Remote Sensing Using Internet of Things (IoT)

Project Report submitted in partial fulfillment of the requirement for the degree of

Bachelor of Technology.

In

Computer Science & Engineering

Under the Supervision of

Dr. Vivek Sehgal

By

Vasuda Trehan (121297CSE)

Navkaran Singh (121295 CSE)

Jaypee University of Information and Technology

Waknaghat, solan-173234, Himachal Pradesh

Certificate

This is to certify that project report entitled "REMOTE SENSING USING INTERNET OF THINGS (IoT)", submitted by Vasuda Trehan and Navkaran Singh in partial fulfillment for the award of degree of Bachelor of Technology in Computer Science & Engineering to Jaypee University of Information Technology, Waknaghat, Solan has been carried out under my supervision.

This work has not been submitted partially or fully to any other University or Institute for the award of this or any other degree or diploma.

Date:

Supervisor's Name:

Dr. Vivek Sehgal

Designation:

Senior Professor

Acknowledgment

We would like to express our special thanks of gratitude to our supervisor Dr. Vivek Sehgal who gave us the golden opportunity to do this wonderful project on the topic Remote Sensing using Internet of Things (IoT), which also helped us in doing a lot of research and we came to know about so many new fields. We are really thankful to him.

Date: Name of the students:

:Vasuda Trehan

:Navkaran Singh

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ABSTRACT

We always wish to see the live images and videos of wildlife animals in the forest of our own choice. But, the system are expensive, large size, hard to install and immovable after installed. Just imagine a picture in which

a herd of elephants walk by, forming a silhouette against the setting sun. They stop to cool down in the heat and take a bath. Nearby a group of zebra graze on.

Wouldn't it be spectacular to be able to watch this imagery from the comfort of your home? Not only is this an appealing scene for wildlife enthusiasts, but the prospect of obtaining such wildlife data is highly beneficial for conservation and would be a great driver to reducing activities such as poaching.

Poaching has troubled people for years, by disturbing the ecosystem. Wildlife poaching has negative side-effects that affect local communities, wildlife populations, and the environment. It is a crime fuelled by a lucrative black market trade of animal parts.

What's the one major problem with this scenario? Why is this not yet a reality if it has so many benefits? The answer lies in the fact that such areas are too remote to have internet connectivity, and even if they do, services are quite limited.

In this project, not only do we discuss how to go around this problem, but also provide a step by step guide on how you could create a setup of your own that would achieve the same objectives of remote data transfer. The Internet of Things is a phenomena that is quickly spreading across technology related circles. It revolves around the connectivity of devices to the internet and how we can process and utilize data being generated by these devices and being stored on the cloud, and sometimes go a step further and use this data to trigger desired outputs.

To solve this problem we have designed a system which do Remote Sensing using Internet of Things (IoT). For this system we are using raspberry Pi B along with other sensors like motor, camera and Infrared sensors.

CHAPTER 1

INTRODUCTION

1.1 Introduction

We always wish to see the live images and videos of wildlife animals in the forest of our own choice. But, the system are expensive, large size, hard to install and immovable after installed. Just imagine a picture in which

a herd of elephants walk by, forming a silhouette against the setting sun. They stop to cool down in the heat and take a bath. Nearby a group of zebra graze on. Wouldn't it be spectacular to be able to watch this imagery from the comfort of your home? Not only is this an appealing scene for wildlife enthusiasts, but the prospect of obtaining such wildlife data is highly beneficial for conservation and would be a great driver to reducing activities such as poaching.

Though it has so many benefits it has not been implemented yet because of the remote areas and highly costly setup. To solve this problem we are doing Remote Sensing using internet of Things (IoT). In this system we are using Raspberry PI B along with sensors like camera module, motor, IR sensor which we will discuss in detail.

1.1.1 Internet of Things (IoT)

Internet of Things (loT) is ongoing development of the Internet by which everyday 'things' objects have communication capabilities which allow them to send and receive data. It is expected to connect systems, devices, sensors which can communicate without the need of machine-to-machine communication. loT refers to an enormous variety of devices such as sensors that assist fire fighters in rescue and search operations, heart beat and blood pressure measuring devices, bio-chips that are implanted in farm animals. It is expected that by 2020, 20 billion devices will be connected with the Internet. The Internet of things presently is being used in the fields of automobiles, agriculture, security surveillance, building management, smart-homes,

and health care. The loT expect to use low-cost computing devices where there is less energy consumption and limited impact to the environment.

The loT will revolutionize everyday life and help in situations like managing airports' passenger flows, smart homes, heating buildings, caring for the elderly. In the present world where we live there are already devices, which are connected to each other and help in day to day aspects, for example wearable fitness devices, sensors which help in automatic garages, RFIDs in ID cards used in Universities and Industries to gain and lock access. However, imagine this after a few years where billions of devices will be connected to each other including cars, phones, jet planes, appliances, wearable gear etc.

Fig 1.1 Internet of Things

1.1.2 Remote Sensing:

Remote sensing is the acquisition of information about an object or phenomenon without making physical contact with the object and thus in contrast to on site observation. Remote sensing is a sub-field of geography. In modern usage, the term generally refers to the use of aerial sensor technologies to detect and classify objects on Earth (both on the surface, and in the atmosphere and oceans) by means of propagated signals (e.g. electromagnetic radiation). It may be split into active remote sensing (when a signal is first emitted from aircraft or satellites) or passive (e.g. sunlight) when information is merely recorded.

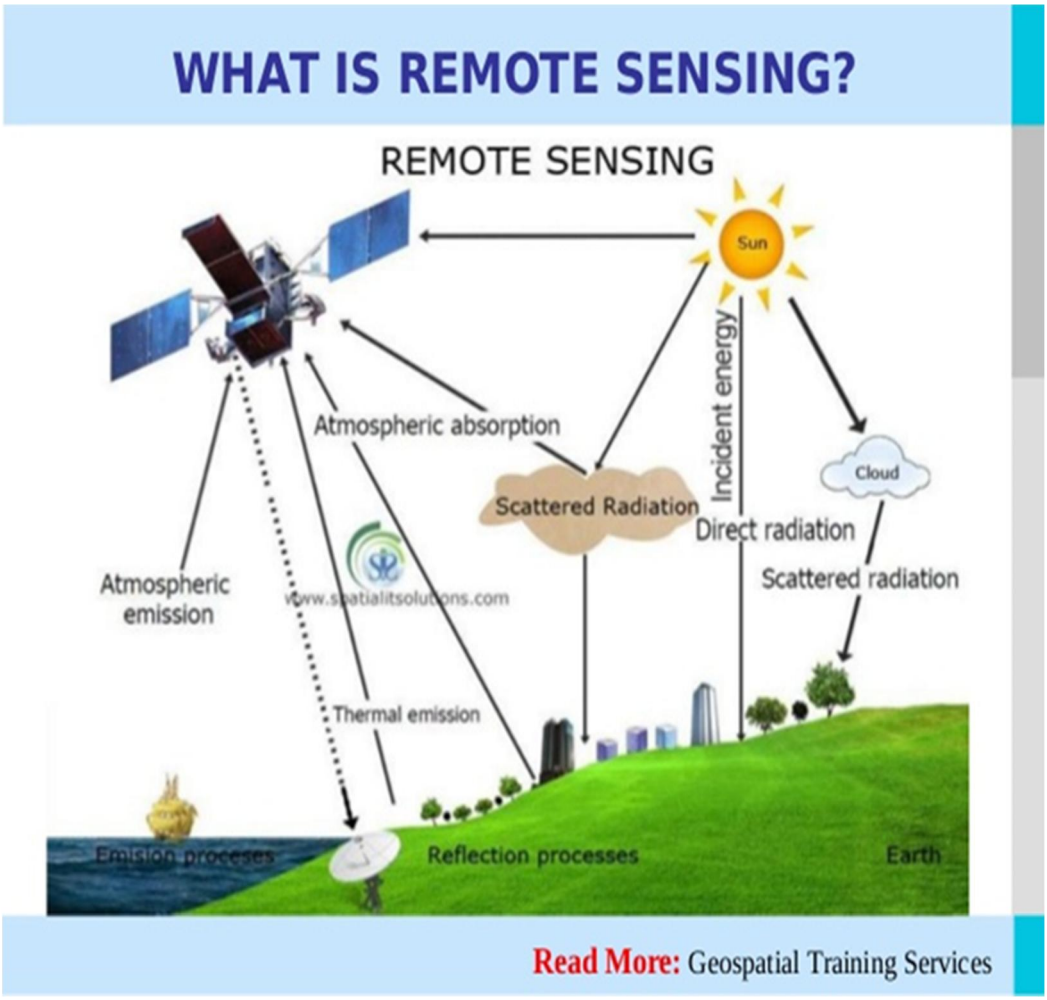

Fig 1.2: Remote Sensing

Remote sensing has a wide range of applications in many different fields:

- **Coastal applications**: Monitor shoreline changes, track sediment transport, and map coastal features. Data can be used for coastal mapping and erosion prevention.
- **Ocean applications**: Monitor ocean circulation and current systems, measure ocean temperature and wave heights, and track sea ice. Data can be used to better understand the oceans and how to best manage ocean resources.
- **Hazard assessment**: Track hurricanes, earthquakes, erosion, and flooding. Data can be used to assess the impacts of a natural disaster and create preparedness strategies to be used before and after a hazardous event.
- **Natural resource management**: Monitor land use, map wetlands, and chart wildlife habitats. Data can be used to minimize the damage that urban growth has on the environment and help decide how to best protect natural resources.

