



Home Security and Automation with Telegram Communication Application using Raspberry Pi

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Abstract: Now, this is the age of speed, everything is happened in the speed of supersonic and the data can be transferred at the speed of light in digital medium. Hence there is need of information inflow the same speed using Internet protocols. IOT is present up going and future technology, it is estimated that 35 billion things are interconnected by the end of 2025. This project goals at implementing the smart home security and automation system which can access remotely using telegram and control doors based on visitors motion at the door. This project is about managed Door accessibility and voice alerting through Android OS supported mobile phone and receive captured image of visitor at Door as Telegram alert. Smart home security control system has become indispensable in daily life. The design and development of a home security system, based on human motion detection and remotely monitoring technology, to confirm visitor identity and to control Door accessibility has been reported in this paper. This paper describes about the implementation and deployment of wireless control system and accessibility in to a home environment for authenticated people only. The Camera module are used to detect motion and capture images respectively are dedicatedly make the security system alive as per the request. Electromagnetic door lock module operate the door accessibility, has been designed and developed. When visitor motion detected at Door, Camera module interfaced to ARM processor used Raspberry pi capture images, save it on system and send it as Telegram alert via TCP/IP. The concerned authority can control the system and view video stream of camera module through Smart mobile Phone. The system also provided concerned authority to use Android OS supported mobile phone to send command for voice alert when intruder identified. Users can monitor visitors and control the door lock on active Secure Shell page or social media application like telegram. This system finds a wide application in areas where physical presence is not possible all the time. The entire control system is built using ARM1196JZF-K microcontroller and tested for actual use in home environment.

Index Terms - Electromagnetic Door lock, ARM processor used Raspberry pi3, JPEG based Camera module, SSH client, Door access, Voice alert; Telegram application.

I. INTRODUCTION

Automation and security are the act of implementing the control of equipment with advanced technology, usually involving electronic hardware. It is the process of automatically performing everyday functions around the home to save the time, energy, money and at the same time offering improved security. "Automation replaces human workers by machines" The system is about remotely managed automation and appliance like Fan, Lamps etc. Control with alerting on Smart Phone and receive captured image of visitor at Door as telegram alert. Smart security control system has become indispensable in daily life. The design and development of a Smart security system, based on human motion detection and remotely monitoring technology, to confirm visitor identity and to control Door accessibility has been reported in this paper. This paper describes about the implementation and deployment of wireless control system and accessibility in to an office environment for authenticated people only. A PIR motion sensor and Camera module are used to detect motion and capture images respectively are dedicatedly make the security system alive as per the request. Electromagnetic door lock module operate the door accessibility, has been designed and developed.

1. When Visitor at the Door detected by sensor
2. The System buzzers Alarm for owner in the house
3. By listening to buzzer alarm Owner can monitor presence of Visitor on Screen/Mobile
4. The System capture image of Every Visitor and save it on Database with date and time.
5. Captured Image of Visitor send to Owners by telegram with Alert message by using Internet connection.
6. In the Absence Owner, When Telegram Alert received, Owner can remotely monitor live video streaming on Android OS supported mobile phone or Laptop.
7. Remotely Access the door by using Android OS supported mobile phone.
8. When Visitor found to be a thief, by using Android OS supported mobile phone Owner remotely play Siren for alerting neighbors and Security.

Telegram protocol:

Telegram is the One of the Solutions for Remote Access and Support over the Internet. It is the social media application used widely for messaging. It connects to any PC or server around the world within a few seconds. The users can remote control his partner's PC as if he is sitting in front of it. Telegram communication combines various applications in one cost-effective solution:

Remote Support: With Team Viewer you can remotely control any computer as if you were sitting right in front of it – even through firewalls. All your partner has to do is start a small application, which does not even require installation or administrative rights.

Meetings / Presentations: Teamwork, presentations and sales talks – a picture says more than a thousand words. Team Viewer enables you to share your desktop with other people over the internet, even through firewalls – the ideal solution for online collaboration.

Remote Access / Remote Office/ Remote Home: Access all your computers and servers remotely around the clock. Need access to your computers on the road? Need access to your customer's unattended servers? No problem – with Team Viewer all host installations are free.

II. BLOCK DIAGRAM

The home security system have of two major components, Home Electronic Unit (HEU) is part of Embedded unit setup at home where security and automation system designed and Telegram Application Unit (TAU) is a framework designed on Users Android OS supported mobile phone.

