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SURVEILLANCE ROBOT USING RASPBERRY PI FOR HOME SECURITY PURPOSES

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Abstract : This study has been carried to understand the security measures and applications that are provided to handle safety measures using Surveillance Technology and Machine learning. It is mainly designed to detect suspicious and precised areas for user without causing any death of human life. The code for the functionality of robot is written in python language. The robot is designed to continuously monitor the desired area of residence to be safe and secured by observing or act as a spy and suspect objects around it. It is used for controlling the limited area using Wi-fi as a medium. The PI camera on the robot captures the video and determines if there is an unknown human around by identifying the person using Face Recognition algorithm and sends a mail to the user with the image of the non-defined human life.

Index Terms - Surveillance, captures, image, Face Recognition, PI camera

I. INTRODUCTION

The Internet of things is a system of interrelated computing devices, mechanical and digital machines provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

Earlier the robots were controlled through wired networks but now to make robot more users friendly, they are framed to make user commanded work. There is no distance limitation issues in this project. The robot is capable to work everywhere where there is a wireless connection. This project can be used for security purposes where we need to get information about some suspicious area/people. We can do this by sitting at a far secure place and safely devise a plan to tackle their activities. It acquires image from cameras through a web browser. As the internet of things is the concept, newly introduced in the field of electronics. The concept is about handling the things with the use of internet and the best model for these applications is raspberry pi. When the surveillance is considered, raspberry pi serve his purpose. On the other hand it can also be very helpful in explorers and animal psychologists need to observe closely the life style of various dangerous animals like lions, snakes and small insects so they use such kind of robots because human life is at risk or their presence can disturb animal patterns of livings. Similarly it can be used in laboratories where dangerous chemicals and gases are tested. It can go to places where chemists can't go, check the leakage and also can perform other tasks. Robots can be classified into different types based on their environment and mechanism of interaction such as mobile and fixed robot of which mobile robot can be further classified as aquatic, terrestrial and airborne. The terrestrial robots are much in use and their applications are vast in each and every field, they are of two types (i) wheeled and (ii) legged each having a different use. Robots are being used in variety of industrial applications for various activities like pick and place, painting, assembling of subsystems and in hazardous places for material handling etc. Nowadays robots in the use of surveillance is emerging because of their miniature size allowing them to enter in tunnels, mines and small holes in building and also have capability to survive in harsh and difficult climatic conditions for life long time without any defect and causing no harm.

Python is an interpreted, high-level, general-purpose programming language. Created by Guido van Rossum and first released in 1991, Python's design philosophy emphasizes code readability with its notable use of significant whitespace. Its language constructs and object-oriented approach aim to help programmers write clear, logical code for small and large-scale projects.

Python is dynamically typed and garbage-collected. It supports multiple programming paradigms, including structured (particularly, procedural), object-oriented, and functional programming. Python is often described as a "batteries included" language due to its comprehensive standard library.

Unlike high-level languages such as C++ or Java, Python is custom-made for implementing business logic directly at a device level. This reduces the amount of data to be dealt with and what is available in Cloud. Whether you're developing IoT solutions from scratch or interacting with sensors, actuators and secondary devices, Python understands your needs. It is easy to learn, debug, and the code can be freely transported from one machine to another. Perhaps one of the best features of Python is its close synergy with Raspberry Pi, one of the most popular boards used in various IoT projects. You can do anything you want with the Python program once it's selected for Raspberry Pi. Its site has a list of official commands and installation basics for using Python code. Python is a very important language in IoT development seeing that it has amazing uses in Raspberry Pi and works with advanced AI and neural libraries. However, presently, it is only used as a backup programming language by popular IoT networks such as Amazon and Google. That is likely to change in the future, though, as Python has many uses due to its simplicity.

II. COMPONENTS USED

RASBERRY PI

The **Raspberry Pi** (/paɪ/) is a series of small single-board computers developed in the United Kingdom by the Raspberry Pi Foundation to promote teaching of basic computer science in schools and in developing countries.The original model became far more popular than anticipated, selling outside its target market for uses such as robotics. It does not include peripherals (such as keyboards and mice) or cases. However, some accessories have been included in several official and unofficial bundles.

