

CALICUT UNIVERSITY

ADVANCED RESCUE SYSTEM WITH TELEMETRY

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Abstract

The system is implemented to save firefighters from potential danger in their working environment. Now a day's hundreds of lives are losing due to unavailability of advanced technology in rescue system. To overcome this situation, the system, ADVANCED RESCUE SYSTEM WITH TELEMETRY can be implemented. In the system the condition of the calamities effected area is monitored where the human presence is critical and also it suggest actions based on the analysis taken by system. When the robot reaches the hazardous site, it detects and sends the environmental conditions such as human presence, presence of poisonous and dangerous gases. A robot equipped with different sensors for detecting poisonous gases and human presence. The software part of system is responsible for controlling the device and analyses the data. Raspberry pi and an embedded system help to monitoring and control hazardous environment for concerning safety and security. If value of hazardous gases crosses set limit then system provide safety to workers who are working in hazardous environment. Today image processing is used in various techniques, this system presents the implementation of image processing operations on Raspberry Pi...

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Abbreviations

UML	Unified Modeling Language
DFD	Data Flow Diagram
IR	Infrared
GSM	Global System for Mobile Communication
WSN	Wireless Sensor Networks
CSI	Camera On a Interface
SOC	System Flow Diagram
HDMI	High Definition Multimedia Interface
USB	Universal Serial Bus
VGA	Video Graphics Array
PIR	Passive Infrared
DIP	Dual In Package

Chapter 1

Introduction

On an average one hundred firefighters dies every year after being exposed to dangerous conditions. It often happens due to the lack of technology used in current rescue system. This situation can be controlled by advanced methods of telemetry system. Telemetry is an automated communications process to measure safety parameters at remote or inaccessible points. Moving devices like drone or remote vehicles are used for monitoring the existing situation of the target place. Safety of human life is an important factor. So improve life safety, many systems have been developed. While working environment such hazardous site safety is an important factor because human life's are not secure. When the robot reaches the hazardous site, it detects and sends the environmental conditions such as human presence, presence of poisonous and dangerous gases. A robot equipped with different sensors for detecting poisonous gases and human presence. The software part of system is responsible for controlling the device and analyses the data. Raspberry pi and an embedded system help to monitoring and control hazardous environment for concerning safety and security. If value of hazardous gases crosses set limit then system provide safety to workers who are working in hazardous environment. Today image processing is used in various techniques, this system presents the implementation of image processing operations on Raspberry Pi.

The Raspberry Pi is a basic embedded system and being a low cost single board. Computer used to reduce the complexity of systems in real time applications. This platform is mainly based on python. Raspberry pi consists of Camera slot Interface (CSI) to interface the raspberry pi camera. The image processing is a form of signal processing where the input is an image, like a photograph or video frame, the output of an image processing may be either an image or a video frame or a set of characteristics or parameters related to the image. So with the implementation of the system we can save many life's of firefighters who are sacrificing their life's for social service

1.1 Objectives

Monitoring the present condition in hazardous area. Poisonous gas detection Taking images of hazardous area to ensure the human presence Images are send to a unique mail

1.2 Motivation

On an average of one hundred firefighters dies every year due to lack of technology used in the security measures.

Chapter 2

LITERATURE SURVEY

2.1 Person identification in webcam images an application of semi supervised

2.1.1 Introduction

An application of semi-supervised learning is made to the problem of person identification in low quality webcam images. Using a set of images of ten people collected over a period of four months, the person identification task is proposed as a graph-based semi-supervised learning problem, where only a few training images are labeled. The importance of domain knowledge in graph construction is discussed, and experiments are presented that clearly show the advantage of semi-supervised learning over standard supervised learning. The data used in the study is available to the research community to encourage further investigation of this problem. The FreeFoodCam offers interesting opportunities for research in semi-supervised machine learning. This system presents an investigation of the problem of person identification in this low quality video data, using webcam images of ten people that were collected over a period of several months. The results highlight the importance of domain knowledge in semi-supervised learning, and clearly demonstrate the advantages of using both labeled and unlabeled data over standard supervised learning

2.1.2 Method

The system describe a new application of semi supervised learning to the problem of person identification in webcam images, where the video stream has a low frame rate, and the images are of low quality. Significantly, many of the images may have no face, as the person could be facing away from the camera. But the spirit of our contribution is to argue that semi-supervised learning methods may be attractive as a complementary tool to advanced image processing. The data developed forms the basis for the experiments reported here will be made available to the research community. The images of each person were captured on multiple days during a four-month period. People changed 2 Instructions for obtaining the dataset can be found at clothes, hair styles, and one person even grew a beard.

A video surveillance scenario is simulated where images for a group of people are manually labeled in a few beginning frames, and the people must be recognized on later days. Here a labeled data is chosen within the first day of a person's appearance, and test on the remaining images of the day and all other days. This is much more difficult than testing only on the same day, or allowing labeled data to come from all days. The FreeFoodCam is a low quality webcam. Each frame has 640 480 resolution so faces of faraway people are small. The frame rate is a little over 0.5 frames per second, and lighting in the lounge is complex and changing. A person could turn their face away from the camera, and roughly one third of the images contain no face at all. Since only a few images are labeled, and all of the test images are available, the task is a natural candidate for the application of semi-supervised learning techniques.

2.1.3 Advantages and Disadvantages

The strength of SVM based classifier improves both generalization and run time performance. Here the system works in real time so that the updating process is possible and also the system shows high performance rate. Webcam is used here for human detection. The resolution of the webcam is too low and as a result it is very difficult to identify the image clearly.