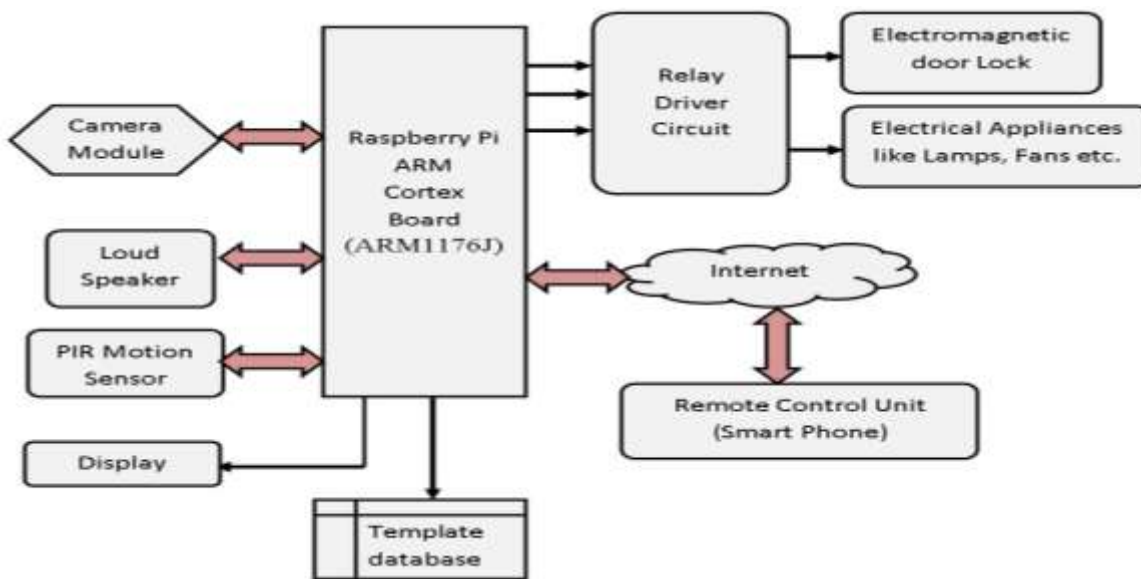


Figure: 1 Block diagram

Home electronics unit (HEU)

HEU is an efficient, low power consumption and low cost embedded processor control system for Smart home security and allows user to remote accessing and controlling. HEU consists of ARM processor used Raspberry pi set up with Linux based Raspbian Operating System on installed SD card. PIR motion sensor and JPEG based Camera module interfaced with ARM processor used Raspberry pi to detect visitor's motion at Door and capture image respectively. Captured images with time and date are saved on SD card. ARM processor used Raspberry pi configured for enabled SSH and camera. HEU also consists of Electrical Relay Driver module for control of Electromagnetic Door lock and Loud Speaker system for enabled Voice alert.

Telegram application unit (TAU)

TAU is a software tool designed on Users Android OS supported mobile phone. Provide GUI (Graphical User Interface) to send predefined Linux Terminal Commands via SSH to HEU. SSH is a secure protocol and the most commonly used to administrate and communicate with Linux servers. TAU is designed on android platform using Java Script on JDK (Java Development Kit) and Eclipse IDE. An efficient and accurate embedded processor control system based on motion detection is very important for wide range of commercial and security application. Many countries are gradually adopting smart home security control system. The most important part of any home security system is accurately identifying visitor who enter and leave through the door. Only few researchers have designed the face recognition based motion detection techniques in an embedded system for real time applications, such as a door access control system. Most of the system was implementing a principle component analysis (PCA) algorithm for motion detection on hardware platform for its simplicity and dimensionality reduction.

IV. HARDWARE IMPLEMENTATION

The remote accessing and controlling of HEU over the Internet can be mechanized by setting up certain network architectural design strategies such as SSH and applying Internet protocol (IPV6) communication standards. If any visitors arrive, HEU capture image of visitor, save it and sends it to an appropriate Telegram including the details of time and date of captured image. The owner can directly login and interact with the HEU. The images captured and the video recorded will be directly streamed on user pre-decided android app on Android OS supported mobile phone. User can access the video directly using the Static IPv6 address or can also stream on local domain with the help of webserver.

