# Safety and Security Aspects of Smart Home Applications using Face Recognition

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**Abstract –** *The present scenario ensures the safety and security has become an inevitably essential. In a few decades due to the technology growth, the security for every system reaches a new peak. Security plays an integral role in today's modern world. IOT means a many hardware can connect with the internet, today internet plays a vital role which is growing a very rapid rate and it can communicate huge number of devices such as MQTT (Message queuing telemetry transport). Home security is a very important application in today world, many thefts happens in world. IOT can prevent from theft and can give a protection to the precious applications in home. The system will intimate the owner of the house about any unauthorized activity happens or whenever the door is opened by sending a notification to the user. After that notification received, owner can take a necessary action. The security system will use a microcontroller known as Arduino microcontroller to interface between the components, the vibration sensor is connected and the door vibrates intimates the authorized person using MQTT, Python to connect and communicate using the MQTT. The main advantages of such a system includes the safe and security, Execution process is speed.*

**KEYWORDS**: MQTT, Arduino MCU AND IOT

## 1. INTRODUCTION

Security plays an integral role in today's modern world. The current scenario ensures the safety and security of the system has become an inevitably essential. In few decades due to the technology growth a security must need reaches it peaks in the current world. When there is a modern home with minimum human effort and maximum security, it's well known as modern home. Since there is an advent of wireless and technological, all together it introduces an automated intelligent security system for more efficiency.   The automated home security system can be designed with the surveillance camera for monitoring and protecting the appliances via cameras and multiple sensors, and the use of these sensors will be defining the features of these sensors. Data transmission quicker is taking place using the Wi-Fi to security systems which helps the user to protect and monitor the system. The innovative IOT based products and services will grow exponentially in next few decades predicted by the analysts. The IOT interface with different digital technologies and a huge range of hardware and software devices. IOT contributes open access to particular set of data. The evolution of internet, software tools and its use of computer systems has resulted in a huge electronic transformation of data quickly which experienced multiple

concerns such as security, privacy and confidentiality of information. Significant activities been made in term of improving computer systems security. However, security, privacy and confidentiality of electronic systems are potentially major concerns in computer systems. In fact, currently no system is available in the world is fully secure.

Recent advancements in the field of communication and information technologies have caused a rapid growth in IOT application development and thereby the smart home technologies. The smart home environments are intended to be able to improve home security systems and achieve goals such as increasing comfort and reducing operational costs while providing security to the users. Here Monitoring the intruders and thief activities which required for a purpose of protection of home appliances and reducing theft, increasing safety. Home security made a drastic change in the past few decades and continue to advance much more in the coming years. Previously home security systems meant having an alarm that would go off when somebody would break in and motion sensor senses and send false notification to the owner but a smart secured home can give much more security than that.

This paper consists of four sections. The first section shows the survey made on existing systems and the findings. The second section elaborates on the methodology or the proposed work. The third section shows the experimental setup and the results. The final section gives the conclusion and future scope of the work.

## 2. LITERATURE SURVEY

The author proposed "Internet of Things Based Home Security Using Raspberry Pi". This paper [1] presents the importance of home security in today's world. In our daily lifecycle wherever, every time, every second we need internet to fulfil our needs/search. Looking at the huge usage of Internet of Things (IOT) so they decided to use IOT in home security system. For IOT based home security it requires Some platform to attach the things and perform a program so, they have selected the newest version of Raspberry Pi model which is Raspberry Pi 3 Model B. This paper's main approach is to secure home in terms of any damage and theft. For Home security system this paper represents detection of the gas, flame, vibration and magnetic sensor are used in the door. If any of the anonymous activity like fire, gas leakage, vibration will take then the buzzer alarm will ring and sends a notification to the owner. Also this paper presents the PIR sensor to detect

the moving objects and relay switches to switch ON and OFF lights in the room and Camera to capture and records the activity. Outside the door there is PIR sensor which detects the motion of intruder. Whenever any motion is detected within the range of 5 to 6 meter and 180degree the PIR sensor sends signal to Raspberry Pi and Raspberry Pi starts the bulb inside the home to alert the intruder. There is magnetic sensor at the door, if someone tries to break or open the door the magnetic sensor breaks and the signal is sent to the Raspberry Pi and within seconds the Raspberry pi activates Pi camera to capture image of intruder. Along with this procedure at a time the buzzer will turn on and captured image will be sent to the user mail.

