an ID. For video streaming and facial recognition, you may use the sample code that

comes with the ESP8266 board, which is Camera Web Server. We built a Face Detection Door Lock System with ESP-8266 as part of this project. Any time the smart lock recognizes an enrolled face, it unlocks immediately. The ESP-8266 module makes this a simple yet practical home automation project.[2]

2. LITERATURE SURVEY

We have found various documents identified by the security framework. The author in supervised classification. A 2D filter bank is used and produces a solid 3D surface vector measurement applied to the monitored divider as well as a border-based face verification method used using this process to achieve a high level of visual acuity. The author of proposed an effective face detection algorithm. This paper introduces key image concepts, a well-functioning Ada Boost segment and segmentation thus reducing computation and resulting in a more efficient and faster acquisition algorithm. The author proposed a system to ensure vehicle safety. The program is based on Arduino and captures a picture of someone trying to launch a car. The algorithm used for facial recognition is PCA. Authors in Used Embedded forum which was very different and easy to use. They have suggested how to take an image on an embedded system based on the Arduino board. The author is developing a project called "Arduino Face Recognition in Treasure Box" which is a good example of how to use an Arduino camera and Pi with Open CV computer algorithms. By combining the latest version of Open CV, it can access the latest Computer visibility algorithms and is as interesting as face recognition. The author of has built a system with an advanced surveillance camera that can detect faces and at the same time detect faces that are detected using the OPENCV library, the Eigen face methodology method and all of these processing has been done in Raspbian OS in Arduino. The authors of have

proposed the use of an Arduino 2 B + model with a camera connection to capture the image and convert this image to a gray image with a digital image processing algorithm. The author of has suggested that the real-time application of the Face Recognition concept by producing the MATLAB code using the image detection toolbox in the basic method used by PCA using Eigen faces. Authors in have used a security system where when anyone comes to the door they are notified by the homeowner via email and twitter where the user can see the person standing at the door using a remote camera.[3]

3. SYSTEM ANALYSIS
a. Existing System

Traditional key systems need you to either physically visit a key-cutting business to obtain keys for approved individuals or to conceal your key in plain sight outdoors.

Those with the highest expertise may be the ones who breach electronic lock codes. Since it is simpler to guess the number on crucial days, it is advised that you select a random password if your password is critical. This will enhance your security. Fingerprint scan door locks need electricity to function, therefore they may be rendered useless in the event of a power outage, in case you are unaware of the pros and cons of obtaining a biometric entry door lock. With the advent of the IoT, home automation has made great strides forward. There is a low-cost passive method that can operate many things by detecting the individual's infrared signal.[1]

4. PROPOSED MODEL ARCHITECTURE:

a. Block Diagram
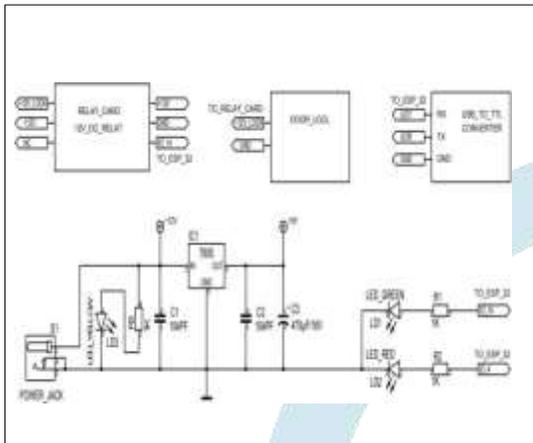
5. PROPOSED SYSTEM

An internet of things (IoT) system that uses face recognition to open doors is currently in development. Now we'll see how it operates: Control Internet of Things capabilities with an in-person system. Our team is currently developing an IoT capability that will enable you to manage the gateway directly from the exit page. Now we'll see how it operates: Our current project is a "IOT-based gateway system employing face recognition" that will allow users to enter portals through the Internet of Things. In order to answer certain exam questions, the smart door system must be changed. It is necessary to modify the smart door system in order to resolve some test issues. Deploying hardware, software, and tablets is all part of the methods it offers for creating complicated building connections. In contrast to runners, this frame shows an effort to identify the owner-conscious individual trying to get into the sand. You may access your images whenever you want because they are kept in the cloud. In this approach, the data you'll require in the future is stored on the cloud. An ESP8266 battery with door and knob controls is a great feature of this system. These services need the development of separate apps in smart gate systems because of communication issues. Complex compilation systems, hardware-integrated systems, computer control systems, and computer hardware are all part of the computer hardware that we provide for sale. A photo booth is used in these photographs to segregate people, unlike backpackers. Some people break into houses in an effort to help the people living there. [3]

