IOT BASED WIFI DOOR LOCK USING ESP 32-CAM & FACE DETECTION SYSTEM

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ABSTRACT

Door plays an important role in home security. To secure the house, the occupants of the house will always have the door locked. However, sometimes the house occupants forget to lock the door due to hurry when leaving the house, or they may doubt whether they have locked the door or not. We propose an application called Door Security System which is based on Android using Internet of Things (IoT) technology to monitor the status of the door, controlling the door and increasing security in a house. MQTT cloud is utilized as the communication protocol between smartphone and door lock system. PIR sensor is implemented in the door lock to detect the movement near the door, while touch sensor is installed on the door handle to recognize the human hand. Should the door is opened by force, the alarm will ring and send notification to alert the house occupant on the existence of intruder in the house. The evaluation results show that motion detection sensor can detect movement accurately up to 1,6 meters ahead, and messages published between smart phone and door lock are encrypted properly so messages are safely sent. The Project reported here in and titled as "Design & Implementation of an IoT Networked Contactless Doorway Security System for Remote Monitoring and Control using ESP32-CAM and a Cloud Server". People want security in everyplace possible when they are into their homes or away from their homes. An anti-theft system is a device or method used to prevent or deter the unauthorized intrusion or trespassing activity in its coverage area. The implemented system was developed in combination of hardware and software. It's a unique security system made with low cost wireless camera and sensors which ensured remote monitoring and control of doorways. The system empowered the user to monitor the doorway by capturing images using a highperformance wireless camera i.e. ESP32-CAM connecting other devices and sensors in an IoT network. For other tasks like to control electronic door lock remotely, to click more pictures as well as to get notifications a cloud server application „Blynk" was used over the smart-phone. A major challenge was to develop this dynamic system with zero error, Real-time response and smooth performance, viable, smart and feasible..

INTRODUCTION

A Face Detection System: The acquisition module: This is the entry point of the face recognition process. It is the module where the face image under consideration is presented to the system. In other words, the user is asked to present a face image to the face recognition system in this module. An acquisition module can request a face image from several different environments: The face image can be an image file that is located on a magnetic disk; it can be captured by a frame grabber and camera. In this module, with the help of a pattern classifier, extracted features of the face image is compared with the ones stored in a face library (or face database). After doing this comparison, face image is classified as either known or unknown. Principal component analysis, based on information theory concepts, seeks a computational model that best describes a face, by extracting the most relevant information contained in that face. Eigen faces approach is a principal component analysis method, in which a small set of characteristic pictures, are used to describe the variation between face images. Goal is to find out the eigenvectors (Eigen faces) of the covariance matrix of the distribution,

Spanned by a training set of face images. Later every face image is represented by a linear combination of these eigenvectors.

Evaluations of these eigenvectors are quite difficult for typical image sizes but, an approximation that is suitable for practical purposes is also presented. Recognition is performed by projecting a new image into the subspace spanned by the Eigen faces and then classifying the face by comparing its position in face space with the positions of known individuals. Eigen faces approach seems to be an adequate method to be used in face recognition due to its simplicity, speed and learning capability. Experimental results are given to demonstrate the viability of the proposed "face detection method".

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The face detection problem is challenging as it needs to account for all possible appearance variation caused by change in illumination, facial features, occlusions, etc. In addition, it has to detect faces that appear at different scale, pose, with in plane rotations. In spite of all these difficulties, tremendous progress has been made in the last decade and many systems have shown impressive real-time performance. The recent advances of these algorithms have also made significant contributions in detecting other objects such as humans/pedestrians, and cars. Operation of a Face Detection System Most detection systems carry out the task by extracting certain properties (e.g., local features 3 faces are usually further processed to combine overlapped results and remove false positives with heuristics (e.g., faces typically do not overlap in images) or further processing (e.g., edge detection and intensity variance).