1.1.3 Raspberry Pi B:

It is credit card sized computer, which can plug into any HDMI input device or RCA video input device and a keyboard is required for operation. Once it is initialized the HDMI and keyboard are also not required for its operation as you can then operate it by other means such as ssh for command line interface and VN C if graphical user interface is desired. The main technical specifications of the latest model of Raspberry Pi also known as Model B have the following features:

- 700 MHz ARM CPU
- 512MB SDRAM
- 101100 Ethernet RJ45
- 2 x USB 2.0
- HDMI (1.4) and Composite RCA

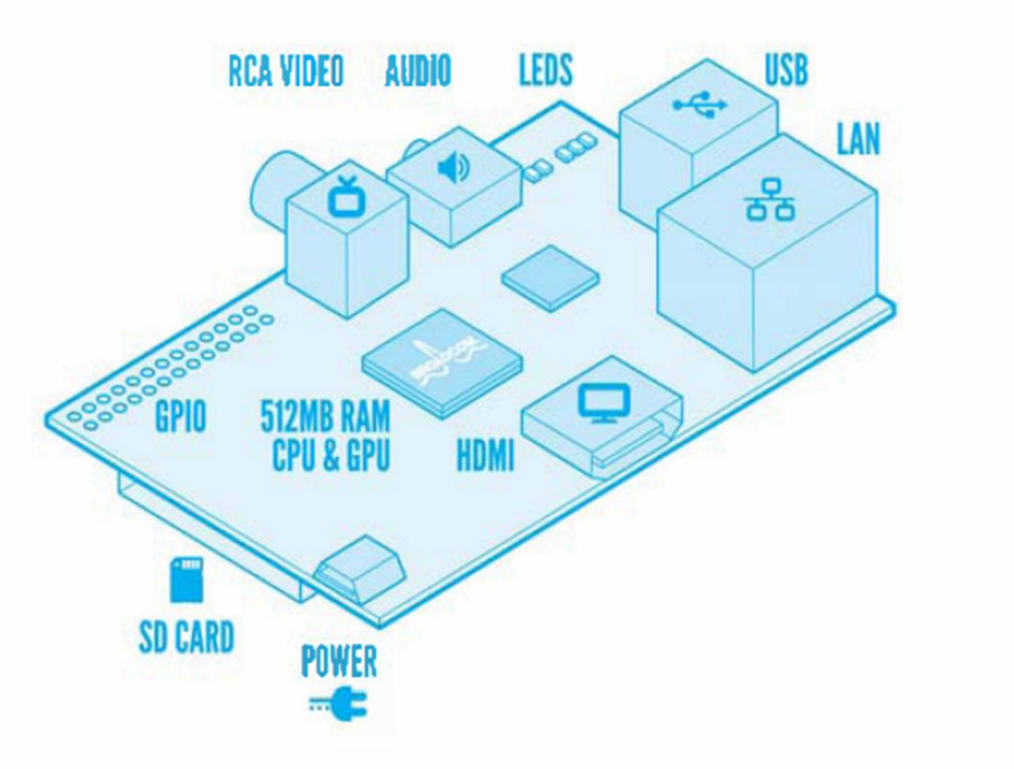

Fig 1.3: Raspberry Pi B

The Raspberry Pi runs Linux based operating systems and there is a specialized version of Linux based kernel known as Raspian which can run almost all programs which are Linux compatible. Hence in this project we have used 'python' script written in python for motion detection.

Advantages of Raspberry Pi B:

The Raspberry Pi being small as a credit card server still has the capabilities of working as a normal computer it can play 10S0p resolution videos without lagging. It has a low price relatively as compared to machines in the market and can serve as a server for light traffic such as web traffic or DNS servers or NTP servers, which can run on low power also for example it can be powered by portable batteries which can act as UPS (uninterrupted power supply), when there is a power cut and notify about the power cut to the network administrators.

1.1.4 Infrared Sensors in Raspberry Pi:

Infrared (IR) light is invisible electromagnetic radiation. Everything absorbs and emits IR, and it's utilized in a plethora of applications. You may have heard of IR used in night vision equipment. This is because, in low visible-light conditions, everything still emits IR radiation. The night vision equipment has IR sensors which detect and output this information.

Fig 1.4: Infrared Sensor

IR sensors consist of a photocell & chip tuned to look out for specific wavelengths of invisible infrared light. This is why IR is used for remote control detection, such as your TV. You "could" use visible light, however you would be essentially shining a torch at you TV, which isn't ideal.

So, in order to use IR for remote sensing, you need an IR LED (in the remote to output the IR signal) coupled with an IR sensor (inside the TV) which detects the IR pulses and follows the direction that these pulses are coded to e.g. turn off, change channel etc.

In our project we are using for infrared sensors which will detect the motion of the animal which come across it. These sensors are placed in each direction north, south, east, west and certain combinations are made. The direction in which animal is there that side sensor will get activated.

1.1.5 Motor:

We are using motor to rotate the camera. The camera is mounted on the motor. When IR sensor which are present in each direction gets activated it sends signal to motor and motor stars rotating the camera and the desired output is get.

Fig 1.5: Motor

An electric motor is an electrical machine that converts electrical energy into mechanical energy. The reverse of this would be the conversion of mechanical energy into electrical energy and is done by an electric generator.

In normal motoring mode, most electric motors operate through the interaction between an electric motor's magnetic field and winding currents to generate force within the motor. In certain applications, such as in the transportation industry with traction motors, electric motors can operate in both motoring and generating or braking modes to also produce electrical energy from mechanical energy.

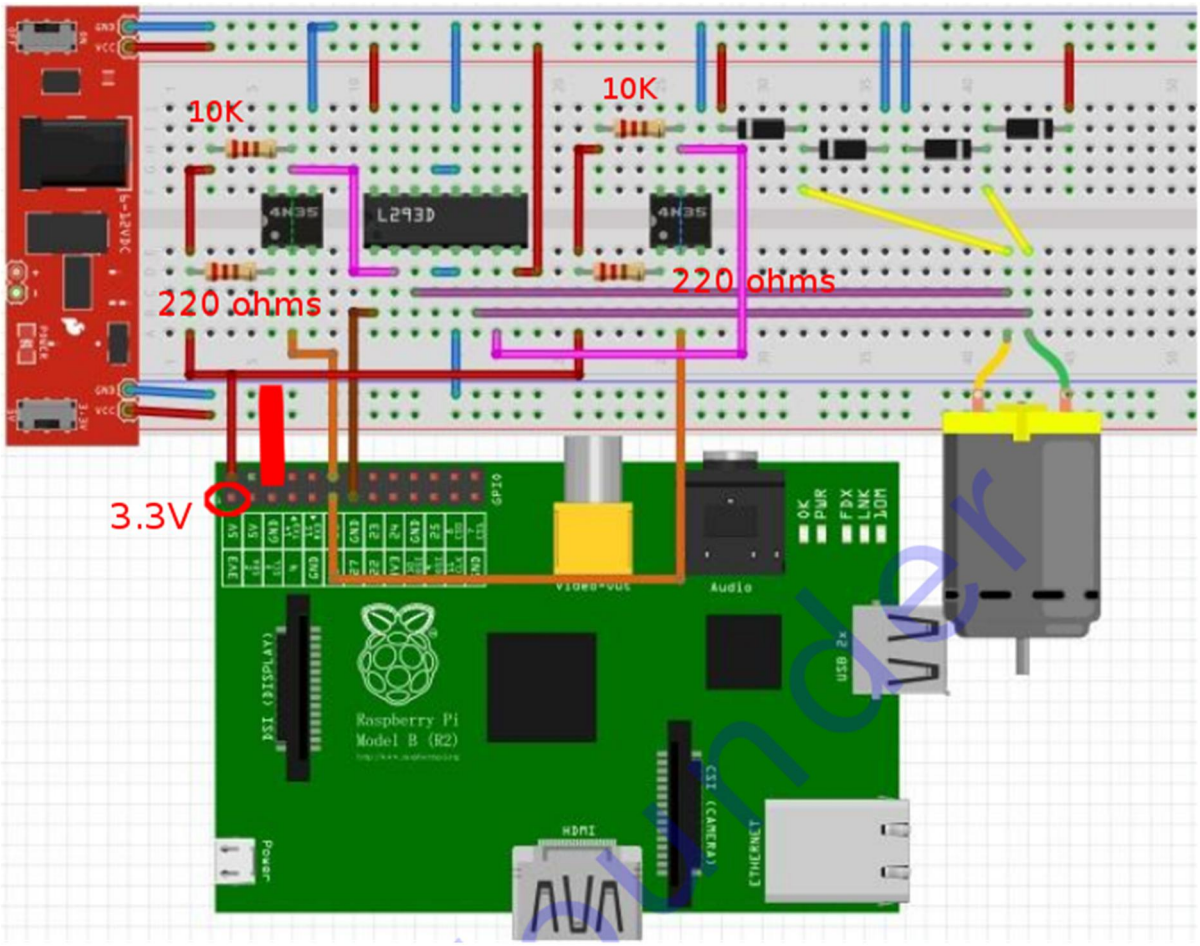

Fig 1.6: DC motor in Raspberry Pi

Found in applications as diverse as industrial fans, blowers and pumps, machine tools, house hold appliances, power tools, and disk drives, electric motors can be powered by direct current (DC) sources, such as from batteries, motor vehicles or rectifiers, or by alternating current (AC) sources, such as from the power grid, inverters or generators. Small motors may be found in electric watches. General-purpose motors with highly standardized dimensions and characteristics provide convenient mechanical power for

industrial use. The largest of electric motors are used for ship propulsion, pipeline compression and pumped-storage applications with ratings reaching 100 megawatts. Electric motors may be classified by electric power source type, internal construction, application, type of motion output, and so on.

1.1.6 Camera Module in Raspberry Pi B:

We are using Camera Module here to record the video and images of wildlife when there motion is detected.

The Raspberry Pi camera module can be used to take high-definition video, as well as stills photographs. It's easy to use for beginners, but has plenty to offer advanced users if you're looking to expand your knowledge. There are lots of examples online of people using it for time-lapse, slow-motion and other video cleverness. You can also use the libraries we bundle with the camera to create effects.

Fig 1.7 Camera Module

If you’re interested in the nitty-gritty, you’ll want to know that the module has a five megapixel fixed-focus camera that supports 1080p30, 720p60 and VGA90 video modes, as well as stills capture. It attaches via a 15cm ribbon cable to the CSI port on the Raspberry Pi.

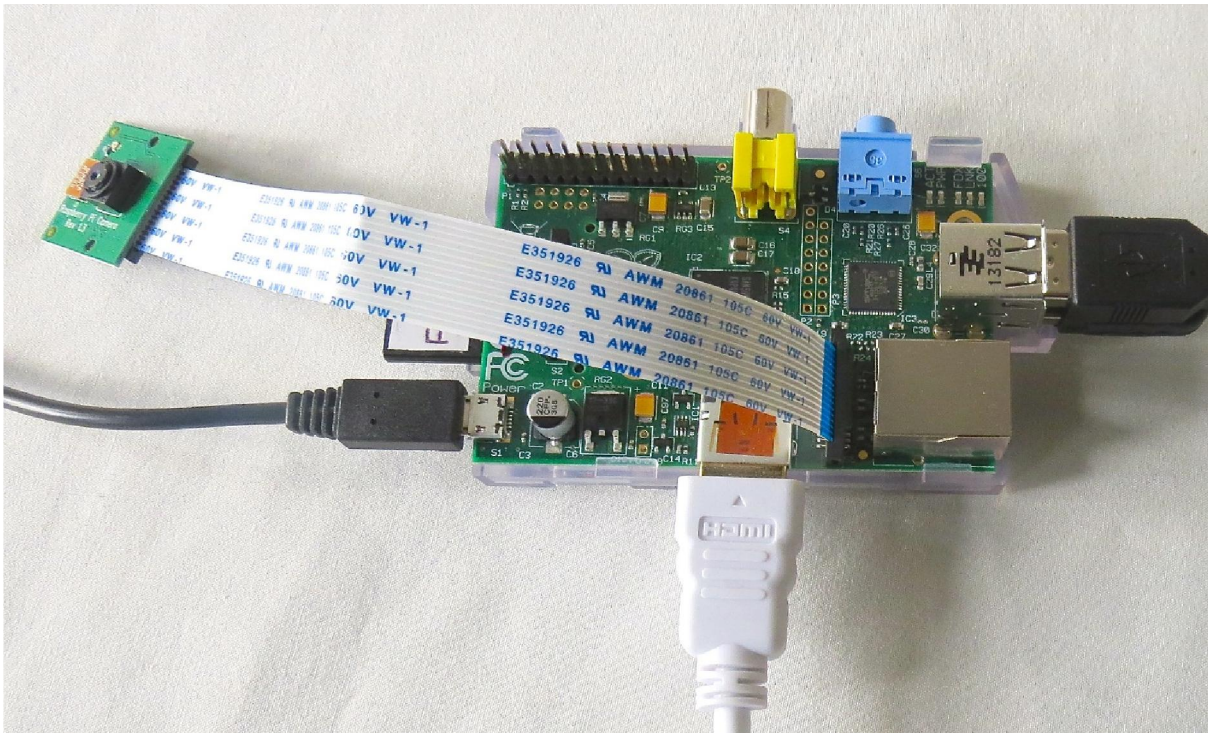

Fig 1.10: Camera Module in Raspberry Pi

The camera works with all models of Raspberry Pi 1 and 2. It can be accessed through the MMAL and V4L APIs, and there are numerous third-party libraries built for it, including the Picamera Python library. The camera module is very popular in home security applications, and in wildlife camera traps.