6. COMPONETS:
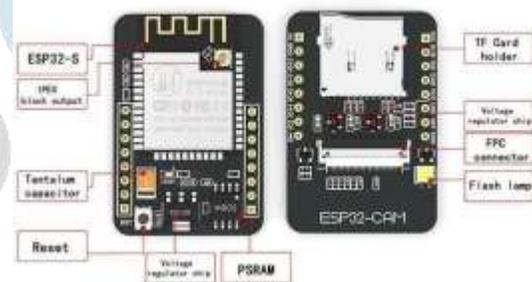
1. ESP32CAM

The ESP32-CAM is a miniature camera module that uses an ESP32-S processor. A OV2640 camera is included with the module. It also features a number of GPIOs that can be used to connect to external devices. The AI-Thinker board is the most popular in the ESP32-CAM module, which is made up of various manufacturers. The controller is built on a 32-bit CPU that runs at up to 240 MHz. It has an internal 520 KB SRAM and an external PSRAM of 4M. It includes a Wi-Fi module (802.11b/g/n) as well as a Bluetooth / BLE SoC. The board is food safe and features a single reset button. However, if you put the Module on the baking board, you won't be able to use the Reset button, as shown below.As a result, when attaching any sensors or modules to the Board, jumper wires are recommended. On the board, there is an LED that can be utilized as an indicator. [3]

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7. SOLENOID LOCK:

The 12V Solenoid lock has a slanted cut slug and a beautiful mounting bracket. It's a basic cabinet, safe, or door that requires an

electronic key.
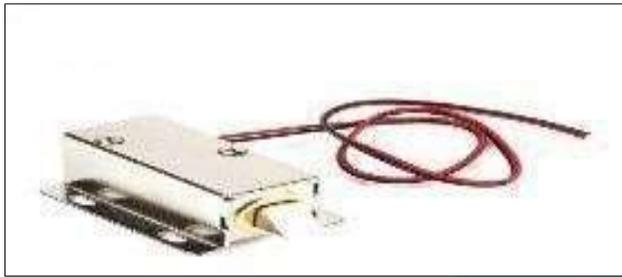
When 9- 12VDC is used, the slug pulls inwards, preventing it from coming out and allowing the door to open. In this circumstance, it does not utilize any electricity. Automatic door lock systems, such as electric door locks with mounting boards, are very simple to install. This solenoid is especially fine and durable. [3]

8. LEDs:
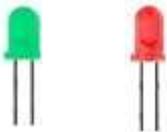
Longevity: LEDs can last more than 100,000 hours (10+ years) when used in limited specifications.

LEDs cannot withstand heat, cold, shock and vibration.[3]

9. RELAY:

A relay is an electrical device that uses electrical energy to turn on or off the switch contacts. The single- channel relay module is more than just an empty relay, it contains components that make switching and connecting easy and act as indicators to indicate whether the module is enabled and whether the relay is working or not.[3]

10. SOFTWARE REQUIREMENTS:

Arduino Integrated Development Environment (IDE)
Diagrams are programs built with the Arduino Software (IDE). These graphics are created with a text editor and saved as.ino files. Cutting and pasting, as well as searching and editing, are available in the editor. The message box reveals mistakes and provides feedback while storing and transmitting. The console shows text output from the Arduino Software (IDE), including entire error messages and other data. The fixed board and serial hole may be seen in the window's lower right corner. You can use the toolbar buttons to validate and upload programmes, as well as to generate, open, and save drawings and to launch a serial monitor.[3]

11. CIRCUIT DIAGRAM
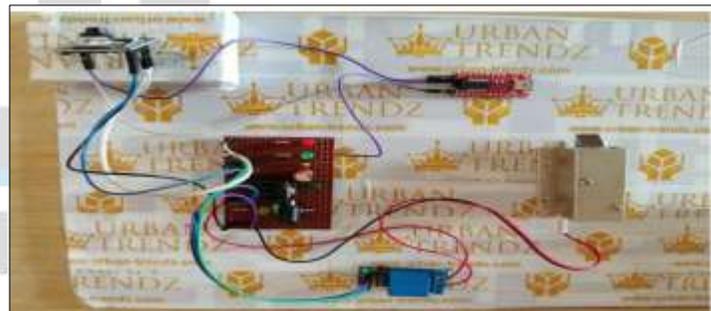
12. RESULT

With IoT, we may link many input/output devices, multiple sensors and actuators in the network so that they can speak for themselves, the data acquired from these items can be used to log, monitor, or operate other things without human intervention, and much more. As a result, IoT is analogous to global networks that connect objects to objects, people to people, and people to people. The Internet of Things (IoT) is the expansion of an existing internet hub for managing everything in the world today and in

the future.

Surveillance, according to this work, is the deliberate detection or monitoring of a person, circle, or other object specially one who is concerned or has doubts According to the application requirements, I created a system that includes a sensor, camera, CPU, relays, buzzer, LED indicators, and actuators for the purposes described above. In the local area, the system worked effectively and behaved as predicted. Because it is the most popular IoT platform for connecting devices to the cloud, building applications to remotely manage and monitor, and managing thousands of used products, the Blynk cloud server was appropriate for that type of application. From the example of a linked product to its marketing launch, Blynk software assists individuals and businesses in developing in a fluid manner.[3]

13. CONCLUSION:

The face recognition door lock system using ESP32-CAM is an efficient and secure way to control access to a door. this system provides a smart, easy- to-use solution for home or office security. It's cost-effective, customizable, and can be controlled remotely via Wi-Fi, making it an excellent choice for modern security applications. It also reduces the need for keys or traditional keycards, adding extra convenience and safety. the system uses a camera (ESP32-CAM) to capture your face and compare it to stored images. If the face matches, the door unlocks; if not, the door stays locked.

14. REFERENCES:

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b.   https://jespublication.com/uploads/2024-V15I4073.pdf
c.   https://www.ijert.org/face-recognition- for door-lock-and-unlock-system