ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 4, Special Issue 11, March 2017

IOT Based Smart Security and Monitoring Devices for Agriculture

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***Abstract*- The rodents in the agriculture fields or in grains stores are monitored and identified by using PIR and Ultrasonic sensor. If the rodent enters into the field means, PIR will detect first then ultrasonic sensor will calculate the distance and camera module will take the image of rodent. The distance will be updated in the webpage and alert SMS is send to the supervisor through Way2sms. The images of the current storage place send to the supervisor through Gmail. This system is useful to know about the current information in the food grains stored place and update in the webpage. The whole system is controlled by the raspbbery pi through IOT.**

Keywords-IOT monitoring and control, WAYTOSMS, Raspberry Pi, sensor

I. INTRODUCTION

Monitoring the food grains stored place is very difficult and it requires more man power. In the fast moving World monitoring the place is very complex. Many persons developed this monitoring system. Energy efficient Clustering for WSN-based Structural Health Monitoring provides cluster-based modal analysis and algorithms for health monitoring using Wireless Sensor Network. In this paper, a cluster-based modal analysis approach is adopted. The basic idea of this approach is similar like the 'divide and conquer', where sensor nodes deployed on a structure are partitioned into clusters and modal analysis is carried out in each cluster. The resultant modal parameters of each cluster are then assembled together to obtain the modal parameters of the whole structure. In this approach, clustering is of great importance and should meet some extra requirements of modal analysis. Moreover, cluster size should be optimized to minimize the total energy. But this system has poor scalability and relatively high energy consumptions.

Two-Level Fuzzy based Fire Prediction Scheme Using Wireless Sensor Network proposal aimed at monitoring the parameters using a wireless sensor network to avoid the fire based accidents in industries. The advantage of the proposal is that though the sensors continuously monitor the parameters, they are not transmitted to the coordinator immediately. Continuous communication of the sensor nodes with Coordinator leads to drainage of node power leading to frequent battery charging. As automatic charging is dangerous in such environments manual charging is the only possibility. This involves manpower. Hence, it is better to design a monitoring system which informs the coordinator only when there is a possibility of fire occurrence. Therefore, for this application an event based WSN is ideal

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and well suited resulting in power saving. Low power consumption and low sensor node overhead increases network lifetime and reduces network traffic respectively. Thus, fire accidents in fireworks could be avoided to a larger extent in addition to energy saving. Control circuits are needed.

An Effective Method of Controlling the Greenhouse and Crop Monitoring Using GSM aimed to makes effective solution for farmers to grow highly efficient and disease free species using GSM. So the method for crop monitoring in agricultural is using crop cultivation techniques. In this paper, the embedded system based on GSM technology is proposed for crop monitoring which is designed and implemented to realize modern precision agriculture. The control system based on the GSM technology found to be very effective that allows control from a remote area to the desired location. The developed experimental system, based on GSM network, collect data from sensors through microcontroller and send real time data to PC for analysis and prediction purpose. But it may not always be an increase in quality and yield.

Design and Development of a Sensor Node to Monitor and Detect Change in Internal Parameters of a Cold Storage System .This deals with Wireless sensor network based cold storage system.The sensor node should have the ability of monitoring all the required environmental parameters and also process the information for further control. Major environmental parameters required to monitor the cold storage system is identified from various sources and a sensor node is designed and developed for the monitoring of all these parameters in the cold storage systems. If the values of the monitored parameters are not falling in the preset tolerance range corresponding LEDs glow, indicating the situation. Further, all the environmental data of the cold storage systems is logged in the system through RF communication. But this system considers monitoring of the temperature alone. All the environment parameter monitoring was impossible.