1.1.7 Python Language:

The language in which we are making this project is python. Python is a widely used general-purpose, high-level programming language. Its design philosophy emphasizes code readability, and its syntax allows programmers to express concepts in fewer lines of code than would be possible in languages such as C++ or Java. The language provides constructs intended to enable clear programs on both a small and large scale.

Fig 1.11 Python LOGO

Python supports multiple programming paradigms, including object-oriented, imperative and functional programming or procedural styles. It features a dynamic type system and automatic memory management and has a large and comprehensive standard library.

Python interpreters are available for installation on many operating systems, allowing Python code execution on a wide variety of systems. Using third-party tools, such as Py2exe or Pyinstaller, Python code can be packaged into stand-alone executable programs for some of the most popular operating systems, allowing the distribution of Python-based software for use on those environments without requiring the installation of a Python interpreter.

1.1.8 Server:

The server which we are using in our project is Django server. It is a free and open source web application framework, written in Python, which follows the model–view–controller (MVC) architectural pattern. It is maintained by the Django Software Foundation (DSF), an independent organization established as a 501 non-profit.

Django's primary goal is to ease the creation of complex, database-driven websites. Django emphasizes reusability and "pluggability" of components, rapid development, and the principle of don't repeat yourself. Python is used throughout, even for settings, files, and data models. Django also provides an optional administrative create, read, update and delete interface that is generated dynamically through introspection and configured via admin models.

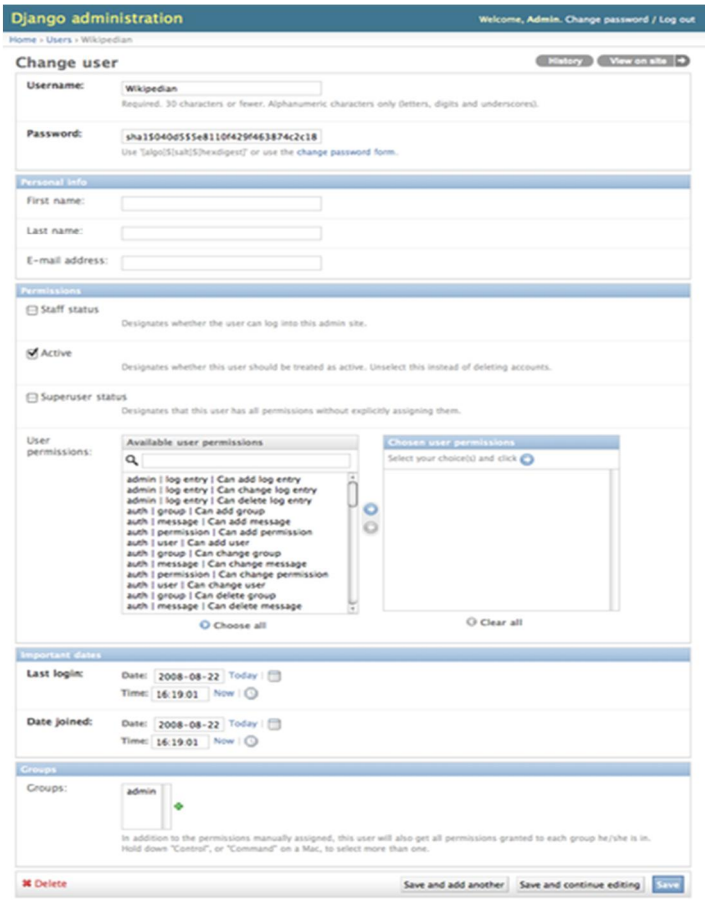

Fig: 1.12: Screenshot of the Django admin interface for modifying a user account.

A Web server is the program using client-server model and the World Wide Web's Hypertext Transfer Protocol, serves the website that form Web pages to Web users. Every computer on the Internet that includes a Web site must have a Web server program.

Server-Client show the relationship between two computer programs in one program, the provider of a service or resource called servers and service requester called clients. The client makes a service request from one program, the server perform the request. Usually clients and servers connect over a computer network on separate hardware, but both client and server may use the same system. A server is a host that is running server programs which share their resources with clients.

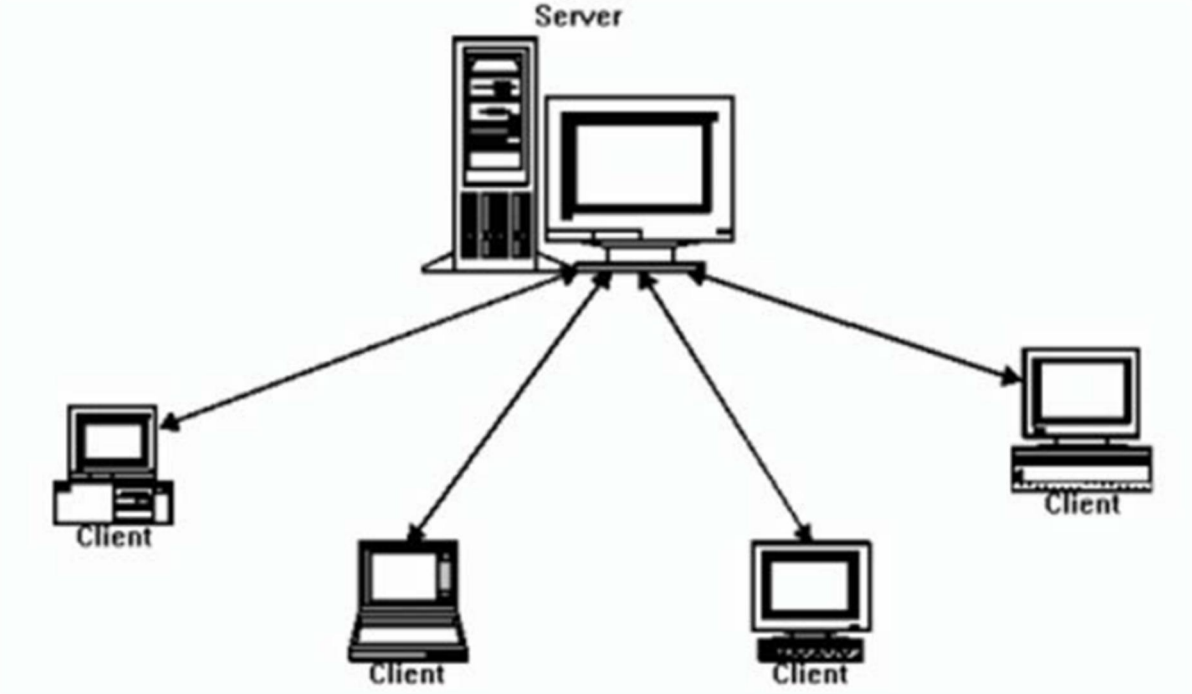

Fig 1.13: Server

Clients not share any resources, but need a server's content or service function. Notwithstanding the Server-Client idea can be used by programs within a single computer, but it is a more important idea in a network. Under a network, the client-server model provides a convenient way to interconnect programs that are distributed efficiently across different locations.

1.2 Problem Statement:

We always wish to see the live images and videos of wildlife animals in the forest of our own choice. But, the system are expensive, large size, hard to install and immovable after installed. Just imagine a picture in which

a herd of elephants walk by, forming a silhouette against the setting sun. They stop to cool down in the heat and take a bath. Nearby a group of zebra graze on. Wouldn't it be spectacular to be able to watch this imagery from the comfort of your home? Not only is this an appealing scene for wildlife enthusiasts, but the prospect of obtaining such wildlife data is highly beneficial for conservation and would be a great driver to reducing activities such as poaching.

Poaching has troubled people for years, by disturbing the ecosystem. Wildlife poaching has negative side-effects that affect local communities, wildlife populations, and the environment. It is a crime fueled by a lucrative black market trade of animal parts.

What's the one major problem with this scenario? Why is this not yet a reality if it has so many benefits? The answer lies in the fact that such areas are too remote to have internet connectivity, and even if they do, services are quite limited.

To solve this problem we have designed a system which do Remote Sensing using Internet of Things (IoT). For this system we are using raspberry Pi B along with other sensors like motor, camera and infrared sensors. The Raspberry Pi is a single-board computer which has a Broadcom BCM2835 system on a chip, includes an ARM 700 MHz processor, 256MB of RAM, and Video Core IV GPU. As we can see, the performance was limited, the program must low hardware requirements, in case can't run on Pi. Pi also don't have hard disk or solid-state drive, but uses an SD card for booting and long-term storage, the storage limited was another problem, we need adjustment the resolution of pictures to make pictures clear to see and not cost so many

memory space. Pi use ARM difference with normal computer which use Intel CPU or AMD CPU.

There is a cardboard on which Raspberry Pi B is placed and in all the four directions IR sensor are placed and whichever sensor detects motion get activated and send signal to the motor on which camera is placed. At this time notification is send to the user that some motion has been detected. Camera then records the video and capture images of the animal whose motion has been detected. Then streaming will take place and using Internet of Things (IoT) tis data will get cloud one can either watch this data live or can save this data to see afterwards.

1.3 Objective:

There are 5 objectives in this project:

1. To write a program that can detect motion on Raspberry Pi using Infrared LM 354 sensor and then activate that IR sensor.

2. To write a program that can rotate the motor in that direction of which IR Sensor got activated.

3. To write the code to send notification to the user that some motion has been detected.

4. To save the pictures or videos of detected motion using Raspberry Pi storage.

5. To build a webserver on the Pi, so that the pictures stored on Pi can be check by a Web browser.

1.4 Methodology:

This project Remote Sensing using Internet of Things (IoT) is made by using Raspberry Pi B along with sensors like camera module, motor, Infrared Sensor. There is a board on which in each direction IR sensor are placed. The direction in which motion is detected that side sensor gets activated and notification is send to the user that some motion has been detected. Once motion is detected motor starts rotating the camera in that direction in which motion is detected and video or image is captured. This data is uploaded to server and gets cloud from where one can see that data and also can save that data.

