

Home Automation using Raspberry Pi-3

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ABSTRACT

This paper deals with the design and implementation of Raspberry Pi based IoT. In this present generation the internet is playing a vital role. In this project we concentrate on home automation using Raspberry Pi with the surveillance camera to detect the theft in advance. The main security is provided by camera module which captures the images and uploads the images on the GitHub server and sends the information to the owner through a Twilio account. The images are initially stored in the Raspberry Pi module SD card. Raspberry Pi works like a small minicomputer and operates on a Linux platform. By just connecting mouse and keyboard, we can operate it as a minicomputer where we can play games, play videos, etc. just like our personal computer or laptop. The image of the person at the door will be captured and the images will be stored in the GitHub server, which will be later sent to the owner of the house through an SMS by twilio-a cloud communication platform.

Keywords: IoT, Surveillance camera, GitHub, Twilio, Advanced IP Scanner, Mobaxterm, Raspberry Pi.

1. INTRODUCTION

An embedded system is a special-purpose system in which the computer is completely encapsulated by or dedicated to the device or the system it controls. Unlike a general purpose computer, such as a personal computer, an embedded system performs one or more predefined task, usually with very specific requirements. Since the system is dedicated to specific tasks, design engineers can optimize it, reducing the size and cost of the product. Embedded systems are often mass-produced benefiting from economies of sale.

Personal Digital Assistants (PDAs) or handheld computers are generally considered as embedded devices because of the nature of their hardware design even though they are more expandable in software terms. Physically, embedded systems range from portable devices such as digital watches and MP3 players to the large stationary installations like traffic lights, factory controllers or the system controlling the nuclear power plants. In terms of complexity embedded system can range from very simple single microcontroller chip to the very complex multiple units, peripherals and networks mounted inside a large enclosure.

The Internet of Things (IoT) refers to uniquely recognizable objects and their virtual representations in an Internet like structure. Internet of Things refers to day-to-day objects that are understandable, distinguishable, locatable, addressable and controllable via the internet using RFID, wireless LAN, wide-area network, or other means. These objects include not only the day-to-day use electronic devices or the products of higher technological development, such as vehicles and equipment, but also include various things like food, clothing, shelter, materials, their parts and sub-assemblies: commodities and luxuries, etc.

Based on a large number of low cost sensors and wireless communication, the sensor network technology brings new demands to the communication technology. It can change the way we live, work and play. Apart from benefits

of IoT's, there are several security and privacy concerns that need to be addressed to be aware of the theft in advance, and secures the home.

The concept of intelligent home automation using Raspberry Pi has captured the attention of the researchers and the consumers to be directed forward the usage of the recent technology. In this project home automation is the automation for the security at the front door in the absence of the owner. Home automation includes the interface of the camera and ultrasonic range sensor with the Raspberry Pi-3 and with the use of GitHub and Twilio this setup sends an SMS to the owner in order to avoid the theft in advance.

1.1. RASPBERRY PI-3

The Raspberry Pi is a credit card sized computer that plugs into your TV and a keyboard. It is capable of being a little computer which can be used in electronic projects and for many of the things that your desktop does like spreadsheets, word-processing and games. It can also play high definition videos.



Figure 1.Raspberry Pi-3.

Raspberry Pi is of low cost. It is a little device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python. It can play a role of a computer like browsing the internet, playing high definition video, making spreadsheets, word-processing and playing games.

Raspbian is the recommended operating system for normal use on a Raspberry Pi. Raspbian is a free operating system based on Debian, optimized for the Raspberry Pi hardware. Raspbian comes with over 35,000 packages; precompiled software bundled in a nice format for easy installation on your Raspberry Pi. Raspbian is a community project under active development, with an emphasis on improving the stability and performance of as many Debian packages as possible.

1.2. RASPBERRY PI-3 AND CAMERA MODULE INTERFACE WITH FACE REGONITION

An area of application of Computer vision, one that has always fascinated people, concerns the capability of robots and computers in general to determine, recognize and internet with human counterparts. Here in this project we

simply take our Raspberry Pi, Night Vision Camera, and open source software products for image acquisition, such as Open CV, Simple CV, that allow a high level approach to this discipline, and therefore quite a simplified one.