LITERATURE SURVEY

ESP32-cam Biometric system and a mobile device. Whenever an individual would stand in front of the door, the camera will detect and send image on the mobile device. User can control the door by using Smartphone. In the mobile device, specifications of appliances are given through which system can be controlled. When individual presence has been identified, web camera will get the signal then it will capture the image of the individual and send to user's mobile device via raspberry pi using Iota (Internet of Things) 6. Gupta, et.al. Proposed a remote access control door entry system for homes and office buildings 7. A remote access control system comprises of

the internet to control the devices and appliances at home or office, with the person controlling them from anywhere around the globe. The equipment used is an ESP32-cam, fdti232, camera for guest authentication, solenoid, blink app, and bell switch. When guests come to visit, the guests will push the bell switch and then the camera will detect a face and send notification to blynk cloud in front of the camera so that they can be photographed. Then, the photo take will be sent to the primary host blynk and maybe to the secondary host as well if needed with the subject "Someone at the door". If the primary host wants to open the door, the primary host can reply to the email with subject "Allow person". If the primary host does not want to open the door, the primary host can reply to email without changing any contents. The primary host has a time limit to answer whether to open the door or not. If the primary host does not answer, the system will send a guest photo to the secondary host and the guest will also be informed that the primary host does not answer. Secondary hosts have a time limit to answer whether to open the door or not. If the secondary host also does not answer, the system will inform the guest if there has been no reply 7. Kodali, et. al. proposed a home security system to detect intruder using ESP32 -CAM 8. When a camera is detected, the system will trigger a send image to the home owner. The owner then needs to decide whether it is an intruder or not.

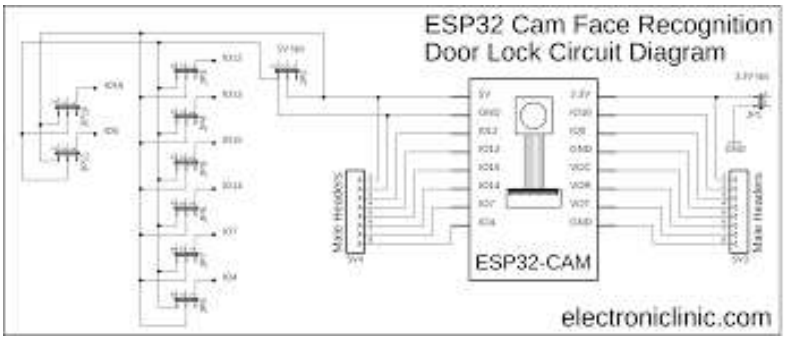
The research by Kodali2016 still didn't mention how the prototype may help the owner to differentiate between an intruder and a guest. However, it is mentioned to use camera in further research. Shoo and Patti proposed a model of home security system which included esp32-cam detection for generating alert and IP camera for verification 9. The model works over Zigbee protocol and is able to send images to the home owner's mobile phone using GSM. Tan war, et. al. also proposed a similar intrusion detection based on esp32-cam sand Camera 10. In the model, a single ESP32-cam minicomputer is connected to multiple sensors placed around a home/building. Upon motion detection, ESP32-cam the sends an blynk to the user. Kumar, et. al. proposed a model which for smart home security, which not only alert on intruder, but also on and gas using respective camera 11. Upon detection of one event by one of the sensors, the owner's mobile phone will be alerted via SMS or image using GSM module. Theresearch by Kodali2016, Sahoo, Tanwar, and Kumar didn't mention any means to lock or unlock the door, they are focused on intruder detection and remote alert to home owner. Prabaharan, et. al. did a research to implement smart home which included security modules, i.e. alarm buzzer and door lock/unlock 12. The MQTT-based prototype is connected to home owner's mobile phone using GSM module. From the home security perspective, the mobile phone can receive alarm buzz when there is a possible intruder and can lock/unlock the door. However, there are still no connection beteween these two security-related functionalities. The alarm buzzer and the door lock/unlocker are still separate modules. In a research by Pandit, et.al. 13, magnetic sensor is used to determine whether a door is closed or opened. An intrusion is detected when the door should be in locked condition but in reality opened. The magnetic sensor is also used to automatically lock the door when it is closed. In addition to the magnetic sensor, the model also incorporates door access authentication using owner's smartphone via bluetooth and face recognition over camera. Dutta, et. al. proposed a model for resident or guest authorization in public building using IoT 14. In the proposed model, a resident needs to have personal tapped to an ESP32-cam. Meanwhile, guest information needs to be input by the security of the building.

