Theft Detection System using PIR Sensor

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***Abstract*— In this paper, we are providing a home security for the theft by implementing smart surveillance system using RP and PIR sensor. Now-a-days, the IoT plays a major role in many fields by automating the application. The sensor used in this paper is PIR and temperature sensor. PIR is an electronic sensor that detects the motion of objects, by measuring the level of IR radiation. This principle is used to detect the stranger entering into the house. Temperature sensor and a camera are used to monitor and control the fire incident that takes place in a house. A sub motor setup with a solenoid value is used to spray chloroform. This action is done, which moves the stranger into unconscious state. The camera and PIR sensor are integrated in such a way that any movement in the room, switches ON the camera automatically. The house owner can view the live stream of motion that take place inside the house by the stranger. A mail and phone call services are included in the paper to alert the owner about the stranger action. The proposed work provides a smart home automation system for theft detection.**

Keywords—Raspberry Pi (RP); Passive Infrared (PIR) sensor; Internet of Things (IoT); Theft Detection System (TDS); General Purpose Input/Output (GPIO); Infrared(IR) rays

I. INTRODUCTION

The technology had made lots of changes in the world. The next century will come become more comfortable base on the bright rise in technologies. The recently emerging technology in real world is the IoT. This technology has bright growth to make the complete system a smart one. The development was the smart surveillance system. There were lots of inventions developed in the field of IoT and the most recognized one was the smart surveillance system development. There were lots of advancements in the wireless technologies such as domain, cloud and many other technologies which were included in the system to show something new. IoT will include many devices such as electronic, electrical and IT related works. Smart surveillance system consists of many systems that has to be monitored properly and must be handled carefully so that the system does not fail for any improper handling of the devices. The issue that people faced after many days is that the problem of connectivity. Among many IoT applications the smart surveillance system plays a vital role in realizing the smart cities. The Government of India has proposed to develop many smart cities across the country which will create a huge demand for smart home automation solutions in near future. In smart surveillance the word "smart" means context aware this can be realized using IT and IOT.

II. LITERATURE SURVEY

Ying-Wen Bai etal. [1] have used a many ultrasonic sensors for the detection of intruders. If someone pass through the sensors, transmission will be blocked and the system knows the situation. Major Voting Mechanism(MVM) is used to turn on the video camera. Haipeng Chen etal. [2] provided a ARM based video surveillance using embedded remote. The system sends the captured video to the user's mobile through e-mail. During long term monitoring the system adapts to the ambient light changes. For sudden appearance in highlight it provides good resistance. A. Anbasari etal. [3] presented a method for network indoor home automation and evaluated the wireless smart homes. It also helps the future researchers for developing a practical and sustainable smart home. This systems provides a gathered information to communication protocols, multimedia devices, sensors and systems. Luo Wei etal. [4] developed a smart home system using AT89552SCM and ARM. They have implemented a GPRS, GSM, camera, sensors, smart phone and speech recognition in an integrated way into their system.

N. Komninos etal. [5] surveyed the opportunities and drawbacks that exists in smart home security and smart grid. They have listed all the treats in the survey. The survey also

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shows the way using the energy in an effective and efficient manner. Suggestion also provided to prevent and the defenses against various attacks. A survey has been conducted by Gayathri P. Sonawane etal. [6] on different video monitoring system. Most of the system used ARM9 and ARM11 for their implementation. The different compression technique available for video compression is MPEG, H.264 and JPEG. H.264 provides a better way of usage without degrading the image quality. U. Ramakrishna etal. [7] has implemented the security surveillance system using RP. It stores the captured images and videos into the cloud and at the same time SMS and email notifications are send to the owner. Live streaming video is also used for better monitoring purpose.

O. Urfaliglu etal. [8] have used Conditional Gaussian Mixture Models (CGMM) for classification of human motions. This approach is based on Bayesian. The PIR sensor is used to detect the motion. The human activities are monitored through a camera. Xin Jin etal. [9] have proposed a Unattended Ground Sensors (UGS) for detection of strangers and for the motion of pedestrian. The wavelet-based approach is used in detection and classification. The advantage of their system is the adaptability for any real time application; it takes less memory and time while implemented.

III. COMPONENTS AND IMPLEMENTATION

A PIR sensor is a motion detector that senses the heat emitted by a living organism. They are very effective in enhance in home security systems. The sensor is passive, it emits microwave energy or beam of light, and instead this sensor is sensitive to the IR energy emitted by a living thing. When an intruder walks into the detector's field of vision, the detector views a sharp increase in IR energy. PIR sensor reacts only for the moving object and doesn't react to the stationary objects. The web camera is to monitor the current situation, temperature sensor is used to calculate the human body temperature, PIR is used to detect the moving objects, the dongle connects user and board through internet communication and solenoid valve is used to release the chloroform gas.