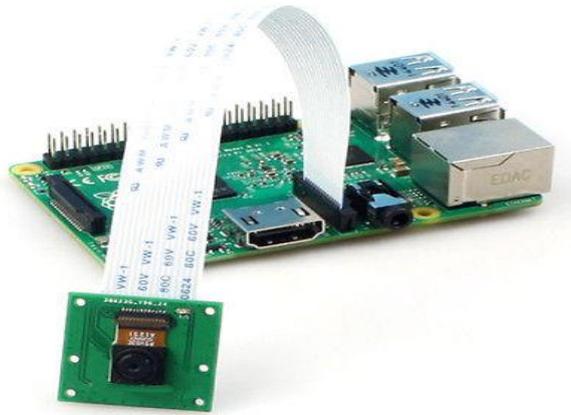


Figure 2. Raspberry Pi-3 and Camera interface.

Night vision is the ability to see in low light conditions. Night vision is made possible by a combination of two approaches: sufficient spectral range and sufficient intensity range. Humans have poor night vision compared to animals, in part because the human eyes lack a tapetum lucidum.

Here the night useful spectral range techniques can sense radiations that are invisible to a human observer. Human vision is confined to a small portion of the electromagnetic spectrum called visible light. The enhanced spectral range allows the viewer to take advantage of non-visible sources of electromagnetic radiations. The enhanced intensity range is achieved via technological means through the use of an image intensifier, gain multiplication CCD, or other very low-noise and a high-sensitivity array of photodetectors.

In this project night vision camera is used for the security basis. Low-light imaging cameras work by using image intensifiers. The intensifiers enlarge the available light to produce an amplified image. This is achieved when the image focuses on the photocathode of an image intensifier. The electrons hit a phosphor screen and the image is created. Intensified camera systems use intensifiers to create a clear image during low-light situations. This allows the broader image of the low-light scene to be viewed.



Figure 3. Night vision camera for security.

Infrared illumination combines with motion detection technology to create an effective home security camera. When the camera detects the movement, the infrared illumination lights up the scene and captures the images.

1.3. TWO TECHNOLOGIES USED

1.3.1. GITHUB

GitHub -originally known as Logical Awesome LLC, is a web-based hosting service for version control using git. It is mostly used for computer code. It offers all of the distributed version control and source code management (SCM) functionality of Git as well as adding its own features. It provides access control and several collaboration features such as bug tracking, feature requests, task management, and wikis for every project. GitHub offers plans for both private repositories and free accounts which are commonly used to host open-source software projects. As of April 2017, GitHub reports having almost 20 million users and 57 million repositories, making it the largest host of source code in the world. GitHub has a mascot, an "Octocat" called Mona, a cat with five tentacles and a human-like face.



Figure 4. GitHub services.

1.3.2. TWILIO

Twilio is a cloud communication platform as a service company based in San Francisco, California. Twilio allows software developers to programmatically make and receive phone calls and send and receive text messages using its web service APIs. Twilio's services are accessed over HTTP and are billed based on usage. Twilio uses Amazon Web Services to host telephony infrastructure and provide connectivity between HTTP and the public switched telephone network (PSTN) through its APIs.



Figure 5. Twilio- Cloud Communication Platform.

Twilio lists a number of other open-source projects on their website.

1.4. ULTRASONIC RANGING SENSOR

The ultrasonic ranging sensor is a device that can measure the distance to an object by using sound waves. It measures distance by sending out a sound wave at a specific frequency and listening for that sound wave to bounce back.

1.4.1. Program

```
#!/usr/bin/python
from gpiozero import Distancesensor
from time import sleep
sensor=Distancesensor(echo=24, trigger=17, max_distance=2.0)
while True:
distance = sensor.distance * 100
Print("Distance : %.1f" % distance)
Sleep(1)
```

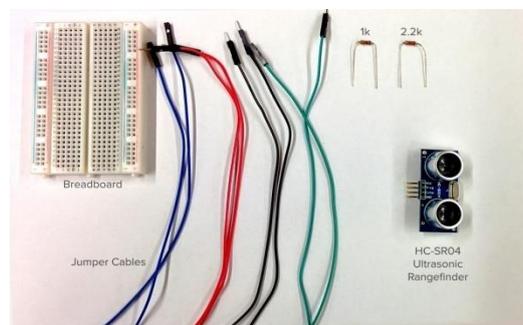


Figure 6. Ultrasonic ranging sensor

2. PROBLEM IDENTIFICATION

When people are away from home, they may want to know who was at the front door. The time of arrival and the photo of the person even in the darkness.

