Secure Home Entry Using Raspberry Pi with Notification via Telegram

Conference Paper · March 2020

DOI: 10.1109/ICSC48311.2020.9182778

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Secure Home Entry Using Raspberry Pi with Notification via Telegram

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***Abstract*— Automated secure entry is a basic need in today's Home Automation System. To accomplish this need, we are proposing secure home entry system using Internet of Things. This proposal is an attempt to construct a smart, innovative and secure entry by using the raspberry pi controller, camera and various other associated sensors. To enhance the home security system, the best possible way is to use facial recognition and has been implemented in our proposal. In existing system, notification is through E-mail or Twitter account. Due to popularity and flexibility of using current social network for all type of generation, we are proposing home security system using Telegram notification. The advantage of using Telegram App for this project is to send notification to the user as it provides an instant secure communication between the user and the home automation system.**

Keywords*— *Raspberry pi, Home automation, Face recognition, Secure door control, Sensors, Telegram.

I. INTRODUCTION

Home automation system includes many features like controlling of light intensity, temperature, music system, other home appliances like washing machine, refrigerator, AC and many more. Internet of Things (IoT) is one of the most suitable method that can be used to control the home appliances remotely [1]. For surveillance purpose motion sensor and camera are widely used and controlled by Raspberry pi [2]. Home security system are build using various sensors like fire sensor, gas sensor, motion sensor, camera, etc.[3] and their detail working is shown in Section III and Section IV. IoT based home and door automation has been designed to give the notification to the owner through twitter or e-mail [4].

In our proposed work IR sensor is used to sense any motion in front door, which triggers camera to capture the image and send it to the owner through the telegram. If the visitor image data is present in the database then the door will open automatically else, the owner receives the intruder image and decides whether to allow or not to allow the entry.

Unlike existing notification systems, ours proposed system uses Telegram notification to notify the owner. The advantage of using telegram is that some of the senior citizens does not use G-mail or Twitter as it requires the account creation and find it difficult to operate. Therefore, most of the senior citizens wish to use Telegram, which is a messaging app that can works over the internet, in the same manner as WhatsApp or Facebook Messenger. The main target of proposing this research work is to design and implement a low-priced, protected, and flexible home automation system that is proficient of controlling most of the house devices.[5] Security using face detection and motion detection also used for home automation.

Section II discuss about literature survey of existing home security systems. Section III discuss about the proposed architecture for secure home system. Section IV discuss about the methodology used. Section V conclude the result of secure home system. Section VI discuss about the future scopes.

II. LITERATURE SURVEY

A study on smart home automation technique with raspberry pi using IoT [2] examine how to control the home gadgets by using the laptop and the mobile device remotely. Author uses simple cv for image processing but its features and accuracy are limited. IOT is a new technology that has become more popular and it can enable sensing, actuating and communication in the system that make the system easy to use [6]. IOT is aimed at providing the user-friendly method for controlling the home appliances like fan, light, machines etc. remotely [6].

Another study on access control of door and home security using raspberry pi through internet [4] was proposed to prevent incidents like robbery, stealing, murder or any other loss to house and this home security system uses twitter and mails for notification. In that work [4] the chances of missing notifications are high. Design and implementation of a Wi-Fi based home automation system uses local control of home appliances using Wi-Fi technology [7] can be see. This limits the remote access of the home appliances. An intelligent door system using raspberry pi and amazon web services IoT system [8] is used for the communication and it has also inserted data into its web server page and then it allow the user to make simple http request to Raspberry pi for accessing and log data for detecting the interruption. The main limitation of this work is face recognition.

Enhanced Home Security Using IOT and Raspberry Pi [9] is popular due to the implementation using Raspberry pi board and its user-friendly programming. Let another popular home security technique is face recognition using Image Processing technique [10]. Another study on smart door security control system using raspberry pi [11] for door lock control is

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discussed. The automatic locking and unlocking of the door by using IoT can leads to secure system.

Face recognition system using IoT is developed for home security system [12]. Here notification technique used is the twitter. Another study is raspberry pi based interactive home automation system through email, its main objective is to design an intelligent remote control and monitoring with embedded web server [6].

Smart home automation system based on IoT through speech [13] which uses raspberry pi that controls number of appliances through speech recognition. Mimicking speech may breach the security. Because of limitations in existing work, a new system is proposed in which face recognition and Telegram notification is used to notify the owner in addition to other sensors for home security system. Together IoT and Image processing produce an enormous methods for the security systems. Next section discusses about the proposed secure door architecture.