The organisation behind the Raspberry Pi consists of two arms. The first two models were developed by the Raspberry Pi Foundation. After the Pi Model B was released, the Foundation set up Raspberry Pi Trading, with Eben Upton as CEO, to develop the third model, the B+. Raspberry Pi Trading is responsible for developing the technology while the Foundation is an educational charity to promote the teaching of basic computer science in schools and in developing countries.

The Raspberry Pi board which is used in this project is Raspberry Pi 3 Module B.

PI Camera

The **Pi camera module** is a portable light weight camera that supports Raspberry Pi. It communicates with Pi using the MIPI camera serial interface protocol. It is normally used in image processing, machine learning or in surveillance projects. It is commonly used in surveillance drones since the payload of camera is very less. Apart from these modules Pi can also use normal USB webcams that are used along with computer.

Dc motor

A DC motor is any of a class of rotary electrical motors that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current in part of the motor.

DC motors were the first form of motor widely used, as they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings. Small DC motors are used in tools, toys, and appliances.

PIR SENSOR

The PIR sensor used to detect the movement of human being within a certain range of the sensor is called as PIR sensor or passive infrared sensor (approximately have an average value of 10m, but 5m to 12m is the actual detection range of the sensor). Fundamentally, pyroelectric sensors that detect the levels of infrared radiation are used to make PIR sensors. There are different types ofThe PIR sensor circuit is used in numerous electronics projects which are used to discover a human being entering or leaving the particular area or room. These passive infrared sensors are flat control, consists of a wide range of lens, and PIR sensors can be easily interfaced with electronics circuits. sensor and here let us discuss about PIR sensor with dome shaped Fresnel lens.The PIR sensor circuit consists of three pins, power supply pin, output signal pin, and ground pin. The PIR sensor circuit is having ceramic substrate and filter window as shown in the figure and also having dome like structure called as Fresnel lens.

GAS SENSOR

This module is made using Alcohol Gas Sensor MQ3. It is a low cost semiconductor sensor which can detect the presence of alcohol gases at concentrations from 0.05 mg/L to 10 mg/L. The sensitive material used for this sensor is SnO2, whose conductivity is lower in clean air. It's conductivity increases as the concentration of alcohol gases increases.It has high sensitivity to alcohol and has a good resistance to disturbances due to smoke, vapor and gasoline. This module provides both digital and analog outputs. MQ3 alcohol sensor module can be easily interfaced with Microcontrollers, Arduino Boards, Raspberry Pi etc.This alcohol sensor is suitable for detecting alcohol concentration on your breath, just like your common breathalyzer. It has a high sensitivity and fast response time. Sensor provides an analog resistive output based on alcohol concentration.The drive circuit is very simple, all it needs is one resistor. A simple interface could be a 0-3.3V ADC.

MOTOR DRIVER

L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motor with a single L293D IC. Dual H-bridge Motor Driver integrated circuit (IC).It works on the concept of H-bridge. H-bridge is a circuit which allows the voltage to be flown in either direction. As you know voltage need to change its direction for being able to rotate the motor in clockwise or anticlockwise direction, Hence H-bridge IC are ideal for driving a DC motor. In a single L293D chip there are two h-Bridge circuit inside the IC which can rotate two dc motor independently. Due its size it is very much used in robotic application for controlling DC motors. Given below is the pin diagram of a L293D motor controller. There are two Enable pins on l293d. Pin 1 and pin 9, for being able to drive the motor, the pin 1 and 9 need to be high. For driving the motor with left H-bridge you need to enable pin 1 to high. And for right H-Bridge you need to make the pin 9 to high. If anyone of the either pin1 or pin9 goes low then the motor in the corresponding section will suspend working. It's like a switch.