Chandra M. L. R, et.al proposed the "IOT enabled with smart security system". This paper [2] presents security to the house and also providing a facility to the user where owner can monitor the surrounding parameters inside the house (like temperature, smoke and light intensity) and can control them by collection and exchange of data between the things for example switching on/off devices (like fan and light based on these parameters) as a globally. In recent days whenever house is locked the break-ins number has been increased enormously. So in order to provide security to the home this presented paper is helpful. When the intruders enter into the house, image of the intruder is captured by the system, even if intruder escapes Police need to caught the intruder to recover the stolen things which needs as the evidence of the intruder to the police. The planned system captures the suspects and sends it to the authorized mail through internet over Simple Mail Transfer Protocol (SMTP).

Kumar, et.al presents presents the security for home by raspberry pi camera. The paper [3] approach the innovative headways have cleared path in private homes too. Shrewd homes are arising to be all the more a need in today and age. Control, observing and security are the vital elements of a savvy home and shrewd gadgets have a noteworthy impact in machine control. This paper focuses on the origination and execution of an inclusive continuous home security framework that is shrewd and totally deals with home security. This gadget can see any development and send warnings on the client dashboard which thus advises the checking focus. Sensors are initiated amid your nonappearance or when you inform the arrangement of your nonattendance at home. The Raspberry Pi, a charge card measure pc with an inbuilt camera board can transform into a data exchange to camera security framework when the camera board is put to utilize. This framework makes utilization of Open CV. The sensors identifying developments can respond to the owners at a different situation.

This paper [4] presents an OSGi based security architecture for a home security system. The "digital home" refers to a home equipped with technological systems and appliances enabling centralized or remotely controllable integrated interfaces throughout the network. With the development of the digital home and home network appliances, different protocols, standards and transmission modes, such as UPnP,

SLP and SIP, have been proposed for interconnection or discovery with these home networked devices. Although more digital devices and home appliances comply with these protocols in the development, the proposed protocols are usually unable to communicate with each other. Thus, the Open Service Gateway Initiative (OSGi) plan has been proposed to provide a way to bind several home network protocols, making the devices or services of one network discoverable to others. It can integrate networked security devices, and respond to intrusion alert or emergency alert.

If intrusion activities occur, the security programs will acquire the intruder automatically

The system proposed here [5] presents an in-house technology, the development of EGAT-SCADA was firstly focused on what it can do. It is developed for supervising the operation on electric power transmission system throughout the country of Thailand. It will be installed and setup on five regional control centers, several dozens of group control centers, and more than two hundred substations. Moreover, an implementation on a hydro center is given in a plan. Since the Primary phase of development was completed, the security issue has become a major concern before the implementation. General procedures on IT security are essentially enforced. Several tests were conducted. Currently, SCADA security is constant studied for shielding EGAT-SCADA from unauthorized access and abuse. This paper will describe in detail the security concerns of EGAT-SCADA.

## 2. PROPOSED WORK

The proposed system is based on the face detection for access main door capturing a real time image of a person is based on the Harr cascade algorithm which can faster computation of the facial features and extraction.

This system contains a 4 modules are listed below

### 2.1. IMAGE ACQUSITION AND PRE-PROCESSING

The input real-time image to the system can be captured using a web cam or can be acquired from the local disk. This image undergoes image enhancement and filter, where tone mapping is applied to that real-time images with low contrast to restore the original contrast of the image. Pre-Processing stage enhances the quality of input image and locates data of interest and smoothing the image. The Image acquisition captures a real-time image in camera and then Stack acquisition are stores image in a stacks. Image selection is the selecting best image from the stored stacks. The image alignment is aligning the face in to the corner and edges. Image segmentation is partitioning image in to a set of pixels and pixels are extracted in to features and finally select a set of usable regions in the face.
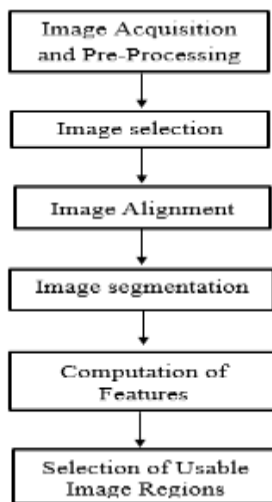
**Image Acquisition and Pre-Processing**

