Intruder Detection and Agriculture Information System

(INTRU-INFI-TH101)

A Smart Agricultural Kit

A SEMESTER PROJECT REPORT

Submitted by

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CONTENTS

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ABSTRACT

Now-a-days, farmers increasingly face the problem of trespassing and lack of information during agricultural practices. Our project tries to address this issue by using the IR sensor for the detection of intruder(s). We are also using the temperature and humidity sensor so that farmer has knowledge about his fields and can plan accordingly. The temperature and humidity values are stored in a file and the same is uploaded on cloud servers. This data is used for future forecasting for the farmer. An app shall be used by farmer to get the stats based on historic data stored on cloud.

A database is also maintained that stores the contact information of the farmer. This contact is retrieved by the program and is used by GSM to send sms to the intended recipient (the farmer).

File handling has been employed to store the temperature and humidity in a file which shall be further uploaded on cloud.

CHAPTER 1

Introduction

In today's world risk of intrusion has increased in the developing technology. Crime prevention using remote monitoring is one of the aims of current Study. There are several monitoring systems such as camera, CCTV etc. However, today even if the person is moving from one place to another place person can monitor and prevent the criminal activity. A video surveillance system is important in different fields of our environment such as in personal security, banking, etc. However, it is expensive for normal peoples to set up such kind of system, So people are using IOT based low cost security systems which will help them secure their commercial places. In Raspberry Pi based home security system, sensors are installed to detect the intruders and a message is passed to the farmer. Raspberry Pi security system uses wireless technology and smart phones for security purpose.

The main Benefits of the current security systems is that it is simple to implement, small size portable, capable with immediate alert, truly low-cost for residential use. The Raspberry Pi based security system focused to save valuable lives, money and time.

1.1 **Defining security**

Security literally means a way or method by which something is secured through a system of inter working components and devices. On the other hand, security systems are

networks of integrated electronic devices working together with a central control panel to protect against burglars and other potential intruders. Security systems work on the simple concept of securing entry points into a farm with sensors that communicate with a control panel or command center installed in a convenient location. The sensors are typically placed in entrances as well as easily accessible windows.

1.1.1 Internet of things:

The Internet of Things (IOT) is the interconnection of uniquely identifiable embedded computing devices within the existing Internet infrastructure. Typically, IOT is expected to offer advanced connectivity of devices, systems, and services that goes beyondmachine-to-machine communications (M2M)and covers a variety of protocols, domains, and applications. The interconnection of these embedded devices (including smart objects), is expected to be implemented in nearly all fields of automation enabling advanced applications like a Smart Grid.The term “things” in the IOT refers to a wide variety of devices such as heart monitoring implants, biochip transponders on farm animals, electric clams in coastal waters, automobiles with built-in sensors, or field operation devices that assist fire-fighters in search and rescue. Current market examples includethermostat systems and washer/dryers that utilize WiFi for remote monitoring. Integration with the Internet implies that devices will utilize an IP address as a unique identifier. However, due to the limited address space of IPv4 (which allows for 4.3 billion unique addresses), objects in the IOT will have to use IPv6 to accommodate the extremely large address space required. Objects in the IOT will not only be devices with

sensory capabilities, but also provide actuation capabilities (e.g., bulbs or locks controlled over the Internet). Largely, the future of the Internet of Things will not be possible without the support of IPv6; and consequently the global adoption of IPv6 in the coming years will be critical for the successful development of the IOT in the future.

1.1.2 Future Vision Of Internet Of Things

The Internet of Things is a vision which is under development and there can be many stake holders in this development depending upon their interests and usage. It is still in nascent stages where everybody is trying to interpret IoT in with respect to their needs. Sensor based data collection, data management, data mining and World Wide Web is involved in the present vision. Of course sensor based hardware is also involved. A simple and broad definition of the internet of things and the basic idea of this concept is the pervasive presence around us of a variety of things or objects – such as Radio-Frequency Identification (RFID) tags, sensors, actuators, mobile phones, etc. – which, through unique addressing schemes, are able to interact with each other and cooperate with their neighbors to reach common goals.

. • Things Oriented Vision• Internet Oriented Vision• Semantic Oriented Vision

a) Things Oriented Vision

This vision is supported by the fact that we can track anything using sensors and pervasive technologies using RFID. The basic philosophy is uniquely identifying any object using

specifications of Electronic Product Code (EPC) .This technique is extended using sensors. It is important to appreciate the fact that future vision will depend upon sensors and its capabilities to fulfill the “things” oriented vision. We will be able to generate the data collectively with the help of sensors, and sensor type embedded system. The summarized vision will be dependent upon sensor based networks as well as RFID-based Sensor Networks which will take care of the integration of technology based on RFID and sophisticated sensing and computing devices and the global connectivity.

b) Internet Oriented Vision

The internet-oriented vision has pressed upon the need to make smart objects which are connected. The objects need to have characteristics of IP protocols as this is one of the major protocols being followed in the world of Internet. The sensor based object can be converted in to an understandable format, which can be identified uniquely and its attributes can be continuously monitored. This makes the base for smart embedded objects which can be assumed to be a microcomputers having computing resources.

c) Semantic Oriented Vision

This vision is powered by the fact that the amount of sensors which will be available at our disposal will be huge and the data that they will collect will be massive in nature. Thus we will have vast amount of information, possibly redundant, which needs to be processed meaningfully. The raw data needs to be managed, processed and churned out in an understandable manner for

better representations and understanding. If we are able to make the sets of data into homogeneous and heterogeneous formats then the interoperability issues of understanding the data will be dependent upon the semantic technologies to process the data. It is here that needs a generic vision of processing the raw data in to meaningful data and a marked separation of data and their interpretation.

1.2 Problem Statement

The need to develop a cost effective surveillance system through innovative technology immensely influenced the development of this project. This project will design and implement a security system based on Raspberry Pi microcomputer. The system should be able to detect motion (intruder) ,send an alert to the facility owner through SMS and also timely report temperature and humidity to the owner of the farm.

1.3 Objectives

The main aim of this project is to design and develop a security system that includes features such as motion detection, examining temperature and humidity and SMS to facility owner. The system is to be based on Raspberry Pi SoC. The specific objectives are:

- To study and describe how the Raspberry Pi can be interfaced with a motion detector.
- To study how a Raspberry Pi can be programmed so as to be able to send a message to a prescribed contact.

- To develop and build a prototype of the surveillance system based on the Raspberry pi
- To sense the temperature and humidity and their interfacing with the Raspberry pi.

1.4 Scope of the project

The project focuses on developing a surveillance system that detects motion and relaying it to an administrator device through the internet platform. The system will require Raspberry Pi module, motion detection sensor, GSM and an internet connection. It will come up with an implementation of a surveillance system which presents the idea of monitoring a particular place in remote areas. The system can be monitored by the user from anywhere. However, this project will not attempt to design the motion detection device, camera or the Raspberry Pi. It will therefore use these systems together with a suitable program script to accomplish a real time surveillance system as desired.

1.5 Justification

The security system to be designed in this project can be used extensively to monitor facilities by owners. The owner shall be able to monitor their property from wherever they are. It will not replace the use of CCTV and camera surveillance systems but reduce the cost of implementation of a basic security system. This, thus, will enable small farm owners to secure their facility at a cheaper cost.

1.6 Thesis Organization

- CHAPTER-1: Chapter one contains the introduction to the project.
- CHAPTER-2: The chapter-2 contains the background theory containing project specifications determined by the along with configuration details of DHT11 sensor, IR sensor and GSM.
- CHAPTER-3: The chapter-3 contains the essential information pertaining to literature survey, gaps in literature and summary.
- CHAPTER-4: The chapter-4 consists of problem definition, problem statement, aims & objectives, methodology, resource requirement.
- CHAPTER-5: The chapter-5 contains the details of design flow, design details, mathematical model and hardware model.
- CHAPTER-6: The Chapter-6 contains the results concluded by the implementation of the designed model after required testing and simulation on the prototype.
- CHAPTER-7: The Chapter-7 contains the details about the conclusions concluded from the designed project and its scope for improvement in future. The references are included to verify the claims of given project

CHAPTER 2

Literature Review

2.1 Research papers

We have found different papers related to security system. Different security systems used for different purposes. Sushma .N. Nichal, Prof. J.K. Singhhas have done the abstraction of Smart supervisor system using IOT based on embedded Linux O.S. with ARM11 architecture. In this Paper they have implemented real-time video monitoring system and acquired data. In this system they have also used PIR, temperature, Humidity sensors. The system first requires authentication from user to activate the system if the system detect human it will send that data to the server or user smart phone

[1].Sowmiya. U, Shafiq Mansoor. J. have developed to connect any door with internet, in this system user also implemented PIR sensor and camera. PIR sensor used for detecting person and camera used for capturing the video of person comes at door. The video will be send through 3g dongle to authorized person. They have also discussed some advantages of this system. They have concluded use of this system like bank, hospital etc.