This whole thing we are doing by using language called python. About these sensors and python everything is explained above. The software which we are using is Linux based and the server which we are using to cloud the data is Django. In order to open the terminals in Raspberry Pi we are using Putty. For sending notification on WatsApp the tool which we are using is Yousoup. Corresponding to every sensor we will install libraries in our system.

1.5 Organization:

As an overview, the structure of this report is organized as follows:

Chapter 1 Describes a general introduction of the project, problem statement project aims and project scope.

Chapter 2 Provides details literature review that includes an introduction to some basic concepts and a survey of existing works in the areas of developing the system in which we are doing Remote sensing using internet of things (IoT). This chapter explains in detail all the researches, studies, theories and gathering that have been make throughout the project.

Chapter 3 Discusses the system and design of the project which provides a detailed description of the design to develop a system which detects motion of the animal and then capture their images and upload to the server. It also discusses about the hardware which has been used in the project.

Chapter 4 Discusses about the result and analysis. It also includes the design of a mobile robot with a flat platform.

Chapter 5 Concludes the project and gives suggestions for future work.

CHAPTER 2

LITERATURE SURVEY

Introduction:

Literature survey is the survey you did for your project, which helps you in completing it and tell you about new research fields. Here we are writing the abstract of all the research papers we studied for those project. This Literature Survey proved to be helpful for us. As we came to know about many new things. This was interesting also.

2.1 Paper 1:

An Internet of Things Approach for Motion Detection using Raspberry Pi

Aamir Nizam Ansari \ Mohamed Sedkyl, Neelam Sharma, Anurag Tyagi

Faculty of Computing, Engineering and Sciences, Staffordshire University, Stoke-on-Trent,

United Kingdom

Electrical & Instrumentation Engineering, Thapar University, Patiala, India, 2015

Abstract: Internet of things is the communication of anything with any other thing, the communication mainly transferring of useable data, for example a sensor in a room to monitor and control the temperature. It is estimated that by 2020 there will be about 50 billion internet-enabled devices .This paper aims to describe a security alarm system using low processing power chips using Internet of things which helps to monitor and get alarms when motion is detected and sends photos and videos to a cloud server. Moreover, Internet of things based application can be used remotely to view the activity and get notifications when motion is detected. The photos and videos are sent directly to a cloud server, when the cloud is not available then the data is stored locally on the Raspberry Pi and sent when the connection resumes. Therefore, advantages like these make this application ideal for monitoring homes in absence.

2.2 Paper 2:

Intelligent Surveillance System For Motion Detection Using Raspberry Pi

Kodinaria Brijesh

Wireless & Mobile Computing Gujarat Technological University, CDAC-ACTS Ahmedabad,

Gujarat

Abstract: Motion detection is one of the key techniques for automatic video analysis to extract crucial information from scenes in video surveillance systems. The method of foreground and background detection start from second frame onwards it employs new object tracking method which detects and remove ghost objects rapidly while preserving abandon objects from decomposing into background. It mainly focuses to improve motion detection based on Low Computing system. This research project is carried out to determine some of the basic human motion detection algorithm that had been founded or developed or even researched in past. As, the report is mainly aimed for the readers that the architecture of a human motion detection system in applications.

Also in recent years, Ambient Intelligence has attracted a number of researchers due to the widespread diffusion of unobtrusive sensing devices. Thus, the availability of acquired data has driven the interest of the scientific community in producing novel methods for combining raw measurements in order to understand what is happening in the monitored scenario.

2.3 Paper 3:

Motion Detecting Camera Security System with Email Notifications and Live Streaming

Using Raspberry Pi

Sundas Zafar, Computer Engineering Technology

New York City College of Technology, CUNY 186 Jay Street, Brooklyn, NY 11201

Abstract: Even when needed, having a security camera system may sometimes be impossible due to the extensive costs for installation. The Raspberry Pi is a credit card sized computer that has the capability to become a camera security system when its own camera board is used. It contains the software motion which enables the Pi's camera to detect motion and save the image as well as view live streaming from the camera. A python script, then directs the Pi to send email notifications every time motion is detected. With these components, a cost effective and efficient security camera system is made and reported here.

2.4 Paper 4

Internet of Things Remote Sensing

Steven Jhonston

School of Electrical and Electronic Engineering, University of Nottingham, Jalan Broga, Semenyih,

Selangor Darul Ehsan, Malaysia, 2000

Abstract: The project focuses on improving healthcare in developing countries using low power, economic electronics such as UDOO Quad. Healthcare make use of extensive networks to gather and share patient monitored data, which is used to perform analysis and provide better healthcare services. Using devices such as the UDOO, help create a system where data can be transported between remote locations, where internet connection is limited - a physical network of sorts.

2.5 Paper 5:

Hand gesture recognition with depth images

Suarej J

Center for Robot-Assisted Search & Rescue, Texas A&M Univ., College Station, TX, USA Murphy, R.R.

September 2012

Abstract: This paper presents a literature review on the use of depth for hand tracking and gesture recognition. The survey examines 37 papers describing depth-based gesture recognition systems in terms of the hand localization and gesture classification methods developed and used, the applications where gesture recognition has been tested, and the effects of the low-cost Kinect and OpenNI software libraries on gesture recognition research. The survey is organized around a novel model of the hand gesture recognition process. In the reviewed literature, 13 methods were found for hand localization and 11 were found for gesture classification. 24 of the papers included real-world applications to test a gesture recognition system, but only 8 application categories were found (and three applications accounted for 18 of the papers). The papers that use the Kinect and the OpenNI libraries for hand tracking tend to focus more on applications than on localization and classification methods, and show that the OpenNI hand tracking method is good enough for the applications tested thus far. However, the limitations of the Kinect and other depth sensors for gesture recognition have yet to be tested in challenging applications and environments.

2.6 Paper 6:

On-road vehicle detection

Zehang Sun

ETreppid Technol., Reno, NV, USA ; Bebis, G. ; Miller, R.

May 2006

Abstract: Developing on-board automotive driver assistance systems aiming to alert drivers about driving environments, and possible collision with other vehicles has attracted a lot of attention lately. In these systems, robust and reliable vehicle detection is a critical step. This paper presents a review of recent vision-based on-road vehicle detection systems. Our focus is on systems where the camera is mounted on the vehicle rather than being fixed such as in traffic/driveway monitoring systems. First, we discuss the problem of on-road vehicle detection using optical sensors followed by a brief review of intelligent vehicle research worldwide. Then, we discuss active and passive sensors to set the stage for vision-based vehicle detection. Methods aiming to quickly hypothesize the location of vehicles in an image as well as to verify the hypothesized locations are reviewed next. Integrating detection with tracking is also reviewed to illustrate the benefits of exploiting temporal continuity for vehicle detection. Finally, we present a critical overview of the methods discussed, we assess their potential for future deployment, and we present directions for future research.

2.7 Paper 7:

Wireless Smart Camera Networks for the Surveillance of Public Spaces

Kevin Abas

University of California, Santa Cruz

May 2014

Abstract: A taxonomy of wireless visual sensor networks for surveillance offers design goals that try to balance enegy efficiency and application performance requirements. SWEET cam, a wireless smart camera network platform, tries to address the challenges raised by achieving adequate energy-performance tradeoffs.

2.8 Paper 8:

Research of image recognition technology about moving object based on low-resolution camera

Yin Liu

Sch. of Inf. Eng, Southwest Univ. of Sci. & Technol.,China ; Yong Xu ; Yaojing Liu

2008-2009

Abstract: In this paper, they focus on the issue of accuracy in the process of motion pattern detection, and propose a new multi-frame superposition motion detection algorithm on the base of traditional adjacent frame difference method. First, we deal the captured image with blurring, color separation process and so on, then implement the multi-frame superposition processing technology and calculate the average coordinates of movement points to analyze the image. And the experiments prove that this algorithm maintains the traditional algorithm's efficiency while has a great improvement on accuracy and versatility at the same time.

2.9 Paper 9:

Research on Detecting Face and Hands for Motion-Based Game Using Web Camera

Young Jae Lee

California University

2013

Abstract: In this paper, they present a new approach of detecting face and hands for the purpose of motion-based game production. In the process, the Web camera has been used to effectively capture and trace the images of the gamerÂ¿s movements. Based on the analyzing algorithm, information on face, eye and hand location and movements has been searched by means of various methods such as color difference, movement information, notch filter and face detection algorithm. With this information found, interaction with object in virtual space has been materialized and movement modeling on action and reaction in collision has been proposed. Most of all, the first person motion-based game which was produced with the proposed algorithm was able to show the validity and robust performance of the proposed algorithm. The proposed method can be applied as the basic algorithm for the production of motion-based game.

2.10 Paper 10:

Internet of Things (IoT): A vision, architectural elements, and future directions

Rajkumar Bhuiy

Department of Electrical and Electronic Engineering, The University of Melbourne, Vic - 3010, Australia

30 th January 2013

Abstract: Ubiquitous sensing enabled by Wireless Sensor Network (WSN) technologies cuts across many areas of modern day living. This offers the ability to measure, infer and understand environmental indicators, from delicate ecologies and natural resources to urban environments. The proliferation of these devices in a communicating–actuating network creates the Internet of Things (IoT), wherein sensors and actuators blend seamlessly with the environment around us, and the information is shared across platforms in order to develop a common operating picture (COP). Fueled by the recent adaptation of a variety of enabling wireless technologies such as RFID tags and embedded sensor and actuator nodes, the IoT has stepped out of its infancy and is the next revolutionary technology in transforming the Internet into a fully integrated Future Internet. As we move from www (static pages web) to web2 (social networking web) to web3 (ubiquitous computing web), the need for data-on-demand using sophisticated intuitive queries increases significantly. This paper presents a Cloud centric vision for worldwide implementation of Internet of Things. The key enabling technologies and application domains that are likely to drive IoT research in the near future are discussed. A Cloud implementation using Aneka, which is based on interaction of private and public Clouds is presented. We conclude our IoT vision by expanding on the need for convergence of WSN, the Internet and distributed computing directed at technological research community.

CHAPTER 3

SYSTEM DEVELOPMENT

3.1 INTRODCTION:

Here we will explain you step by step how to make your own motion detector camera of wildlife. This will be quite easy for you to make one for you. Which will help you enjoy wildlife sitting at home and also control poaching and saving the environment, our ecosystem.

3.2 What you'll need

For this project, you'll need:

- a Raspberry Pi Model B
- a Raspberry Pi camera module
- a Raspberry Pi motor module
- a case with a camera mount
- 4 Infrared Sensors
- Wifi/ ethernet
- an SD card with an up-to-date Raspbian installation
- Cardboard
- Wires
- Battery
- a monitor, keyboard and network connection to set up the software

3.3 Assembling the Circuit- Hardware Setup

Adding Power and Ground

It is important to do this while the power to the Raspberry Pi is off, or disconnected, as you want to avoid shorting any connectors by mistake.

The first thing you need to do is connect up the power and ground wires. As with most electronics projects, everything that connects together will require a common ground. This is shown with the black wires.