III. SECURE DOOR ARCHITECTURE

In this proposal to increase the interaction with home security system various additional modules like image processing and Telegram are used. To develop secure home system we need both hardware, software codesign. In hardware we need a microcontroller that control the overall functioning of the system. Actuators used are LED and servo motor. The sensors like IR sensor, temperature sensor, gas sensor and Raspberry pi camera are used. IR sensor is used for motion detection, temperature sensor for sensing the temperature, gas sensor for sensing any harmful gases. Raspbian stretch is use to program the raspberry pi controller and Open cv is used for image processing. Telegram Messaging is used to interact with home security system and to receive notification. The architecture of complete secure home entry system is shown in the Fig. 1.

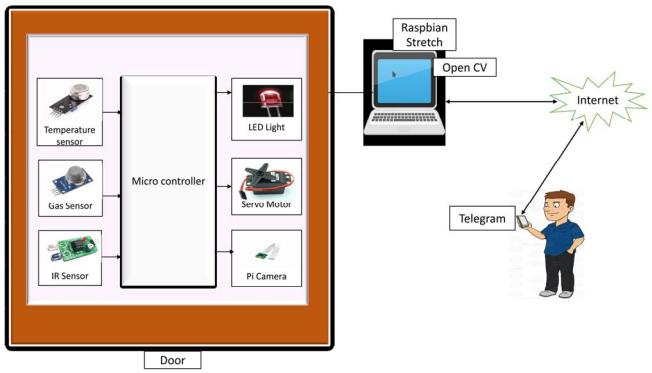

Fig. 1. Architecture of Secure Door System

IV. METHODOLOGY

Implementation design of the proposed system requires the following requirements: hardware requirements, software requirements, and user requirements. Control flow of the proposed system is as shown in the Fig. 2.

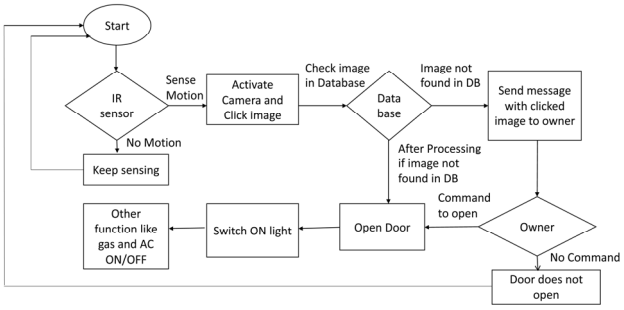

Fig. 2.Control flow of Secure Door System

A. Hardware Requirement

The Hardware Requirements for the working of the proposed system are as follows:

- Raspberry pi board: The raspberry pi is a credit card sized computer that cost between 2500 to 3000(Rs). It can be easily available and can function as a proper desktop computer and can be used to build secure devices [2].
- Raspberry pi camera**:** It is of 5 mega pixel camera modules, which is compatible to raspberry pi. The flex cable that is to insert is connected between the Ethernet and HDMI ports, with the silver connectors facing the HDMI port, use for clicking the image of object in front of door [2].
- Silicon TechnoLabs IR sensor (STL015V1.0): This sensor is used to detect motion at the door. IR sensing element permits to sense motion in or out of the sensors.
- MQ2 Gas Sensor module: This sensor is used to identify any gas leakage at home. Regularly it identifies and determines the existence or the concentration of methane gas.
- Temperature Sensor (DHT11): This type of sensor is used for measuring the temperature of the house. Temperature measurement range is 20-95% humidity and 0-50 degree centigrade. Resolution for temperature and humidity is 8bit. Operation voltage is 3.3 or 5V DC.

B. Software Requirement

The following software are required for the proposed work and are available as an open source

- Raspbian Stretch**:** It is a Linux-based pc software system for raspberry pi. There square measures many versions of Raspbian as well as Raspbian Stretch and Raspbian Jessie.
- Open cv: Open cv is python-based computer vision library which is used in image processing.

C. Requirements at user end

The User requirements are also one of the most important requirements for operating this system and are needed by the user

- Telegram**:** Telegram is also one of the messaging app that works over the internet, same as WhatsApp or Facebook Messenger. That means we can send as well as receive messages by using a Wi-Fi connection or mobile data allowance. As it has high security feature so it is used to send and receive messages, pictures, and videos on raspberry pi.