Crop diseases and pests monitoring based on remote sensing is first, in order to get more comprehensive biochemical parameters about crops and spectral datum, the further exploitation of agronomic sampling and ground remote sensing monitoring for crop diseases and pests should be considered. Second, taking advantage of the multiple high-resolution sensors to obtain multi-temporal and multi-angle remote sensing datum, the remote sensing will provide comprehensive spatial, temporal and spectral resolution information of Vegetation. But it is difficult to obtain the expected accuracy of remote sensing monitoring for crop pests and diseases. Hardware Implementation of Intruder Recognition In a Farm through Wireless Sensor Network farmers encounter severe threats like reparation done by animals, natural disasters and thefts resulting in poor yields. Hence, to overcome this issue a Wireless Sensor Network based monitoring system is proposed. This proposal is capable of detecting unauthorized entries such as humans and animals into the farm. The authorized persons are permitted on verification of their RFID tags with RFID reader. A prototype model is designed, developed and tested and it is found to effectively monitor the movement of animals and humans in the farm and inform the farm owner. The benefits of the model are cost effective, duplication of devices is avoided through Co-coordinator and member node configuration, Simple and easy to implement (IV) Easy monitoring, Powering through PV avoids frequent charging of batteries, Easy maintenance. But this system used Zigbee and GSM. There is

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no assurance of the receiver received the message or not and there is no automatic control.

II. PROPOSED WORK

As mentioned in previous section a lot of work has been done related to crop monitoring, paddy growth monitoring etc. However, there is no work in the literature that deals with automatic control through Internet. Agriculture sector being the backbone of the Indian economy deserves security. Security not in terms of resources only but also agricultural products needs security and protection at very initial stage, like protection from attacks of rodents or insects, in fields or grain stores. Such challenges should also be taken into consideration. Security systems which are being used now a day are not smart enough to provide real time notification after sensing the problem. The integration of traditional methodology with latest technologies as Internet of Things and Wireless Sensor Networks can lead to agricultural modernization. Keeping this scenario in our mind we have designed, tested and analyzed an 'Internet of Things' based device which is capable of analyzing the sensed information and then transmitting it to the user. This device can be controlled and monitored from remote location and it can be implemented in agricultural fields, grain stores and cold stores for security purpose. This paper is oriented to accentuate the methods to solve such problems like identification of rodents, threats to crops and delivering real time notification based on information analysis and processing without human intervention. In this device, mentioned sensors and electronic devices are integrated using Python script.

BLOCK DIAGRAM:

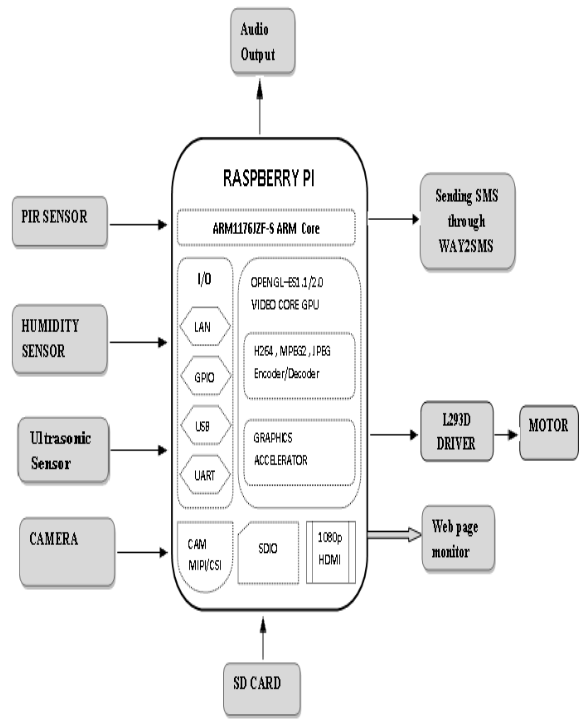

Fig.1. Block diagram of the monitoring device

RASPBERRY PI 3 MODEL B:

The processor at the heart of the Raspberry Pi system is a Broadcom BCM2837 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 256 MB memory chip at the centre of the board. It's not just this SoC design that makes the BCM2837 different to the processor found in your desktop or laptop, however. It also uses a different instruction set architecture (ISA), known as ARM. The BCM2837 SoC, located beneath a Hynix memory chip Developed by Acorn

