IMPLEMENTATION OF A SMART SAFETY AND SECURITY DEVICE USING RASPBERRY PI, TELEGRAM BOT, PROTA OS AND MANYTHING WEB SERVICE

Vinit Jain¹, Soniya Chawla ²
¹Department of Information Technology MIT College of Engineering Pune, India ²Department of Information Technology MIT College of Engineering Pune, India

ABSTRACT:

Safety and security at home, schools, and workplaces is a never-ending and ever increasing phenomena. Every entity enforces them using some or the other monitoring or surveillance devices and sensors. The emergence of Internet Of Things(IoT) has led to the evolution of smart safety and security systems. Internet Of things enables devices to communicate with each other and take real-time decisions enabling them to make smarter decisions. But the problem lies in the cost, complexity, and implementation of such smart devices for safety and security. In this paper, we propose a smart safety and security device using various components like Raspberry pi 3, Telegram bots API, Pir sensor, Manythings web services, Prota Os, Motion Os, Web cameras or Spare Smartphone and flame sensor. This paper aims to suggest a cost-effective approach for creation of such a device which is less complex system along with the ease of setup and installation and also low maintenance but highly precise device inspired by IOT.

Keywords: Internet of Things, Raspberry Pi, ManyThings web service, Prota OS, Telegram bot, Pir Sensor.

[1] INTRODUCTION

Security is an important aspect which has become a necessity in today's world. Security has evolved from a security guard to guarding cameras. With this evolution in technology, security systems have improved to provide high-level security and surveillance. But all of this requires the involvement of a human to monitor and keep track of the activities. Also, it requires human assistance to inform about any unusual activity detected. These security and safety
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devices are dependent totally on humans and constantly require instructions from humans. Even if there occurs any sort of discrepancy from the usual series of events, all these devices can do is monitor and capture moment. This problem has been overruled by the emergence of Internet Of Things (IOT) which has eliminated human intervention in the task of constant task of surveillance.

Internet Of things is a network of devices consisting of various machines, sensors, devices communicating with each other using network connectivity which enables them to communicate and exchange data with each other. By 2020 IoT is estimated to consist of more than 20 billion objects and have a market of more than 5 trillion dollars. It is used across several sectors, revolutionizing every sector in which it is deployed. From petroleum sector, health, smart transportation, intelligent systems to smart and secure homes, this technology is successfully leaving an imperishable mark in every part of work and life. This technology has led devices to take real-time action upon occurrence of particular events, hence providing a sort of intelligence to the devices. Figure 1 illustrates the network of the Internet of Things which explains in detail as to how various devices are connected with each other, how they are directed by human actions and how and what components work together to add to the functionality and make it a complete connected network.

The emergence of IoT and exchange of data among devices has led to the creation of exceptional smart devices offering a great level of safety and security. But at the same time cost, complexity and implementation pose a major obstacle. The paper aims to propose an implementation to overcome the above-mentioned issue.

Figure. 1. Network of Internet of Things

Implementation of such smart security device is possible in less than 5000 rupees by making use of Raspberry pi 3. Technology enthusiast and many others can easily build it as a do it yourself project and can deploy this device for commercial purpose. The device consists of several components like a PIR sensor which will be used to detect a person passing through a particular point. This will be connected to the Raspberry Pi 3. The camera connected to the Pi will be used to capture the image as soon as the person's motion is detected by the PIR sensor. The smartphone will be used as a webcam in this device. Using telegram bots API, the captured image will be sent to the desired user. In a similar way, for safety at various places from fire and inflammable gases, MQ2 Sensor will be used. MQ2 sensor also connected to Pi.
will be detecting the smoke and upon an occurrence of an abnormal event will inform using telegram bots API.

This paper further explains all the hardware and software components that are required for this implementation. After that, a more detailed and proper flow of the working of the device is presented followed by the future scope.

[2] COMPONENTS

2.1 PIR SENSOR

A Passive infrared sensor (PIR sensor) is an electronic sensor which measures infrared light radiating from objects in its field of view and they are most often used in PIR based motion detectors. It is used to sense movement of people, animals or other objects.

2.2 PROTA OS

Prota Os is an operating system for personal server computers. It runs various applications and does not require any input or output peripherals like monitor, keyboard, mouse etc. It is originally designed for home automation, connecting devices, and internet services together for optimizing everyday workflow seamlessly. It supports the Raspberry Pi models. It is easy to install and has a very detailed and descriptive documentation for its setup on Raspberry Pi.