2.2 Monitoring and controlling of hazardous gases inside vehicle and alerting using GSM technology

2.2.1 Introduction

In Modern world, passenger vehicles are the main source of transportation. These vehicles produce toxic gases due to incomplete combustion of fuel. These Toxic gases are very harmful for humans. In today's world safety and security plays a vital role so there should be good safety and security. This paper designs an embedded system for a vehicle, which senses the gases like carbon monoxide (CO), monitors them and displays their content at each and every second. If the level of the CO increases than the normal level, then an alarm is generated automatically and also ventilation is provided immediately. A warning message SMS is sent to the authorized user via GSM. The advantage of this automated detection and alerting system over the manual method is that it offers quick response time and accurate detection of an emergency and therefore leading faster diffusion of the critical situation. Though there is increase in the development of technology and human race, people always failed to take care about the surroundings in which they live in. Environment pollution through Motor Vehicles is one such example. Motor Vehicles are the main source of transportation and there by main contributors of pollution. Approximately 25

2.2.2 Method

The level of the toxic gas CO is continuously sensed by the sensor MQ-7. The level is displayed in the LCD continuously for each and every second. When the level of the toxic gas CO exceeds the normal level then the microcontroller proceeds with an alarm. The GSM modem inside the vehicle sends a message to the authorized user about the alarming situation inside the cabin with the levels of the gases monitored by the sensors. Then ventilation is provided, so that the level of the toxic gases can be lowered as early as possible. This provides an immediate response to the situation which is an added advantage of the system.

2.2.3 Advantages and Disadvantages

This system provides an immediate response to the situation so that necessary actions can be taken as fast as possible. This system can be upgraded further in home, educational center, working institutions etc. Since the system is fixed at specific region and are stationary, detection of gases at the places far from the region is a difficulty.

2.3 Poisonous gas detector with electro chemical nose

2.3.1 Introduction

Human lives are more important than anything else in the world. People lose their lives mainly due to carelessness. Many accidents occur due to negligence and without following safety rules. Sometimes, the accidents are due to the standard of living of people. Many people in India are below poverty line and they adopt unsafe work to lead their day to day life. This makes them to ignore the safety measures. Quite a many times they work near the road or place where there are many manholes. Lack of standby worker outside the manhole for communication for emergency purpose also leads to accidents. Drainage cleaning people are not aware of risk of sudden attack of poisonous gas; if the gases are odorless they will be exposed to it for a long time which may cause serious health problems. Gases like CO (carbon monoxide) are odorless which with concentration above 350 ppm cause confusion and fainting, above it will surely kill individual. Each gas has its own physical and chemical properties, which make them difficult to analyze without any instrument. Toxic gases present in various levels depending on the concentration and density of it. For example, H₂S (Hydrogen sulfide) gas is heavier and it is present at the lower surface, while the CO (carbon monoxide) is bit heavier than Hydrogen sulfide. Hence it stays above the H₂S; the CH₄ gas is lighter than the above mentioned gases and stays near these man hole.

There are many gas detecting sensors discussed in the literature. The air particles diffuse through the electrochemical sensor to the electrode and chemically oxidized or reduced depending upon the property of gas. The methane is oxidized when it passes the electrode and heats the sensor. The heat is directly proportional to the amount of gases present there. Though instruments available in market for detecting the toxic gases are not affordable by poor drainage cleaner whose monthly earning is less than the detectors available.

2.3.2 Method

A low cost poisonous gas detector which detects multiple harmful gases to the human and living beings is proposed. The Atmel microcontroller which is cheap and better in performance is used to control this device. This device is not only designed for detecting the gases in sewage but also for detecting LPG leakage in home, toxic gas leakage in industry, poisonous gas formation in mines. The presence of many such harmful gases can be detected at a time with this proposed device. Atmel ICE software is used to simulate the leakage of LPG and methane gases. The presence of H₂S and CO can also be tested in the same simulation platform. A DC motor is used to travel through the manhole during leakage there by avoiding human involvement. The direction and speed of the DC motor is controlled using an ultra sonic module. An alarm is used to give indication during harmful situation. In future an LCD monitor can be attached to show the ppm of the toxic and flammable gases present in the area where it is necessary. A GSM module can also be attached to notify the LPG leakage in home, which will send messages to people if they are out for work.

2.3.3 Advantages and Disadvantages

The system uses Atmel micro controller which is cheap and better performance. A dc motor is used to travel through the man hole during the leakage. So that the system is upgradable. The movement of rover is inefficient since it uses wired connection. The system uses messaging process which are not efficient all the time.

2.4 Coal Mine Robot for Detection of Hazardous Gas

2.4.1 Introduction

In past years, in underground coal mine explosion accidents 55 people died and injuries from 1984 and 1993. from 1993 to 1999 from coal mine fires and explosions caused 37 deaths. When the concentration of methane in air is exorbitance, it can kill people caused by suffocation. In the underground of coal mine, when the environmental temperature reaches certain condition, the coal will be spontaneous combustion, as the Oxygen supply of those places is insufficient, it will cause combustion inadequate and forms a large amount of CO, have a strong attractive to hemoglobin. When CO entered respiratory system it will cause anorexia, and lead to his anoxia, and the inhibition of tissue respiration can have killed people caused by suffocation. According to their features of the mash gas and CO they are both possess explosive, and dangerous for human body. When the robot reaches the explosive coal mine site, it detects and sends the environmental conditions such as temperature, presence of poisonous and dangerous gases. A robot equipped with different sensors for detecting various poisonous gases and if value of hazardous gases crosses set limit then system provides safety to workers who are working in coal mine.