A. RASPERRY PI

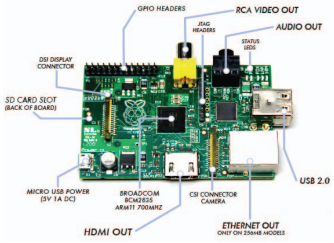

Fig. 1. Rasperry Pi.

RP is shown in Fig. 1. It is a single board computer developed by Raspberry Pi foundation in the United Kingdom. It is the advanced form for microcontroller. Raspbian OS is used as an operating system. To transmit an image capture by a video camera to the mobile phone through mail, Raspbian OS has to be installed.

B. PIR SENSOR

The radiation emitted in the wavelength of IR rays is not visible to human eye. An object having a body temperature greater than absolute zero emits an invisible radiation. This radiation is detected by the electronic devices. One such device is PIR sensor shown in Fig. 2.

Fig. 2. PIR Sensor.

C. LM35

The LM35 sensor in Fig. 3 has an advantage over linear temperature sensors calibrated in Kelvin. At room temperature, this sensor does not require any external trimming or calibration to provide typical accuracies.

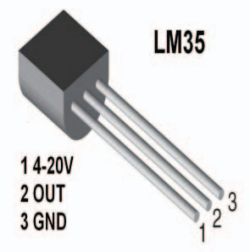

Fig. 3. Temperature Sensor.

D. SOLENOID VALVE


Fig. 4. Solenoid Valve.

It is an electromechanical device that controls the gas flow or liquid flow through it. The electrical current, which is run through a coil, controls the solenoid valve. A plunger moves inside the coil when it gets energized due the magnetic field. The plunger will either close or open the valve, based on the design. The valve will return to its de-energized state, when electrical current is removed from the coil. Solenoid valve is shown in Fig. 4.

E. CAMERA

Fig. 5. Web Camera.

It has in-built CMOS image sensor and sensitive microphone. It offers an image resolution of 300k pixels and has light sensor to switch on 4 lights automatically when in dark. The camera provides a superior image control, color saturation, brightness and sharpness. Here the brightness is adjustable and snap shot switch is perfect for taking still pictures. It supports YUY2 video format USB2.0 interface and is compatible with USB1.1. It offers a transmission speed of 320*240 25 frames/second, 640*480 15 frames/second and 2560*1920 15 frames/second. Has microphone with 3.5mm jack and supports Windows XP/VISTA/7/8 systems, manual focus adjusting and manual snapshots.

F. STEPS TO INSTALL RASPBIAN OS

1. First step is to download RP Supported Raspbain OS.
2. Install Win32Disk Imager application on your windows system.
3. Insert SD card adapter into your system.
4. Burn OS into SD card using Win32 Disk Imager.
5. Configure the Pi.
6. Final step is modifying the firmware.

IV. SOFTWARE IMPLEMENTATION

Software implementation of this work uses RP and Python programming language. The programming language used to is Python which includes some packages; the program includes capturing the image when motion detects, saving the image and send it to the user through mail. The Python packages include configuring GPIO, I2C set up, and installing python smbus, smtplib.

V. BLOCK DIAGRAM

This paper provides a home security for the theft using RP, PIR sensor, temperature sensor and sub motor with solenoid valve. In proposed system we capture information through web camera and transmit the capture image via dongle to our mobile phone using web application. RP controls, operates and give logical sequence to motion detector and video cameras for smart surveillance, stream live videos and records it for future reference using PIR sensor. We can also find number of person located. Once the motion is detected the cameras automatically switches on and starts recording. The recorded data will be altered and the altered data will be sent to the owner through mail. Once owner receives the mail he/she controls the device using application and operates the sub motor to release chloroform gas which is in the solenoid valve and will spread throughout the room. The role of temperature sensor is to calculate and detects body temperature of burglar to indicate the person is in.

The block diagram of Fig. 6 illustrate about the project based on how devices are connected and the workflow of the system. A domain is created and then the required files are loaded into the domain and it is being hosted as the web page then web application is created. The sensors, webcam, motor, dongle devices are connected with the RP through the domain so that the webpage that is hosted can be accessed from anywhere through an internet connection. In the next phase the RP should be connected with the relay circuit.