[2] Ms. Renuka Chuimurkar, Prof. Vijay Bagdihave presented smart monitoring system using Raspberry Pi, PIR sensor and mobile device. Authors have also used smoke detector to detect the fire. User will be notifying about the intruder or fire after capturing the image to user mail via Wi-Fi. They have used background subtraction algorithm for motion detection and smoke detection algorithm. They have stated advantages like reliability and privacy

[3]. ShivprasadTavagad et alConducted survey on various Surveillance System, they have discuss the importance of video surveillance and benefits of many security systems. They have discussed why the security system is important Authors also explained Architecture of proposed system, they have concluded that new design will be implemented to provide security and safety

[4]. Khushbu H Mehta, Niti P Guptahave presented real time monitoring and security system using Raspberry Pi the system allow user to live monitor from any place. In the system Authors have discuss that if motion is detected it will check for face detection if the face is detected it will stored on local storage, they have used background subtraction Algorithm for face detection. Authors concluded that system is able to identify faces and user can able to monitor remotely

[5]. Dr. S. Kanagasuba raja et alhas focused on home automation and security system using Raspberry Pi. In this paper authors have implemented security s detects the intrusion and captures the video for playing in future. They have also implemented the automation of the home appliances. User can remotely on or off the home appliances

[6]. Md. Nasimuzzaman Chowdhury et alhave implemented security system where if any person comes at door it will be notify to the home owner via e-mail and twitter then the user can see the person comes at door using camera from remote location. The image of person captured and sends to twitter and e-mail. They have stated that user can control the door remotely. They have concluded that this system is useful for preventing unauthorised access

[7]. R.Chandana et alhave implemented monitoring and home security system using think and speak with the help of raspberry Pi, they have used Gyro sensor to detect the movements of

person if the movements is detected camera will be captured image and the image will be send to the owners mail id with captured image. They have also stated some importance of this system. Authors have concluded that this system is important for security purpose

[8]. K Saravana Kumar et alhave developed the security system with proximity sensor, Raspberry Pi, and Camera, proximity sensor detect the person after detecting the person camera will be initiated and capture the image and image will be uploaded to drop box and user gets the notification about the intruder in the form of SMS. They have discussed few advantages like cost effective, portable. Authors concluded that this security system is useful for security of homes

[9]. Dhadiwal Kalpesh Paraskumar et alhave designed and implemented security system with Raspberry Pi, IR sensor and camera IR sensor detects the person then the cameraystem which will be capture image of intruder and microphone records the vice of the person then the captured image along with vice recorded will be send to user mobile phone. They have also discussed advantages and disadvantages of this system in this paper. Authors concluded that this system is useful for real time monitoring of home

[10]. Yogita Vijay Narkhede,S. G. Khadkehave presented smart security system with Raspberry Pi and IR sensor if IR sensor detects the person camera will capture image as well as video of the person, the data then encrypted first and then decoded. User will get notification on his mobile device. Authors discussed that user can also perform the live streaming and provide security. Authors have concluded that this system is important for commercial places; they have discussed few advantages of the system

[11]. Harikrishnan G.R. et alhave implemented home automation and security system in this

system user can continuously monitor home from remote location if the intruder detected system will generate alarm and captures the image of the intruder and the captured image will be send to owners mobile through SMS, WhatsApp, Call, Email. They have discussed few advantages of this system. Authors have concluded that this system is useful for securing commercial places

.2.2 Evolution of security

With the invention of electricity, the art of home protection was greatly improved. In 1853, the first patent on electro-magnetic alarms meant that businesses and wealthy residents could secure valuables. Magnetic contacts were installed on the windows and doors that, when tripped, would send a signal through the electromagnetic wiring and sound an alarm. These groundbreaking security systems were effective in deterring break-ins from occurring[10]. According to Cisco Expo, major strides have been made with regards to surveillance systems. After the alarm system, analog video camera with Video Cassette Recorder evolved. It had poor imaging and no remote access. To overcome the drawbacks of this system, digital video recorders evolved. They gave good quality pictures and enable for transmission of video signals through data networks and thus allowed for remote monitoring[11]. Network Video Recorder then emerged. They have the advantages of the DVRs but have other merits over DVRs. They give more storage options and network connection. The most superior version is the type that uses Cisco Video Surveillance Platform. They give secure remote access and control from anywhere, fail-safe redundant storage, easy integration with other systems and enterprise class storage and support

2.3 Summary

Year	Authors	Techniques/Algorithms	Tools used	Future work
January 2016	Ms. RenukaChuimurkar, Prof. Vijay Bagdi	Background subtraction and smoke detection Algorithm	Raspberry Pi, smoke sensor, Camera	Locating number of persons
February 2016	ShivprasadTavagad et al	MPEG-2 Algorithm	Raspberry Pi, Camera	Making everything Wireless
February 2016	Khushbu H Mehta, Niti P Gupta	Background subtraction Algorithm	Raspberry Pi, OpenCV	Home Automation
February 2016	Yogita Vijay Narkhede, S. G. Khadke	Encode & Decode, Algorithm for video streaming	Raspberry Pi, Camera, 3g Dongle	Fire Detection
February 2015	K Saravana Kumar et al	Intrusion detection Algorithm	Raspberry Pi, Camera, Smart Phone	Live Streaming
April-2015	Sowmiya .U, ShafiqMansoor.J.	Alarm switch, Algorithm for video streaming	Raspberry Pi,sensor,3g Dongle	Designing of battery backup system
May 2015	Harikrishnan G.R. et al	Motion detection algorithms	Raspberry Pi, camera, sensor	Face detection and Elimination of unwanted motion
July 2015	R.Chandana et al	Quaternion algorithm	Raspberry Pi, I2C, Camera,	Home Automation

2.4 Conclusion

Based on the survey of all these papers different authors have presented different security systems. We have found that most of the security systems are developed using Raspberry Pi because it is cost effective and it is compatible with many programming languages. Raspberry Pi can work with various sensors like IR to detect movement of person, smoke sensor to detect fire and temperature sensor to detect temperature. With the help of Raspberry Pi person can implement security system which will be accessed remotely and user will be notify about the illegal activity. We can conclude that every person needs cost effective security system. There are different tools and parameters are used to provide the security. These security systems are useful for securing many places from remote location using mobile devices. In future we can implement energy efficient security systems.

CHAPTER 3

Selection of technology and components

3.1 Resources

For an embedded real-time surveillance system to be utilized for effective monitoring and alerting, the system has to have at least three functions. These functions are: detection, monitoringa temperature and humidity and alert mechanism. This Raspberry Pi based security system is thus composed of mainly two parts. These are: design hardware and design software

3.2 Design Hardware (System Modules Set Up and Configuration)

The entire system modules consist of seven parts components namely:

Raspberry Pi Model B+ controller,

IR motion sensor,

RJ45 Ethernet connector,

Temperature and humidity sensor

3.2.1 Raspberry Pi Model

This is the model that was chosen to implement the project. It has merits over other models in that it has increased number of USB ports and large number of GPIO pins.

Moreover, this piece of hardware was available at the department.

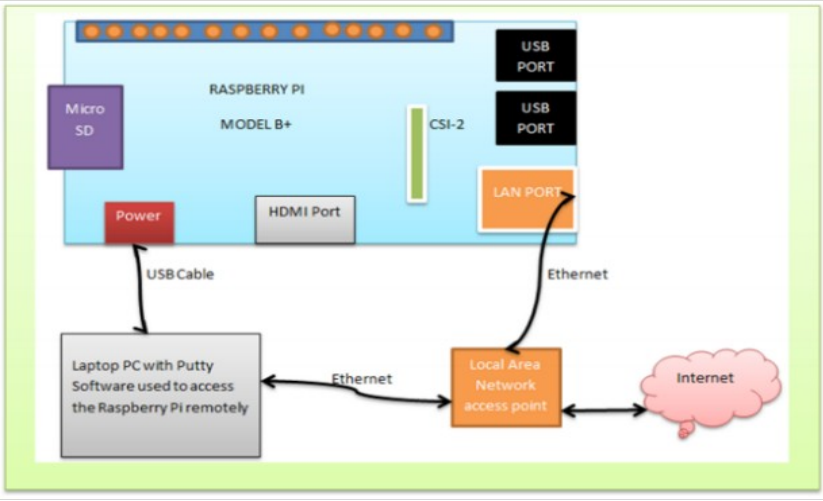
3.2.1.1 Booting Up the Pi Model

Raspbian ‘Wheezy’ image was written into the 4GB Micro SD card. This was the operating system chosen to run on the Pi because the OS has been optimized and ported to the Raspberry

Pi ARM architecture. This OS has very good integration with the hardware and comes preloaded with a GUI and development tools. After slotting in the Micro SD card and connecting RJ45 Ethernet cable to the Pi and the personal computer with Putty software (Putty is an SSH client used to remotely access and control the Pi from computer running on Windows platform) the system was powered. Putty was then started and the default static IP address of the Pi was typed into the host name field. While doing this, windows pc was set to manual IP configuration. This was to allow it communicate with the Raspberry Pi.

3.2.1.2 Setting Up internet connection on the Pi

Internet was necessary in so that the Pi can communicate over network protocols and thus allow for installation Since the broadcast router uses Dynamic Host Configuration Protocol (DHCP) to dish out IP addresses to devices connected to it, it was necessary to change the IP address of the Pi from static to dynamic of necessary Python packages. The architecture above was used to achieve that.



3.3 System initialization and configuration

This involved the following tasks:

Importing Python libraries and packages. These libraries are predefined and help in making the interfaced modules work properly.

GPIO settings and pin initialization: (the channel was set using the BCM channel numbering. Passive infrared pin channel was set to read mode while the led channel was set to drive/write mode.

DHT11 setting and configuration

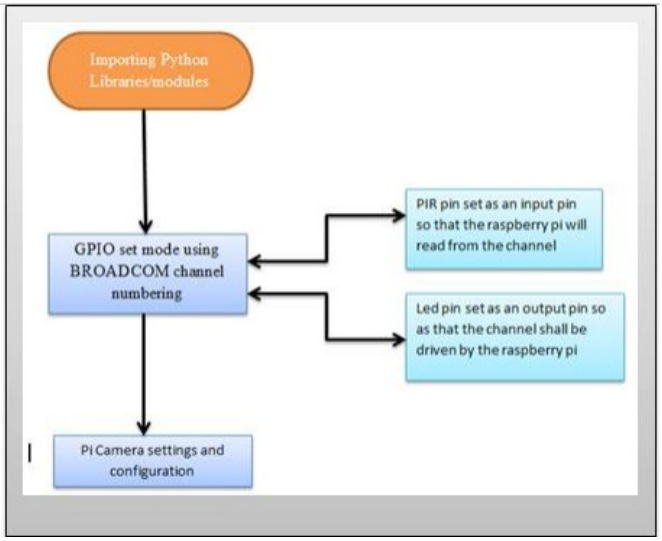
a) Read a Channel

In order to read the value of any GPIO pin, simply type; GPIO.input(channel)

b) Drive a channel

In order to drive a channel of GPIO pin, type; GPIO.output(channel, status)

This sequence of events can be elaborated well using the block diagram below.



3.4 Generating and sending e-mail

After configuring the system to send an alert to the predefined subscriber, it was then necessary to generate and send the mail. Multipurpose Internet Mail Extension (MIME) package was then called and used to generate the attachment. MIME supports characters other than ASCII, non – text attachments (audio, video and application programs) etc. It thus extends the format of an email. Simple Mail Transfer Protocol (SMTP) program was then used to deliver the email from the Raspberry Pi to the configured mailhub. This can be summarized using the blocks below.