2.4.2 Method

Coal mine workers are benefited using this system. This robot enters into hazardous environments and provides various gases data. This prototype system provides at AT-MEGA 8A alert when hazardous gas level increases. By using MQ135, LM35 sensor robot detect environment in the underground mines by monitoring physical parameter and parameters are observed using monitor status log and display, and increase life safety of coal mine workers.

2.4.3 Advantages and Disadvantages

The system uses wireless transmission of data regarding presence of toxic gas and human presence. As the system is transportable, it is upgradable with change in environment. With the help of the system rescue team can understand the present condition before entering into the coal mine. The system cannot assure the humans presence with the help of IR sensor. The system is less efficient due to the use of dc motor in rover. The system uses a rover which cannot climb the slop surface.

2.5 Raspberry Pi Based Hazardous Environment Monitoring Using Wireless Communication

2.5.1 Introduction

The Proper use of wireless sensor networks (WSNs) can lower the rate of catastrophic failures, and increase the efficiency and productivity of industrial operations. Diversification of remote control mode is the inevitable trend of development of smart appliances. The project proposes a review on remote control system of smart appliances based on Zig Bee wireless sensor network. Status of the industrial appliances can be queried and controlled through the remote controller. The proposed work presents the design and implementation of a novel wireless sensor network based industry security system with a modular self-reconfigurable remote controller. Zig Bee frequency range is 2.4 GHz; These devices can transmit data over long distances by passing data through a mesh network of intermediate devices to reach more distant ones. It is typically used in low data rate applications that require long battery life and secure networking. The Zig Bee has a defined rate of 250k bits/s, best suited for intermittent data transmissions from a sensor or input device. The Raspberry Pi is a low cost credit card sized Linux computer which has the ability to interact with the outside world and has been used in a wide array of digital maker projects. An open source operating system that uses Linux kernel called Debian 8.3 named Jessie is used on the embedded Raspberry Pi device in an operating system called Raspberry.

The Zig Bee transceivers present in slave and master boards uses the process of serial communication and as most of the Computers have more than one serial port there is no need of any special hardware other than a cable. The effective baud rate is the main advantage of using RS232 and also the transmissions is on both directions which mean the inverted logic is also handled with the same. RS232 uses MARK (negative voltage) and SPACE (positive voltage) as two voltage states. So the baud rate is identical to the maximum number of bits transmitted per second including the control bits. The transmission rate of the device is 9600 baud with the duration of start bit and each subsequent bit is about 0.104ms. The complete character frame of 11 bits is transmitted in 1.146ms. MAX 232 IC mounted on the master board converts the 0's and 1's to TTL logic

2.5.2 Method

The entire system is designed using embedded board with different sensors and a Raspberry Pi that can compile and communicate the data received from the sensors. The Raspberry Pi when operated on the Linux operating system can perform multi-tasking. The design of the embedded board includes the interfacing of different sensors to slave board and connecting the slave to a master board through wireless transmission. The master board uses Raspberry Pi processor and slave board uses ARM7 microcontroller, Zig Bee transceiver, GSM, Water level sensor, LM35 sensor, Fire sensor, Gas sensor, Voltage and Current sensors.