3. EXISTING SYSTEM

In the present system, the image of the person at the front door is captured and are used later. For this notification surveillance camera is used. The drawback is that this camera cannot be used in the darkness. The theft, which is going to be happen cannot be forecasted in advance. And the security is being reduced.

4. PROPOSED SYSTEM

In this project, night vision camera and ultrasonic ranging sensors are used to capture image of the person at the front door. Here, additionally, an SMS will be sednt to the owner through a telephone number provided by twilio and the theft can be stopped by intimating the police regarding the theft. The main advantage is that GitHub server is a version control, hence the data get stored for later clarification.

5. IMPLEMENTATION

The project proposed is mainly to stop the theft which is going to happen later. To handle the burglars our project will be the best way to pre-empt the plans with proven preventive measures. Here the night vision camera is used to take an image of the person and sends it to the GitHub site. To reduce the theft by intimating the owner in advance

through a SMS with a link pointing the photo storage which is sent by the Raspberry Pi-3. It helps the owner to alert the nearby police station about the suspicious people.

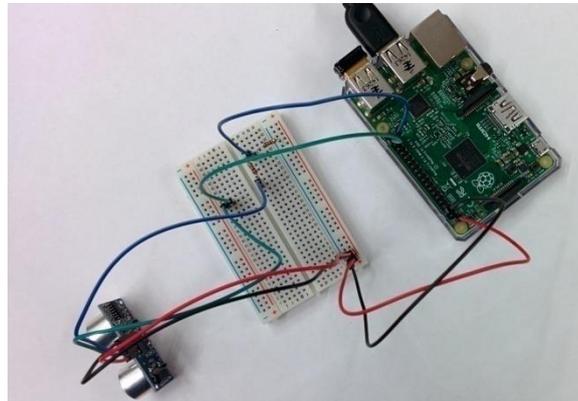


Figure 7. Interfacing Raspberry Pi-3 with the Ultrasonic Sensor.

Program for capturing image:

```
import picamera
from time import sleep
#create object for PiCamera class
camera = picamera.PiCamera()
#set resolution
camera.resolution = (1024, 768)
camera.brightness = 60
camera.start_preview()
#add text on image
camera.annotate_text = 'Hi Pi User'
sleep(5)
#store image
camera.capture('image1.jpeg')
camera.stop_preview()
```

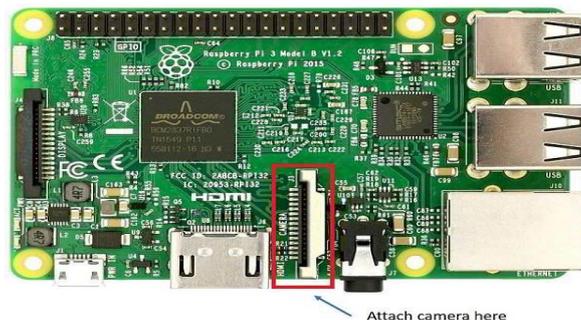


Figure 9. Interfacing Raspberry Pi-3 with Night vision Camera

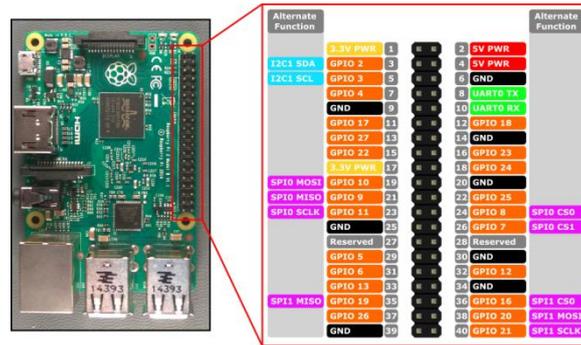


Figure 9. GPIO pins in Raspberry Pi-3.

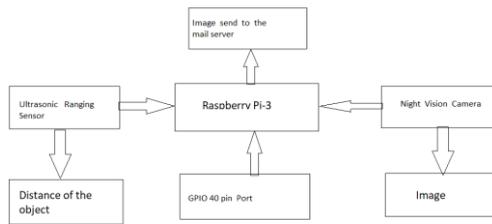


Figure 10. Block diagram.

6. CONCLUSION

In this paper, home automation using Raspberry Pi-3 is done in such a way that the theft is being stopped in advance. An SMS to the owner provides the image of the person at the front door, even when the owner is not inside the house. It relates to security basis. The implementation is also low cost.

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