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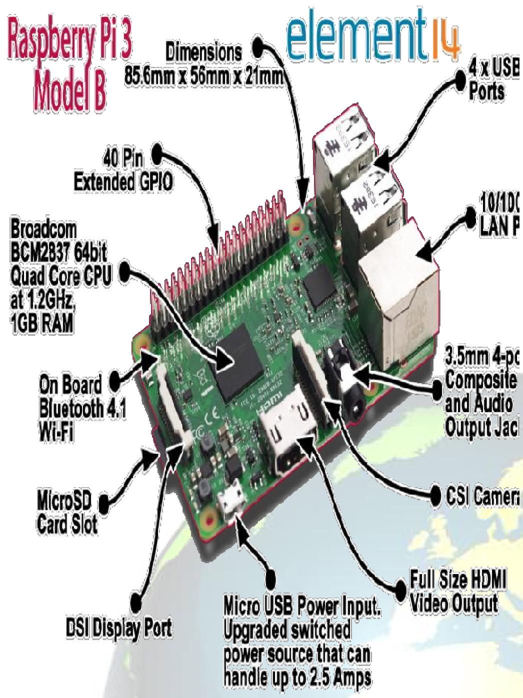
Computers back in the late 1980s, the ARM architecture is a relatively uncommon sight in the desktop world.



Where it excels, however, is in mobile devices: the phone in your pocket almost certainly has at least one ARM-based processing core hidden away inside. Its combination of a simple reduced instruction set (RISC) architecture and low power draw make it the perfect choice over desktop chips with high power demands and complex instruction set (CISC) architectures. The ARM-based BCM2837 is the secret of how the Raspberry Pi is able to operate on just the 5V 1A power supply provided by the onboard micro-USB port. It's also the reason why you won't find any heat-sinks on the device: the chip's low power draw directly translates into very little waste heat, even during complicated processing tasks. It does, however, mean that the Raspberry Pi isn't compatible with traditional PC software. The majority of software for desktops and laptops is built with the x86 instruction set architecture in mind, as found in processors from the likes of AMD, Intel and VIA. As a result, it won't run on the ARM-based Raspberry Pi. The BCM2837 uses a generation of ARM's processor design known as ARM11, which in turn is designed around a version of the instruction set architecture known as ARMv6. This is worth remembering: ARMv6 is a lightweight and powerful architecture, but has a rival in the more advanced ARMv7 architecture used by the ARM Cortex family of processors. Software developed for ARMv7, like software developed for x86, is sadly not compatible with the Raspberry Pi's BCM2837—although developers can usually convert the software to make it suitable. That's not to say you're going to be restricted in your choices. As you'll discover later in the book, there is plenty of software available for the ARMv6 instruction set, and as the Raspberry Pi's popularity continues to grow, that will only increase. In this book, you'll also learn how to create your own software for the Pi even if you have no experience with programming.

Getting Started with the Raspberry Pi

Now that you have a basic understanding of how the Pi differs from other computing devices, it's time to get started. If you've just received your Pi, take it out of its protective anti-static bag and place it on a flat, non-conductive surface before continuing with this chapter.

Connecting a Display

Before you can start using your Raspberry Pi, you're going to need to connect a display. The Pi supports three different video outputs: composite video, HDMI video and DSI video. Composite video and HDMI video are readily accessible to the end user, as described in this section, while DSI video requires some specialized hardware.

Connecting Audio

If you're using the Raspberry Pi's HDMI port, audio is simple: when properly

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configured, the HDMI port carries both the video signal and a digital audio signal. This means that you can connect a single cable to your display device to enjoy both sound and pictures. Assuming you're connecting the Pi to a standard HDMI display, there's very little to do at this point. For now, it's enough to simply connect the cable. If you're using the Pi with a DVI-D monitor via an adapter or cable, audio will not be included. This highlights the main difference between HDMI and DVI: while HDMI can carry audio signals, DVI cannot. For those with DVI-D monitors or those using the composite video output, a black 3.5 mm audio jack located on the top edge of the Pi next to the yellow phonon connector provides analogue audio. This is the same connector used for headphones and microphones on consumer audio equipment and it's wired in exactly the same way. If you want, you can simply connect a pair of headphones to this port for quick access to audio. While headphones can be connected directly to the Raspberry Pi, you may find the volume a little lacking. If possible, connect a pair of powered speakers instead. The amplifier inside will help boost the signal to a more audible level.

If you're looking for something more permanent, you can either use standard PC speakers that have a 3.5 mm connector or you can buy some adapter cables. For composite video users, a 3.5 mm to RCA phono cable is useful. This provides the two white and- red RCA phono connections that sit alongside the video connection, each carrying a channel of the stereo audio signal to the TV. For those connecting the Pi to an amplifier or stereo system, you'll either need a 3.5 mm to RCA phono cable or a 3.5 mm to 3.5 mm cable, depending on what spare connections you have on your system. Both cable types are readily and cheaply available at consumer electronics shops, or can be purchased even cheaper at online retailers such as Amazon.