Raspberry Pi

Raspberry Pi board is a miniature marvel, packing considerable computing power into a footprint no larger than a credit card. The processor at the heart of the Raspberry Pi system is a Broadcom BCM2835 system-on-chip (SoC) multimedia processor. This means that the vast majority of the system's components, including its central and graphics processing units along with the audio and communications hardware, are built onto that single component hidden beneath the 512 MB memory chip at the centre of the board. It's not just this SoC design that makes the BCM2835 different to the processor found in your desktop or laptop, however. It also uses a different instruction set architecture (ISA), known as ARM. The Raspberry Pi, by contrast, is designed to run an operating system called GNU/Linux Raspbian. Hereafter referred to simply as Linux. Unlike Windows or OS X, Linux is open source: it's possible to download the source code for the entire operating system and make whatever changes you desire.

The Raspberry Pi Camera

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.

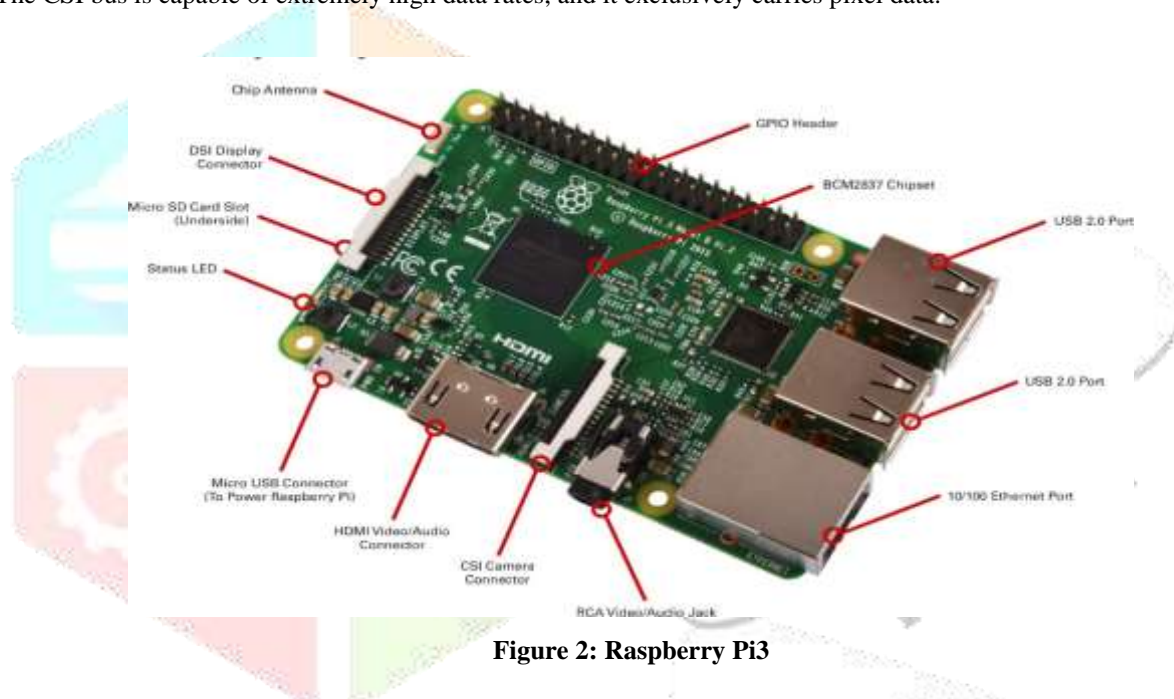


Figure 2: Raspberry Pi3



Figure 3: Raspberry Pi Camera Module



Figure 4: Electromagnetic Door Lock

Electromagnetic Door lock

An electromagnetic lock, magnetic lock, or maglock is a locking device that consists of an electromagnet and an armature plate. There are two main types of electric locking devices. Locking devices can be either "fail safe" or "fail secure". A fail-secure locking device Telegrams locked when power is lost. Fail-safe locking devices are unlocked when de-energized. Typical single door electromagnetic locks are offered in both 600 lbs. (272 kg) and 1200 lbs. (544 kg) dynamic holding force capacities. A "fail safe" magnetic lock requires power to Telegram locked and typically is not suitable for high security applications because it is possible to disable the lock by disrupting the power supply.

Relay driver

The 4-Channel Electrical Relay Driver Module makes it simple and convenient to drive loads such as 12V relays from simple 5V digital outputs of your Arduino compatible board or other microcontroller. You can use any of the control channels independently, so simply leave any unused channels disconnected.