Blynk App

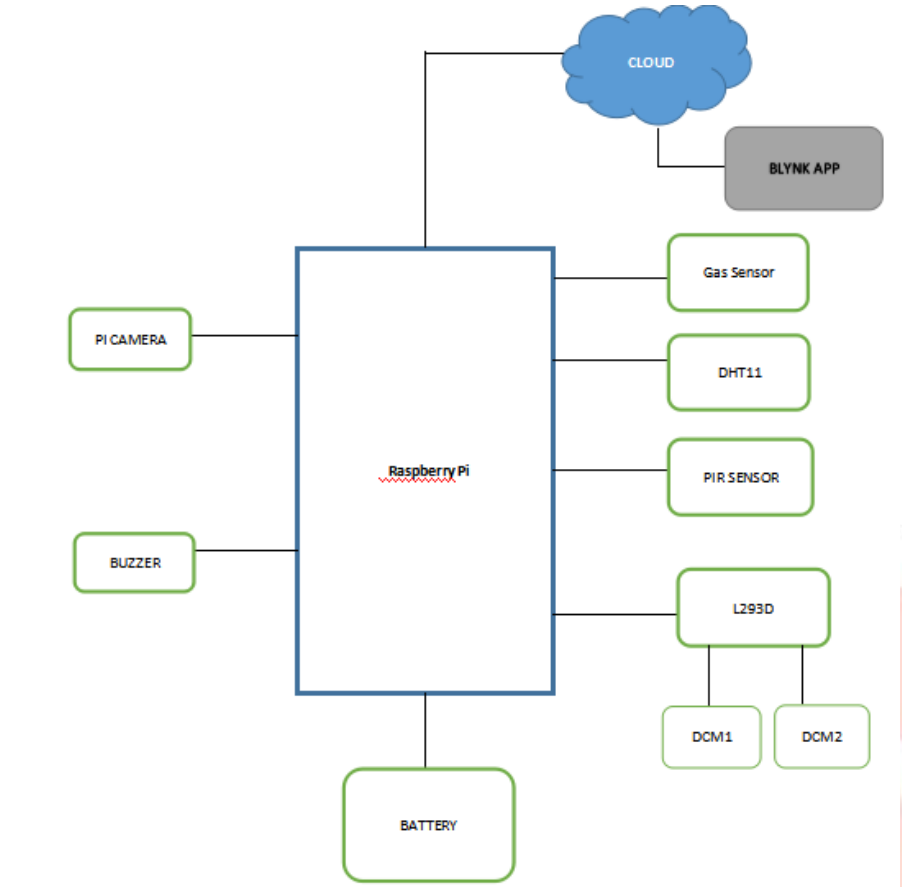
Blynk is a Platform with IOS and Android **apps** to control **Arduino**, Raspberry Pi and the likes over the Internet. It's a digital dashboard where you can build a graphic interface for your project by simply dragging and dropping widgets. It is an Internet-of-Things platform designed to make development and implementation of smart **IoT** devices quick and easy. It can be used to read, store, and visualize sensor data and control hardware remotely.

SOFTWARE COMPONENTS

OpenCv:

OpenCV [OpenCV] is an open source computer vision library. The library is written in C and C++ and runs under Linux, Windows and Mac OS X. Th ere is active development on interfaces for Python, Ruby, Matlab, and other languages. OpenCV was designed for computational efficiency and with a strong focus on realtime applications. OpenCV is written in optimized C and can take advantage of multicore processors. If you desire further automatic optimization on Intel architectures [Intel], you can buy Intel's Integrated Performance Primitives (IPP) libraries [IPP], which consist of low-level optimized routines in many diff erent algorithmic areas. OpenCV automatically uses the appropriate IPP library at runtime if that library is installed. One of OpenCV's goals is to provide a simple-to-use computer vision infrastructure that helps people build fairly sophisticated vision applications quickly. The OpenCV library contains over 500 functions that span many areas in vision, including factory product inspection, medical imaging, security, user interface, camera calibration, stereo vision, and robotics.