Connecting a Keyboard and Mouse

Now that you've got your Raspberry Pi's output devices sorted, it's time to think about input. As a bare minimum, you're going to need a keyboard, and for the majority of users, a mouse or trackball is a necessity too. First, some bad news: if you've got a keyboard and mouse with a PS/2 connector—a round plug with a horseshoe-shaped array of pins—then you're going to have to go out and buy a replacement. The old PS/2 connection has been superseded, and the Pi expects your peripherals to be connected over the Universal Serial Bus (USB) port. Depending on whether you purchased the Model A or Model B, you'll have either one or two USB ports available on the right side of the Pi (see Figure 1-4). If you're using Model B, you can connect the keyboard and mouse directly to these ports. If you're using Model A, you'll need to purchase a USB hub in order to connect two USB devices simultaneously. Figure 1-4: Model B's two USB ports A USB hub is a good investment for any Pi user: even if you've got a Model B, you'll use up both your available ports just connecting your keyboard and mouse, leaving nothing free for additional devices such as an external optical drive, storage device or joystick. Make sure you buy a powered USB hub: passive models are cheaper and smaller, but lack the ability to run current hungry devices like CD drives and external hard drives.

If you want to reduce the number of power sockets in use, connect the Raspberry Pi's USB power lead to your powered USB hub. This way, the Pi can draw its power directly from the hub, rather than needing its own dedicated power socket and mains

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adapter. This will only work on hubs with a power supply capable of providing 700mA to the Pi's USB port, along with whatever power is required by other peripherals.

Connecting the keyboard and mouse is as simple as plugging them in to the USB ports, either directly in the case of a Model 3 or via a USB hub in the case of a Model B.

Storage

As you've probably noticed, the Raspberry Pi doesn't have a traditional hard drive. Instead it uses a Secure Digital (SD) memory card, a solid-state storage system typically used in digital cameras. Almost any SD card will work with the Raspberry Pi, but because it holds the entire operating system, it is necessary for the card to be at least 2 GB in capacity to store all the required files. SD cards with the operating system preloaded are available from the official Raspberry Pi Store along with numerous other sites on the Internet. If you've purchased one of these, or received it in a bundle with your Pi, you can simply plug it in to the SD card slot on the bottom side of the left-hand edge. If not, you'll need to install an operating system—known as flashing—onto the card before it's ready to go. Some SD cards work better than others, with some models refusing to work at all with the Raspberry Pi. For an up-to-date list of SD card models known to work with the Pi, visit the eLinux

Flashing the SD Card

To prepare a blank SD card for use with the Raspberry Pi, you'll need to flash an operating system onto the card. While this is slightly more complicated than simply dragging and dropping files onto the card, it shouldn't take more than a few minutes to complete.

Firstly, you'll need to decide which Linux distribution you would like to use with your Raspberry Pi. Each has its advantages and disadvantages. Don't worry if you change your mind later and want to try a different version of Linux: an SD card can be flashed again with a new operating system at any point. The most up-to-date list of Linux releases compatible with the Pi is available from the Raspberry Pi website at The Foundation provides Bit Torrent links for each distribution. These are small files that can be used with Bit Torrent software to download the files from other users. Using these links is an efficient and fast way to distribute large files, and keeps the Foundation's download servers from becoming overloaded. To use a Bit Torrent link, you'll need to have a compatible client installed. If you don't already have a Bit Torrent client installed, download one and install it before trying to download the Raspberry Pi Linux distribution. One client for Windows, OS X and Linux is µTorrent, which distribution you choose to download is up to you. Instructions in the rest of the book will be based on the Debian Raspberry Pi distribution, a good choice for beginners. Where possible, we'll give you instructions for other distributions as well. Linux distributions for the Raspberry Pi are provided as a single image file, compressed to make it faster to download. Once you've downloaded the Zip archive (a compressed file, which takes less time to download than the uncompressed files would) for your chosen distribution, you'll need to decompress it somewhere on your system. In most operating systems, you can simply double-click the file to open it, and then choose Extract or Unzip to retrieve the contents. After you've decompressed the archive, you'll end up with two separate files. The file ending in sha1 is a hash, which can be used to verify that the download hasn't been corrupted in transit. The file ending in image contains an exact copy of an SD card set up by the

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distribution's creators in a way that the Raspberry Pi understands. This is the file that needs to be flashed to the SD card.