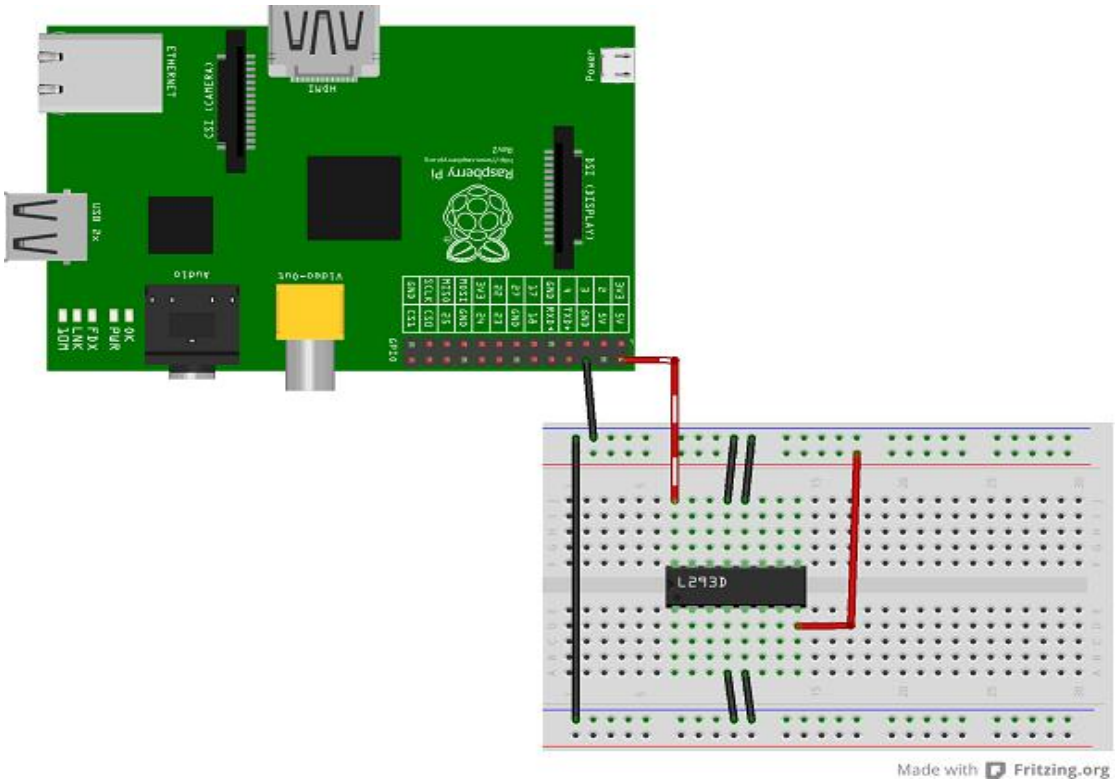

Fig 3.1: Connecting to the power and ground wires

The ground on the Raspberry Pi is physical pin 6. Referring to Figure one this is worked out by starting at the top left with pin 3V3, counting left to right so 5V is pin 2, GPIO 2 (labelled 2) is pin 3 and so on.

Reading pin numbers on Integrated Circuit (IC) chips is easily done by having the notch or dot to the left then starting from bottom left gives us pin 1.

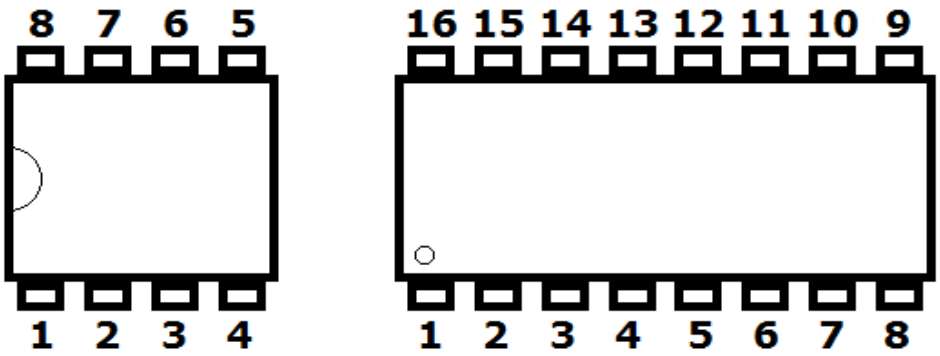

Fig 3.2: Pin 1 is at the bottom left

3.3.1 Raspberry Pi PIR Sensor Hardware Setup

We will be putting together a simple circuit that makes use of a PIR sensor, a camera, a motor.

The low-cost Raspberry Pi microcomputer made headlines earlier this year when the Zoological Society of London and the Kenya Wildlife Service joined forces to produce a network of remote cameras to monitor animals and catch poachers.

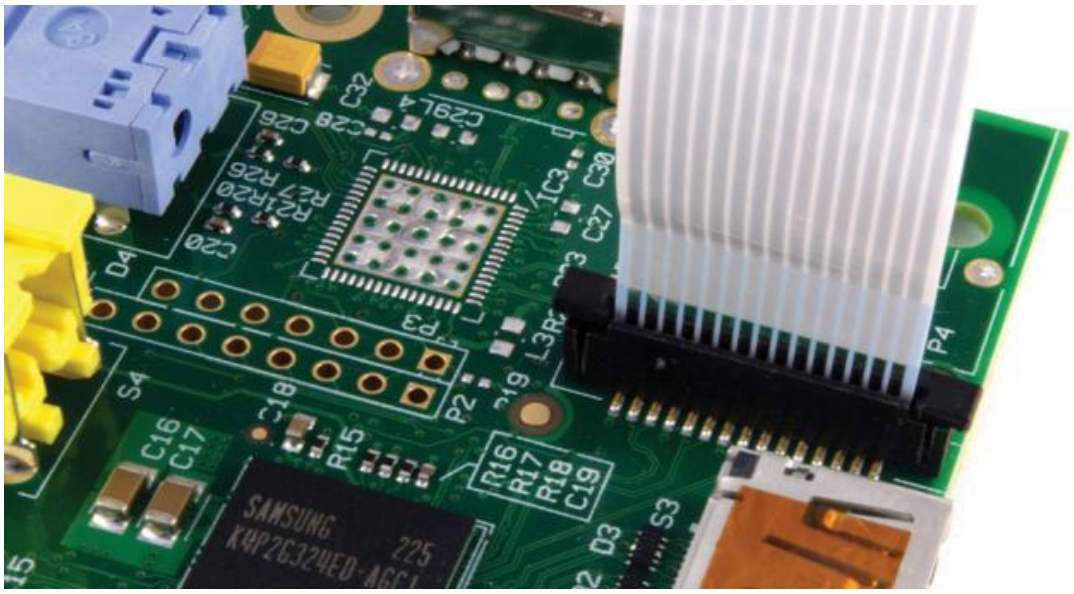

Fig 3.3: Raspberry Pi

Although it's unlikely poachers are a problem in your garden, you can use the same technology to keep an eye on the comings and goings of wildlife in your back yard – albeit with rather more footage of squirrels, and fewer lions.

If you haven't used a Raspberry Pi before, you'll need to install the Raspbian OS to your SD card and make sure it's up to date.

A PIR sensor is most commonly seen in security systems to detect movement before sending the alarm off. They detect motion whenever there is a change of infrared temperature in their field of view.

Most PIR sensors have some adjustable screws on them that will allow you to adjust both the time and sensitivity of them. The time will allow you to set a delay before it will go off (Send a high signal). (About 2-4 seconds). The sensitivity is how much movement needs to occur before it will go off.

A breadboard isn't necessarily required for this project but I would highly recommend using one. They make prototyping and building circuitry a lot easier.

You don't have to use a breadboard like I am you can just simply hook these straight up to the Raspberry Pi.

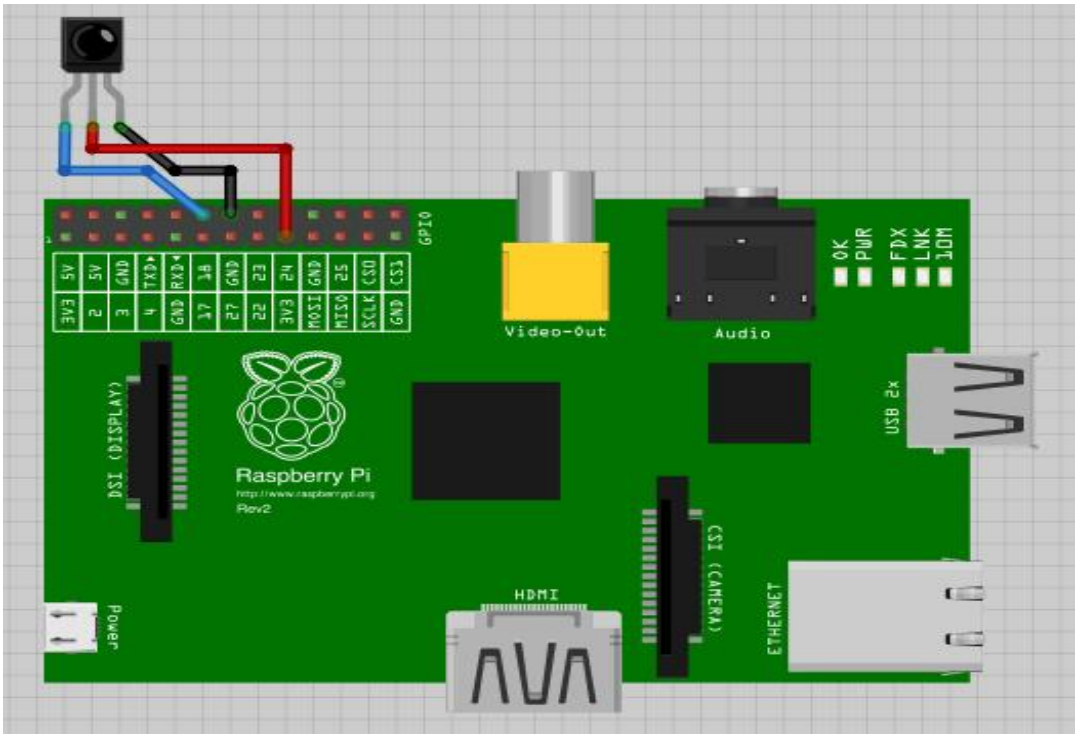

Fig 3.4: IR Sensor connected to Raspberry Pi

To construct the circuit simply do the following:

- Run a ground pin to the ground/negative rail on the breadboard.
- Run a 5v pin to the positive rail on the breadboard.
- Connect the piezo buzzer to pin 7 (Red wire) and the negative rail (Black wire).
- Run a wire from pin 11 to the breadboard. Place a 100-ohm resistor at the end of the wire. Then connect this up to the yellow wire of the PIR sensor.
- Now for the PIR sensor run the red wire to the 5v line and the black wire to the ground rail on the breadboard.

3.3.2 Raspberry Motor Hardware Setup

Now add three wires from the GPIO pins to the L293D.