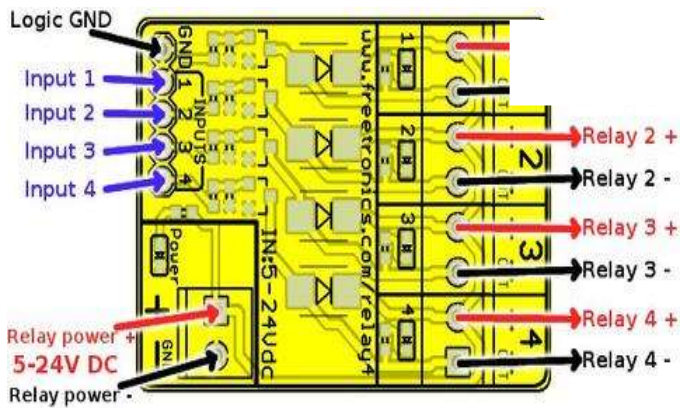


Figure 5: Electrical Relay Driver module configuration

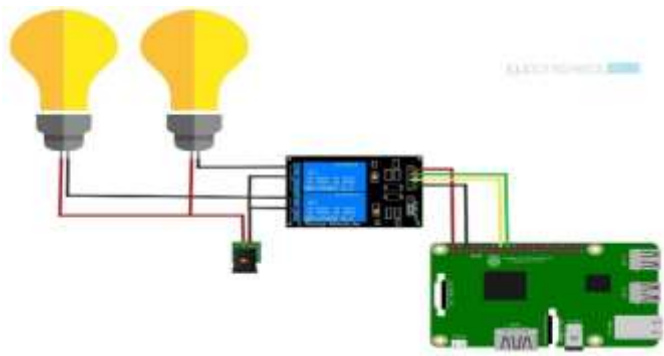


Figure 6: Wiring connection for Electrical Relay Driver

V. SOFTWARE IMPLEMENTATION

The concerned authority can control the system and view video stream of camera module through Smart mobile Phone. The system also provided concerned authority to use Android OS supported mobile phone to send command for voice alert when intruder identified. Users can monitor visitors and control the door lock on active SSH (Secure Shell) page designed on android platform and enhanced with JavaScript. This system finds a wide application in areas where physical presence is not possible all the time.

VI SOFTWARE IMPLEMENTATION FOR HEU

The System was designed on a ARM processor used Raspberry pi development board in Linux environment, which supports SMTP (Simple Mail Transfer Protocol), TCP/IP, HTTP. The web server Flash File System supports dynamically generated files that can include output data from hardware resources. This type of file is called an embedded server page (ESP).

Installing os and configuring arm processor used Raspberry pi

First we need to install Linux based Raspbian on your micro SD card that will be used in ARM processor used Raspberry pi. We can download the latest image of Linux based Raspbian OS from ARM processor used Raspberry pi website at <http://www.raspberrypi.org/downloads/>
<http://www.raspberrypi.org/documentation/installat...>

After successfully installing Linux based Raspbian OS on ARM processor used Raspberry pi, we need to update software.

Raspberry camera module configuring

After successfully installing Linux based Raspbian OS on ARM processor used Raspberry pi, we need install JPEG based Camera module Library files. To do this we need to run following Linux commands

```
$ sudo apt-get install motion -y
$ sudo apt-get install python-JPEG based Camera module --y
$ sudo apt-get install python3-JPEG based Camera module -y
```

Installing software for sending Telegram

Now after setting up the JPEG based Camera module, we will install software for sending the Telegram. Here we are using **TCP/IP**, which is an easy and good solution for **sending Telegram using command line or using Python Script**. We need to install two Libraries for sending telegram commands using TCP/IP:

```
$ sudo apt-get install telegram
$ sudo apt-get install mailutils
$ sudo nano /etc/dhcp/telegram/telegram.conf (for changing telegram login credentials)
```

After installing libraries, user needs to open **ssmtp.conf** file and edit this configuration file as shown below and then save the file. To save and exit the file, Press 'CTRL+x', then 'y' and then press 'enter'. We can also **test it by sending a test Telegram** by issuing below command; we shall get the Telegram on the mentioned Telegram address if everything is working fine.