During the following, you'll be using a software utility called dd. Used incorrectly dd will happily write the image to main hard drive, erasing operating system and all your stored data. Make sure you read the instructions in each section thoroughly and note the device address of SD card carefully. Read twice, write once!

Flashing from Linux

If your current PC is running a variant of Linux already, you can use the dd command to write the contents of the image file out to the SD card. This is a text-interface program operated from the command prompt, known as a terminal in Linux parlance.

Follow these steps to flash the SD card:

1. Open a terminal from your distribution's applications menu.

2. Plug your blank SD card into a card reader connected to the PC.

3. Type sudo fdisk -l to see a list of disks. Find the SD card by its size, and note the device address (/dev/sdX, where X is a letter identifying the storage device. Some systems with integrated SD card readers may use the alternative format /dev/mmcblkX—if this is the case, remember to change the target in the following instructions accordingly).

4. Use cd to change to the directory with the .img file you extracted from the Zip archive.

5. Type sudo dd if=imagefilename.img of=/dev/sdX bs=2M to write the file imagefilename.img to the SD card connected to the device address from step 3. Replace imagefilename.img with the actual name of the file extracted from the Zip archive. This step takes a while, so be patient! During flashing, nothing will be shown on the screen until the process is fully complete.

Wireless Networking

Current Raspberry Pi models don't feature any form of wireless network capability onboard, but—as with adding wired Ethernet to the Model 3 Wi-Fi support to any Pi using a USB wireless adapter. Two USB wireless adapters, suitable for use with the Raspberry Pi Using such a device, the Pi can connect to a wide range of wireless networks, including those running on the latest 802.11n high-speed standard. Before purchasing a USB wireless adapter, check the following:

• Ensure that Linux is listed as a supported operating system. Some wireless adapters are provided with drivers for Windows and OS X only, making them incompatible with the Raspberry Pi. A list of Wi-Fi adapters are known to work with the Raspberry Pi.

• Ensure that your Wi-Fi network type is supported by the USB wireless adapter. The network type will be listed in the specifications as a number followed by a letter. If your network type is 802.11a, for example, an 802.11g wireless adapter won't work.

• Check the frequencies supported by the card. Some wireless network standards, like 802.11a, support more than one frequency. If a USB wireless adapter is designed to work on a 2.4GHz network, it won't connect to a 5GHz network.

• Check the encryption type used by your wireless network. Most modern USB wireless adapters support all forms of encryption, but if you're buying a second-hand or older model, you may find it won't connect to your network. Common encryption types include the outdated WEP and more modern WPA and WPA2. Configuration of the wireless connection is done within Linux, so for now it's enough to simply connect the adapter to the Pi (ideally through a powered USB hub.) You'll learn

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how to configure the connection in Chapter 4, "Network Configuration".

Connecting Power

The Raspberry Pi is powered by the small micro-USB connector found on the lower left side of the circuit board. This connector is the same as found on the majority of smart phones and some tablet devices. Many chargers designed for smart phones will work with the Raspberry Pi, but not all. The Pi is more power-hungry than most micro-USB devices, and requires up to 700mA in order operating. Some chargers can only supply up to 500mA, causing intermittent problems in the Pi's operation. Connecting the Pi to the USB port on a desktop or laptop computer is possible, but not recommended. As with smaller chargers, the USB ports on a computer can't provide the power required for the Pi to work properly. Only connect the micro-USB power supply when you are ready to start using the Pi. With no power button on the device, it will start working the instant power is connected and can only be turned off again by physically removing the power cable.

The GPIO Port

GPIO Output: Flashing an LED

For the first example, you'll need to build a simple circuit consisting of an LED and a resistor. The LED will provide visual confirmation that the Pi's GPIO port is doing what your Python program tells it to do, and the resistor will limit the current drawn by the LED to protect it from burning out. To assemble the circuit, you'll need a breadboard, two jumper wires, an LED and an appropriate current-limiting resistor (as described in the "Calculating Limiting Resistor Values" sidebar). Although it's possible to assemble the circuit without a breadboard by twisting wires together, a breadboard is a sound investment and makes assembling and disassembling prototype Circuit. Assuming the use of a breadboard, assemble the circuit in the following manner to match

1. Insert the LED into the breadboard so that the long leg (the anode) is in one row and the shorter leg (the cathode) is in another. If you put the LED's legs into the same row, it won't work.