Using this mechanism, every activity of people going in/out of a building can be recorded in a database for future auditing. From the literature review that have been discussed, there are few researchers that discusses the IoT, home security system, and remote door. Therefore we make a research that can monitor and control the door remotely, receive alerts when a movement is detected near the door, grant a door

access to people who are trusted to control the door, view the door access history log and user access, get a notification that the door is still open after a certain limit time. The big differences between the related works and the system we proposed are that our program can give access to other users and the owner of the house can see the log history of door's activity such as who has opened or closed the door and, when the activity happen.

IMPLEMENTATION & WORKING

The below figure shows the complete circuit diagram of face detection include the few components like solenoid lock,12v power supply, 7805 regulator, ESP-32 CAM, relay module and LED.



Circuit diagram

IoT has been applied in previous researches in smart home technology to remotely control and monitor various appliances, namely fire, gas, water, air conditioner and fan 3 . Some research also focus on efficiency to lower energy consumption 4 . Some of research like the following, have been done about home security system. Agarwal, et.al. proposed a home security system called the HDSL system, which will give freedom of fear from laziness 5 . The HDSL system itself provides two main functions, namely 'Home Security', which can analyze people outside the door and 'Smart Locking', which can give members of the house the freedom to control the locking system via cellphone.

This system requires a Rasberry that controls hardware such as ESP32-cam,FDTI232 and electric locks. The method used in this research is to control the locking system using wifi and receive messages from the internet. The system will always start checking from the Bluetooth handshake. If a handshake occurs, the system will unlock the door, and after a specified time, the system will lock the door again. If there is no wifi handshake, the system will check whether it receives any message. If the system receives an 'unlock door' message, the system will unlock the door and will lock the door when the system gets a 'lock door' message. If there is no message, the system will check for the possibility of a guest. If there is a signal from the bell, the system will take photos through the camera and send the photo to the user's email. If there is no bell signal, and the motion sensor detects a movement, the system will assume there is an intruder, hence the system will take photos through the camera, send the photos to the user's blynk cloude as a warning and send a warning message via the internet as a warning of an intruder .

METHODOLOGY:

Security is at most concern for anyone nowadays, whether it's data security or security of their own home. With the advancement of technology and the increasing use of IoT, digital door locks have become very common these days. Digital lock doesn't require any physical key but it uses RFID, fingerprint, Face ID, pin, passwords, etc. to

control the door lock. In past, we have developed many digital door lock applications using these various technologies. In this tutorial we build a Face ID controlled Digital Door lock system using ESP32-CAM.

The AI-Thinker ESP32-CAM module is a low-cost development board with a very small size OV2640 camera and a micro SD card slot. It has an ESP32 S chip with built-in Wi-Fi and Bluetooth connectivity, with 2 high-performance 32-bit LX6 CPUs, 7-stage pipeline architecture. We have previously explained ESP32-CAM in detail and used it to build a Wi-Fi door Video doorbell. This time we will use the ESP32-CAM to build a Face Recognition based Door Lock System using a Relay module and Solenoid Lock.

Now navigate to the browser and enter the ESP IP address that is copied from the Serial monitor to access the camera streaming. It will take you to the streaming page. To start the video streaming, click on the 'Start Stream' button at the bottom of the page.