3.4.1 Pseudocode

i. Upon restart of the system, send out email with boot IP assigned to a mailhost.

ii. Check the status of the GPIO pin. If the pin is LOW, GPIO output pin 13 should remain LOW and the system is idle. Else if the pin suddenly goes HIGH. Interpret this as an interrupt event.

iii. While the value of the input GPIO pin is HIGH (interrupt event), set pin 13 to be HIGH. This instance blinks the LED. Call the function that starts the Pi Camera.

iv. Camera takes a 10 seconds video and save it in a file.

v. The system checks whether the internet is enabled on the Raspberry Pi. vi. If internet, send email to a prescribed mailhost. If no internet, wait for 5 seconds then check again. Reset the PIR sensor pin to LOW and recheck again the status after 2 seconds. This should return the program to the main loop.

3.4.2 Developing the Full Code Listing.

To be able to develop the Python script that executes the algorithm defined in the flowchart, the following were done at the CLI of the Raspberry Pi: The Pi was started and a directory was created using mkdir command.

Inside the directory, a file was created using the touch command and made executable using sudo chmod +x (filename).

The nano command was then used to open the editor and the full Python code was written there.

3.5 GSM (Global System for Mobile)

It is a second generation cellular standard developed to cater voice services and data delivery using digital modulation. It operates at either the 900 MHz or 1800 MHz frequency band. Since almost all GSM network operators have roaming agreements with foreign operators, users can often continue to use their mobile phones when they travel to other countries and also number of its users is not limited. The coverage of GSM network is vast so it provides a strong platform for the user to monitor and control devices from any part of the world via SMS (Short Message Service).

Features of GSM

- Wide range
- Mobility
- Low maintenance cost

Limitations

- No real time monitoring

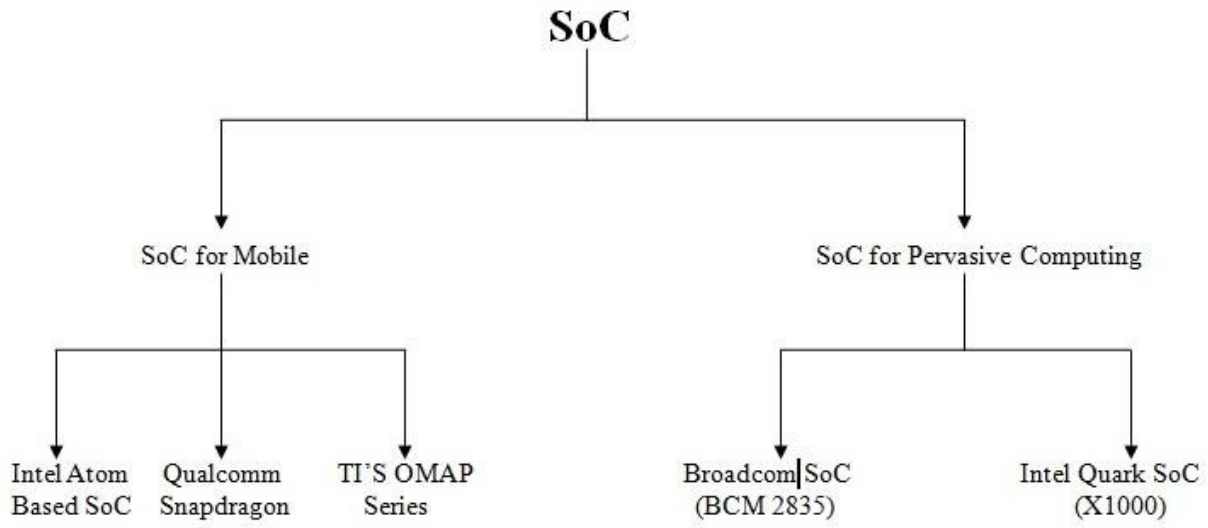
3.5 Selection of sensor interface

- A **sensor** is a device that detects events or changes in quantities and provides a corresponding output, generally as an electrical or optical signal; for example, a thermocouple converts temperature to an output voltage.
- There are various sensors available but out of those we are using:

IR sensor. IR obstacle sensor module consists of an IR LED, IR photodiode, potentiometer and a comparator. The negative input of the comparator is connected to potentiometer which is used as threshold voltage. Reverse-biased photodiode resistance is high and voltage at positive input of the comparator is lower than voltage at negative input. So comparator output is 0 volts (LOW). When IR waves emitted from IR LED are reflected from an obstacle to the photodiode, then resistance of the photodiode decreases, voltage at positive input of the comparator is higher than voltage at negative input. So comparator output is 5 volts (HIGH).

3.6 Selection of SoC

System on Chip (SoC) is an integrated circuit(IC) that integrates all components of a computer, or other electronic system into a single chip. It may contain digital, analog, mixed-signal and radio frequency functions- all on a single chip substrate. SOC includes on chip memory (RAM & ROM), the microprocessors, peripheral interfaces, I/O logic control, data converters & other components that comprises a mobile device.



3.6.1 SoC's for Mobile

There are various types of SoC's available for Mobile Device as follows:

a) Atom SoC

Atom is a system on chip (SoC) platform designed for smart phones and tablets launched by Intel in 2012. It is a continuation of the partnership announced by Intel and Google on 13 September 2011 to provide support for the Android operating system on Intel x86 processors. Atom range competes with existing SoCs developed for the Smartphone and tablet market from companies like Texas instruments, Nvidia, Qualcomm and Samsung. The Intel Atom processors Z2580 (2.0 GHz), Z2560 (1.6 GHz) and Z2520 (1.2 GHz) deliver dual core performance built on Intel's leading 32 nm process technology. Intel Hyper-Threading Technology1 supports four simultaneous application threads for smooth and seamless multitasking and responsive Web browsing

b) Qualcomm Snapdragon

Snapdragon is a family of mobile system on a chip (SoC) by Qualcomm. Qualcomm considers Snapdragon a "platform" for use in smart phones, tablets, and smartbook devices.Compared to SoC's from many competitors, Snapdragon SoC's have been unique in that they have the antenna for cellular communication on-die. That means they do not require a separate external antenna on the PCB. Snapdragon SoC also have on-die Wi-Fi, GPS/GLONASS and Bluetooth basebands.

c) OMAP SoC

OMAP (Open Multimedia Applications Platform) is a series of image/video processors developed by Texas Instruments. They are a category of proprietary system on chips (SoCs) for portable and mobile multimedia applications. OMAP devices generally include a general-purpose ARM architecture processor core plus one or more specialized co-processors. Earlier OMAP variants commonly featured a variant of the Texas Instruments TMS320 series digital signal processor.

The OMAP family consists of three product groups classified by performance and intended application:

- High-performance applications processors
- Basic multimedia applications processors
- Integrated modem and applications processor

3.6.2 SoC for Pervasive Computing

The different SoCs available for pervasive computing are described as follows**a)**

Broadcom BCM2836 SoC

The new Raspberry Pi 2 is the advance version of raspberri Pi1 with several new features. It has a quad core ARMv7 900MHz processor and with 1GB RAM. It's 6 times faster than Pi1 at the same cost of Pi1. It is a card sized Linux computer and supports android, windows10 operating systems. Its integrated with GPU Videocore IV 250 Mhz, a 40-pin GPIO, four USB ports and 10/100 thernet. Technical Specifications of Pi 2 aare as follows:

- SoC: Broadcom 2836
- CPU: Quad-core ARM7 900MHz
- GPU: Videocore IV 250MHz
- Memory: 1GB
- GPIO: 40pin
- Ports: 4x USB 2.0, 100BaseT Ethernet, HDMI, MicroSD card
- Size: 85.60 × 56.5mm (about 3.2 x 2.1-inch)

Broadcom SoC has been selected in our SBC- Raspberry pi because of following reasons:

a) **Power consumption** - The BCM2836 draws about five to seven watts of power.

b) **No moving parts**- The BCM2836 used in Raspberry Pi uses an SD card for storage, which is

fast and has no moving parts. There are also no fans and other things to worry about. A Class 10 SD card is usually the best performing compared to lower class cards, but this will mainly only affect boot time where there is the most I/O.

c) **Small form factor** - The Pi (with a case) can be held in your hand.

d) **No noise** - . RPi does not produce any noise while running.

e) **Status lights** - There are several status lights on the Pi's motherboard. With a clear case you can see NIC activity, disk I/O, power status, etc.

f) **Expansion capabilities** - There are numerous devices available for the Pi, all at very affordable prices- everything from an I/O board (GPIO) to a camera. The Pi has two to four USB ports depending upon the model.

g) **Built-in HDMI capable graphics** - The display port on the Pi is HDMI and can handle resolutions up to 1920×1200. It leads to develop video player and run the gaming applications**.**

h) **Affordable** - Compared to other similar alternatives, the Pi (revision B) offers the best specs for the price. It is one of the few devices in its class that offers 512 MB to 1 GB of RAM. The Pi has come down in price of approximately Rs. 2500.

i) **Huge community support** - The Pi has phenomenal community support. Support can be obtained quite easily for the hardware and/or GNU/Linux software that runs on the Pi mainly in user forums, depending on the GNU/Linux distribution used.

j) OS Support - At presents it supports Linux OS. Android kernel is also ported into the Pi.

Windows 10 is also accepted to support for Pi 2 for IoT applications

3.7 Selection of Software Development Tool

Software development tool is a software package which is used to develop the software part of the system i.e. the software code. It consists of lots of supporting tools such as editor, compiler, project manager, simulator and debugger. Here in this proect we are using high level language PYTHON which is being edited in text editor like gedit or VIM all of which can be extended with features like syntax highlighting and autocomplete. Other users are also using integrated

development environment. Various IDE's are:

1)Eclipse with pydev

2)Eric

3)PyCharm

4) Bluefish

5) IDLE

6)PythonWin and many more.

But here we are using text editor plus terminal combination. Now we will see how to run python code over this.

Running Python

There are three different ways to start Python:

(1) Interactive Interpreter

You can start Python from Unix, DOS, or any other system that provides you a command-line interpreter or shell window.

Enter **python** the command line.

Start coding right away in the interactive interpreter.