2. Insert one leg of the resistor into the same row as the LED's shorter leg, and the other resistor leg into an empty row. The direction in which the resistor's legs are placed doesn't matter, as a resistor is a non-polarized (direction-insensitive) device.

3. Using a jumper wire, connect Pin 11 of the Raspberry Pi's GPIO port (or the corresponding pin on an interface board connected to the GPIO port) to the same row as the long leg of the LED.

4. Using another jumper wire connect Pin 6 of the Raspberry Pi's GPIO port (or the corresponding pin on an interface board connected to the GPIO port) to the row that contains only one leg of the resistor and none of the LED's legs.

Be very careful when connecting wires to the Raspberry Pi's GPIO port. As discussed earlier in the chapter, may do serious damage to the Pi if connect the wrong pins.

A breadboard circuit for a simple LED output At this point, nothing will happen. That's perfectly normal: by default, the Raspberry Pi's GPIO pins are switched off. If you want to check your circuit immediately, move the wire from Pin 11 to Pin 1 to make the LED light up. Be careful not to connect it to Pin 2, though: a current-limiting resistor suitable for a 3.3 V power supply will be inadequate to protect the LED when connected to 5 V. Remember to move the wire back to Pin 11 before continuing. To make the LED do something useful, start

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a new Python project. "An Introduction to Python", you can use a plain text editor or the IDLE software included in the recommended Debian distribution for this project as well. Before you can use the GPIO library you installed earlier in this chapter, you'll need to import it into your Python project. Accordingly, start the file with the following line:

import RPi.GPIO as GPIO

Remember that Python is case-sensitive, so be sure to type RPi.GPIO exactly as it appears. To allow Python to understand the concept of time (in other words, to make the LED blink, rather than just turning it on and off), you'll also need to import the time module. Add the following line to the project:

Import time

With the libraries imported, it's time to address the GPIO ports. The GPIO library makes it easy to address the general-purpose ports through the instructions GPIO.output and GPIO.input, but before you can use them, you'll need to initialise the pins as either inputs or outputs. In this example, Pin 11 is an output, so add the following line to the project:

GPIO.setup(11, GPIO.OUT)

This tells the GPIO library that Pin 11 on the Raspberry Pi's GPIO port should be set up as an output. If you were controlling additional devices, you could add more GPIO.setup lines into the project. For now, however, one will suffice.

With the pin configured as an output, you can switch its 3.3 V supply on and off in a simple demonstration of binary logic. The instruction

GPIO.output(11, True)

will turn the pin on, while

GPIO.output(11, False)

Switch off again. The pin will remember its last state, so if you only give the command to turn the pin on and then exit your Python program, the pin will remain on until told otherwise.

Although you could just add GPIO.output(11, True) to the Python project to switch the pin on, it's more interesting to make it blink. First, add the following line to create an infinite loop in the program:

while True:

Next, add the following lines to switch the pin on, wait 2 seconds, and then switch it off again before waiting another 2 seconds.Make sure each line starts with four spaces, to signify that it is part of the infinite while loop:

```
GPIO.output(11, True)
time.sleep(2)
GPIO.output(11, False)
time.sleep(2)
```

The finished program should look like this (see Figure 12-4):

```
import RPi.GPIO as GPIO
import time
GPIO.setup(11, GPIO.OUT)
while True:
GPIO.output(11, True)
time.sleep(2)
GPIO.output(11, False)
time.sleep(2)
```

The gpiooutput.py program, being edited in nano, and waiting for its final line Save the file as gpiooutput.py. If you're using a Python development environment such as SPE, don't try to run the program from within the editor. Most Raspberry Pi Linux distributions restrict the use of the GPIO port to the root user, so the program will need to be run using the command sudo python gpiooutput.py at the terminal to get it started. If all has gone well, you should see the LED begin to blink on and off at regular intervals—and you've created your first home-made output device for the Pi.