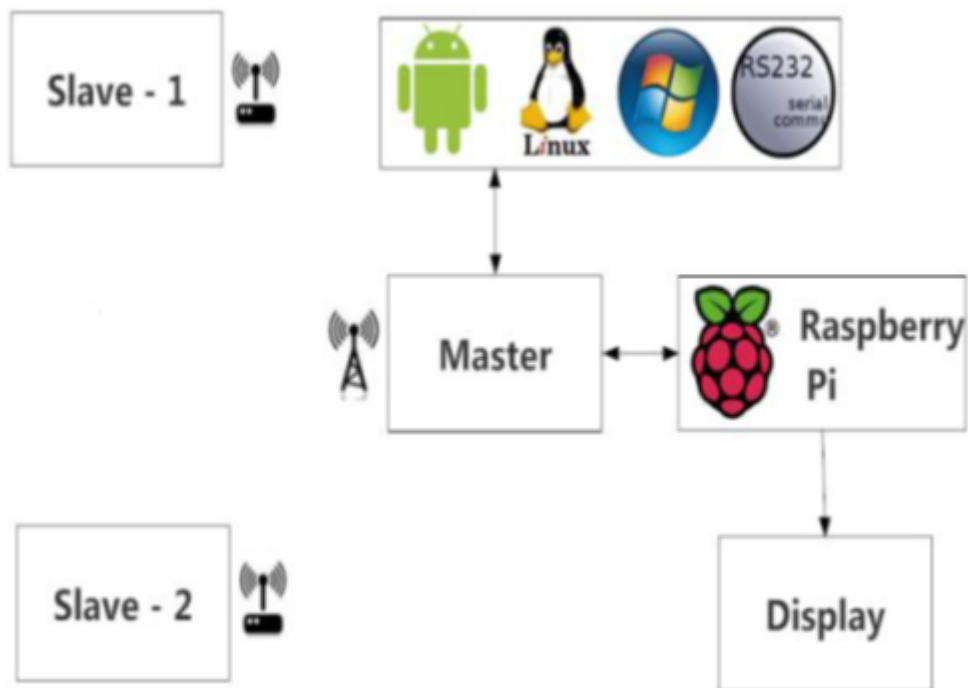


FIGURE 2.1: Process monitoring system using Raspberry Pi

System that is designed with both wireless slave and wireless master where the communication is a half-duplex communication. The master module acts as a bridge device between slave and the Raspberry Pi computer. The master can also communicate with any android devices and compactable with all X86, X64 and ARM architectures that runs any operating system with RS232 functionality. The communication between the master and Raspberry Pi is wireless and Raspberry Pi can be operated through remote computing. The entire module functionality is controlled by the microcontroller. One of the major future enhancements of this master module is the in-built USB to UART converter which can directly communicate with the devices that have USB –OTG functionality without using any other driver software and hardware.

2.5.3 Advantages and Disadvantages

The system uses raspberry pi which is an advanced technology. It is small in size, low cost and also easy to implement. With the help of raspberry pi the system can do all the operations which are done using computer multiprocessing of python in raspberry pi is not efficient. So it will make the system slow and there will be a time lag. The sensors used in the system are not accurate.

2.6 Implementation of Image Processing on Raspberry Pi

2.6.1 Introduction

Today image processing is used in various techniques, this system presents the implementation of image processing operations on Raspberry Pi. The Raspberry Pi is a basic embedded system which is a low cost single-board computer used to reduce the complexity of systems in real time applications. This platform is mainly based on python. Raspberry pi consists of Camera slot Interface (CSI) to interface the raspberry pi camera. This concept is used in the real time application of MAV. The MAVs are basically used to capture images and videos through the Raspberry pi camera module. Raspberry Pi is a credit card sized (small) system and is less weight in the design. The image processing is a form of signal processing where the input is an image, like a photograph or video frame, the output of an image processing may be either an image or a video frame or a set of characteristics or parameters related to the image. The acquisition of digital image usually suffers from undesirable camera shakes and due to unstable random camera motions. Hence image enhancement algorithms are required to remove these unwanted camera shakes. This image processing concept is implemented in Raspberry pi in the application of MAV.

The Raspberry Pi is a basic embedded system having a credit card-sized single board computers developed in the UK by the Raspberry Pi Foundation. The Raspberry Pi is based on the Broadcom BCM2835 system on a chip (SOC) which includes an ARM1176JZF-S Core (ARM V6K)700 MHz CPU processor, Broadcom Video Core IV GPU having 17 pins, 3.5W of power, and 512 MB of RAM memory. The Raspberry Pi system has Secure SD card reader (models A and B) or Micro SD card reader (models A+ and B+) sockets for boot media and persistent storage. The system provides Debian Linux operating system Raspbian image for download.

2.6.2 Method

The proposed method uses the raspberry pi board as the main controller. The latest version of raspbian wheezy is used. The user captures the objective image and specifies the reference image, the rest of the process is completely automatic and there is no need for user intervention. Here the algorithm has been applied to the complete image. In the application of micro air vehicle (MAVs) there is a noise present in the images due to the atmospheric conditions, so removing noise from images is important in this application and improving the quality of images. For this method I used the Rudin-Osher-Fatemi de-noising model (ROF).

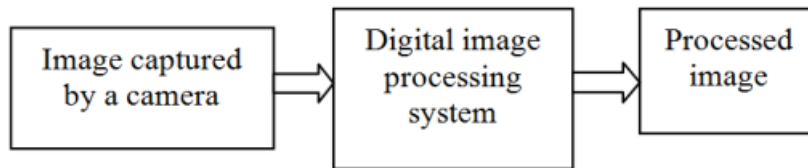


FIGURE 2.2: Image processing

In general, any digital image processing algorithm consists of three stages: input, processor and output. In the input stage image is captured by a camera. It is sent to a particular system to focus on a pixel of image that gives its output as a processed image. The Raspberry Pi board is the central module of the whole embedded image capturing and processing system as given in fig. 2. Its main parts include: main processing chip unit, memory, power supply, HDMI Out i.e. VGA display, Ethernet port, and USB ports.

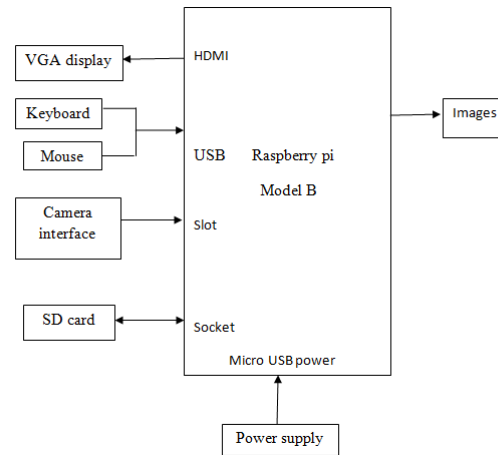


FIGURE 2.3: Image processing

2.6.3 Advantages and Disadvantages

The system uses microprocessor which are high efficient than micro controller. Also the size of the system is small since it uses raspberry pi. The system can be used as security camera. Here the system will consume only less power. In the system the data is transferred through a wired connection so the chance of insecure action is high and also the system will have a specific boundary. In the case of image processing the system is stationary as a result the system is not upgradable. The image processing system is stationary so the system is not upgradable.

