

# Face Recognition System Using IoT

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**Abstract**— Home security is growing field. To provide security to home, face recognition system can be implemented. A standard UBS camera captures the image to identify the person. It's a prototype that identifies the visitor. If the door recognize the visitor, it will greet them by name, and the door will be unlocked named opened. If they are'nt identified the door will be firmly locked. The system will perform the detection and recognition rapidly in real time.this project utilizes the basic web cam, and the internet connection to create a door that unlocks itself via facial recognition. If the visitor at the door is recognized, the door will be unlocked!

This project adds mainly four features: security, safety, control and monitoring to home automation. Firstly the system needs a face authentication for the user to be able to enter the home(locked/unlocked). When an unauthenticated tries to log in, this face will be captured and would be sent to gmail as an attachment. The system should also support remote home control. Temperature sensor is used for home temperature monitoring,. The date can be visualized remotely in real time.

**Index Terms**—IoT, Face Recognition, Raspberry Pi

## I. INTRODUCTION

We want to provide high level security to home by using IoT technology. IoT is new technology which has made an enormous impact on the modern world. The IoT can be defined as the system of interconnected mechanical, electrical and computing devices and other objects like animals, humans which are given an unique identifier and this system has an ability to transfer data over a wide network of such interrelated systems without requiring human-to-human or human-to-computer interaction. In short, the IoT has an ability to make things self-instructed. Hence it can make significant impact on modern security technologies [2][10].

Home security has become a solemn issue in the society. Anyone can be harassed in its own house. Older security systems can't tackle some situations like hacking, break down in the system. Unwanted persons like thieves, murderers and some known criminals will try to intrude in the home any time they want. Also we know that the gadgets now

a days are not that secured and hence can be easily hacked. Even intruders have found their way to take over these gadgets. So to avoid such situations, we have to develop the system in such way that no one should get an intrusion to the system. The use of IoT will enhance some security level as well as it will help in accessing and controlling the system remotely. Therefore we are trying to develop a face recognizable [7] automated door unlocking system using an IoT.

IoT will enable sensing, actuating and communication in the system. System can be made automated easily. So we can go on developing a smart home by extending this security system. To develop this we will use a Raspberry Pi micro-controller board for system development, a pi camera module for face recognition and a programmable stepper motor to open door lock. We will install appropriate linux based Raspberry pi operating system on raspberry pi micro-controller board. For the door unlocking system, we will place a stepper motor at door latch. This motor will be programmed in such a way that when the system authenticates the person in front of the camera, the motor will rotate to open latch.

We will use image processing technology to authenticate the person to enter in home. For image processing, we will use pi camera module. Pi camera module is attached to Raspberry pi, and it aids to store various faces in the databases. When someone wants to enter in home, he should stand in front of the camera. Camera will recognize the face and compares with the faces stored in the LFW database [8]. If the face matches, the door will be automatically unlocked [3], otherwise a warning call will be sent to the owner of the house.

## II. MOTIVATION

Now adays the security has become main issue in the society. Nobody's home is safe, and the technologies which are developed for security purpose till now can be easily tackled by the intruders. Therefore, we are trying to develop a home security system using IoT [5].

Till date, Face recognition [1][4] technology has not been developed using IoT [2] and we will develop an IoT based automated door lock system using face recognition. Development of the system in IoT will make significant change in modern security technologies. The use of micro-controller board will establish simplicity and flexibility in the system.

The use of IoT will aid in controlling and monitoring the system remotely. We will also develop a new face recognition algorithm which will take over the disadvantages of algorithms like PCA (principle component analysis) and LDA (linear discriminant analysis) [6].

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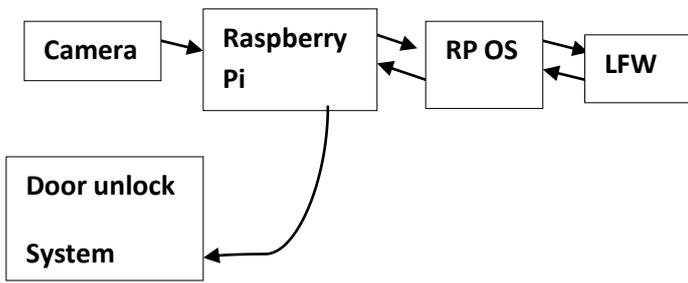
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### III. PROPOSED SYSTEM ARCHITECTURE