The proposed system working is shown step by step as follows:

- **Step1: Database -** This contains the faces of person who are authenticated to enter the house as shown in Fig. 3.

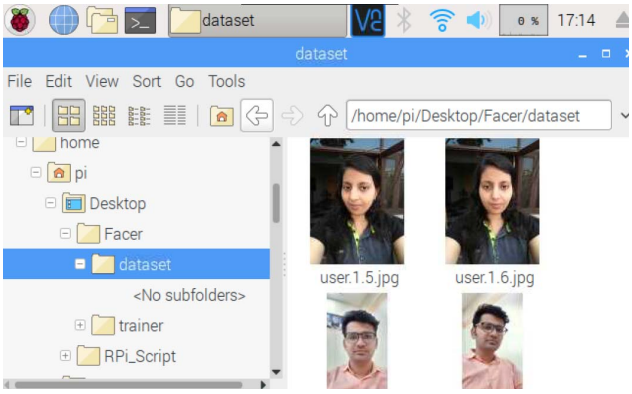

Fig. 3. Database with images for face reorganization

- **Step 2: Start-up of Secure Door** – The user can keep the security system ON/OFF depending on whether he is available at home or not. When 'start' command is typed on the Telegram then it activates the monitoring system. In return home security system notifies a welcome message as "Welcome to House Notification" as shown in Fig. 4.

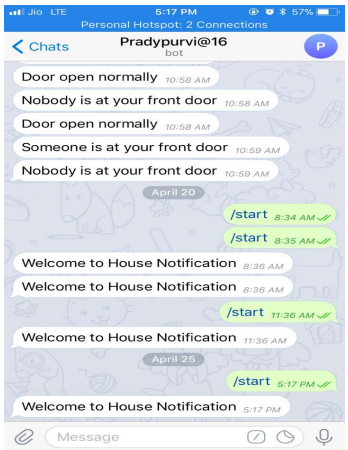

Fig. 4. Snap shot of Start-up of System as shown in Telegram application

- **Step 3: Object Identification using IR Sensor -**IR sensor is activated when it senses any motion near the door and activates the camera. When activated camera clicks the image of the person standing in front of the door for surveillance as shown in Fig. 5.

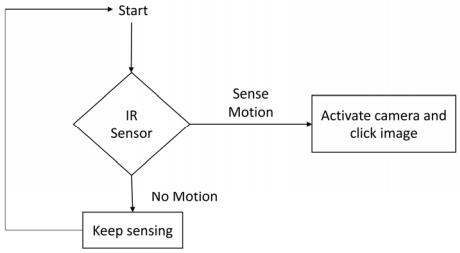

Fig. 5. Object Identification

- **Step 4: Identification of Person -** When image is clicked, face recognition is done against the image stored in the database. For authenticate person door will open and for unauthenticated person it notifies the house owner as shown in Fig. 6.

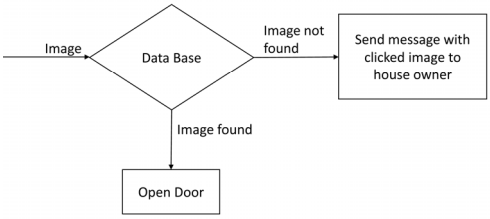

Fig. 6. check image in Database

- **Step 5: Door Action** – Authenticated person is allowed to enter the house and corresponding detail message about the person is shared with the owner. If any person who is not available in the database and the owner wants him/her to enter in the house then open command is manually given to the Raspberry pi by the owner of the house to open the door automatically. 'Open' command is used to open the door by owner. Raspberry pi in response to the above command give the message "open door!" to notify the status of the door to the owner as shown in Fig. 8. And the opened door is shown in Fig. 7.

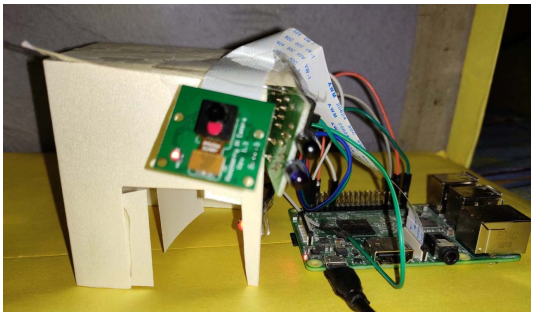

Fig. 7. Opened door operation of system

'Close' command is used to close the door and in response "close door!" message is shown on the Telegram as shown in Fig. 8 and Fig. 9 shows the snap shot of closed door.