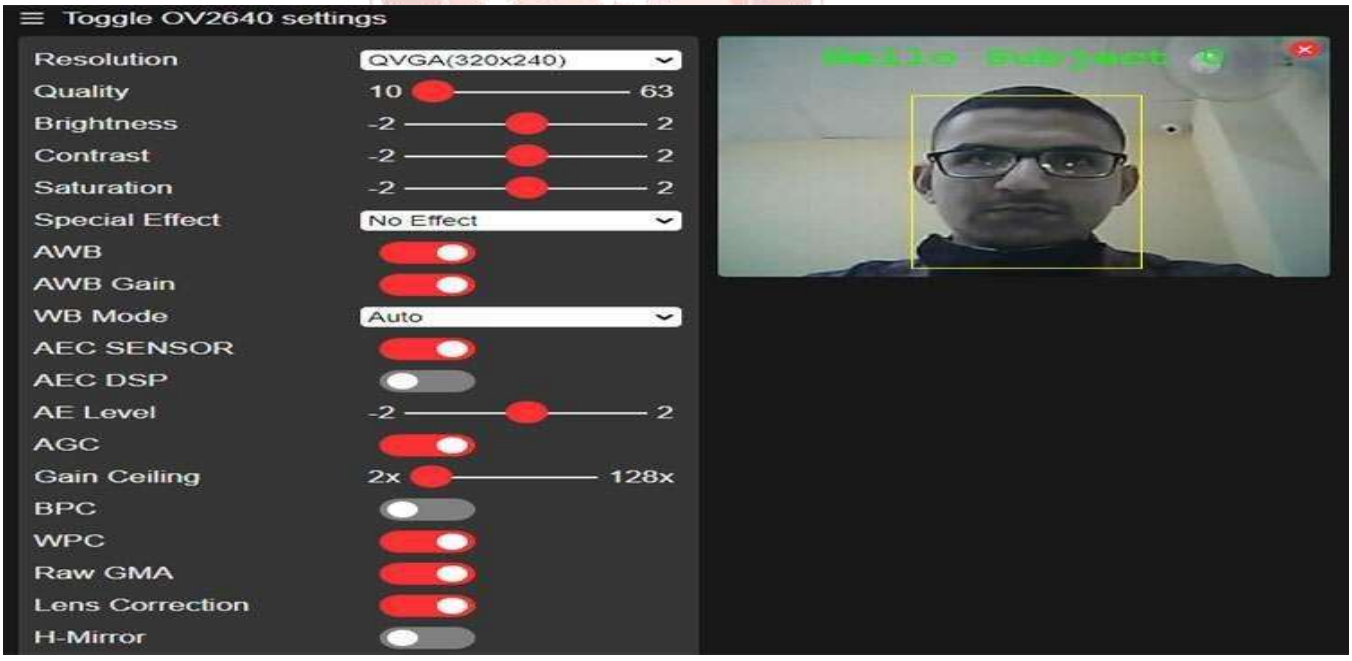
Step 1:

To recognize the faces with ESP32-CAM, first, we have to enroll the faces. For that, turn on the Face recognition and detection features from settings and then click on the Enroll Face button. It takes several attempts to save the face. After saving the face, it detects the face as subject 0 where zero is the face number.

Step 2:

After enrolling the faces, if a face is recognized in the video feed, ESP32 will make the relay module high to unlock the door.

Step 3:



CONCLUSION & RESULT:

This demonstrates that it is both dependable and enjoyable. It is only accessible from a distant point. Locker rooms, bank keys, auto doors, bank vaults, and home offices are all easy to use. It's a global perspective on what's dedicated to the Internet. We have successfully created a strong face-to-face export system that may be used as a low-cost project to replace fingerprint / facial recognition systems.

By the end of successful completion of this work it was concluded that through IoT we can connect multiple input/ output devices, multiple sensors and actuators in a network so that they can talk to each other, data acquired from these things can be used to keep a log or monitor or control the other things without human intervention and much more. Thus, IoT is like global networks which give the communication between things to things, human to things and human to human. IoT is the development of existing internet facility to manage everything which exists in the world or exists in the future. As per this work, surveillance is the procedure of close deliberate perception or supervision kept up over an individual, gathering, and so forth particularly one in care or under doubt. For the above-mentioned purposes, I developed here a system which was equipped with sensor, camera, processor, relays, buzzer, LED indicators and actuators as per the application requirements. The system worked well in the local environment and responded well as per the expectations. The Blynk cloud server was perfect for such type of applications as it is the most popular IoT platform for connecting devices to the cloud, designing apps to remotely control and monitor them, and managing thousands of deployed products. Blynk software helps individuals and organizations to seamlessly progress from a prototype of a connected product to its commercial launch. The software is super easy to use.. Very little coding is required and one can get a system up and running in no time.

Face and face design can be employed with this door lock system. The facial detection system allows authorized users to log in. Those who do not have access to it can use ESP32CAM to log in. The ESP32 CAM records the image of un authorized people and sends a notification to the owner. All of the data created is saved in the cloud. As a result, all control is in the browser. Utilizes a digital camera.

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