$python # Unix/Linux

or

python% # Unix/Linux, or

C:>python # Windows/DOS

(2) Script from the Command-line

A Python script can be executed at command line by invoking the interpreter on your application, as in the following:

$python script.py # Unix/Linuxor

python% script.py # Unix/Linuxor

C:>python script.py # Windows/DOS

Note: Be sure the file permission mode allows execution.

CHAPTER 4

Design of the System

4.1 Introduction to System Design

The embedded systems consist of many modules, which are comprised of software components, hardware components and interfaces. All these modules can be independently modeled as complex systems. In order to achieve a correct implementation of a project all of the independent designs must work in synergy. Therefore, application of system design principles to the design of embedded system can dramatically streamline the design work and avoid future problems involved with integrating the modules to constitute a larger system. The embedded system is a system in which the processing unit is actually embedded between its peripherals and the system is designed to perform some predefined tasks. Being dedicated to certain tasks, the embedded system provides a very efficient solution compared to their general purpose counterparts. When designing complex systems, it is beneficial to approach the design via an architecture, which is structured as an integration of sub-systems. In this approach the designers identify the system requirements for subsystems, which are based on overall system requirements. The subsystems are designed independently and then interfaced to achieve the completed system architecture. This approach simplifies the procedures related to testing, debugging and integration of the subsystems, which are required to ensure proper design and working of the whole system and also divides the functionality to verify the working of the subsystems independently.

4.2 Design Methodology

A good design methodology can help the system design process in many ways. It can help to verify the system for functionality and for errors and helps realize a solution, which achieves all the goals of the system including manufacturing cost, performance and power consumption.

Figure 4.1 shows the major steps in system design process of a project.

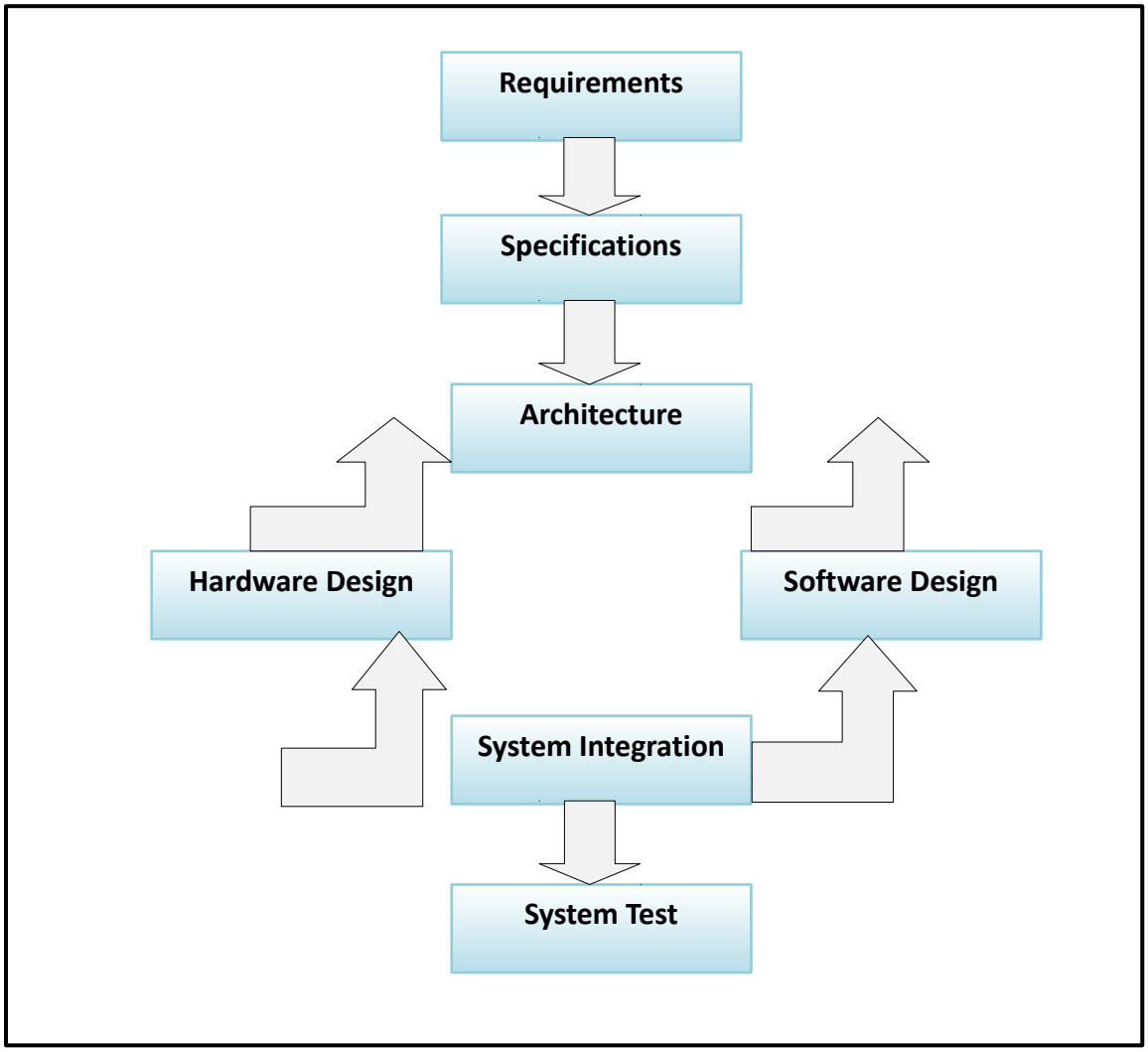


Figure 4.1 System Design Process

There are two approaches to the system design process. One is top-down design and other is bottom-up design. In top-down approach the design procedures are initiated from requirements for system integration. This approach involves arriving at the right solution after considering all the possible alternatives. The alternative is the bottom-up in which we start from the components to build a system i.e. the reverse of the top-down approach. The bottom-up design is needed because one does not know how the later stages of the project will turn out to be. In this remote monitoring and control system with automatic light controller we have considered a top-down design approach. The detailed description of the steps is given in the following sections.

4.3 Requirements and Specifications

The requirements are objective descriptions of the system, which includes functional as well as nonfunctional requirements. The requirements are the customer's expectations about what the system has to achieve. The requirements put monetary and timing constraints on the design, which will have to be considered along with the technical specifications. The designers need to incorporate these requirements and realize a system, which can perform the expected tasks. The system specifications are more focused on system implementation. They offer the designer a role map for the design of the system. The specifications have to be written carefully to ensure that they meet requirements. The system design has to fulfill the system requirements. The planning stage is the most important stage in the design cycle since it considers all the available resources and their efficiencies.

For this project many of available hardware and software components have been studied and compared and the optimal ones in terms of cost and specifications which best suits our requirements have been selected. Chapter 2 gives all the details of the existing solutions.

4.4 Hardware Architecture

Hardware of the system comprises -

- Raspberry pi
- GSM module
- IR Sensor Module
- Power supply unit

We will be attaching an IR sensor at the entry of farm so that whenever someone enters the farm, a message is send to the farmer informing him that someone entered the farm.

In this project we have also put two conditions to check

A) Poultry farming temperature and humidity standards

B) Normal wheat and standard grains checking

4.5 Summary

In this chapter the design process and approaches of an embedded system are discussed. Section 4.2 gives the details about the requirements and specifications for the project. Section 4.3 explains the hardware architecture. The remaining two building blocks of the design process i.e. design of hardware and software components, their integration and testing is explained in the following chapter.

CHAPTER 5

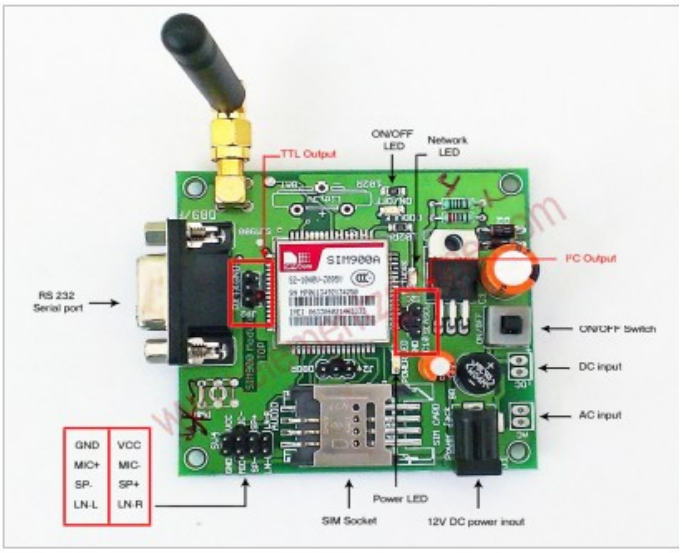
Implementation

In this section the hardware and the schematic diagram of the intruder detection and information kit is explained in detail. The schematic show the detailed connections of the hardware components with the Raspberry pi 2. Then the integration of the hardware and software is explained with the help of a diagram and few tests are performed on different modules to test the functionality of the system.