## 2.2 Storing of Datasets

The details of the owner along with their biometrics, measurement and radius of the house, number of doors and windows in the house are stored. The House and owner details are stored. When the biometrics of the person matches with the biometric data stored in the cloud, the main door is enabled to access. The accessed main door automatically opens using DC motor. In such case of detection of unauthorized access, the face of the intruder is captured and the information is sent to owner and also to the nearest police station.
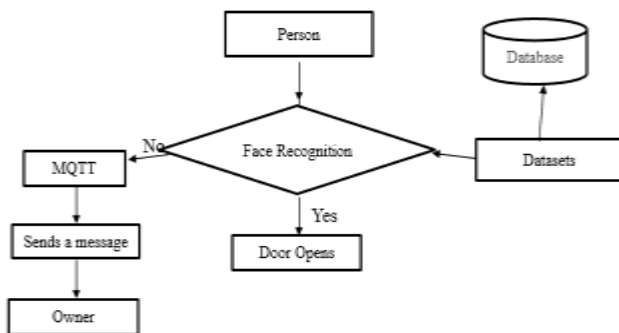
**Storing of Datasets**

## 2.3 SENSORS CONNECTIVITY

The system is embedded with automatic door using face recognition, and a vibrator sensor also embedded with this automatic door. Message Queuing Telemetry Transport(MQTT) is a central hub which stores all the data and publish, send/receive message. Python module which sends the information received from MQTT to the owner and also to the nearest police station. PC Camera is fixed at top of the automated door in case to detect the unauthorized users, intruders, thieves. A buzzer alarm is also included to alert the neighboring house. A DC motor & sound sensor is embedded with buzzer alarm in case of alertness. An IR sensor is built

within the locker in any chance of theft taken. It can be also used for bank locking purposes and security needs

This module works with the sensors, Arduino Mega board and the microcontroller. The input is obtained from the user who is the owner. The owner images are already stored his image in the system it takes the Harr cascade algorithm to detect the face and the DC motor fixed at the door for automatically functioning when it recognizes the authorized the user. As in Fig-1 shows a DC motor which is embedded in door. Unauthorized user or intruder try to break the door then vibration sensor reaches a specific range and it sends a message to the owner by MQTT. As in Fig-2 Shows a Vibration sensor.

As in Fig-3, the Arduino Mega is a microcontroller board based on ATMega328. Arduino ATmega328 has 14 digital input/output pins of which 6 can be used as PWM outputs, 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button.

**Fig-1:** DC Motor

**Fig -2**: Vibration Sensor

**Fig-3**: Arduino Mega board with ATMega328 microcontroller

The intruder try to do any other activity surrounding the home when sound will reach a specific range then the sound sensor embedded in door and it sends a message to the owner and nearby Police station and buzzer alarm will rang inside the house so neighbour can intimate it. In Fig-4 Shows a sound sensor and Fig-5 shows a Buzzer alarm.



**Fig-4:** Sound Sensor



**Fig-5:** Buzzer Sound alarm

Once the main door is broken, the thief automatically tries to search for jewels, money or any other documents. The thief automatically finds the locker where all the ornaments are kept. The thief is unaware about the IR sensor that is placed at the top of locker and tries to break it. When the thief attempts to break the locker, the IR sensor senses the Intruder's body rays and sprays the chloroform on the thief and he is forced to faint. Fig-6 shows a IR sensor



**Fig-6 :** IR Sensor

## 2.4 INFORMATION TRANSMISSION

The MQTT broker transmits the information to the owner and the police station when the data doesn't match with the data that are already stored in the cloud. The Police will arrive in the mean- time and the corresponding actions will be taken against the thief.

## 3. SYSTEM ARCHITECTURE

The Fig-7 shows the architecture diagram of the system proposed. The architecture involves the sensor, microcontroller, Arduino Mega board, and so on.
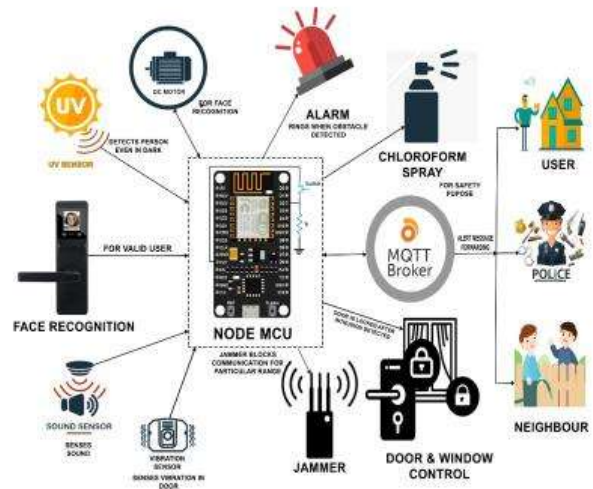


**Fig -7**: System Architecture

## 4. IMPLEMENTATION OF THE SYSTEM

The Arduino Mega board embedded with AtMega328p microcontroller is used. The Vibration sensors are added to receive Vibration from the intruder. The Python, MQTT modules are received notification to the user. implementation is shown in Fig-8.