GPIO 25–Pin 22 > L293D–Pin 1

GPIO 24–Pin 18 > L293D–Pin 2

GPIO 23–Pin 16 > L293D–Pin 7

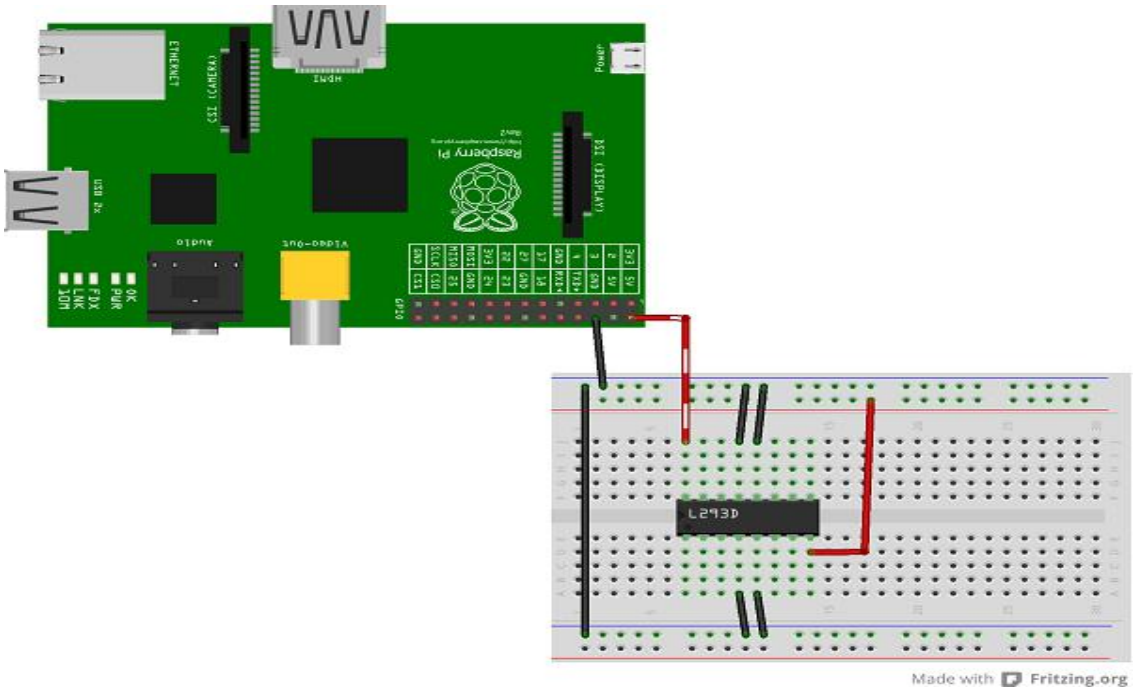

Fig 3.5: Add the three GPIO wires to control the motor

Add the motor:

Motor–wire 1 > L293D–pin 3

Motor–wire 2 > L293D–pin 6

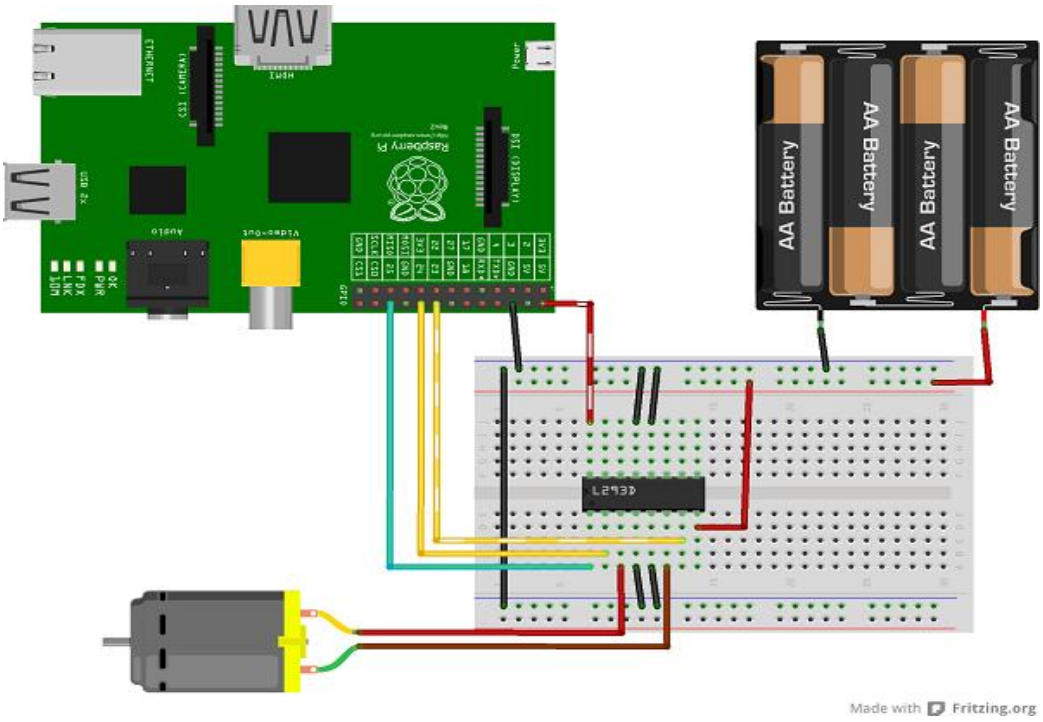

Fig 3.6: raspberry Pi with motor

It is extremely important that you double-check every connection before adding the batteries. Only when you are happy that everything is in place, connect the battery wires to the power rails of the breadboard.

3.3.3 Raspberry Pi with Camera Module

The first step is to attach the Raspberry Pi Camera Module into the Camera Serial Interface (CSI) port on the top of the Raspberry Pi. This small slot-like port is found on the bottom right of the board's top surface, between the HDMI port and the Ethernet port.

Pull the tab gently up, then push the bare end of the Camera Module's ribbon cable into the slot, with the silver contacts on the cable facing towards the left of the board. When the cable is at the bottom of the slot, hold it in place with one hand while pushing the tab back down with the other hand to secure it in place.

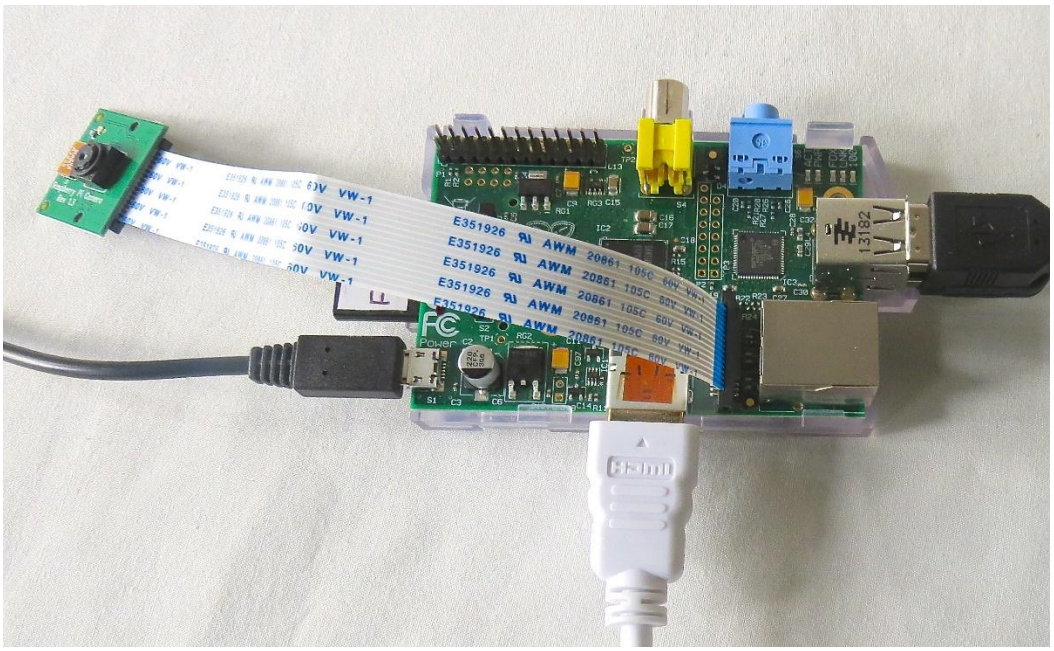

Fig 3.7: raspberry pi with camera module

Connect the Pi to a monitor, keyboard and network with internet access. If you have a Model A, you'll need to use a USB to Ethernet or Wi-Fi dongle in order to download the required software, but this can be removed when the camera is in use.

When the Pi has booted, log in using the "pi" accountand load the Raspberry Pi Software Configuration Tool by typing:

sudo raspi-config

Scroll down the list to the Enable Camera option and select it with the Enter key. Choose "Enable" in the menu that appears, then choose Finish and then Yes when asked to reboot.

3.4 SOFTWARE SETUP

3.4.1 Setup for Raspberry Pi System

Step 1:- Installing Raspbian

To install Raspbian the micro SD card is to be prepared properly with the help of a PC. There are GUI tools for various operating systems to make this process easy. A good example is the Fedora Arm Installer for Fedora and Windows. The micro SD card with the operating system is to be inserted in the slot and the Raspberry Pi is to be connected to a LAN cable, a monitor and a USB keyboard. Once everything is set up power supply is provided. The operating system starts booting displaying a guided installation setup. For implementing a surveillance system it is necessary that SSH and camera are enabled so that the device can be controlled without the keyboard and the monitor and the camera module becomes functional.

Step 2:- Updating software

It is recommended to update the software by entering the following commands in the terminal.

Commands to update Raspberry Pi:-

```
sudo apt-get install rpi-update

sudo rpi-update
```

Command to update packages:-

```
sudo apt-get update

sudo apt-get upgrade
```

Step 3:- Connecting to Raspberry Pi from another computer.

The Raspberry Pi is now set up and ready to be accessed from another computer. To connect to the Gnu/Linux console of Raspberry Pi from a computer running Windows software named PuTTY can be used. The same can be accomplished on a computer running Gnu/Linux with the help of a few terminal commands. You need to become a

member of the dialout group and then use a terminal emulator like GtkTerm to connect to the Pi by entering the correct port name and baud rate.

Commands for Gnu/Linux:-

Checking dialout group - ls -l /dev/ttyUSB0

To check if current user is in dialout group – id

Add current user to dialout group - sudo usermod -a -G dialout username

Step 4:- Enabling Wi-Fi

The network interfaces of Raspberry Pi can be edited using text editor nano to enable Wi-Fi.