Chapter 3

COMPARATIVE STUDY

All the systems which are discussed in the literature papers can be compared on the basis of image processing and toxic gas detection. In the literature papers "person identification in webcam images an application of semi supervised"[1] and "implementation of image processing on raspberry pi"[2] the main technology used is image processing. The main purpose of these two system is to take the pictures of the place where hazard occurred. In one system webcam is used for the imaging process where as in the second literature paper instead of webcam, raspberry is introduced which improves the quality and resolution of the image. This will help to identify the images clearly and accurately. In the case of efficiency and feasibility both the system are well feasible and efficient. The advantage of the system "person identification in webcam images" is that it is a real time system so that it is upgradable. Similarly, the system "implementation of image processing on raspberry pi" is that it can be use instead of security camera and it will consume only less power. The toxic gas detection is the next major concern in the study.

The papers "monitoring and controlling of hazardous gases in vehicle and alerting using GSM technology"[3] and the system "raspberry pi based hazardous environment monitoring using wireless communication"[4] we focused on the said purpose. These system contains the technology of both embedded part and software part. The major drawback of the system is that it is fixed and also highly feasible.

The advantage of the system is that it will send an alert message when the level of toxic gas exceeded the preset threshold. But the system which uses raspberry pi, monitors the current status of the hazardous environment and communicates the information wirelessly. Compared to system "monitoring and controlling of hazardous gas" this system is not that much efficient and feasible. The main advantage of the system is that it is easy to implement and many application can be done in a single system.

Nextly in the papers "coalmine robot for detection of hazardous gas" [5] and the system "poisonous gas detector with electro chemical nose" [6] the detection of poisonous gas by means of IR sensors is delineated. The first paper "coalmine robot" have both embedded and software technologies. But the other paper "poisonous gas detector" system have only embedded system technology. Both the system is feasible but in the case of efficiency coalmine robot are efficient than poisonous gas detector. The main advantages of coalmine robot are it is a moving system and so is upgradable with change in location and it transfers data wirelessly. In the case of poisonous gas detector, the main advantage is that it will detect various types of hazardous gases. The coalmine robot uses IR sensors and are not that efficient due to usage of dc motors.

Chapter 4

PROBLEM STATEMENT

Current rescue systems so far reviewed are using the major technologies like Image detection using webcam with the help of moving rover, IR sensors for toxic gas detection and python based raspberry pi microcontrollers. These three methods are not so fruitful due to some major concerns. Firstly, the quality of the captured image is very low due to low resolution webcam pictures. Also dc motor based rover used for movement process are not efficient since there is a great chance of loss of power while climbing the inclined areas or hills with dc motor. Similarly, IR sensors used for toxic gas detection are not much efficient since they are designed in such a way to capture pictures as soon as the moment when any particle or anything which cuts the infrared rays. System cannot assure that the captured image is that of a human body or not and so there is a chance of getting unwanted images in such systems. Similarly, the image processing systems developed until now are stationary, i.e. they were fixed at a certain position so that the system will have the limits for the boundary up to which the image can be taken. These systems cannot be used with change in places and so are not maintainable. Another problem is that raspberry Pi based systems hitherto do entire processing based on python language. But in the case of multiprogramming the python language is not efficient in raspberry pi. These all issues will slow up the entire process as well as working of the system.

Chapter 5

PROPOSED SYSTEM

5.1 Introduction

This system proposes an advanced rescue system which helps the firefighters who are working in the hazardous atmosphere. The system will help them to know about the current status of the place where hazardous or disaster occurred. There are mainly two modules in the system which are image processing system and telemetry system.

5.2 System Architecture

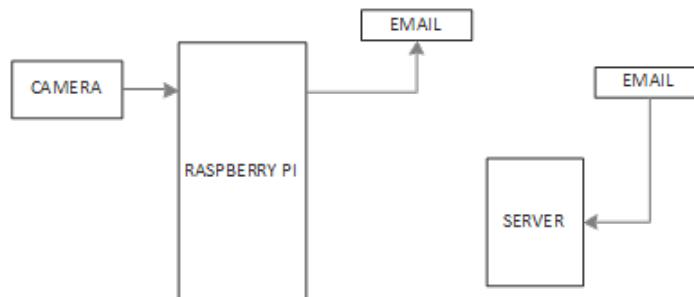


FIGURE 5.1: Image processing system

The image processing module is responsible for performing various image enhancement operations. Here a camera will be connected to the raspberry pi. The image taken by the camera will be processed inside the raspberry pi and from there the system will detect the presence of human face. When a human face is detected then the system will send an image to the email ID. Then this mail will send to the server. .

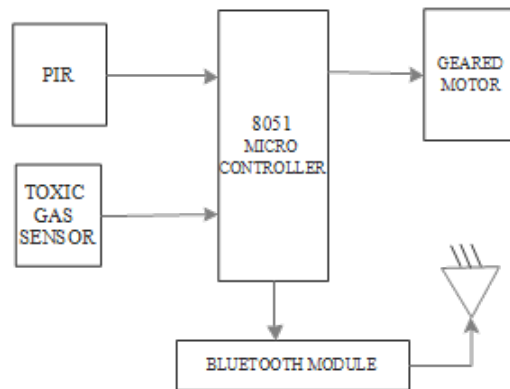


FIGURE 5.2: Telemetry system

Telemetry module is dealing with the embedded part of the system. This module contains a rover which consist of an 8051 microcontroller. The PIR sensor and toxic gas sensor are connected to the central 8051 controllers. PIR sensor will perform the image processing and toxic gas sensor will detect the presence of toxic gas. These data will be processed by 8051 microcontrollers and it will send to the server with the help of Bluetooth module. Here the admin controls the movement of the software with the help of a software.

