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Smart Door Lock System with Face Recognition Based on IoT

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ABSTRACT: As we know that today's era of digital world privacy and security of our loved ones is very important, So We have introduced this project. The aim of this project to makes every home secure and build modern, easily used smart door lock system. This smart door lock system is user friendly, convenient that allows user to unlock their home door better secure way. It allows users to open their home door remotely through IoT app, or by using face recognition through camera which is mounted front to the door. The system made of three components onboard logical unit, cloud system and IoT app. However instead of using door model we assume solenoid lock is door lock which is used for lock and unlock mechanism. This prototype system work on images instead of video due to this system cost efficient and also limit the internet traffic. This system captures images by the camera and saves photos in databases it will local system or clous system. Then facial recognition technology start works when any person detected in front of home system matches captures images to the known databases if found in the system database then door unlock if not found then system inform to the owner about unknown person through any type messaging system. This system includes raspberry pi, facial recognition technology, deep learning, IoT, security mechanism.

KEYWORDS: Deep learning, Facial recognition, Home security system, Internet of things (IoT).

I. INTRODUCTION

The important aim of this project was to design and build a door lock system that allows users to unlock a door via face recognition technology, through a camera implanted on the door. In today's world of connectivity need of smart devices which makes people's life easy. It is not the era when we can blindly trust the old and conventional security measures of door lock unlock system, specifically speaking is our door locks. To change and modernize any object we need to eliminate its existing drawbacks and add extra functionality.

The major drawbacks in a common door lock are that anyone can open a conventional door lock by duplicating or stealing the key and its simply impossible if we want our friends and family to enter our house, without being actually present over there. Thus, why not just eliminate these problems. So, to simply convert this normal door lock into a smart lock, which can open the door whenever we turn up in front of the gate or when we want it to open up for someone else without being physically present, we need to modify the door. So, an era has come where devices can interact with its users and at the same time ensure of their safety and keep improvising themselves. Nowadays, home security system is a crucial issue. Indeed, this system is to ensure properties and loves ones is always safe and protected.

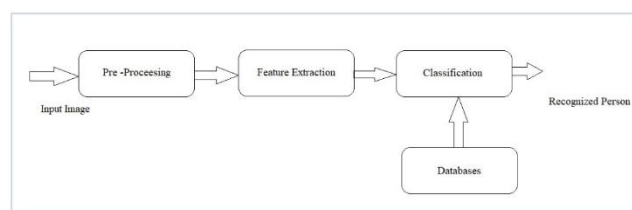


Figure I Typical Face Recognition System

This paper is organized as follows. Section II describes facial recognition technology history. In section III described about methodology used and how system work with hardware description. Section IV presents experimental results showing results of images tested. Finally, Section V presents conclusion.

II. RELATED WORK

Since 2010 the industry has seen a dawn of work being done in fields of Artificial Intelligence (AI), Machine Learning (ML), Neural Networks, IoT, Big Data Analytics all this thing a common aim to make things better and easier, self-learning and to the connects internally to the all types of devices by making everyday objects internally connected and operable. The need has been identified in the field of digital security tools and hence a greater number of works has been modelled on making daily life locks smart by introducing locks movable using of stepper motor.

A major study of literates implemented Smart Door Locks System is to be been done and literature also implemented Smart Door Locks with the help of GSM phones and the stepper motors has been study. The model introduced by us is the unique one. The features of this system are offers with its one-of-a-kind combination of functionalities and the simplicity. The large difference is in the reduction by the application as it detects the face out of the image store in the databases and sends it to app program which is interfaced with our app system, which is not introduced in any other system which efficient used of solenoid. we have to eliminates the used use of not necessary components such as stepper motors and drivers which is used in the existing system, and also without compromising facial recondition features.

The goal proposed this system work is to be to implemented to convert to the working model of a smart door lock system. Also, to give reliable solution which problem faced by the people in day-to-day life in case loss of key.

III. METHODOLOGY

The prototype is built by combining the part of face recognition and IoT together. Face recognition is operated at first place. There are five steps in face recognition, which are collecting images, creating database, pre-processing images, training images and testing images.

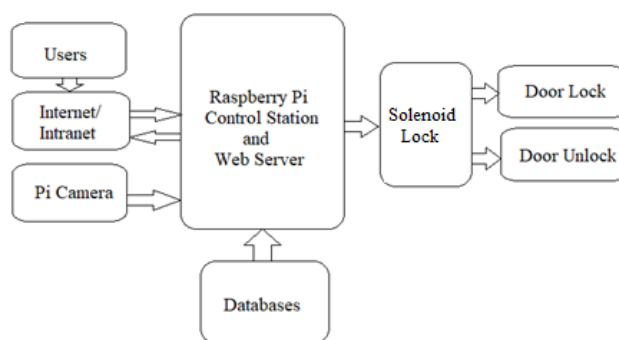


Figure III (a) System Block Diagram

In this prototype system we have using following equipment which is given below. Raspberry Pi 3 B+, Pi Camera Module Version 2, PIRSensor, Solenoid Lock, Relay.