2.3 RASPBERRY PI 3

![Figure 2. Raspberry Pi 3](image)

Raspberry Pi is a credit card sized single board computer developed by Raspberry Pi foundation. It was developed in order to promote the teaching of computer science and robotics. The above figure 2. is the actual image of Raspberry Pi 3. Raspberry pi 3 is the latest model of Raspberry Pi with many added functionalities.

It consists of quad-core 64 bit ARM Cortex-A53 processor running at 1.2 GHz which makes it 10 times faster than the first version of Raspberry Pi. It consists of 1 GB RAM and has 4 USB ports. It has a 40 pin extended GPIO. It has a CSI camera port for connecting the Raspberry Pi camera. The Micro SD port will be used for loading the operating system and storing data.
2.4 MANYTHINGS WEBSERVICE

ManyThing is a web service that allows you to turn any smartphone or tablet into a smart camera by installing its application. It enables to see a live stream and also record particular moments when a particular motion is detected. The service is free for one camera. The major advantage of using a smartphone is that both the front and rear cameras can be used for free as the application will be installed on a single device, hence letting us capture both front and back side moments. ManyThing is connected to IFTTT, therefore it will allow us to automate the camera's use.

2.5 TELEGRAM BOT

Telegram is a chat based application that can be downloaded from the play store for Android users or app store for iOS users. Telegram bots are the third-party applications that run inside Telegram. Users can interact with bots by sending them messages, commands, and inline requests. A user can control its bot using HTTP request to the bots API. Bots enable smartphones to be controlled not only by humans but also by machines like Raspberry Pi.

2.6 CAMERA

A web camera is a component required to shoot and capture the moment when a motion is detected and send the captured moment using Telegram bot to the user. This task becomes more inexpensive and effective by using any spare smartphone or a cost-effective smartphone.

2.7 MQ-2 SENSOR

Sensors are necessary to detect components in the air. MQ-2 is a gas sensor for flammable gas and smoke by detecting the concentration of combustible gas in the air. They are used in gas detecting equipment for smoke and inflammable gasses in household, industry or automobile. It can be used along with Raspberry Pi in order to create a safety device for detecting the high concentration of smoke and hazardous gases.

[3] IMPLEMENTATION

In the above section, all the components that are required in the implementation have been explained in detail. Here we describe step by step about building a smart safety and security device. Firstly Raspberry Pi 3 needs to be set up by connecting to a power supply and all the rest credentials. Now the setup of the device using Raspberry Pi 3 will be explained step by step as follows:

STEP 1: SETTING PROTA PI SMART HUB

We first need to build the smart hub that will control the automation and will connect devices together. Prota OS is our free smart hub OS which is very easy to install. It will be installed on an SD card in Raspberry Pi 3. The easy installation of the Prota OS over Raspberry Pi is explained step by step with all the details and image references on its official documentation on its website.
STEP 2: SETTING PIR SENSOR

We now need to connect the Pir sensor to the Raspberry Pi 3 which becomes our second step. The sensor will have a pin with each having indications as D which is for data, + for current connection and – is for the ground connection. Next step after connecting Pir sensor to Raspberry Pi is to open Prota Space and download the GPIO app in App libraries. In GPIO app click on GPIO18. Select ‘Interrupt’ and ‘Pull down’ and click on ‘set’. The sensor is now set up.

STEP 3: SETTING WEB CAMERA, MQ-2 SENSOR, AND TELEGRAM BOT

Now plug in the camera's USB cable to the Raspberry Pi. Download the Webcam application on on Prota Pi in App libraries. Open and check whether the camera is working or not. Now connect the MQ-2 sensor to Raspberry Pi. Next step is to download Telegram app on the mobile phone and on Prota. Setup a name and username for the bot and then click Create. Now the bot is created.

STEP 4: TURNING SMARTPHONE INTO WEBCAM WITH MANYTHING

ManyThings is a web service that allows turning any smartphone into a smart camera by simply adding its application. Using this we can record live moments and capture moments upon motion detection. Download this application on the smartphone. Sign Up and choose Camera to put it in a Web Camera mode. The viewer is the mode to use on the device from which we want to monitor. The smartphone will now switch to a camera and immediately start recording as soon as the red button for recording is pressed. ManyThing is connected to IFTTT so it will allow automating the camera's use.

STEP 5: CREATE AND CONNECT THE IFTTT ACCOUNT

IFTTT will connect smart devices and web services together, to connect the smartphone and telegram application with Prota. Download the IFTTT application on the Prota's App libraries. Create an account and search for Prota channel. Search for the ManyThing channel and connect your ManyThing account to it. Similarly, search for Telegram channel and connect the application and immediately start recording as soon as the red button for recording is pressed. ManyThing is connected to IFTTT so it will allow automating the camera's use.