Chapter 6

FEASIBILITY STUDY

All projects are feasible when given unlimited resources and infinite time. It is both necessary and prudent to evaluate the feasibility of a project at the earliest possible time. An estimate is made of whether the identified user needs may be satisfied using current software and hardware technologies. The study will decide if the proposed system will be cost effective from the business point of view and if it can be developed in the given existing budgetary constraints. The feasibility study should be relatively cheap and quick. The result should inform the decision of whether to go ahead with a more detailed analysis. Feasibility analysis is the procedure for identifying the candidate system, evaluating and electing the most feasible system. This is done by investigating the existing system in the area under investigation or generally ideas about a new system. It is a test of a system proposal according to its workability, impact on the organization, ability to meet user needs, and effective use of resources. The objective of feasibility study is not to solve the problem but to acquire a sense of its scope.

Feasibility analysis involves 6 steps

- Form a project and appoint a project leader
- Prepare system flowcharts
- Create a web site
- Weigh system performance and cost data
- Prepare and report final project directive to management

The study is done in these phases

- Operational feasibility
- Technical feasibility
- Economical feasibility
- Behavioral feasibility
- Software feasibility
- Hardware feasibility

6.1 Operational feasibility

Proposed projects are beneficial only if they can be turned into information system that will meet the organization's operating requirements. Simply stated, this test of feasibility asks if the system will work when it is developed and installed. Are there major barriers to implementation? Here are questions that will help test the operational feasibility of a project: Is there sufficient support for the projects from management? Are current business methods acceptable to the users? Have the users been involved in the planning and development of the project? Will the proposed system cause harm? The purpose of the operational feasibility study is to determine whether the new system will be used if it is developed and implemented. And whether there will be resistance from users that will undermine the possible application benefits.

6.2 Technical feasibility

A study of function performance and constraints may improve the ability to create an acceptable system. Technical feasibility is frequently the most difficult area to achieve at the stage of product engineering process. Considering that are normally associated with the technical feasibility include

- Development risk
- Resource availability
- Technology

Technical feasibility study deals with the hardware as well as software requirements. The scope was whether the work for the project is done with the current equipments and the existing software technology has to be examined in the feasibility study. The outcome was found to be positive. In proposed system, data can be easily stored and managed using database management system software. The reports and results for queries can be generated easily. Thus, system is technically feasible.

6.3 Economical feasibility

A cost evaluation is weighed against the ultimate income or benefit derived from the developed system or product. When compared to the advantage obtained from implementing the system its cost is affordable. Also the system is designed to meet the modifications required in the future. So, most of the required modifications can be done without much re-work. Proposed system was developed with the available resources. Since cost input for the software is almost nil the output of the software is always a profit. Hence software is economically feasible. In the existing system, manpower is required. In the proposed system, number of employees to be involved is reduced drastically. So, the proposed system is to be economic.

6.4 Behavioral Feasibility

People are inherently resistant to changes and computer is known for facilitating the changes. An estimate should be made of how strongly the user staff reacts towards the developments of the computerized system. In the existing system more manpower is required and time factor is more. In proposed system, both man power and time factors are reduced and also unnecessary burden is reduced. Thus the remaining people are made to engage in some other important work.

6.5 Software feasibility

Even though software is developed in a very high software environment, it will be supported by many other platform and environments with minimum changes.

6.6 Hardware feasibility

The software can be developed with resource already existing. Here the consideration is that the existing hardware resources support the technologies that are to be used by the new system. No hardware was newly bought for the project and hence. Software is to achieve hardware feasibility.

Chapter 7

REQUIREMENT SPECIFICATION

7.1 Software Requirements

- Windows 10
- Raspabian OS
- SD card formatter
- The Unarchiver
- Xming
- Python
- Open CV
- Picamera
- sciPy

7.2 Hardware Requirements

- Raspberry pi
- 8051 microcontroller
- PIR sensor
- Toxic Gas sensor
- Gear motors

7.3 Platform details (front end and back end)

Front End

- ASP.NET
- KEIL C
- PYTHON

Back end

- Visual basic
- AVR studio
- PYTHON IDLE

Chapter 8

SYSTEM DESIGN

8.1 UML Diagrams

The Unified Modeling Language (UML) is a general-purpose, developmental, modeling language in the field of software engineering that is intended to provide a standard way to visualize the design of a system. The elements are like components which can be associated in different ways to make a complete UML picture, which is known as diagram. Thus, it is very important to understand the different diagrams to implement the knowledge in real-life systems.

Any complex system is best understood by making some kind of diagrams or pictures. These diagrams have a better impact on our understanding. If we look around, we will realize that the diagrams are not a new concept but it is used widely in different forms in different industries. UML diagrams is used to understand the system in a better and simple way. A single diagram is not enough to cover all the aspects of the system. UML defines various kinds of diagrams to cover most of the aspects of a system.

8.1.1 Use Case Diagram

Use case diagrams are usually referred to as behavior diagrams used to describe a set of actions (use cases) that some system or systems (system) should or can perform in collaboration with one or more external users of the system (actors). Each use case should provide some observable and valuable result to the actors or other stakeholders of the system.