III. GENERAL STRUCTURE



IV. RELATED SURVEY

Dr M Senthamil Selvi, M.Faesa Fathima, S.Dhivyuaa, S.Mouriya

The main objective behind this paper is to develop a cost effective easy to control surveillance vehicle through remote desktop for the implementation of military purpose. Since the risk factor in military border is too high causing threats to the lives of soldiers at time patrol by both climatic conditions and enemy nation which needs a replacement, that is done effectively by the surveillance vehicle that comprises the Raspberry Pi (small single-board computer), pi camera and sensors. The information regarding the detection of living objects by PIR sensor and image capture of moving objects by pi camera capture is posted inside the webpage simultaneously. The movement of a robot is also controlled automatically through obstacle detecting sensors to avoiding the collision, and the system causes an alert at the time of metal detection through metal detecting sensor. Since the system does multitask this can be used in surveillance purpose.

This paper presents an overview of the design, implementation, testing, and performance of an innovative robotic surveillance vehicle controlled wirelessly by a remote user, developed for the purpose of directing the movement and detection of the living, nonliving and metal objects and displaying status feedback to the operator through a web application. Since these robot sare implemented at the border region they should be designed to be water proof and should be able to loco mote in the rugged surface As they replace humans at the battle region it is necessary that the robot will be defense himself and protect our nation from the enemy. To make robot self-defense they can be designed to be equipped with a robot laser gun.

Mayank Dharaskar, Vatan Gupta, Priyanka Kale, Reeta Chopade, Aayush Jaiswal

Developing surveillance and monitoring systems can be quite challenging at times, since the systems should be designed with consideration of the environment to be monitored. Good surveillance systems need to have dynamic features, e.g. monitoring cameras. Monitoring such a large area would also be a challenge for the security officers, as they will need to spend too much time to patrol covering all places. To address the challenges like surveillance of a large building with many levels, which would insure a high cost to install many cameras at many places dynamic surveillance systems include dangerous areas.

In this project we used raspberry pi working on Raspbian OS. As the communication is done with the help of internet so limitation of range of operation does not arise and thus we can monitor any remote areas. One can easily monitor as well as control the activity of the robotic unit.

This is the internet of things (IOT) based project , where we are particularly uses the Raspberry Pi, USB web camera and two DC motor with Robot chassis to build this Robotic car setup. It has a web camera mounted over it, through which we will get live video feed and the interesting part here is that we can control and move this robot from a web browser over the internet. As it can be controlled using webpage, means it can also be controlled by using the other smart devices where we can control through the webpage. We built a webpage in HTML which has Left, Right Forward Backward links, clicking on which we can move the robot in any direction. Here we use the term “Motion” for getting live Video information from USB camera and used “Flask” for sending commands from webpage to Raspberry Pi using python script to move the Robot. The webcam will capture live data with regards to its surroundings and then send it to a desired device through internet. The user will be observing this data on the monitor at the user end. According to the desired movement, the user will control the robotic vehicle through the webpage available at the user end.

Ghanem Osman Elhaj Abdalla, Dr T Veeramanikandasamy

At present the surveillance of International border areas is a difficult task. The border guarding forces are patrolling the border seriously, but it is not possible to watch the border at each and every moment. An essential requirement of this situation is a robot which automatically detects trespasser in the border and report nearby border security control unit. Many of the military departments now utilize the robots to carry out risky jobs that cannot be done by the soldiers. In this present work, a Raspbian operating system based spy robot platform with remote monitoring and control algorithm through Internet of Things (IoT) has been developed which will save human live, reduces manual error and protect the country from enemies. The spy robot system comprises the Raspberry Pi (small single-board computer), night vision pi camera and sensors. The information regarding the detection of living objects by PIR sensor is sent to the users through the web server and pi camera capture the moving object which is posted inside the webpage simultaneously. The user in control room able to access the robot with wheel drive control buttons on the webpage. The movement of a robot is also controlled automatically through obstacle detecting sensors to avoiding the collision. This surveillance system using spy robot can be customized for various fields like industries, banks and shopping malls

V. PROBLEM STATEMENT

Earlier the robots were controlled through wired networks but now to make robot more users friendly, they are framed to make user commanded work. There are no distance limitation issues in this project. The robot is capable to work everywhere where there is a wireless connection. This project can be used for security purposes where we need to get information about some suspicious area/people. We can do this by sitting at a far secure place and safely devise a plan to tackle their activities.