Fig. 8. Command to open and to close the door by user as shown in Telegram application

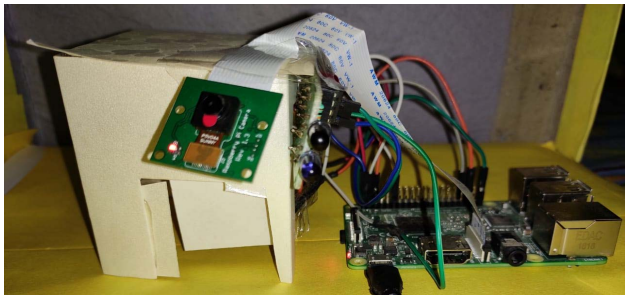

Fig. 9. Closed door

- **Step 6: Light Control** – Fig. 10 shows the door opening and instant lights ON while rest of the time lights are OFF.

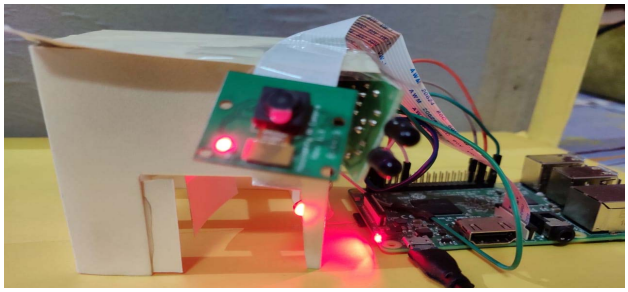

Fig. 10. Light is ON when Door is opened

- **Step 7: No Motion Detected** - When no motion detected, then "No motion" message is displayed as shown in Fig. 11.

V. CONCLUSION AND RESULTS

For high level of security, two emerging technologies Internet of Things and Image Processing are used in this proposal. The proposed work is implemented using raspberry Raspberry pi which can be interface with mobile or pc hence the user can operate the system easily. Our proposed system is an integrated solution of all the existing work in which IR sensor is used for object detection which in turns trigger the camera for face recognition. In addition to this we have temperature sensor which can be used for fire detection and gas sensor for sensing the gas leakage. The system is designed for remote access and control home appliances with security.

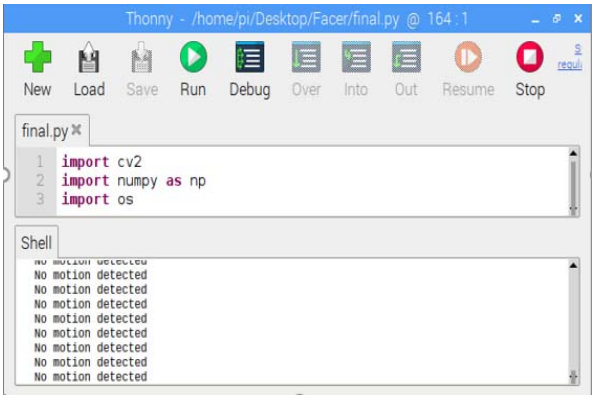

Fig. 11. Snapshot of a system when no person detected at the door.

The proposed system is smart, innovative, secure and is of low cost, low power consuming system. One of the advantages of this proposal is the Telegram notification. Telegram notification can be easily used by older generation as it does not require Email and Twitter accounts. The developed system cost is very low and detail cost of the system is shown in Table 1 provides overall cost of the system and is as low as Rs 3950. Integration of such additional feature for door security is much feasible and will be appreciated by the users.

TABLE 1. COST OF PROPOSE SYSTEM.

Component	**Cost (Rs)**
Raspberry Pi Model B	2950
Raspberry pi Camera	330
Silicon TechnoLabs IR sensor (STL015V1.0)	150
MQ2 Gas Sensor module	320
Temperature Sensor (DHT11)	180
Connecting Wires	20
Total Cost	3950

VI. FUTURE SCOPE

By using the raspberry pi the proposed system can be used as a Smart Surveillance Monitoring security system. As we are using open cv in our project which can be used for designing an attendance system of the class. Therefore, no one can mark proxy of another student. The technology is scalable, upgradation can be done easily with the proposed work.

With upgradation, secure home will be smart home that means we do not need to give commands every time to the system. Artificial intelligence place an important role in understanding the user need and controllers the home accordingly. This proposal can be extended to smart card swapping, finger print detection, alcohol detection, and many more to develop extremely smart system.

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