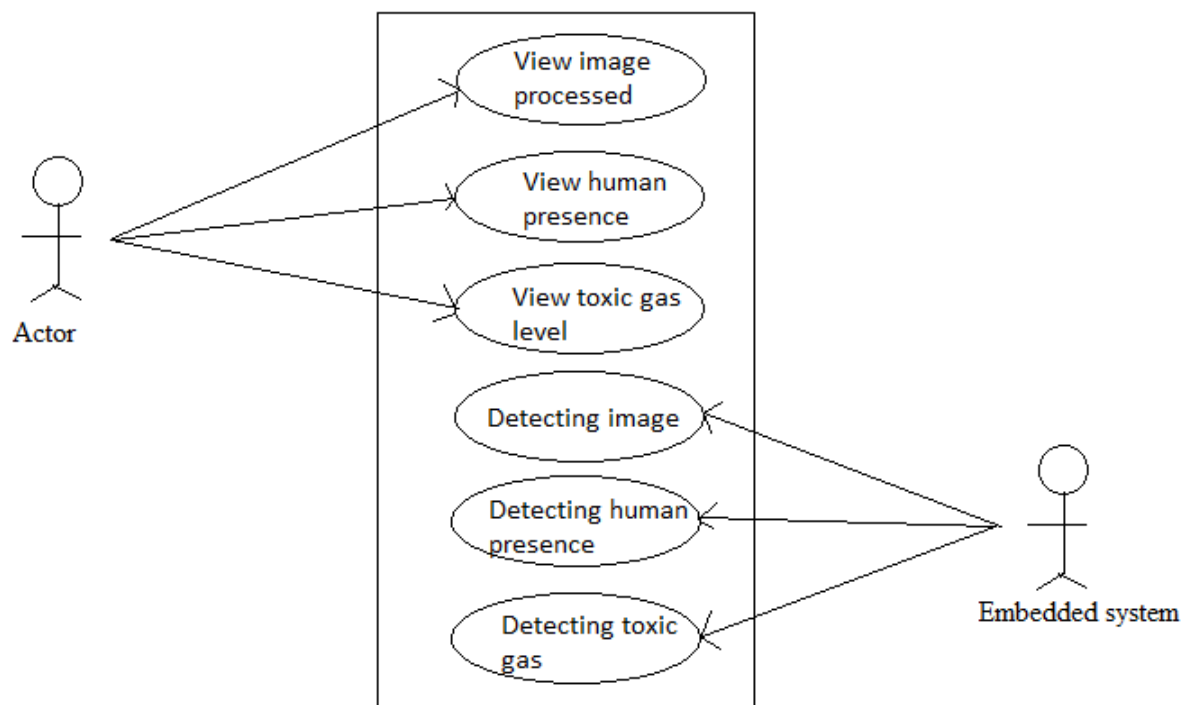


FIGURE 8.1: Use case diagram

8.1.2 Activity Diagram

Activity diagram is another important diagram in UML to describe dynamic aspects of the system. Activity diagram is basically a flow chart to represent the flow from one activity to another activity. The activity can be described as an operation of the system. So the control flow is drawn from one operation to another. This flow can be sequential, branched or concurrent. Activity diagrams deals with all type of flow control by using different elements like fork, join etc.