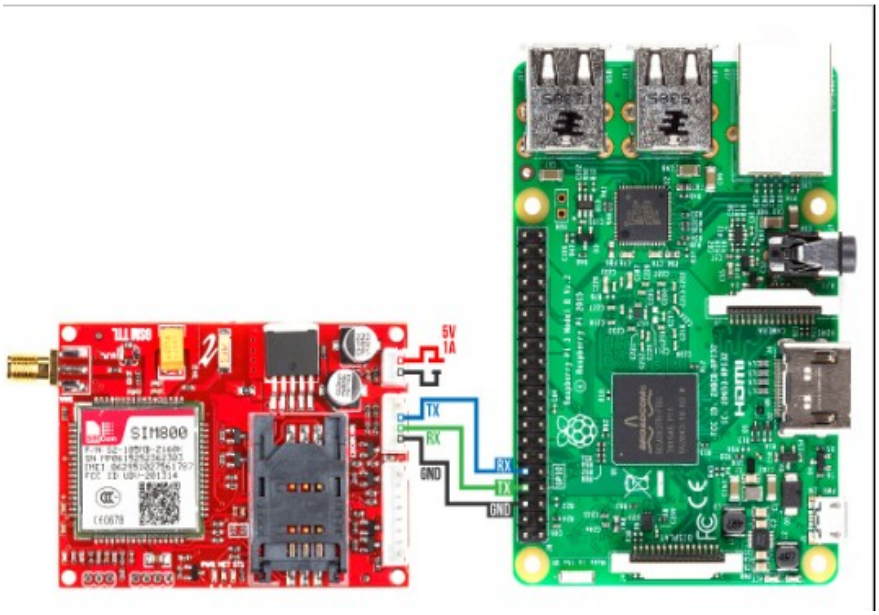
5.1 Hardware

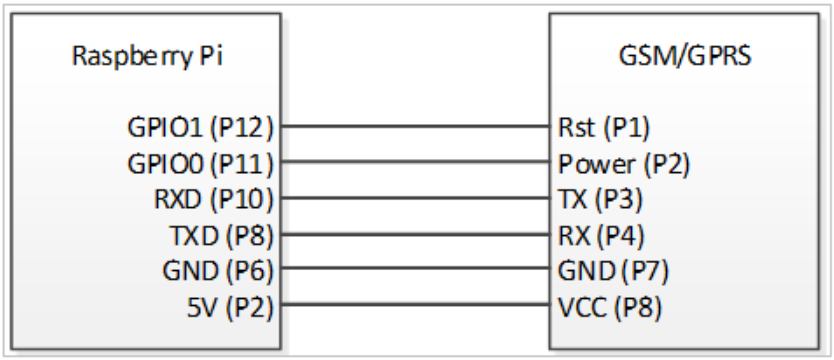
1. GSM

Global System for Mobile Communications, (GSM)is standard developed by the European Telecommunications Standards Institute (ETSI) to describe protocols for second-generation (2G) digital cellular networks used by mobile phones.GSM supports voice calls and data transfer speeds of up to 9.6 kbps, together with the transmission of SMS (Short Message Service).



The interfacing diagram is as follows





CODE:

```
import Adafruit_DHT

import serial

import time

sensor = Adafruit_DHT.DHT11

pin = 22

port= serial.Serial("/dev/ttyAMA0",9600,timeout=3.0)
```

```
try:
        print =”Temp=28.0*C Humidity=57.0%”
        print "Sending message ..."
        msg1= 28.0*C 57.0%”
        number=raw_input("Enter mobile number")
        port.write('AT+CMGS=”"+number+'”\r\n')
        time.sleep(2)
        port.flushInput()
        port.flushOutput()
        port.write(msg1)
        time.sleep(2)
        port.write('\x1A\r\n')
        print port.read(50)
        port.flushInput()
        port.flushOutput()
except:
        port.close()
```

2. DHT11 SENSOR

DHT11 Sensor senses temperature & humidity together and gives calibrated digital signal as output. By using the exclusive digital signal

-acquisition technique and temperature & humidity sensing technology, it ensures high reliability and excellent long-term stability. This sensor includes a resistive-type humidity measurement component and an NTC temperature measurement component, and connects to a high-performance

8-bit microcontroller, offering excellent quality, fast response, anti-interference ability and cost-effectiveness. The features of DHT11 includes:

1.Relative humidity and temperature measurement

2.Calibrated digital signal

3.Outstanding long-term stability

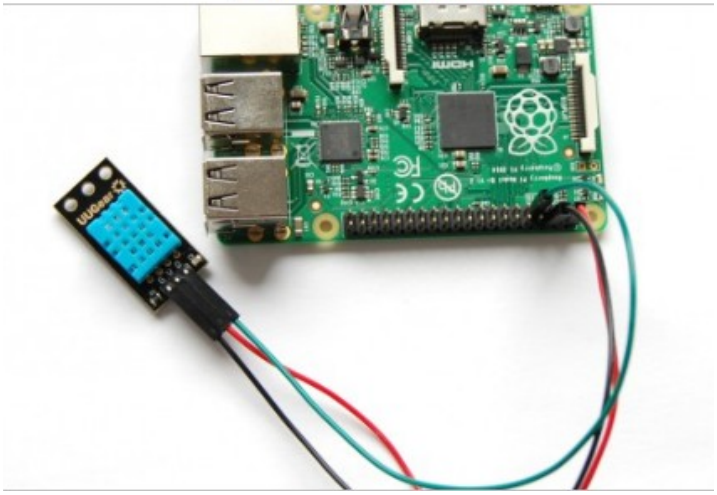
4.Long transmission distance

5.Low power consumption

6.Resistive-type humidity and temperature sensor

7.Body size 15.5mm x 12mm x 5.5mm

The interfacing:



3. **Programming of Raspberry Pi 2 for DHT 11**

For running the DHT11 python code on raspberry pi, we need to install the DHT driver from github.Downloading the Code from GithubThe easiest way to get the code onto Pi is to hook up an Ethernet cable, and clone it directly using 'git', which is installed by default. Simply run the following commands from an appropriate location (ex."/home/pi")

- Download Adafruit_Python_DHT-master.zip from github

$ cd Adafruit-Raspberry-Pi-Python-Code

$ cd Adafruit_DHT_Driver_Python

- Download bcm2835 library from the given link.

http://www.airspayce.com/mikem/bcm2835/

Extract it in /home/pi location.

- Configure the bcm2835-1.42 by using given commands

$ cd bcm2835-1.42

$ ./ configure

$ make

$ make install

- Download setuptools-4.0.1

$ cd setuptools-4.0.1

$ sudo python setup.py build

- Update the OS and install python-dev

$ sudo apt-get update

$ sudo apt-get install build-essential python-dev

$ cd Adafruit_python_DHT-master

$ sudo python setup.py install

Program:

```
import dhtreader

import time

type = 11

pin = 04

dhtreader.init()

while True:

  try:

        temp, hum=dhtreader.read(type, pin)

except TypeError:

        if temp and hum:

                print dhtreader.read(type, pin)

                print "Temp=",temp,"*c"

                print "Humidity=", hum,"%","\n"

        else:

                print "No data"

                time.sleep(2)
```

5.2 Running Python

There are three different ways to start Python:

(1) Interactive Interpreter

You can start Python from Unix, DOS, or any other system that provides you a command-line interpreter or shell window.

Enter **python** the command line.

Start coding right away in the interactive interpreter.

$python # Unix/Linux

or

python% # Unix/Linux

or

C:>python # Windows/DOS

(2) Script from the Command-line

A Python script can be executed at command line by invoking the interpreter on your application, as in the following:

$python script.py # Unix/Linuxor

python% script.py # Unix/Linuxor

C:>python script.py # Windows/DOS

Note: Be sure the file permission mode allows execution.

Apart from writing a code to detect the drowsiness and sending SMS , we have written another code to create a user interface where driver can write down his emergency contact numbers. Driver will type his name and number on an entry widget and submit it.

We have also written a code to store the data (name and number) ,submitted by the driver, in a database so that when an accident is detected his/her kiths and kins can be informed through SMS about accident location and necessary assistance can be provided.

5.3 SEQUENCE OF THE ACTIVITIES

First we store the farmer's number and mail id in database

This project contains two parts

1) Reporting temperature and humidity and advising farmer whether the environment is suitable for layer and broiler breeding and for wheat cultivation.

   1.1The DHT11 sensor will sense the temperature and humidity and accordingly provide the info to farmer based on following data:

   If temp=20 c then layer bird can breed

   If temp>30 c and temp<40 c while humidity is between 60 and 80 then broilers can breed

If hum>33 and hum<=43 and temp<110 F then fit for wheat cultivation

If temp<33 then too dry for cultivation

2) The IR sensor will detect any unauthorized access to farm

   As soon as radiation detects any object an email notifies the farmer that someone has entered the farm

5.4 Steps for sending Email via Raspberry Pi

There are many cases when it can be very useful to be able to send emails from the Raspberry Pi to arbitrary recipients. This is not the same as having a real MTA running on the Pi (like Sendmail, Postfix, Exim, QMail, etc.), which can also receive and store emails. In the following we are only going to cover the possibility of sending emails, not receiving. In most cases this is enough, as people tend to use GMail, Yahoo! Mail and other major email service providers and they store their emails on the servers of these providers. Still, sending out emails from the Raspberry Pi can come in handy in many situations. For example, you could have some sensors connected to the GPIO pins of the Pi and you could program the Pi to send you an email when the temperature in the room rises above or drops below certain threshold values, when a gas sensor registers unwanted gas leaks or when the measured voltage of a monitored battery becomes too low. You could also have your Pi send you daily or weekly emails with summarized system data. Or maybe you could connect a webcam to the Raspberry Pi and set up some motion detection software, which would send you an email as soon as it detects motion in a given area of your house. Maybe we don't even need to go this far. Maybe you are hosting a WordPress website on your Raspberry Pi and you would like to provide your readers with the possibility to subscribe to the posts. This all means that the Pi needs

to be able to send out emails, which, unfortunately, can be complicated to accomplish.

In order to achieve this we are going to install a piece of software called SSMTP, which is a simple tool for sending emails. We are also going to configure PHP in a way which is going to make it possible to send emails from inside PHP scripts. This way it's going to be easy for web applications (like WordPress plugins) to send mails to chosen recipients.

Many email servers today have very strict rules for accepting emails. For example if the email is not coming from a machine with a static IP address, they might classify the email as SPAM. We don't want that to happen with the emails sent from the Raspberry Pi, so we are going to send the emails to a Goggle server, which will send them forward to the real recipients. In order to be able to accomplish this, you must have a GMail account.

Installing and configuring SSMTP

1. Make sure your repositories are up-to-date:

apt-get update

2. Install SSMTP and mail utilitites:

apt-get install ssmtp

apt-get install mailutils

3. Edit the SSMTP configuration file:

nano /etc/ssmtp/ssmtp.conf

a) Mandatory lines:

root=postmaster

mailhub=smtp.gmail.com:587

hostname=raspberrypi

AuthUser=YourGMailUserName@gmail.com

AuthPass=YourGMailPassword

UseSTARTTLS=YES

Be sure to specify the correct GMail user name and password here, otherwise you will get authentication errors.

If the host name of your Raspberry Pi is different from “raspberrypi”, specify your actual host name here instead.

4. Edit the SSMTP aliases file:

nano /etc/ssmtp/revaliases

This file contains data about the email accounts for existing Linux users in the format local_account:outgoing_address:mailhub[:port]

You should create one line for all the users in your system from which you plan to be able to send emails. For example:

root:root@your.domain:smtp.gmail.com:587

www-data:yourwebpagesname@your.domain:smtp.gmail.com:587

In case you wish to send out emails from a WordPress plugin, you must make sure that you have a line for the user www-data, which is the user under which WordPress runs.