**Fig -8**: System Implementation

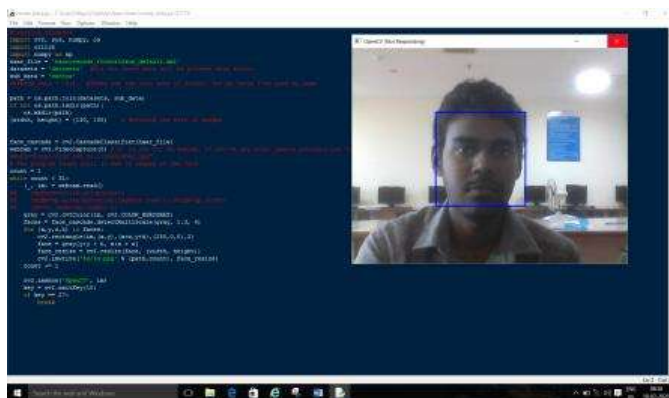The Harr Cascade algorithm implementation is carried out according to the face datasets storage.



**Fig-8 : Implementation of Harr cascade algorithms**

## 5. RESULTS

The output of the system shows the Recognized the authorized user with face square pixels in green color shown in Fig-9 and Fig-10 shows authorized user face in the datasets. Sensors are automatically switched ON when intruder enters it shows in Fig-11.
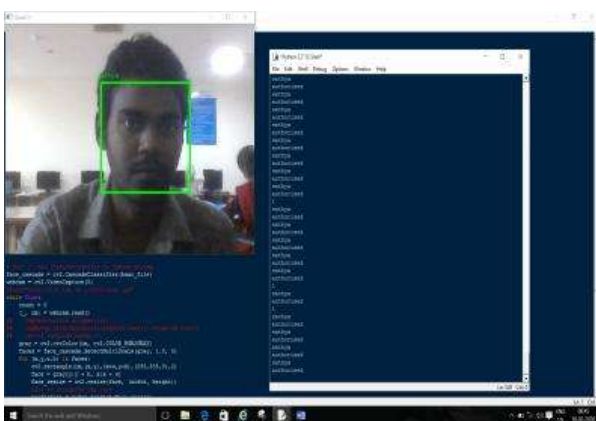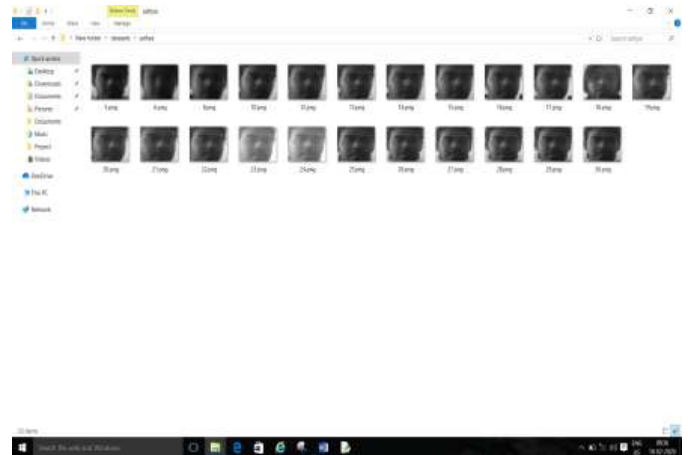


**Fig -9:** Authorized user



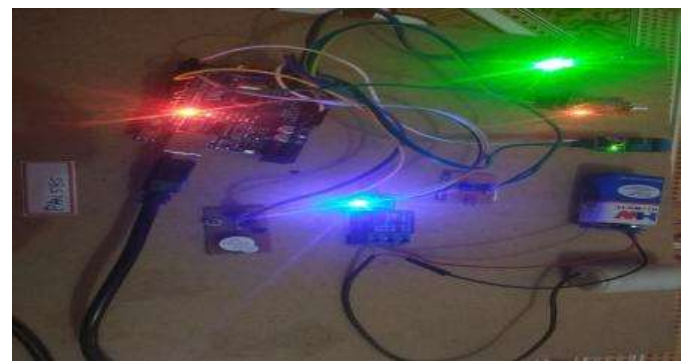**Fig -10:** Storage of authorized user



**Fig-10:** Sensors Activation

## 6. CONCLUSION AND FUTURE WORK

This system is useful for the mute House owners to control and monitoring a Home globally from anywhere and easy communication to neighbor when buzzer sensor rings. Nearby Police station can monitor it by receiving notification via MQTT. This helps to prevent from theft. In future work, it can be implemented in two type of environments such as the sensor working in the house, when owner of the house is present inside and outside Environments.

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