VI. PROPOSED SYSTEM

In this project we have provided applications like, the user gets a notification by receiving a mail on his system if there is any undefined human-life or unrecognised face captured on the camera. Also, if the face is recognised by the Robot it specifies the name of that person from the database where the user would have provided a unique identity name for the face recognition. The user can add as as many as identities in the database according to the number of people present in the family. If a non-family member comes across the robot then, the identity would be unrecognised and immediately buzzes with a loud alarm and also the notification would be sent to the user if he is in a place elsewhere.

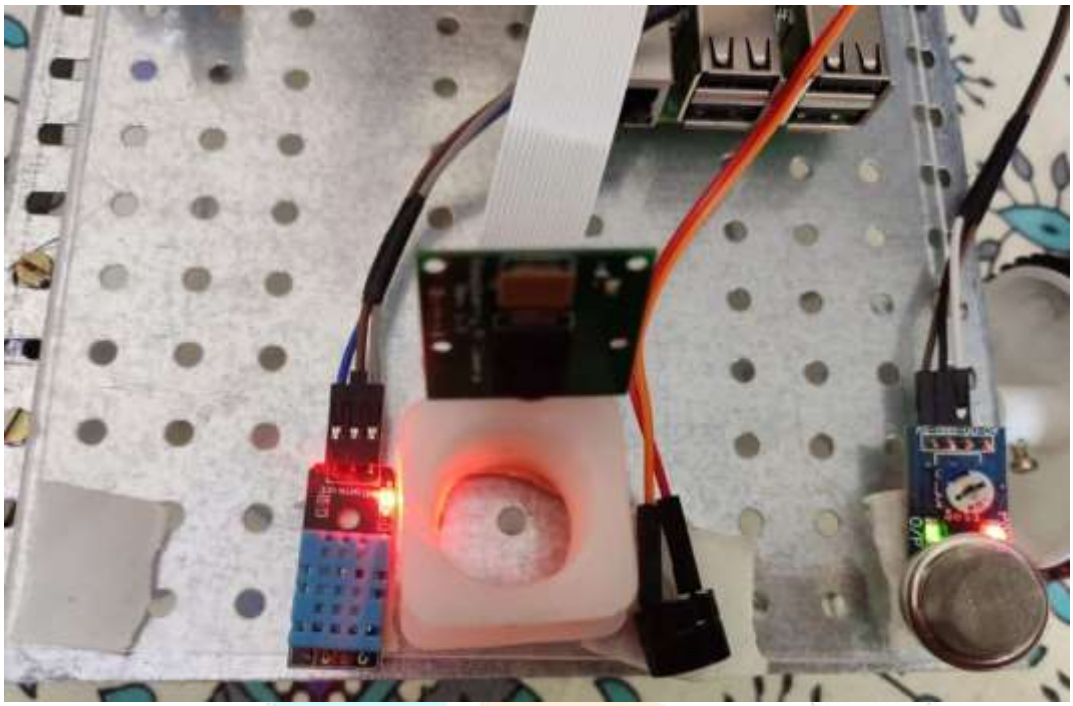


Figure.1 PI Camera attached to the Robot Chases

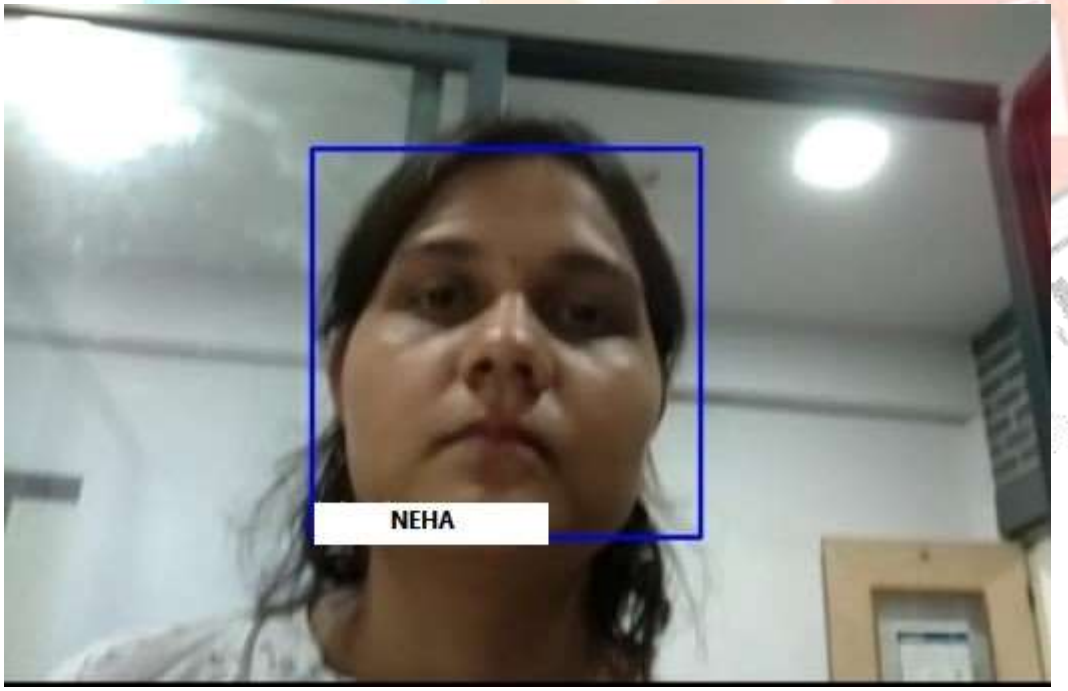


Figure.3 Image showing as recognised with the name provided below

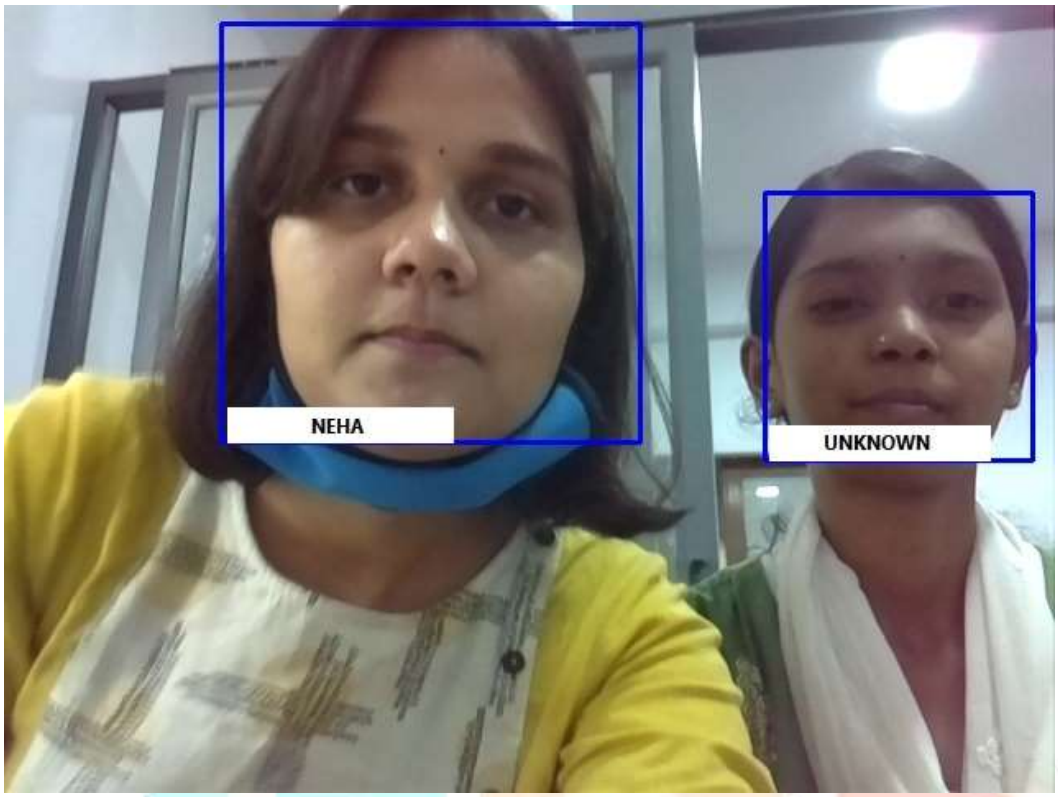


Figure.4 Recognised and unrecognised images shown with the name below and unknown as unrecognised

We have tried to provide the accuracy of face recognition in a more precised manner. The robot captures images only when it comes across a human-life while moving around the area of residence. So this is an advantage by not receiving mails unnecessarily.