**Fig -1:** Face recognition system  
RP OS: Raspberry Pi Operating system  
LFW: Labeled Faces in the Wild Database

#### A. Raspberry Pi



**Fig -2:** Raspberry PI

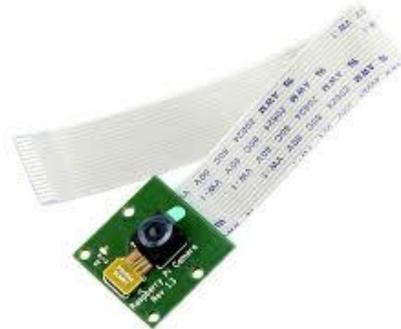
Raspberry Pi board is a micro-controller board used for development of various embedded level projects. Its size is no more than a credit card. It has a Broad-com BCM2835 system on chip (SoC) multimedia processor [11]. It also has 512 MB memory chip on the board at the centre. Its IAS (Instruction Set Architecture) is different than other architectures and it is used for ARM (Advanced RISC Machines). The Raspberry Pi runs on Raspberry Pi compatible operating system which is known as GNU/Linux Raspbian. Operating systems like windows, IOS are also compatible to Raspberry Pi. But the reason of using Linux is that the LINUX is open source and programming oriented and hence becomes easy for development.

#### Features of the Raspberry Pi:

- CPU quad core 64 bit ARM Cortex A53 clocked at 1.2 GHz.
- GPU: 400 Mhz VideoCore IV multimedia.
- Memory: 1GB LPDDR2 900 SDRAM i.e. (900MHz)
- Video outputs:HDMI, Composite Video (PAL and NTSC) via 3.5mm jack
- Network 10/100 Mbps Ethernet abd 802.11n wireless LAN
- Bluetooth version 4.1
- width: 85.60 mm\* 56.5 mm
- Weight: 45g

#### B. Camera Module

The Raspberry Pi Camera Module is a custom designed add-on for Raspberry Pi. It attaches to Raspberry Pi by way of one of the two small sockets on the board upper surface. This interface uses the dedicated CSI interface, which was designed especially for interfacing to cameras. The CSI bus is capable of extremely high data rates, and it exclusively carries pixel data.



**Fig -3:** Camera Module

#### C. Stepper Motor

A stepper motor is a brushless, and can be both synchronous as well as asynchronous electrical motor. Due to this, the motor can convert digital pulses into mechanical rotations. When the motor revolves, its revolutions are divided into particular steps, and hence it is known as stepper motor. These steps are discrete and for every step the motor is sent a pulse. All steps of the stepper motor are equal and they are divided for unit time.



**Fig -4:** Stepper Motor

Each of these pulses causes the motor to rotate in particular angle. The motor speed is depending upon the frequency of the pulses. As the frequency changes, the rotational speed also changes. The speed of the motor is directly proportional to the frequency of the digital pulses. If the frequency increases, the speed of the motor also increases. Stepper motors are low cost, highly reliable and their performance rate is high at low digital frequency.

#### D. Labeled Faces in the Wild Database

Labeled Faces in the Wild is a database of various face photographs which was designed for proper study of various distinguished faces. Hence this database consists of images of

over 13000 faces collected from various resources [13]. Every image is labeled with the name of person in the picture. Hence with such wide variety of faces, the study of faces has become easy. These faces were detected by Voila-Jones face detector.

This database was released in 2007 for aiding the face recognition technology. It contains four distinguished sets of LFW images which includes the original and three different types of "aligned" images. The aligned images include "funneled images" (ICCV 2007), LFW-a, which uses an unpublished method of alignment, and "deep funneled" images (NIPS 2012). Among these, LFW-a and the deep funneled images produce superior results for most face verification algorithms over the original images and over the funneled images (ICCV 2007)[13].

#### IV. ADVANTAGES

- It is low cost system which can be made under 5000 INR.
- Using this system, the home can be monitored and controlled remotely, as we can place sensors at the different places.
- This is an IoT based system and hence can be made automated [12].
- By using Raspberry Pi, the system becomes scalable and flexible.
- The system can be modified easily without disturbing the other components in the system.
- As we will use Raspberry Pi to develop the system, the total system has become low power system.
- New embedded technologies can be easily inserted into this development, due to the use of raspberry pi.
- New connections like cascade connections, parallel connection, series connection to extend the system.
- The system can work on both modes online and offline mode. In online mode, the system can use internet at its working time. In offline mode, the system does not use any internet connection.

#### V. FUTURE SCOPE

This security system is a combination of face recognition system and IoT. These two technologies are growing technologies and with the help of them, much advancement can be done. There are many face recognition algorithms developed till date but none of them are proper and hence each one has its disadvantages. Hence in the future a proper designing in the face recognition algorithm can be done and a new algorithm can be introduced.

The technology is scalable therefore new modifications can be easily done. New hardware can be easily attached hence new smart home concept can be implemented. Everything in that home will be smart. That means we don't need to give command to hardware every time. Hardware itself will know do's and don'ts.

#### VI. CONCLUSION

The security system, proposed, is low cost, low power consuming system. This system can easily provide high level of security as it combines two modern technologies together i.e. Face recognition and IoT. These are rapidly growing technologies in industries and scientists are still researching on them. Therefore these two have made a significant impact on security system development. Due to these, the security will almost double. Remote controlling and monitoring is possible because of using IoT and Face recognition has made it almost impossible to hack.

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