Raspberry Pi 3 B+

Raspberry Pi is a series of small single board computers developed in the United Kingdom by the Raspberry Pi foundation. Raspberry Pi board was developed for applications and installations where space is premium and projects are made as permanent setups. The Raspberry Pi 3 Model B+ is the latest product in the Raspberry Pi 3 range, boasting a 64-bit quad core processor running at 1.4GHz, dual-band 2.4GHz and 5GHz

wireless LAN, Bluetooth 4.2/BLE, faster Ethernet, and PoE capability via a separate PoE HAT. The dual-band wireless LAN comes with modular compliance certification, allowing the board to be designed into end products with significantly reduced wireless LAN compliance testing, improving both cost and time to market. The Raspberry Pi 3 Model B+ maintains the same mechanical footprint as both the Raspberry Pi 2 Model B and the Raspberry Pi 3 Model B.



Figure III (b) Raspberry Pi Model 3B +

Raspberry Pi Camera

The Raspberry Pi Camera Module v2 used for to capture images in the system. The Raspberry Pi Camera Module v2 replaced the original Camera Module in April 2016. The v2 Camera Module has a Sony IMX219 8-megapixel sensor (compared to the 5-megapixel Omni Vision OV5647 sensor of the original camera). The Camera Module can be used to take high-definition video, as well as stills photographs. The camera works with all models of Raspberry Pi 1, 2, 3 and 4.

PIR Sensors

Passive Infrared Sensors are made of pyroelectric sensors, which can detect levels of infrared radiation. Everything radiates some low level of radiation. However, the hotter the object is, the more radiation is emitted. The sensor in a motion detector is split in two halves in order to detect change between the two.



Figure III (c) PIR Sensor

Solenoid Lock

Solenoid lock has a low-voltage solenoid that pulls the latch back into the door when an interrupt (Pushbutton, Relay, etc.) is activated. The latch will retain its position until the interrupt is enabled. The operating voltage for the solenoid lock is 12V. You can also use 9V, but it results in slower operation. Solenoid door locks are mainly used in remote areas to automate operations without involving any human effort.



Figure III (d) Solenoid Lock

Relay

A relay is an electromagnetic switch where a small control signal usually from a microcontroller at the input of the Relay will control a high voltage supply usually AC mains. Since this is a Raspberry Pi based project. The Raspberry Pi computer, although a powerful device, works on a 3.3V Logic. Solenoid lock works on 9-12 volt, due to this we are using relay circuit. Relay is a simple electromechanical device that consists of a coil and few electrical contacts.



Figure III (e) Solenoid Lock

IV. EXPERIMENTAL RESULTS

This work was aimed to be complete system for detection and recognition of human faces, which is easy to build and cost effective. Its utility is to be set as an alert for home visitors, industries, air ports or in offices and provide information about the visitors. An automatic smart lock monitoring system using webcam, Python, Open CV, Raspberry Pi, controller is designed for monitoring and security purpose, Since IoT is booming technology, we can also explore the possibilities of IoT in security and automation.

Face recognition is tested on two types which are by testing image and real-time to determine the system accuracy. For testing image, there are ten images that are not in the database are tested for each label which are authorized and unknown person. The tested image will have labelled the image with names for authorized person while unknown for unauthorized person. Figure 5 (a) shows the IoT app interface before login, figure 5 (b) shows IoT app interface after login and figure (c) shows the smart door lock system.

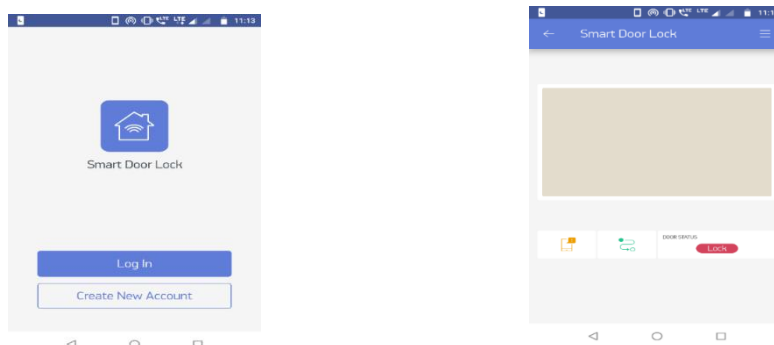


Figure IV (a) Blynk IoT App Login Interface Figure IV (b) Blynk IoT App After Login Interface

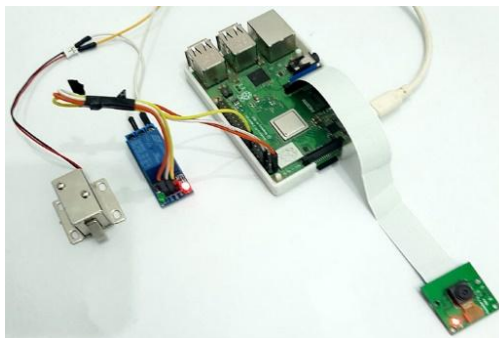


Figure IV (c) Smart Door Lock System

V. CONCLUSION

- ❖ As a conclusion, security system by using face recognition combined with IoT is successfully done.
- ❖ The face recognition is able to recognize the face and capable of sending notification to a user when an unknown being has been detected through IoT.
- ❖ On the other hand, this project is this project still has a big room of improvement to be done, especially in the efficiency of the image processing part.
- ❖ Due to the module used which is Raspberry Pi 3, the processing time of the coding took a long time so process the image taken and take action. By using another better module, this project can be improved greatly.
- ❖ It is also used in a different scenario like a safeguarding and surveillance.

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