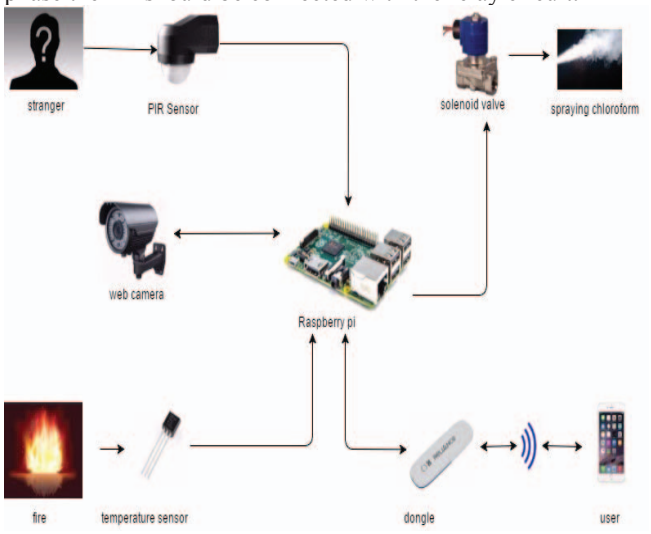

Fig. 6. Block diagram of TDS.

The relay circuit is connected by means of wires to the GPIO pins of the RP. This circuit consists of many components which are interfaced. The relay is connected to the power supply. The power supplied to RP can be controlled only by the relay so that there is no power fluctuation in the RP. This is the ordinary connection of how the system is to be implemented. The temperature sensor is connected with the board to detect the human temperature, then a web camera is connected to the board along with the PIR sensor, the keyboard interface is connected to control the overall system. The power supply system in the RP is very simple it uses the micro USB port to charge. The booting of the system is also a major part so that the controls of the system can be carried out efficiently.

VI. FLOWCHART

The Fig. 7 describes the work flow of various action performed as a stranger enter into the house. The components used in the system are PIR sensor, web camera, temperature sensor, RP, Dongle, mobile phone and a sub motor. The PIR sensor detects the burglar entering into the home. It initiates the entry action to the RP. Web camera is used to monitor the

activities performed in the room. It records the burglar's activities and sends it to the RP. The RP in turn conveys the video to the owner mobile through the dongle. The owner looks the video through the mobile phone, and tries to monitor the activities of the burglar. The owner finds the abnormal activities performed by the stranger and turns on the sub motor through the RP.

Solenoid valve in the sub motor is turned on to spray the chloroform into the room. The stranger after breathing the chloroform loses his consciousness. The live activities of the stranger after spraying the chloroform are watched by the owner or user. After stranger losing the consciousness, the sub motor value is turned off by the owner to avoid the imbalance situation. The imbalance situation arises, if huge amount of chloroform is sprayed into the room. Thus the system provides the live usage of monitoring and controlling the activities inside the house when the owner is not present.

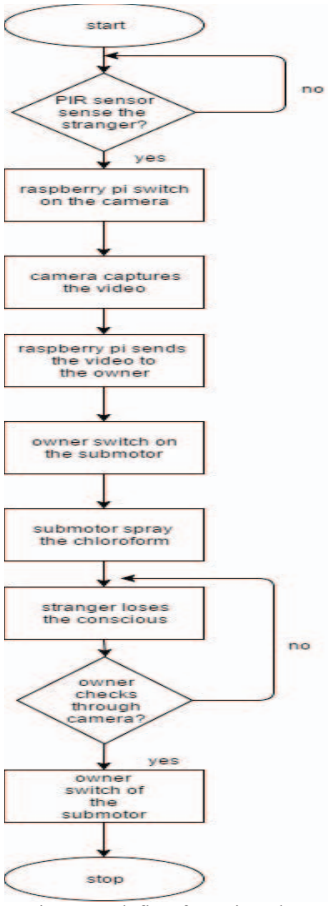

Fig. 7. Work flow for an intruder.

The Fig. 8 shows the flow chart for fire accident. In addition to that, TDS is capable of sense the temperature inside the room. Due to the fire accident, the room temperature goes beyond the range. The owner looks into the live stream of the video through the camera. The user indicates the nearby fire station about the fire incident. Additionally necessary action is also taken by the owner, by quickly arriving to the spot.

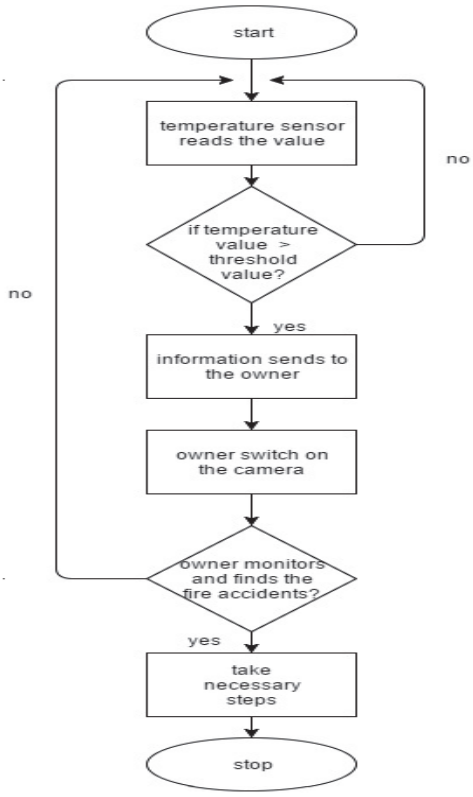

Fig. 8. Work flow for fire accident.