STEP 6: CREATING THE AUTOMATION

The central part of home automation is writing the right automation rule that will fit perfectly the particular needs and all possible situations. Prota OS provides a very flexible and intuitive tool with Stories app. Combined with IFTTT, it allows one to connect to hundreds of services and devices together in a very specific way. We will create the following automation:

- When PIR sensor sense motion before 7 PM, send a notification to my Telegram account with a snapshot of the room (camera)
- When my smartphone camera detects motion (camera), send me a notification to my
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Telegram account with a link to the video
- When I send “Report” to my Telegram Bot, send me a snapshot of camera
- Use Telegram Bot to control camera with simple messages
- Use Telegram Bot to trigger an alarm when intruders have been detected or when hazardous gases or smoke has been detected

1. When PIR sensor sense motion before 7 PM, send a notification to my Telegram account with a snapshot of the room (camera)

- Open Stories app
- Click on + and on “When” to start writing your storyline
- Select “GPIO detects rising interrupt on PIN GPIO18” as sensor event
- Add an “And” field, select the sensor by “Scheduler - the clock is on?” and set the time for instance <= 19:30 on weekdays (if you're not back home before 7:30 PM)
- Select “Webcam takes a snapshot” as action
- Click on “then” and add “Telegram Bot sends a text message” with “Unusual motion detected”
- Click on “then” and add “Telegram bot sends a photo”. Select the snapshot file and yourself as recipient

2. When my smartphone camera detects motion (camera), send me a notification to my Telegram account with a link to the video

- Open IFTTT and start a new applet
- Search Manything and select “Motion detected”. Select your device.
- Search Telegram and select “Send a message”. The default message will provide all necessary information, but you can edit it if you want.
- Click on finish

3. When I send “Report” to my Telegram Bot, send me a snapshot of camera

- Open Stories App
- Click on + and on When
- Select “When Telegram Bot receive message text ‘Report’” as event
- Select “Webcam takes a snapshot” as action
- Click on “Then” and add “Telegram Bot sends a photo” as the second action

4. Use Telegram Bot to control the camera with simple messages

There are many things you can tell your old smartphone’s camera to do via an IFTTT applet. The most important ones are start and stop recording, use a front-facing camera, turn on sound and motion emails, turn camera flashlight on. You can decide to create an automation to trigger those settings with a simple Telegram message to your IFTTT bot.

We will use here applets for start and stop recording (send a message "Video start" and "Video stop”) and for the flashlight to be turned on ("Flash on").
5. Use Telegram Bot to trigger an alarm when intruders have been detected

Let's assume the worst! You look at your snapshots or live stream and realize intruders have gotten into your house. A good way to frighten them could be either to play a recorded message to make them think someone is here or to play an alarm sound. Well with IFTTT, you can remotely trigger your phone to play such sound! You can find many alarm sounds for free with a quick research. We recommend you this high pitch sound, highly disturbing! You can edit it to make it last a long time or to add a vocal message.

Download it and put it on the old smartphone that will be used as a camera. Make sure its name is recognizable, such as "High Pitch Alarm".

Now let's automate the alarm:
- Open IFTTT and start a new applet
- Select Telegram - “New message” and set the trigger message as “Alert”
- Select Android Device - “Play a specific song” and write down the exact name of your track (for us it will be “High Pitch Alarm”)

[4] FUTURE SCOPE

The safety and security of the devices can be increased in various manners. Machine Learning can be used in understanding the patterns of the user. An abnormal pattern as the time for a detected motion can be detected as an intruder by using this technology. The daily patterns of the user which the camera would capture can act as the input data for the training dataset.

Also, image processing can be used to straightaway detect the actual owner and detect an unknown person entering. Such detection of an unknown person using image processing could further be updated to the user using telegram bot as explained above. The image processing can be embedded on Raspberry Pi 3 by coding in Python using OpenCV.

[5] CONCLUSION

There are various safety and security devices available. The emergence of IoT leading to exchange of data between devices and communication between them has led to the development of smart safety and security devices. In this paper, we have proposed the idea and development of such a device in a detailed and precise manner. The step by step setup and installation of such device has been explained making it possible for an individual to create such a device like a do it yourself(DIY) project. This paper has been constructed and framed in a manner such that tech enthusiasts and many people can get themselves started with Internet Of Things and create such better devices for them and society at such a minimal cost with ease. Raspberry Pi 3 being the main component of this device along with all the dependencies makes it possible to create a cost-effective low complex safety and security device. The development of such devices would hence lead to better development in the field of IOT and such economical smarter devices.
REFERENCES