To open network interfaces: - sudo nano /etc/network/interfaces

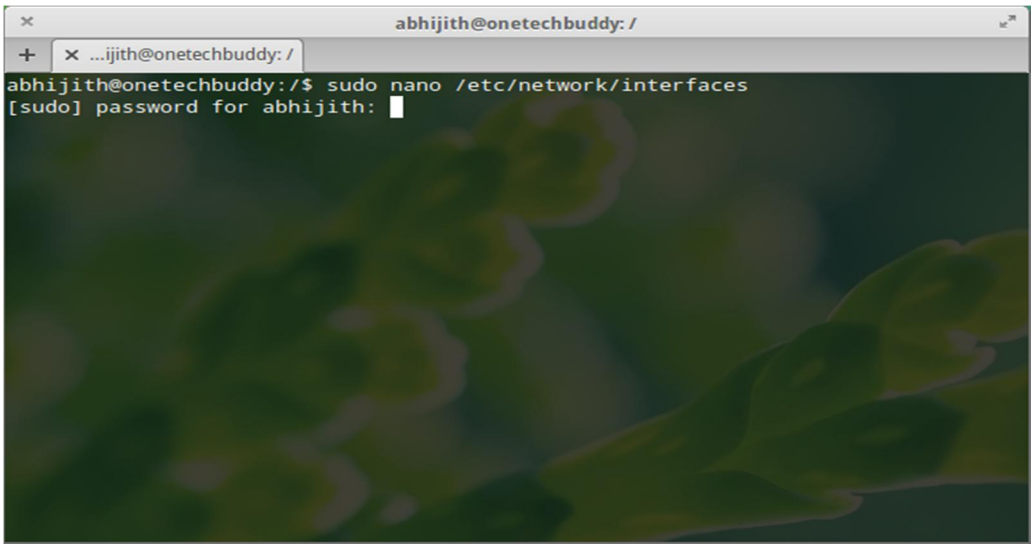

Fig 3.8

Lines to be inserted into the file:-

```
allow-hotplug wlan0

iface wlan0 inet dhcp

wpa-ssid "YOUR NETWORK SSID"

wpa-psk "WIFI PASSWORD"
```

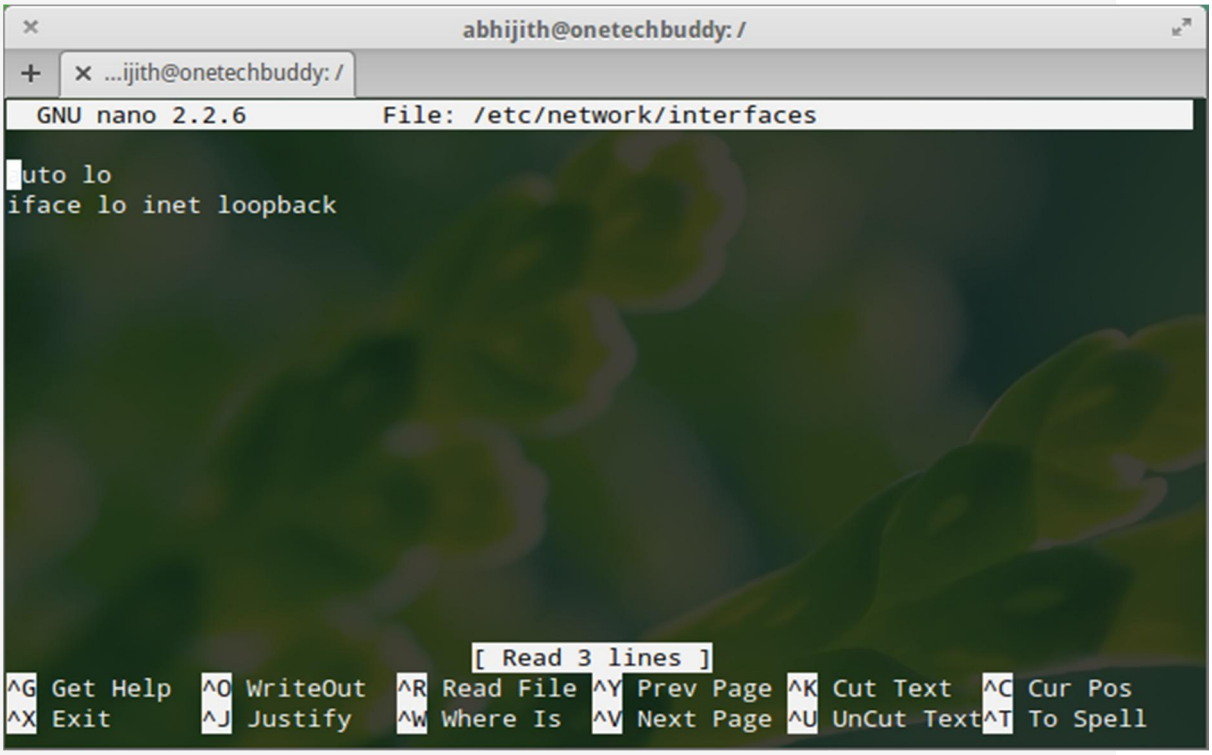

Fig 3.9

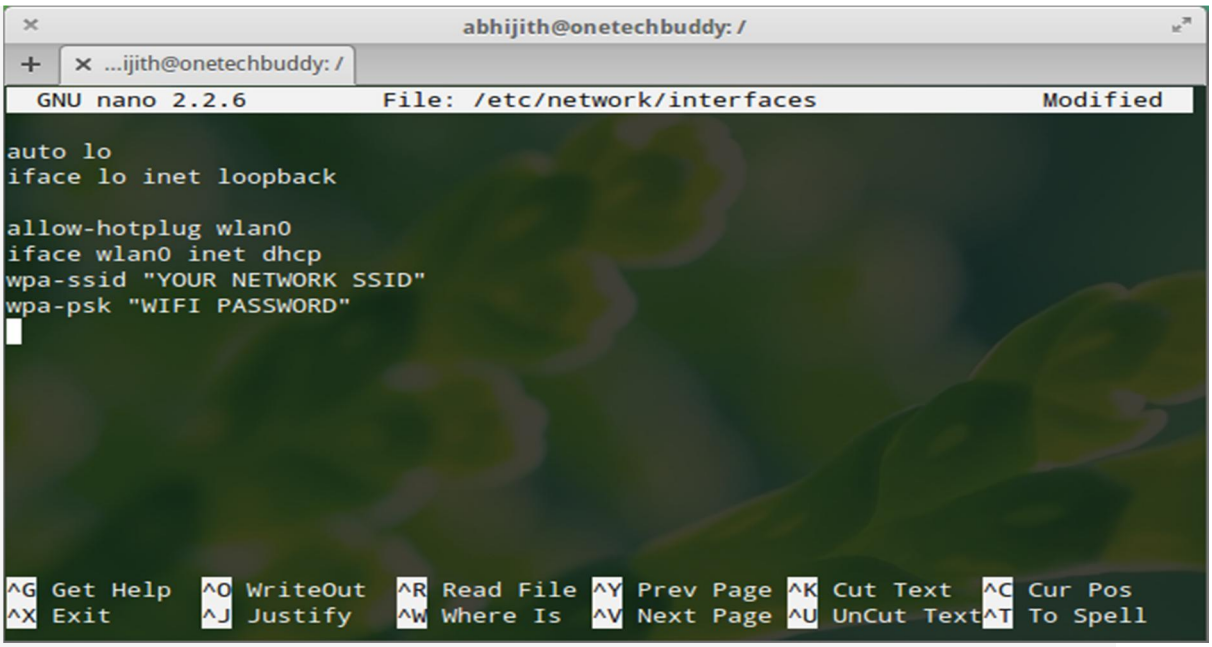

Fig 3.10

To reboot Raspberry Pi – sudo reboot

Step 5:- Assembling Hardware

The hardware must be assembled carefully. The Raspberry Pi must be placed properly so that it does not tumble inside the camera mounting. The hardware inside the mounting can be hidden without disturbing the view of the camera using a dark paper that has a hole. A red LED glows to indicate the camera is active. This can be turned off by editing a configuration file in the boot directory.

Step 6:- Enabling motion detection

Motion detecting can be enabled in Raspberry Pi by installing software like motion. If motion is used a custom build supporting Raspberry Pi camera module has to be installed. The motion detecting software needs to run continuously and hence motion will have to be run as a daemon. The log file of motion is to be made available to auto start user by moving it to a directory outside the home directory of current user.

To install motion: -

```
sudo apt-get install motion
```

To install custom build:-

```
cd /tmp

sudo apt-get install -y libjpeg62 libjpeg62-dev libavformat53 libavformat-dev libavco
dec53 libavcodec-dev libavutil51 libavutil-dev libc6-dev zlib1g-dev libmysqlclient18 l
ibmysqlclient-dev libpq5 libpq-dev

wget https://www.dropbox.com/s/xdfcxm5hu71s97d/motion-mmal.tar.gz
```

To unpack tarball: -

```
tar zxvf motion-mmal.tar.gz
```

To update motion: -

```
sudo mv motion /usr/bin/motion

sudo mv motion-mmalcam.conf /etc/motion.conf

t motion configuration :- sudo nano /etc/motion.conf
```

Lines to be added:-

```
daemon on

logfile /tmp/motion.log

Enabling motion daemon: - sudo nano /etc/default/motion

Change the line: - start_motion_daemon=yes

Edit motion configuration: - sudo nano /etc/motion.conf
```

Lines to be added:-

```
daemon on

logfile /tmp/motion.log
```

Step 7:- Modifying the video recording

The video being recorded and stream can be modified to suit the requirements by setting appropriate values for resolution and frame rate. Surveillance cameras need very small frame rates and need not be very long. The live stream can be protected from unauthorized access by making it password protected.

```
width 1280
height 720
framerate 2
pre_capture 2
post_capture 2
max_mpeg_time 600
ffmpeg_video_codec msmpeg4
stream_localhost off
stream_auth_method 2
stream_authentication SOMEUSERNAME:SOMEPASSWORD
```

Step 8:- Saving video to a shared folder

To save memory of the microSD card the video being recorded can be saved to a shared folder in the personal computer. The details of the shared folder are to be inserted into a modified fstab configuration file in Raspberry Pi. The shared folder can be set as the target for the video recording after rebooting the Raspberry Pi.

Step 9:- Streaming the video

The video can be streamed by entering an appropriate URL on a web browser that bears the port address. Enabling a dynamic domain service lets the video to be streamed from anywhere.

3.4.2 Steps for using WhatsApp on Raspberry Pi

Step 1:- Installation of necessary packages

To use WhatsApp on Raspberry Pi we will need Yowsup which is a Python library that lets you access all the functionalities of **WhatsApp** on Raspberry Pi just as you would from the official client app on your smartphone. It is recommended that you update all the packages before you install new packages. It has been mentioned in the above article that you can do so with the help of apt – package manager used in Debian and Debian-based operating systems.

Once you are done updating the packages you may update the firmware.

Command :- sudo rpi-update

Note :- Those who are not familiar with Gnu\Linux may wonder what this sudo is? It gives a user elevated privileges much like the administrative privileges in Windows. The article will have many commands beginning with sudo. You may not start every such command with sudo. Instead you can be the super user called root by typing su and then entering the root password. Then, you can ignore sudo and just type in the rest of the commands.

To install Yowsup you need to install certain packages. As apt is the package manager in Raspbian you can use the apt-get install tool to install packages.

Commands :-

sudo apt-get install python-dateutil

sudo apt-get install python-setuptools

sudo apt-get install python-dev

sudo apt-get install libevent-dev

sudo apt-get install ncurses-dev

The Yowsup library can then be downloaded.

Command :- git clone git://github.com/tgalal/yowsup.git

Use cd command to get into the Yowsup folder and install the library.

