International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 04 | Apr 2021 www.irjet.net p-ISSN: 2395-0072

Door Unlocking System using Facial Recognition and Cloud Computing

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Abstract - *There is no doubt that the Humans have gained remarkable development in each and every aspect for making their life easier since the days of early men. Still One of the main concerns of the Modern world is about Security and Accessibility. Making our homes secure and accessible from far is one of these concerns. Physical keys and locks were the basic requirements of a door but managing these keys are always cumbersome. To overcome these things, we have implemented a solution Intelligent door Lock which is smart, secure and has accessibility features by remotely controlling the door using Telegram App. In our system we used Raspberry pi microcontroller linked with camera to capture the image and image processing for recognition, we use Azure cloud for computing. For alerting the owner we use Telegram messenger using Telegram API messaging service.*

***Key Words*: Facial Recognition, Home Security, Azure cloud, Raspberry Pi, Telegram API.**

1. INTRODUCTION

Now-a-days burglary is becoming more common. According to an FBI report a burglary is happening every 30 seconds in the USA. The average loss from the burglary is estimated to be $2661. The normal door locks are very easy to break and the home security system is very expensive. So in our proposed system we created a cheap smart Door locking system using facial recognition and cloud computing. We used a camera module connected to the Raspberry pi to capture the image and we used the facial recognition to authenticate the face.

We run the algorithm in the Azure cloud and if the face is not detected , our proposed system will send an alert message along with the intruder's image to the Telegram messenger of the owner. Our proposed system is very safe as we run our algorithm in the Azure cloud. The main disadvantages of the conventional locks are physical keys can be lost and the intruder can easily break the lock. In our proposed system even if the intruder breaks the lock , the owner will immediately know about the intruder and he can report to the police. Thus the burglary can be stopped.

2. LITERATURE SURVEY

In [1], the author uses Raspberry Pi to process the image. The door will open if the image of the person is present in the Raspberry pi database. But the problem with this system is that the owner will never know who tried to access the lock. If the intruder tries to break the door, the owner will never know about the burglary in real time.

In [2] paper, the proposed system uses facial recognition to detect the face. They used MYRIO 1900 as the microcontroller to process. In the proposed system they used G graphical programming language in the labview. The main disadvantage of this system is that MYRIO is costly compared to Raspberry pi.

In [3], the proposed system uses the Microsoft Azure Face API to process the image. If the proposed system detects the intruder it will activate the alarm system. The proposed system is good but it's complex as it uses many additional components for working. If the owner is not near the system, he/she will never know about the burglary. There is no real time altering message to the owner if the owner is far away.

In [4], the proposed system uses the facial recognition and voice command to open the door lock. It uses the raspberry pi as the microcontroller to process. This model is cost efficient and simple. The person trying to access the door must pass the facial recognition and correctly say the name of the owner. But the drawback of the system is there is no real time altering about the intruder.

In [5], the proposed system uses a camera module to capture the image of the person and send the alert mail to the owner via the TCP/IP. Then the owner can unlock the door via the mobile app. Raspberry pi is used as the microcontroller. The user can monitor the visitor and control the lock using an active SSH page on the mobile phone. This proposed system is quite good and cost efficient but the owner must always have the phone in hand for the system to work.

In [6], the author uses the GSM based door locking system using the PIC platform. The author uses a gear motor and 5 digit password lock to lock and unlock the door. If the user enters the password wrong three times, the system will

alter the owner using the GSM module. The system is very simple and cost efficient but the owner can't know the face of the intruder.

3. PROPOSED METHODOLOGY

In the proposed system we used the following hardware and software to meet our requirements.

3.1 Hardware Requirements

3.1.1 Raspberry pi Zero WH

Every IoT device needs at least one microcontroller device to function properly. In our proposed system we use Raspberry Pi Zero WH microcontroller for processing. It has a BCM 2835 SOC processor and has a clock speed of 1 GHz and 512 MB RAM. The main advantage of Raspberry Pi is it has an inbuilt Wifi and bluetooth module attached to it.

Fig-1: Raspberry pi Zero WH

3.1.2 Raspberry pi Camera Module

The Raspberry Pi camera Module is used to capture the image or video and send it to the Raspberry pi microcontroller to process it. The camera module has Sony IMX219 8-megapixel sensor. It works well with all kinds of Raspberry pi microcontroller.

Fig-2: Raspberry pi Camera Module

3.1.3 PIR sensor

Passive InfraRed sensors are often used in motion detection. It is used in alarm systems and automatic lighting systems to sense the presence of a person. In our system we used to detect the presence of the user near the door.

Fig-3: PIR sensor

3.1.4 Ultrasonic sensor

Ultrasonic sensors are used to measure the distance of the target object. It works by emitting the Ultrasonic waves and measuring the time taken by the reflected wave and it calculates the distance between the target and the sensor.

Fig-4: Ultrasonic sensor

3.1.5 Solenoid Lock

Solenoid lock has a latch and it is used for electrical locking and unlocking. It locks the latch as long as the power is provided and it unlocks when the power is turned off.

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Fig-5: Solenoid Lock

3.2 Software Requirements

3.2.1 Microsoft Azure cloud

Azure is a cloud computing service provider by Microsoft. It offers IaaS,SaaS and PaaS services. It's one of the top cloud computing providers in the world. Azure offers various kinds of virtual instances, IoT services, storage services etc. In our proposed system , we used Face recognition service which provides many AI face detection algorithms and API services to detect,analyse the human face.