5. Set the permissions of the SSMTP configuration file:

chmod 774 /etc/ssmtp/ssmtp.conf

The permissions of the file /etc/ssmtp/ssmtp.conf determine who will be able to send emails from the Raspberry Pi. By default this file is owned by the user root and the group of the file is also root. So if you want other users,

like www-data to be able to send emails (which you definitely want if you're using a WordPress plugin for example to send out emails), then you need to give read rights to the users who are not the owner of the file and not in the group of the file. The above permissions (774) mean that the owner (root) will be able to read/write/execute the file (7), the other users in the root group will be able to do the same (7) and the users which are not in the group will only have the right to read the file (4). For more details type chmod –help.

If you prefer not to allow every user on your system to send emails, then add the www-data user (or the user who you would like to grant permission for sending emails) to the root group and only give the rights to the users in this group:

sudo usermod -a -G root www-data

chmod 770 /etc/ssmtp/ssmtp.conf

Be careful though. Adding the www-data user to the root group might sometimes not be very safe, as it will allow your website to do many things on your system.

6. Once you're done with the above setup and configuration process, you can send emails very easily from command line, which is great because you can also put the sending into Bash scripts, which can be called by other applications running on your Pi. A simple example looks like this:

echo “Test text” | mail -s “Test Mail” targetperson@example.com

The text “Test text” is sent to the email address targetperson@example.com (you may also specify multiple addresses separated by spaces) with the subject “Test Mail”. For more options type mail –help.

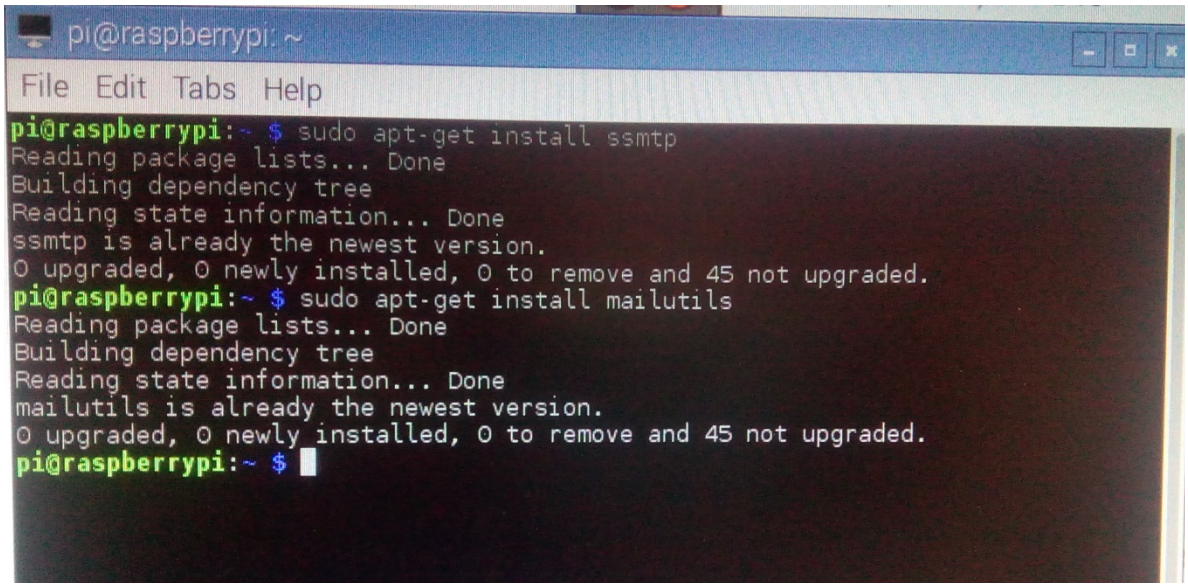
In the similar way we can also send files via Email using Raspberry pi and the command will be as follows:

echo “path-of-file-to-be-sent” | mail -s “Subject” targetperson@example.com

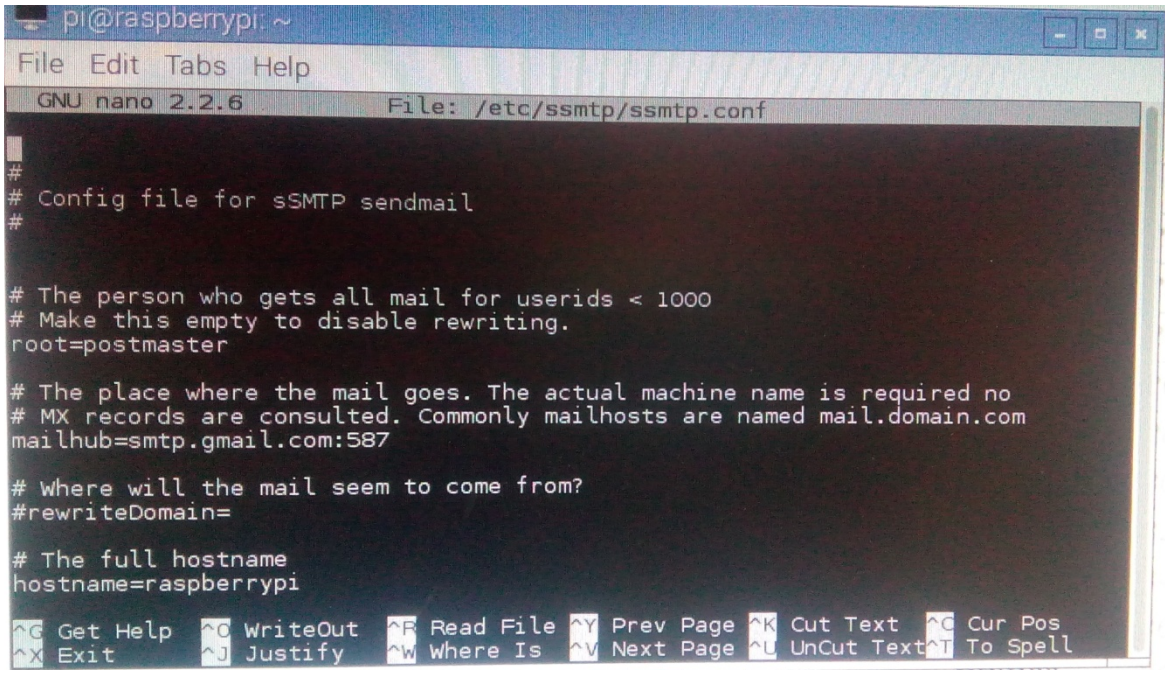
Screenshots:

1. **apt-get install ssmtp**

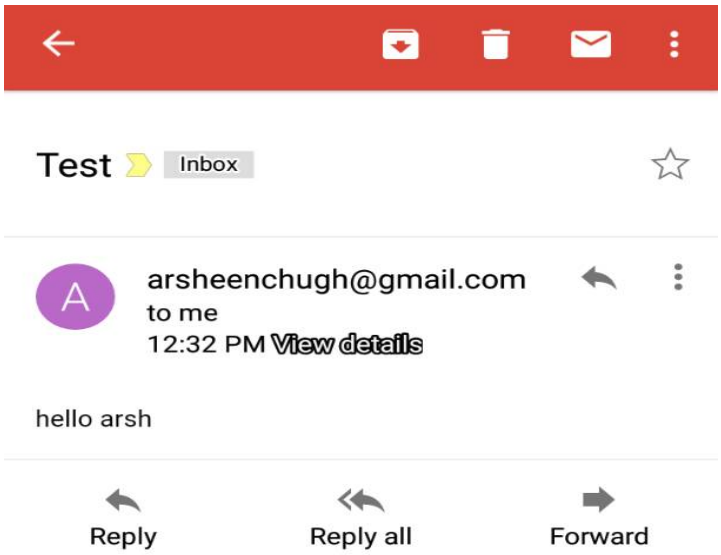
   apt-get install mailutils



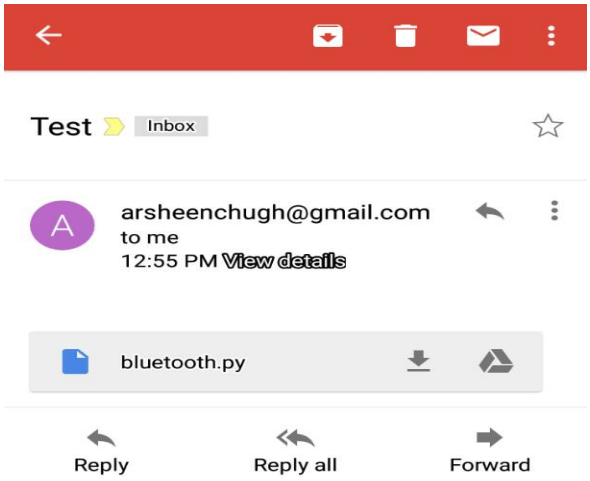
2. **nano /etc/ssmtp/ssmtp.conf**



3. **echo “hello arsh” | mail -s “Test”alkakasotia@gmail.com**



4. **echo "/home/pi/bluetooth.py" |mail -s "Test" alkakasotia@gmail.com**



5.5 System Integration and Testing

After both the Hardware and software of the system are built, we put them together to see a working system. Initially we start with the components of the system. The components are partitioned into software and hardware components. Then these software and hardware components are selected for the desired functioning of the system. The hardware components are assembled together. Software code for programming is designed or written in python language in the editor and this code is then run on terminal. The code is debugged there for any bugs or errors. Here comes the integration part. Now the system is evaluated for any errors. If the system works properly as desired, we are through with the implementation. But if it does not perform according to the desired functionality then we have to go back to the code and hardware. We have to rework with the software code and also reassemble the hardware in order to find out what went wrong or where the error lies. Testing is an important phase of implementation of any project. We can perform this testing with the different small modules of hardware and software so that the chances of errors after the integration are reduced.