VII. SOURCE CODE

PYTHON CODE

```
import RPi.GPIO as GPIO1
import time
GPIO1.setmode(GPIO.BCM)
PIR_SENSOR_PIN = 7
GPIO1.setup(PIR_SENSOR_PIN, GPIO.IN)
try:
        print "PIR Sensor Module (CTRL+C to exit)"
        time.sleep(2)
        print "PIR Sensor is ready"
        while True:
                if GPIO1.input(PIR_SENSOR_PIN):
                        print "Motion is Detected!"
                time.sleep(1)
except KeyboardInterrupt:
                print "Quit"
         GPIO1.cleanup( )
```

Begin with importing the Python GPIO library and time library and then set the GPIO pin numbering. Next, give some name to the input pin, so that we can refer it later with our Python code. And we name it as *"PIR_SENSOR_PIN"* that will enable us to detect any movement in the house if the

PIR is sending the outputting signal. *GPIO1.setup( )* function sets the PIR_SENSOR_PIN as input pin to sense the movement.

A two second delay is provided by the *sleep( )* function in between the print statement. A *true* in the *while* statement makes it to run infinite loop, that enables to read the PIR sensor status. The *input( )* statement continuously checks the status of PIR input inside the *while* loop. A time limit of one second is given, to enable only one input when a movement is detected. The *cleanup( )* function is used to reset the ports used in the program. It moves the state of the used ports to input.

VIII. OUTPUT

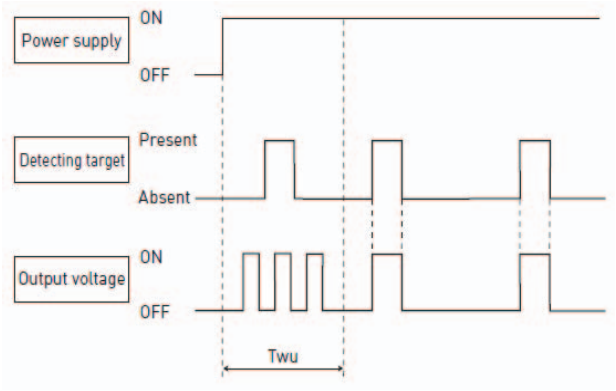

Fig. 9. Digital output and the detection of PIR sensor.

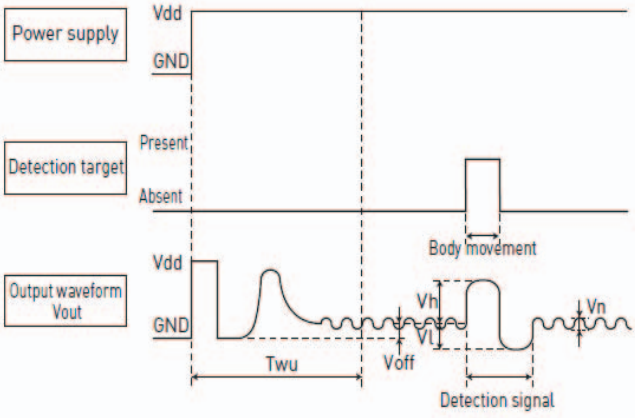

Fig. 10. Analog output and the detection of PIR sensor.

The Fig. 9 shows the digital output of PIR sensor when an stranger is detected. T_{wu} is circuit stability time. It is total taken to stabilize the PIR circuit, when it is powered ON. This is true regardless of whether or not the sensor has detected anything. The total circuit stability time is 45 sec. The Fig. 10 shows the analog output of PIR sensor when an intruder is detected and as well as the circuit stability time. V_{off} is the output offset voltage at non detection. V_{dd} is the operating voltage. V_n is the steady noise. V_h and V_l are the high and low detection sensitivity voltage.

IX. CONCLUSION

The project has designed as a smart surveillance system capable of capturing video, images, recording it and transmitting to a mobile phone. It will provide safer environment for the owner to avoid being lost. It is encrypted and authenticated on the receiver side, so that it will offer only the owner so that he could view the details. Necessary action could be taken within some part of time in the case of any burglary activities takes place. In Future a copy will be sent to owner and to police station simultaneously and implementation of automatic iron gate lock will be imposed where the escape of the burglar will be stopped when he wears mask to avoid the chloroform gas.

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