If things don't work, don't panic. First, check all your connections. The holes in a breadboard are quite small, and it's easy to think you've inserted a component into one

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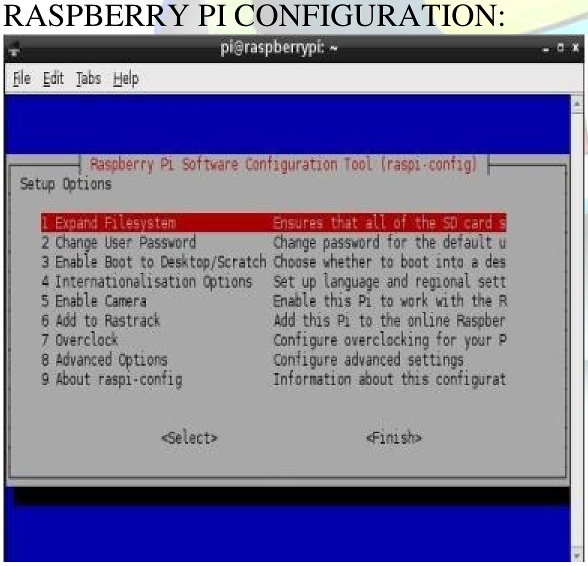
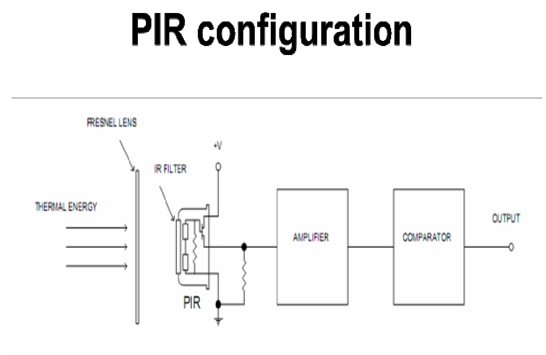
row only to find it's actually in another. Next, check that you've connected the circuit to the right pins on the GPIO port—with no labelling on the Pi itself, mistakes are unfortunately easy to make. Finally, double check your components—if the forward voltage of your LED is higher than 3.3 V or if your current limiting resistor is too large, the LED won't light up. Although this example is basic, it's a good demonstration of some fundamental concepts. To extend its functionality, the LED could be replaced with a buzzer to make an audible alert, or a servo or motor as part of a robotics platform. The code used to activate and deactivate the GPIO pin can be integrated into other programs, causing an LED to come on when new email arrives or a flag to be raised when a friend has joined an IRC channel. [3] discussed about a project, in this project an automatic meter reading system is designed using GSM Technology. The embedded micro controller is interfaced with the GSM Module. This setup is fitted in home.

RASPBERRY PI CONFIGURATION:

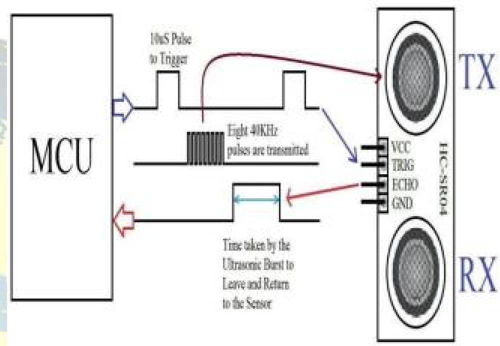


PIR SENSOR:

A passive infrared sensor (PIR sensor) is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view. They are most often used in PIR-based motion detectors.

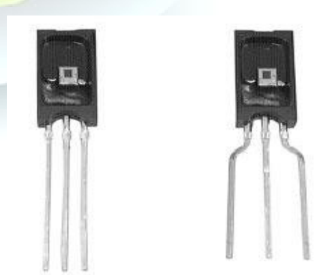


ULTRASONIC SENSOR:



The sonic waves emitted by the transducer are reflected by an object and received back in the transducer. After having emitted the sound waves, the ultrasonic sensor will switch to receive mode. The time elapsed between emitting and receiving is proportional to the distance of the object from the sensor.

HUMIDITY SENSORS:



Humidity sensors relying on this principle consists of a hygroscopic dielectric material sandwiched between a pair of electrodes forming a small capacitor. ... By definition, relative humidity is a function of both the

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ambient temperature and water vapor pressure.

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