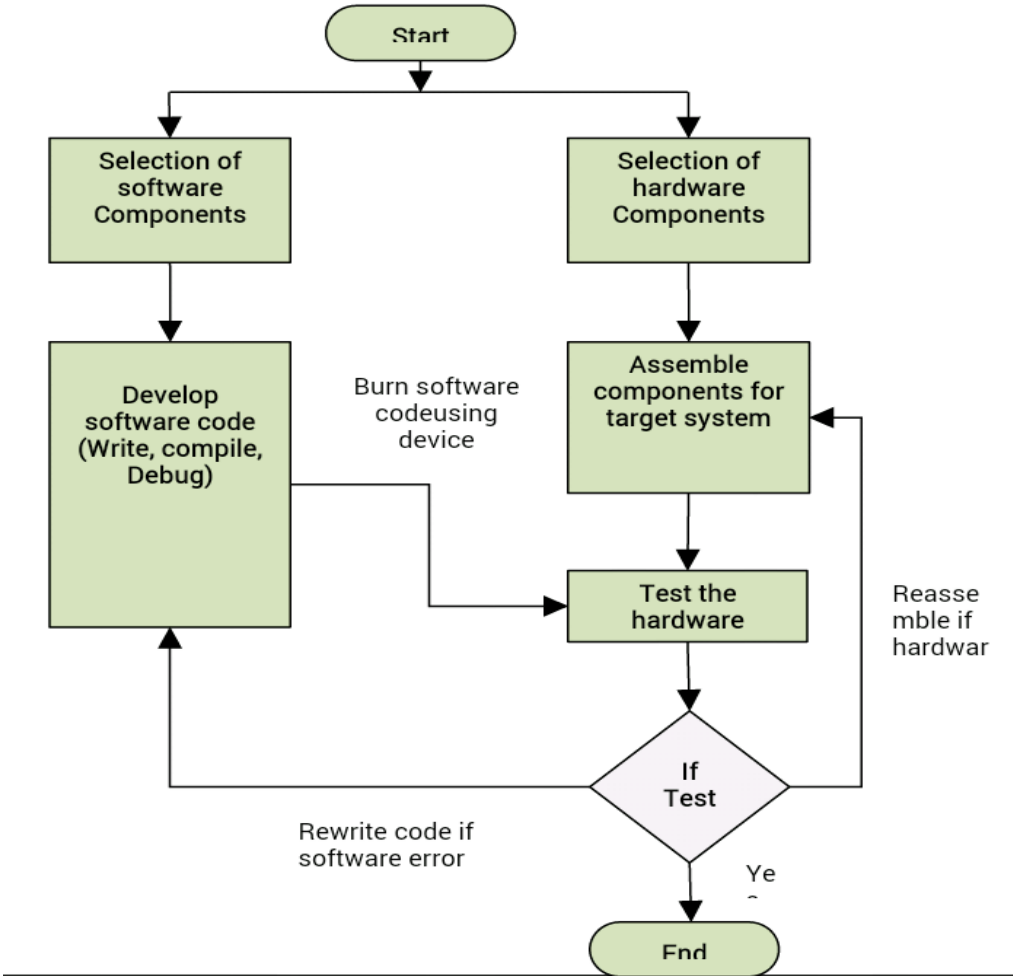


Figure 5.5 Flowchart for System Integration and Testing

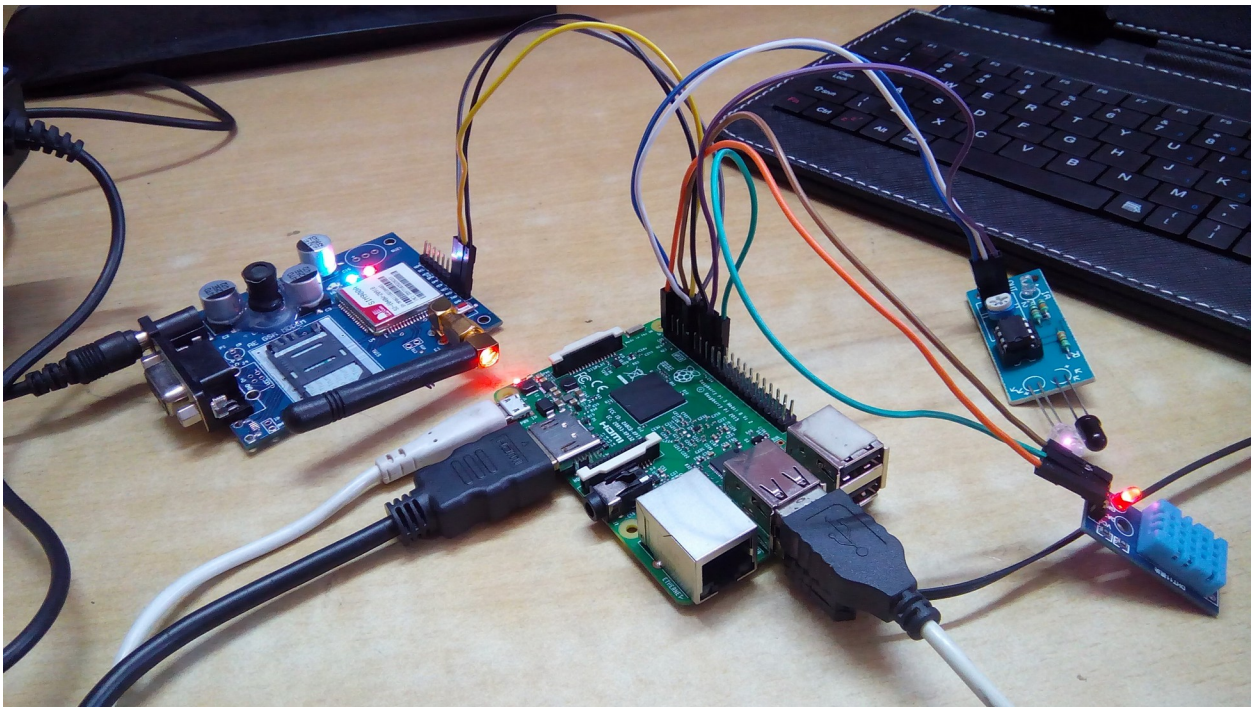
5.6 Summary

In this chapter the hardware and software design of the system is explained. Section 5.1 explains the hardware implementation of the system. This section gives details about how the hardware components are connected to each other. Next section gives details on the flow of software in the form of flowcharts. Section 5.3 explains how the assembled hardware and software are integrated and tested to make the overall system functional. This process is also explained with the help of a flowchart.

CHAPTER 6

Result and Analysis

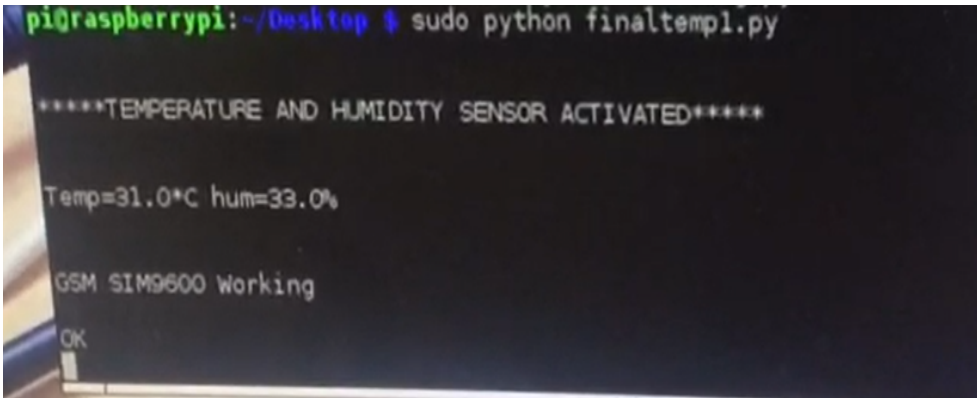
An intruder detection and information kit for farmer prototype is developed and experiments have been conducted. This system is designed with the objective of alerting the farmer when someone enters his farm and sending messages to emergency contact by SMS using GSM module and to help him in poultry and wheat cultivation by reporting temperature and humidity. If any abnormal condition occurs such as temperature rises beyond a certain limit, a SMS is sent to the user's mobile as an alarm so that necessary actions are taken accordingly by the user.



Representation of the field. Here assumption is that there is only one entry to the field. One can see the IR sensor has been attached at the entry gate of the field.

6.1 Layer and broiler breeding environment

In poultry farming, there is a particular temperature which is best suited for hatching. The most favorable temperature is 41^0C for the Layer breeding. If the temperature is below or above this, then the farmer will have to supply more nutrients so as to balance. Hence, by having the idea about the temperature, farmer can decide which breed is best suited according to the current environmental conditions.



As soon as the temperature and humidity sensor is activated, a message will be passed to the farmer in accordance to the temperature recorded. The following is one such message received-

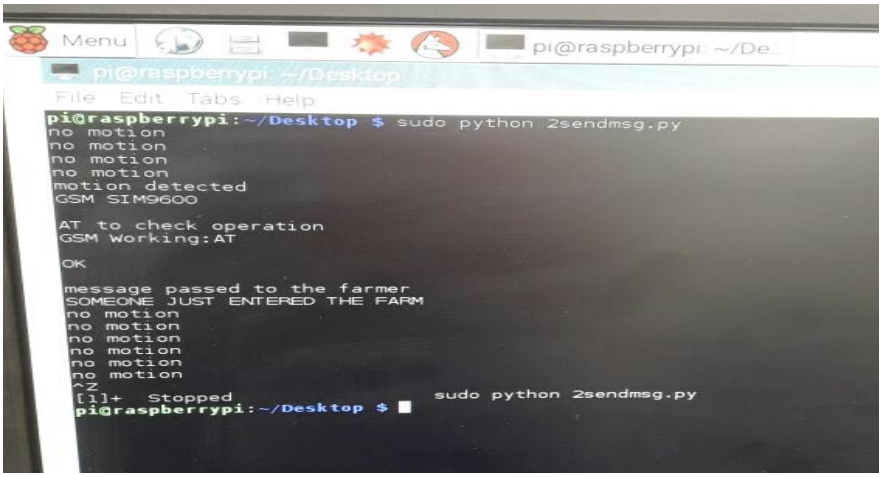
The above message is sent to farmer suggesting that