Algorithm for Home security system

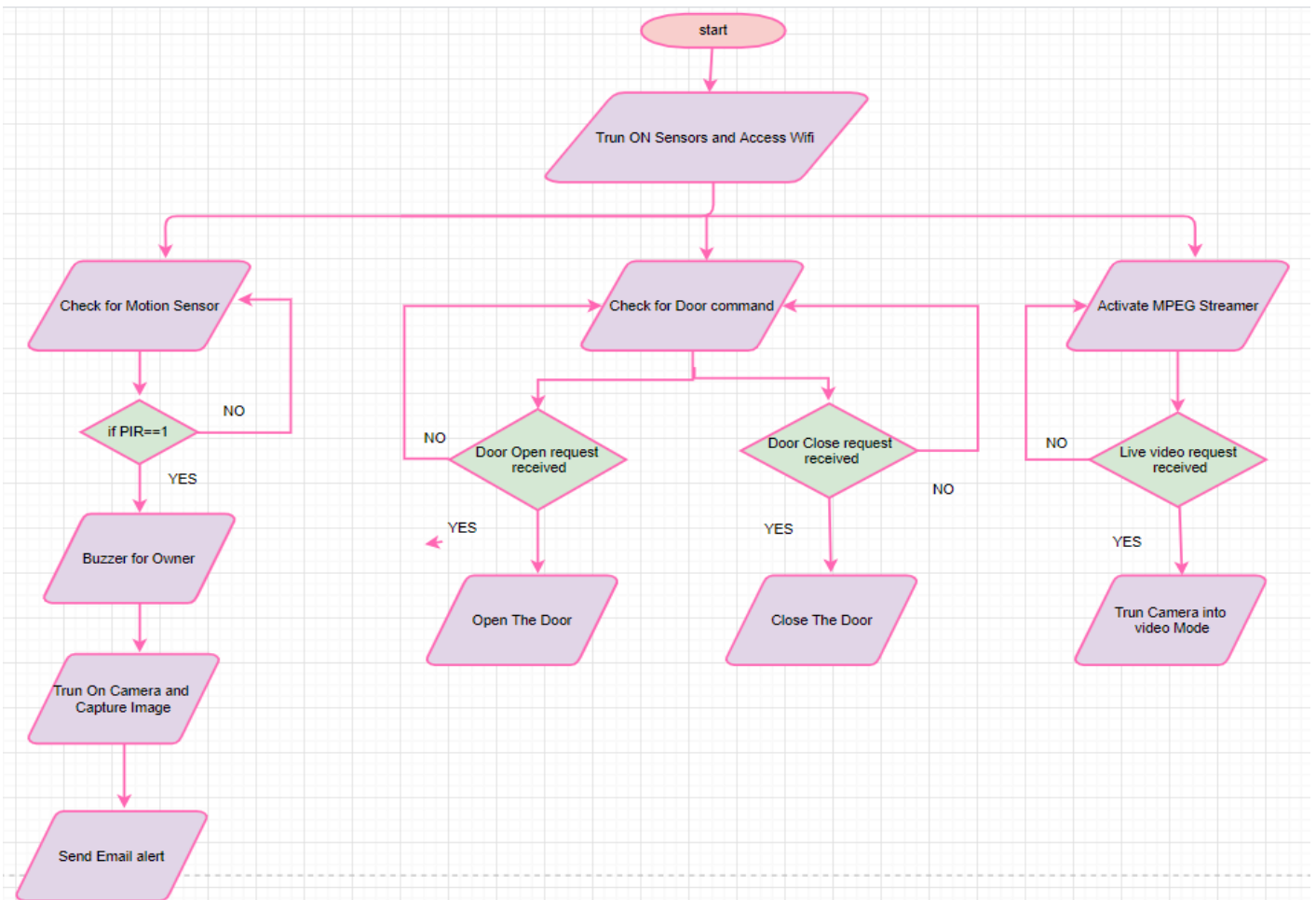


Figure: 7 Algorithm for home security system

Algorithm for Home automation

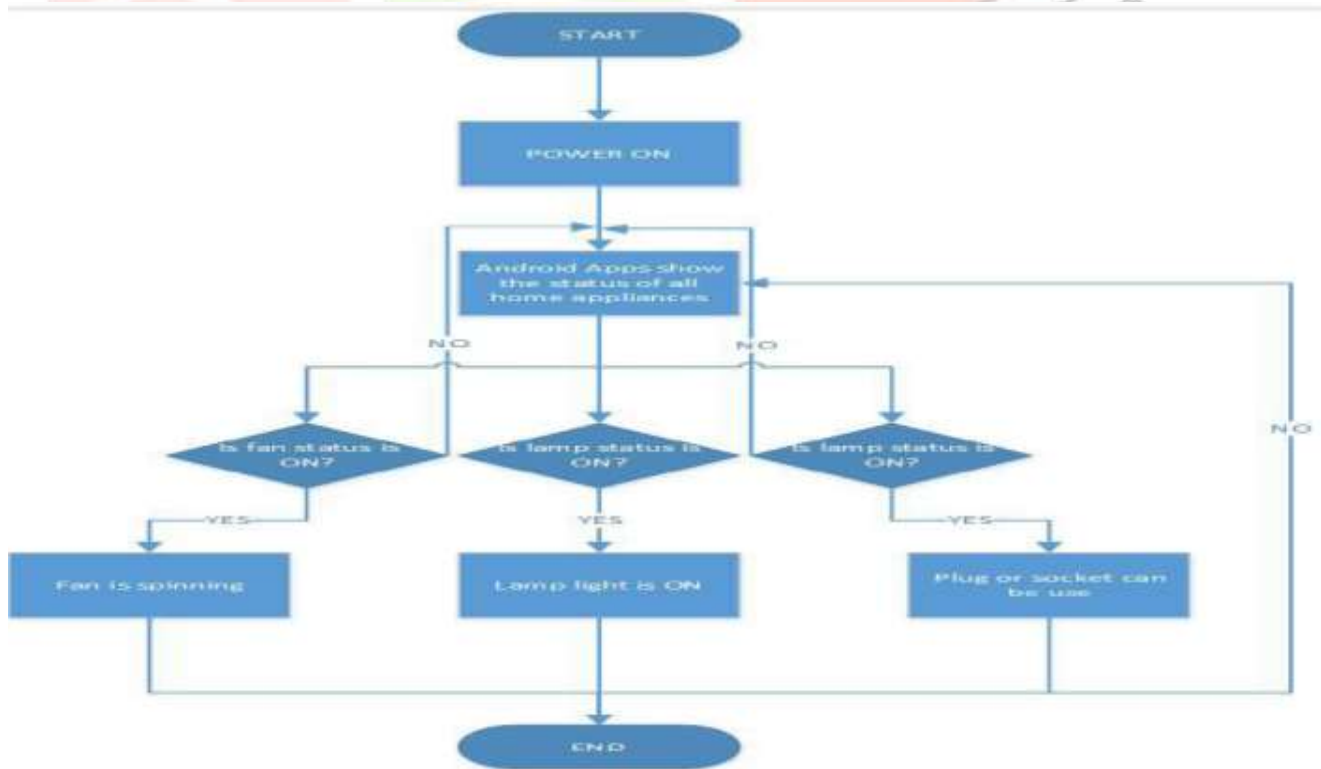


Figure: 8 Algorithm for home automation

Setting Telegram app in system or mobile

- | | | |
|--|---------------------|-----------------------|
| 1 Open Telegram app in your system or mobile | 2 Start "BotFather" | 3 Open "BotFather" |
| 4 Start "BotFather" | 5. Create a new Bot | 6 Obtain access token |

Python program for HEU

The Python Program of this project plays a very important role to perform all the operations. First of all, we include required libraries for Telegram, initialize variables and define pins for PIR, LED and other components. For sending simple Telegram, SMTP Library is enough but if we want to send mail in cleaner way with subject line, attachment etc. then we need to use MIME (Multipurpose Internet Mail Extensions). The following library module files are imported on python script. After importing required Library modules, we need to define Telegram address and message for alert Now, we need to define GPIO pins for PIR sensor and define JPEG based Camera module function to capture image when PIR sensor trigger input.

Program for voice alert and door access

User can send Linux command using SSH Client over internet to activate voice alert which is done by playing MP3 file on preinstalled MP3 library The Electromagnetic Door Lock which use a relay to Lock or Unlock. It done by running simple Python script.

```
$ sudo apt-get install omxplayer
$ omxplayer voicealer.mp
```

VII SOFTWARE IMPLEMENTATION FOR TAU

Software tool TAU designed to provide GUI (Graphical User Interface) of SSH client to send predefined Linux Terminal Commands via SSH to HEU. SSH is a secure protocol and the most commonly used to administrate and communicate with Linux servers. SSH Client is designed on android platform using Java Script on JDK (Java Development Kit) and Eclipse IDE. Android is the first complete, open, and free mobile platform. Developers enjoy a comprehensive software development kit. Eclipse is an integrated development environment (IDE) used for implementing Android application. It is based on Java IDE. Eclipse is written mostly in Java and its primary use is for developing Java application.