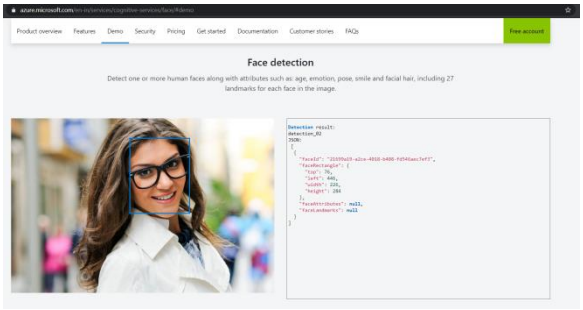

Fig-6: Azure Face Detection service

3.2.2 Telegram Bot API

Telegram Bot API is an HTTP interface for developing the bots in the Telegram. Creating a Bot in telegram is easy as it is open source.

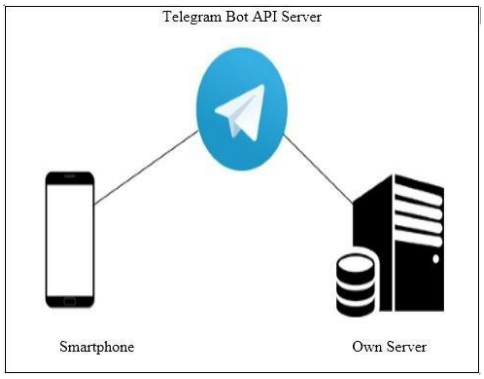

Fig-7: Telegram Bot API

4. SYSTEM ARCHITECTURE

The camera module is connected to the Raspberry Pi microcontroller. If a person approaches the door, the PIR sensor will detect the motion of the person and turn on the camera. The Ultrasonic sensor is used to measure the distance between the face and the camera. If the face is at an accurate distance , the camera will capture the face and send the image to the Azure cloud for face detection. The Face API will check the image for the existing face database. If the face is found in the database, it will send a signal to the Raspberry Pi to open the Solenoid lock. If the face is not found, a virtual instance is running in the Azure cloud with the deployed Telegram API bot code. The virtual Instance will send an alert message along with the image of the intruder. If the user knows the person , he can add the person's face to the database and allow him to open the door. If the person is an intruder, the user can contact the authorities and take legal action. The user will also get the face image and time when a person unlocks the door.

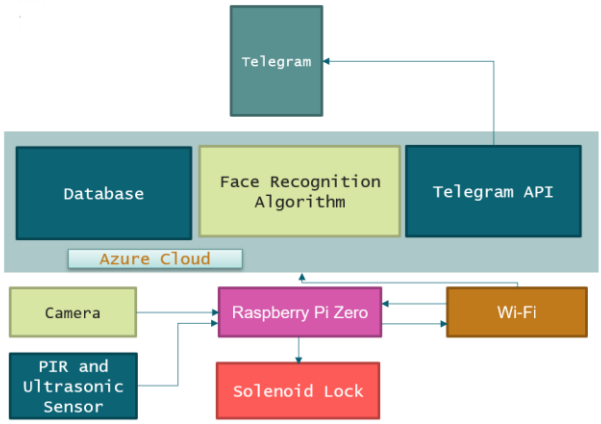

Fig-8: System Architecture

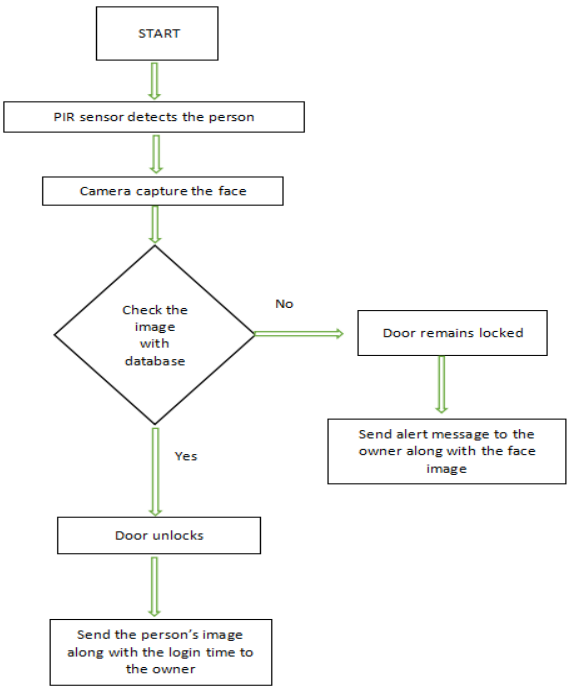

Fig-9: Flow chart for the proposed system

5. CONCLUSION AND FUTURE WORK

The main advantage of using the Cloud for face detection is when the facility is large, we can add the face of a person once in the cloud instead of adding it to all the doors one by one. Thus, running the face detection in the Azure cloud saves so much time if the facility has lots of doors. Our proposed system is cheap and efficient at the same time. This system is safe as the owner gets real time alter messages if the intruder tries to unlock the door and the owner can call the authorities if he finds any suspicious activity.

This proposed system can be enhanced by installing the proposed device in an enterprise fashion or in an organization where multiple face recognition points are required for security purposes and all the log data and registration can be done in a single registration window via Telegram and using a cluster of virtual machines to run the Face recognition algorithm.

ACKNOWLEDGEMENT

The authors acknowledge the Management of Bannari Amman Institute of Technology, Sathyamangalam for providing high standard infrastructure and laboratory facilities to carry out this work.

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