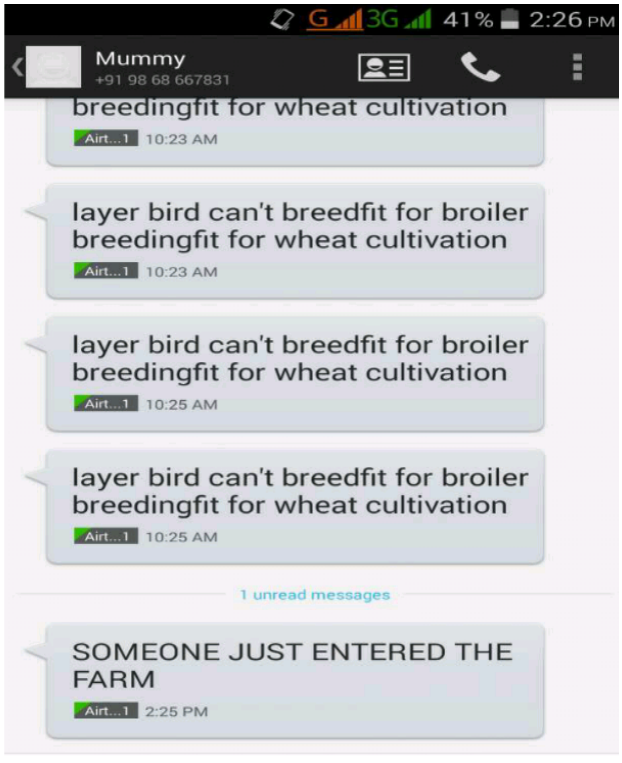
1) layer bird can't breed as temperature is not equal to 20 C
2) Broiler can breed as temp>30 and temp<=40 and humidity is greater than 60 but less than 80
3) Wheat cultivation can be done as humidity >33 and hum<=43 and temp<110 farenheit.

6.2 Unauthorized access in farm (Intruder detection)

Here, “no motion” suggests that there is no one in the field.

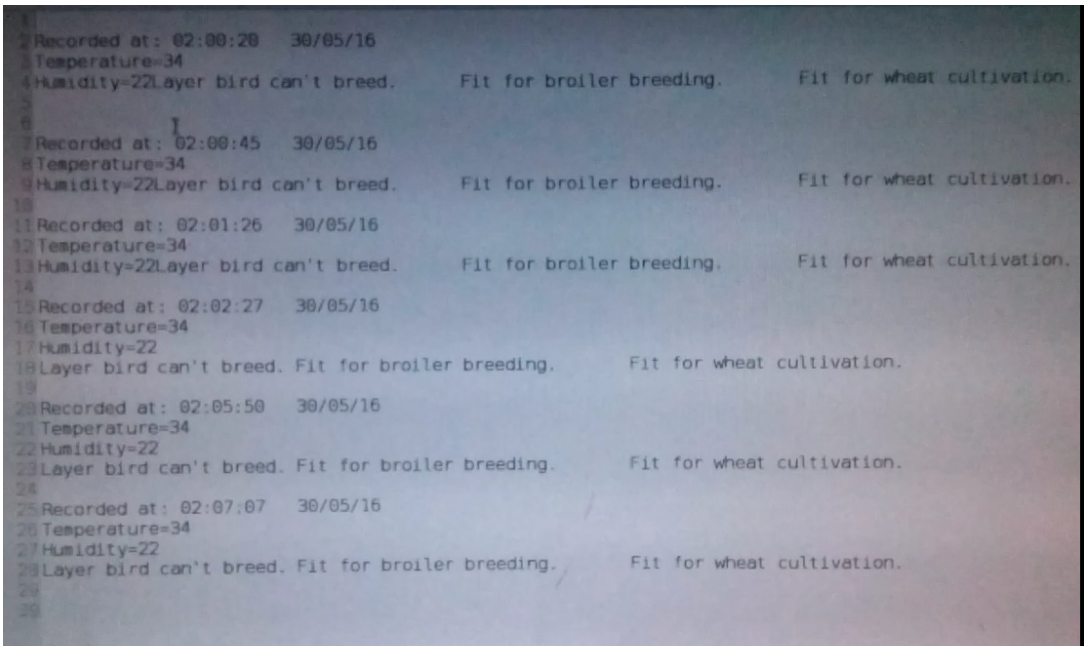
As soon as someone enters the farm gate, the IR sensor will detect it and GSM will be activated to send the farmer a message about the intrusion.





6.3 Keeping the record

Here, the concept of file handling has also been embedded to store the temperature and humidity as and when recorded. This data is stored in a file which can then be stored on cloud. The advantage of doing this is that farmer can do forcasting based on this data. When the temperature and humidity sensor is activated, the data will be stored in the file as below:



The file contains not only the temperature and humidity, but also date and time of recording and also the corresponding message that had been sent to the farmer. Hence this information is quite useful for future references for the farmer.

6.4 Summary

In this chapter, we saw how our device detects intruders. We've also seen how DHT11 works. The intruder is observed using IR sensor which either gives high or low signal. The IR sensor also detects the possible intruder in less than a second and an SMS from GSM network is send during such detection. A database is also maintained for the farmer's contact and GUI is made for the user to enter his number only once.

CHAPTER 7

Conclusion and Future Work

This work was taken up with an objective to produce appropriate technology for the safety of farms and the crops, in order to minimize the inputs and significant monetary losses.

7.1 Conclusion

We studied different technologies like GSM, along with an array of different sensors, IR and DHT11 sensor. We found that each technology has its own merits and demerits. We studied and compared these merits and demerits and found different problems while communicating using these technologies. These are cost, range, real time monitoring, data rate and much more. As it is a very complicated task to develop a system which eliminates all these demerits simultaneously we developed a prototype based on DHT11, IR technology which takes care of few of these drawbacks and has an improved performance in most of the respects that will work optimally in many different applications.

The project designed and implemented a security system based on the Raspberry Pi. The aspects of the system are: Intruder detection using a IR sensor and sending out an alert through sms.

7.2 Future Work

- In the future nearby, we'd like to make a mobile application that will allow the farmer to get the predictions according to the data that the kit stored previously. The statistics shall be made available to the farmer on one button click. Further the application will allow the farmer to turn on or off the kit. Hence he/she won't need to go to the farm to activate the kit.
- We'd also like to work more in developing this kit that will not only tell whether temperature is suitable for a particular breed or crop, but will also suggest farmer what he/she can do to maximize his/her output based on current conditions. That way we'll have to add some level of intelligence in our kit.
- Also, instead of simply sending a message we would include camera so that farmer get to know who entered his/her field.

7.3 References

[1] Z. Sundas, "Motion Detecting Camera Security System with Email Notifications and Live Streaming Using Raspberry Pi." .

[2] M. Peter and H. David, "Learn Raspberry Pi with Linux," Apress, 2012

. [3] P. S. Dhake and B. Sumedha S., "Embedded Surveillance System Using PIR Sensor.," vol. No. 02, no. 3, 2014.

[4] J. D., "Real Time Embedded Network Video Capture And SMS Alerting system," Jun. 2014.

[5] S. Sneha, “IP Camera Video Surveillance using Raspberry Pi.,” Feb. 2015.

[6] F. C. Mahima and A. Prof. Gharge, “Design and Develop Real Time Video Surveillance System Based on Embedded Web Server Raspberry PI B+ Board. International Journal of Advance Engineering and Research Development (Ijaerd), NCRRET.,” pp. 1–4, 2015.

[7] J. G. J, “Design and Implementation of Advanced ARM Based Surveillance System Using Wireless Communication.,” 2014.

[8] P. Sanjana, J. S. Clement, and S. R., “Smart Surveillance Monitoring System Using Raspberry PI and PIR Sensor.,” 2014.

[9] U. Kumar, R. Manda, S. Sai, and A. Pammi, “Implementation Of Low Cost Wireless Image Acquisition And Transfer To Web Client Using Raspberry Pi For Remote Monitoring. International Journal of Computer Networking, Wireless and Mobile Communications (IJCNWMC).,” vol. No. 4, no. 3, pp. 17–20, 2014.

[10] “The History of Security _ PerspecSys.com.htm.” .

[11] A.-D. Osama, “Cisco IP Video Surveillance Introduction,” Cisco Expo, 2009.

[12] “What is a security system and how does it work _ SafeWise.htm.” .

[13] T.K. Hareendran, “GSM Home Security Alarm System With Arduino,” Library Security System, 2014. .

[14] R. Verman, “Distance Education In Technological Age,” Anmol Publ. Pvt Ltd, p. 166, 2005.

[15] “Television Rides Wires,” Pop. Sci., no. February, p. 179, 1949.

[16] “Introduction to Closed Circuit Television,” Jan-2013. .

[17] B. Messauod, Access Control Systems: Secuiry, Management and Trust Models., 1st ed. Austin, TX, USA: Springer, 2006.

[18] “IP Surveillance,” IT Encyclopedia. .

[19] “ijcsit2014050648.pdf.” .

[20] B. E. Reddy, M. Veeresha, and N. Rao, “Image Processing: A Survey.”

[21] A. Ambrosetti and P. H. Rabinowitz, “Dual variational methods in critical point theory and applications,” J. Funct. Anal., vol. 14, no. 4, pp. 349–381, 1973

. [22] “113-115-OBJECT-DETECTION-AND-TRACKING-USING-IMAGEPROCESSING.pdf.” .

[23] “Simon_Denman_Thesis.pdf.” .

[24] S. Prasad, P. Mahalakshmi, A. J. C. Sunder, and R. Swathi, “Smart Surveillance Monitoring System Using Raspberry PI and PIR Sensor,” Int. J. Comput. Sci. Inf. Tech., vol. 5, no. 6, 2014.

[25] Raspberry Pi for Begginers, 2014th ed. London UK.: Imagine Pulishing Ltd. 35

[26] B. J. Glenn, Computer Science: An Overview, 11th ed. Edwards Brothers.

[27] “The Raspberry Pi Education Manual,” Dec. 2012.

[28] “How Infrared Motion Detector Components Work,” Glolab Corporation., 2013.

[29] “pir-passive-infrared-proximity-motion-sensor.pdf.” .

[30] G. Honey, Intruder alarms, 2nd ed. Oxford ; Burlington, MA: Newnes, 2003. [31] “The Raspberry Pi Education Manual,” no. 1.0, Dec. 2012.