VIII. RESULT ANALYSIS

The results produced by the system of Telegram application based door accessing system and alerting through voice based ARM processor used Raspberry pi. It has presented the GSM mobile screenshot and Telegram screenshot. In such ways Observations were made here by taking various constraints into account. The experimental setup shown in the Figure 9 is monitoring the environment for visitor at the Door, the HEU sends the Telegram alert indicating the update visitor to the authorized users and the user then sent command using SSH Client over Internet to HEU for controlling action which is shown from Figure 9 and Figure 10, respectively. Based on command HEU run the Python script and activate respective devices. For example, a command with the subject ON CAMERA ALERT was sent to HEU to active JPEG based Camera module, capture image and send it as Telegram alert if any Visitor at Door found.



SSH client is setup by knowing static IP address and Port. When we connect through SSH, we will be dropped into shell session, which is text based interface where we can interact with our server. For the duration of SSH session, any command that we type into local terminal are sent through an encrypted SSH tunnel and executed on server. We can also stream JPEG based Camera module video over internet by installing and configuring uv4I Linux Driver. Simply by identifying ARM processor used Raspberry pi IP address, on any internet browser we can login to view JPEG based Camera module Video stream



Figure: 10 Screenshot of Telegram alert on Android OS supported mobile phone

VIII. CONCLUSION

This paper presents the design and the implementation of an interactive home security system with Web-enabled measurement and control systems. The application based monitor and automatic control of equipment is forming a trend in automation field. Replacing PC with low-cost single chip processor which can make administrators to get parameters of different remote devices and send control information to field equipment's at any time through Internet. This paper presents the design and the implementation of an interactive Smart home security system and automation with Telegram alert. The IOT is an excellent choice for this due to its extensive coverage. Since SMS is a text based protocol, even the most basic IOT systems can have an access to the status of the devices or make changes on these states. The complete system is secured through a login Telegram and Webpage. The system also generates voice output. The design is completely wireless and integrated with the software to form a low cost, robust and easily operable system. The telegram message over internet as command controlled duplex communication system provides a powerful decision making device concept for adaptation to several smart home scenarios.

FUTURE SCOPE

1. Computer vision can be used for motion detection and alerting through telegram.
2. The system can be used in many fields, for example industrial control and monitoring, automation.
3. Information applications, intelligent systems, and so on. We can implement as a full sensor network.
4. Further advanced concepts of shocking for unauthorized persons can be adopted to provide ultimate security to the home.

REFERENCES

- [1] Jinsoo Han; Chang-Sic Choi; Ilwoo Lee, "More efficient home energy management system based on ZigBee communication and infrared remote controls," *Consumer Electronics, IEEE Transactions on*, vol.57, no.1, pp.85,89, February 2011
- [2] Erdem, H.; Uner, A., "A multi-channel remote controller for home and office appliances," *Consumer Electronics, IEEE Transactions on*, vol.55, no.4, pp.2184,2189, November 2009.
- [3] Yuksekkaya, B.; Kayalar, A.A.; Tosun, M.B.; Ozcan, M.K.; Alkar, A.Z., "A GSM, internet and speech controlled wireless interactive home automation system," *Consumer Electronics, IEEE Transactions on*, vol.52, no.3, pp.837,843, Aug. 2006.
- [4] Shaik Anwar, D. Kishore "IOT BASED SMART HOME SECURITY SYSTEM WITH ALERT AND DOOR ACCESS CONTROL USING SMART PHONE" 2016 *International Journal of Engineering Research and Technology (IJERT)*.
- [5] G. Changsha, A. J A. Rice, and A. Changzhi Li, "Wireless Smart Sensor Network based on Multi-function Interferometric Radar Sensors for Strut", *IEEE Transaction on structural Health Monitoring*, 978-1-4577-1238-8/12 2012.
- [6] G. Feltrin, O. Saukh, J. Meyerand and M. Motavalli, „structural monitoring with WSN: Experiences from field deployments first middles east conference on smart monitoring, 2011; 8-10. <http://www.mdpi.com/journal/sensors>.
- [7] Chia-Hung Lien; Ying-Wen Bai; Ming-Bo Lin, "Remote-Controllable Power Outlet System for Home Power Management," *Consumer Electronics, IEEE Transactions on*, vol.53, no.4, pp.1634,1641, Nov. 2007.