The Raspberry Pi board is also connected to several sensors like Gas Sensors to alert the user when there is an incidence of gas leakage by buzzing with the help of a buzzer attached on the robot.

DHT11 which determines the humidity and temperature of the particular region and acknowledges the user about the same.

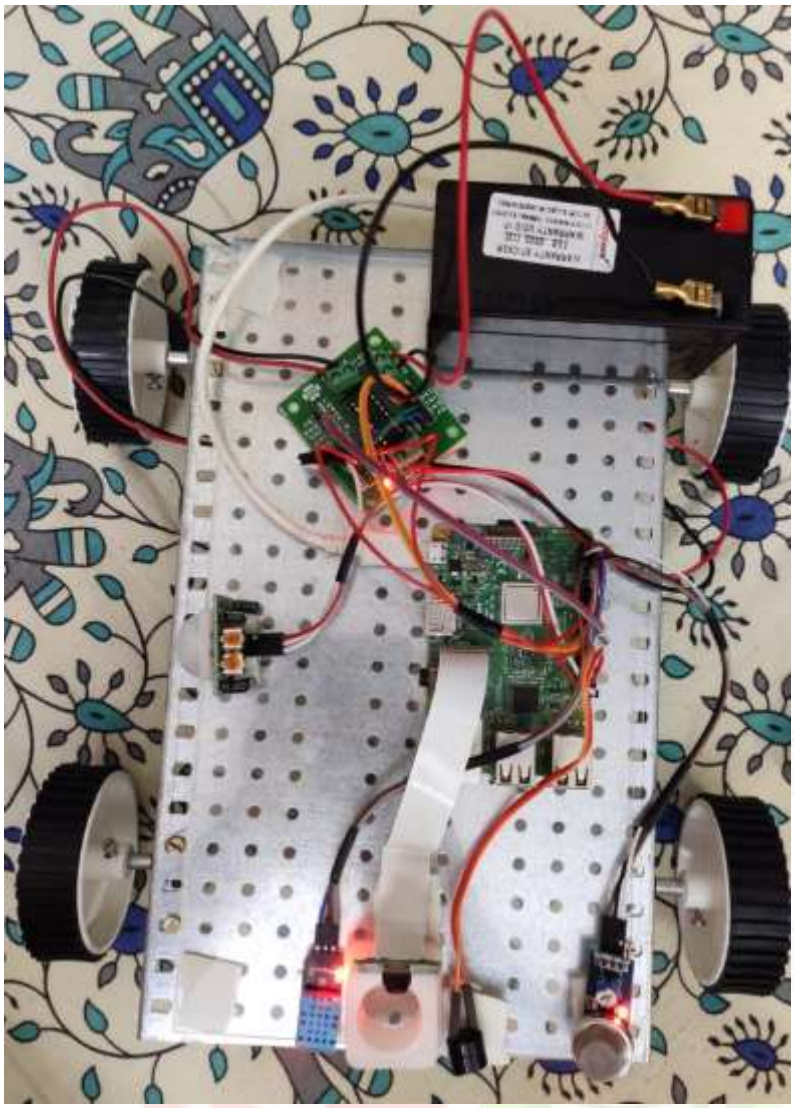


Figure 2. Robot Design with connections

VII. CONCLUSION

It is concluded that surveillance system using Raspberry pi capable of capturing video/image and transmitting through emails. Also this paper contains detailed information for controlling a robotic vehicle guided via internet. All this techniques can be used in any conditions and areas where safety is important and mandatory for secure place to live. It can monitor the areas and secures a place from the adversaries which can be done by surveillance robot all the times with great accuracy and high precision.

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