Commands :-

cd yowsup

sudo python setup.py install

Step 2 :- WhatsApp registration

To register with WhatsApp you do not have a **GUI** but you can make use of a command line utility provided by Yowsup – yowsup-cli. To use it you need to know your country code(cc), mobile country code(mcc) and mobile network code(mnc). You may be familiar with the country code which you see in the beginning of phone numbers. To find mcc and mnc visit the link below.

Command :- python yowsup-cli registration --requestcode sms --phone 91xxxxxxxxxx --cc 91 --mcc 405 --mnc 035

While entering phone number keep in mind that you can use WhatsApp for one number on one device only. Do not use a number that you use for you daily WhatsApp messaging.

You will receive a code like your normal WhatsApp registration process. Send back this code using the following command. The code is to be entered by replacing the 'x's after register.

Command :- python yowsup-cli registration --register xxx-xxx --phone 91xxxxxxxxxx --cc 91

If your registration is successful you will get a confirmation message.

Step 3:- Using WhatsApp

To use WhatsApp you will need to enter your phone number and password. You can save them on a config file inside the Yowsup folder. Use nano, a command line text editor for the same.

Command :- sudo nano /home/pi/yowsup/config

Add the following lines into the config file.

Actual config starts below

cc=39 #if not specified it will be autodetected

phone=39xxxxxxxxxx

password=xxxxxxxxxxxxxxx

To begin using WhatsApp use the yowsup-cli demo.

Command :- yowsup-cli demos --yowsup --config config

You will be greeted with the Yowsup prompt. To login you may enter '/L' and enter your login credentials you saved in the config file. You can see a list of commands by typing '/help'. Use the /message command to send a message to your desired number.

Command :- /message send 91xxxxxxxxx "Your message"

The replies will be displayed on your Raspberry Pi.

CHAPTER 4

PERFORMANCE ANALYSIS

4.1 Introduction

This chapter will talk about the result we got in our project of Remote Sensing using Internet of Things. In which we capture the images and record the video of the animals whose motion is detected by our sensors. You will see the result of program and website interface. You will see the print screen of the program result.

4.2 Result of Programming

- When an animal come near this device its motion gets detected.

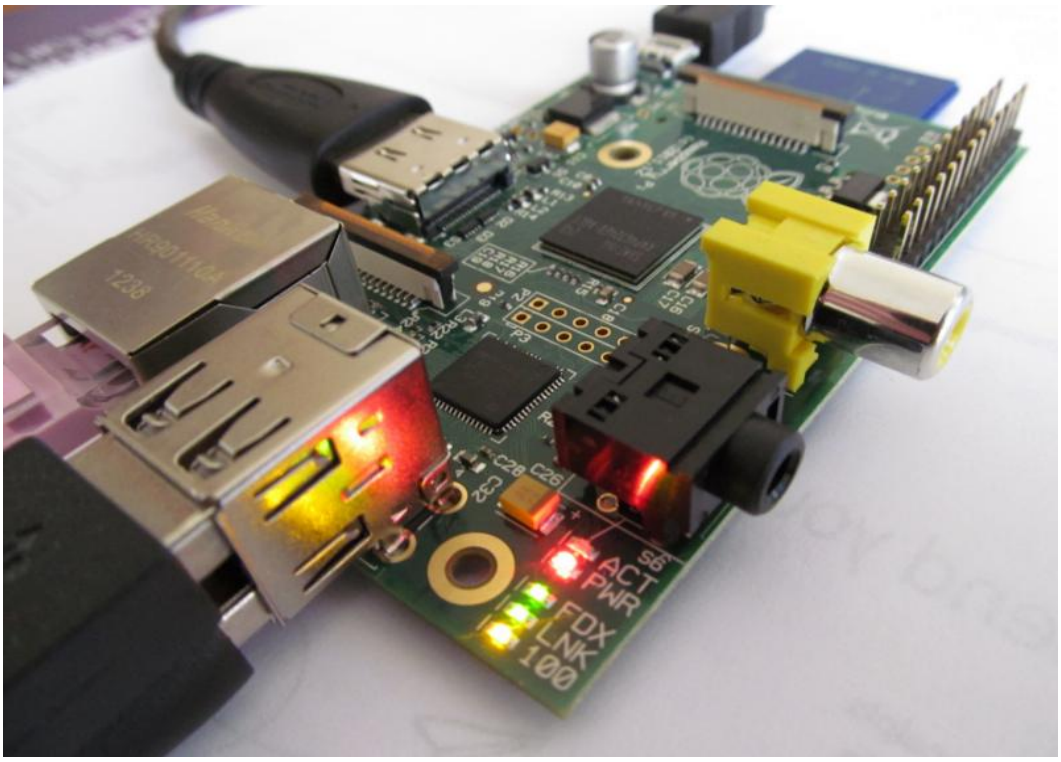

Fig 4.1 Raspberry PI

- That side sensor gets activated.

- At this time notification is send to watsapp that some motion has been detected.

Fig 4.2 Watsapp Notification

- Once sensor gets activated motor starts rotating the camera toward that side.

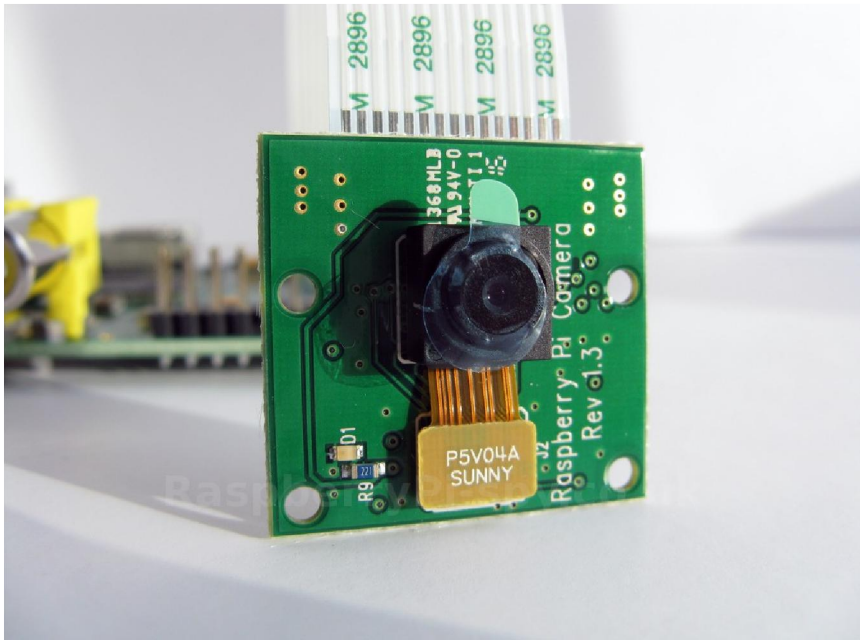

Fig 4.3: Camera facing the animal

- Okay, now the camera is running. You can monitor it by watching the output window. If you see a line like

`==========  1432 pixels changed` that means it detected something and will snap a high-res image.

Fig 4.4: Motion detected of a dog

Fig 4.5: Motion detected of two dogs

- Or you can periodically ls the ssh-mounted directory. You'll see a debug.png which shows you the latest image with the test region and any changed pixels highlighted, a file with a name like first-2014-05-18-09-09-24.jpg which is a high-res snapshot taken at the beginning of the run. Any subsequent motion-induced photos will be named something like snap-2014-05-18-09-22-57.jpg (snap instead of first).
- Happy snapping!

CHAPTER 5

CONCLUSION

5.1 Conclusion

We have successful designed Remote Sensing using Internet of Things. In which we are detecting motion of the animal and then taking its images and videos and then sending notification to the user that some data has been captured and do video streaming and cloud that data using Raspberry Pi and webcam, IR Sensors, motor for hardware and write a program using python language and save pictures in JEPG format.

This is acting as an enjoyment by which you can enjoy the wildlife sitting at your home without spending much money. Also it is helpful in controlling potching and saving the environment. We can use this device at our homes also in our locker rooms in order to find the intruder.

We learnt how to send notification on Watsapp that some data has been recorded .Please check it. This we are doing using Yousoup tool.

During the process to complete the project, we have learnt many thing, like how to study by yourself, how to find the document you need, how to use Linux system and write program and compile program under Linux system. I also learned basic knowledge of python programing, web site design and webserver. Also I learned a lot about sensors and Raspberry Pi. How to write their code and then compile together to do parallel programming.

Parallel programing was the interesting topic and in demand also now a days. Also we learnt about Internet of Things (IoT), new technology which is very helpful now a days and in demand. Along with Remote Sensing. Here we are using Internet of Things with Remote Sensing for which we studied lot of Research papers. Which was quite interesting.

5.2 Future Scope

The performance of my project are able save 2 pictures per second when motion been detected, resolution 640x480. 1 GB storage space able to save 17,000 pictures. My project able automatically starts up at boot.

But there still many things can do to improve my project. Like my project detect motion of animal using 4 Infrared Sensors. The direction in which motion is detected that side sensor gets activated and image is recorded. In future we can use combinations, in which if motion is detected in any two continues direction then camera will rotate first clockwise and then anti clockwise to capture images so that no area can left untouched. If motion is detected in alternate two directions then camera will do complete clockwise rotation. The speed of the camera is also under control so that it should not be too fast or too slow.

This time we are using battery for camera and motor to work. In future we will be using solar panel. In order to save energy and wok. Since in remote areas one can't go to change the battery, as this is wastage of time and money. Solar panel will take energy from sun and store it in a battery which motor and camera can use.

At present the notification to the user is send only at Watsapp. In future notification as mail can also be send.

Also at present our project is static. In future we will make it dynamic. So that one can use his phone or laptop as a remote control and move this device from one place to another in order to catch the images of the animals.

At present we are using Wifi and Ethernet to give internet connection. In future we will be using Dongel to this.

And my website also have many part need improve, like my project can choose hourly check pictures, but you don't know which hour have detected motion, if only can click the hour have pictures will much good for users check pictures.

My program can automatically start up at boot, but if you want to stop it or delete pictures, you need keyboard, mouse and monitor. It is not easy for use, if can find any program can control Raspberry Pi use other device, make Raspberry Pi no need so connect other devices, so the system will better for normal users.

This time we are using this project to only capture and record the images and videos of animals. In future we will be using this device at houses, in banks, in academics where important stuff is present. Which need to be protected.

5.3 APPLICATIONS CONTRIBUTION

This idea is our own idea. We often wonder about animals gazing I the grass and sunset is going on, nearby zebras are drinking water. This image if we imagine is so wonderful. So we made it reality. Now we can enjoy this scenario by sitting at home with all our comforts. This not only just a mere beautiful scenario. It is also helpful in controlling poaching. Which in return saving our environment, our ecosystem.

Though it was so beneficial it was not implemented before because of the remote areas. We solved this problem by using Internet of Things. Other problem was the system was very costly. So we used raspberry Pi which uses simple sensors to do this project. So it is cheap and so beneficial.

We are thinking to use this project further in home Security. Where it can be helpful in catching thief. As it will detect their motion and send notification to the user at the same time and record its image and do it cloud.

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