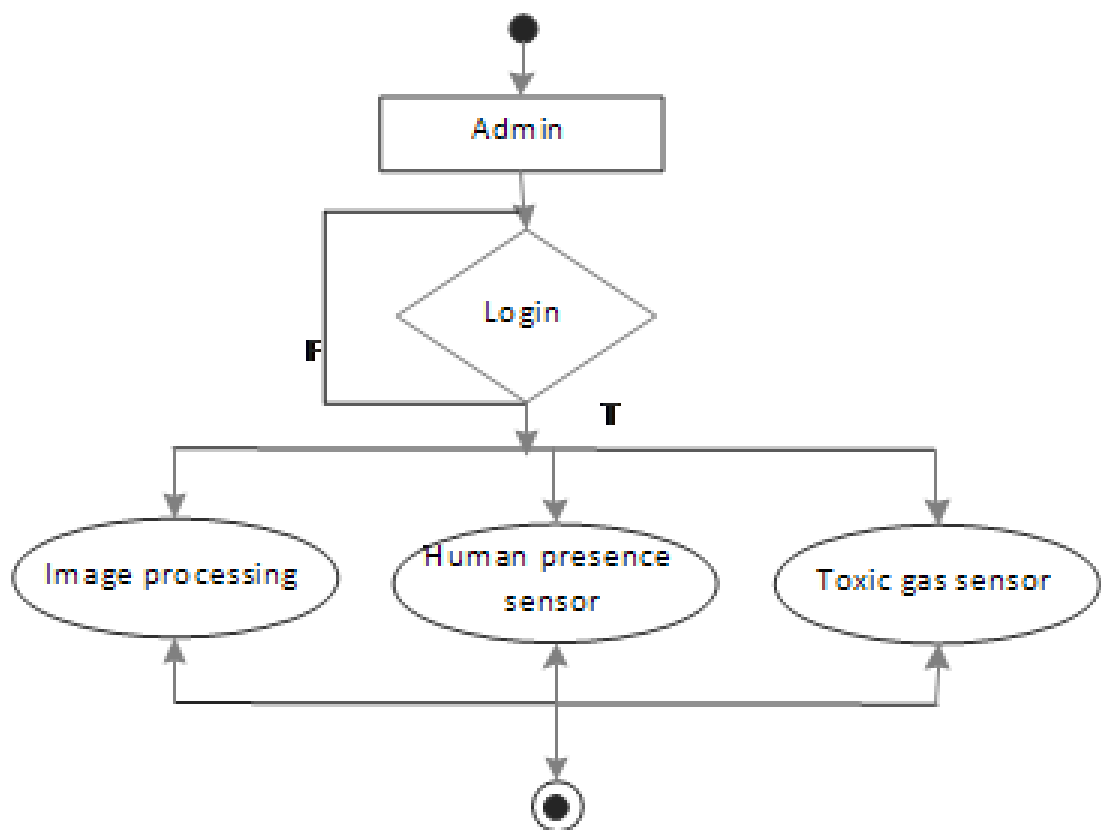


FIGURE 8.2: Activity Diagram

8.1.3 Sequence Diagram

A sequence diagram is an interaction diagram that shows how objects operate with one another and in what order. It is a construct of a message sequence chart. A sequence diagram shows object interactions arranged in time sequence. It depicts the objects and classes involved in the scenario and the sequence of messages exchanged between the objects needed to carry out the functionality of the scenario. Sequence diagrams are typically associated with use case realizations in the Logical View of the system under development. Sequence diagrams are sometimes called event diagrams or event scenarios.

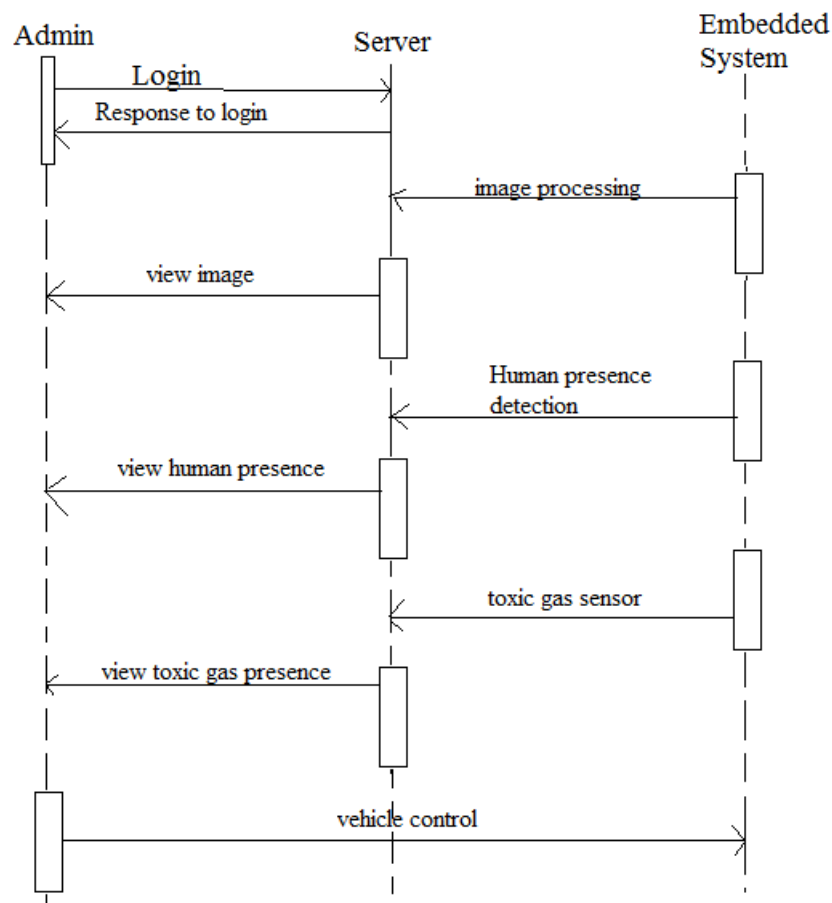


FIGURE 8.3: Sequence Diagram

8.2 Data Flow Diagrams

A data flow diagram (DFD) is a graphical representation of the "flow" of data through an information system, modeling its process aspects. A DFD is often used as a preliminary step to create an overview of the system without going into great detail, which can later be elaborated. DFDs can also be used for the visualization of data processing (structured design). A DFD shows what kind of information will be input to and output from the system, how the data will advance through the system, and where the data will be stored

8.2.1 level 0

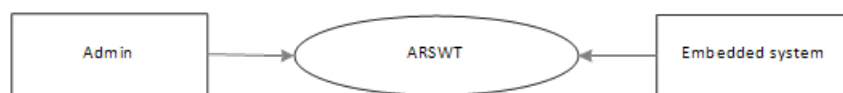


FIGURE 8.4: Advance rescue system with telemetry

8.2.2 level 1

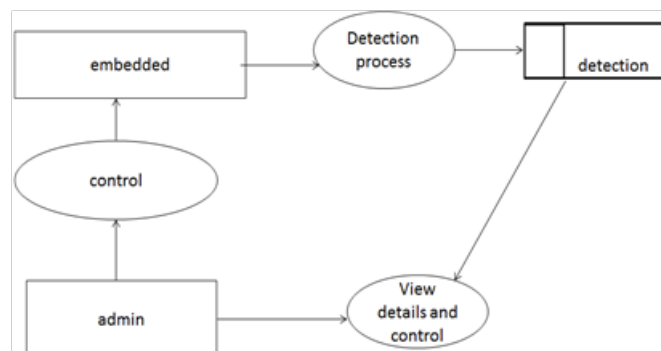


FIGURE 8.5: Level 1

8.2.3 level 2

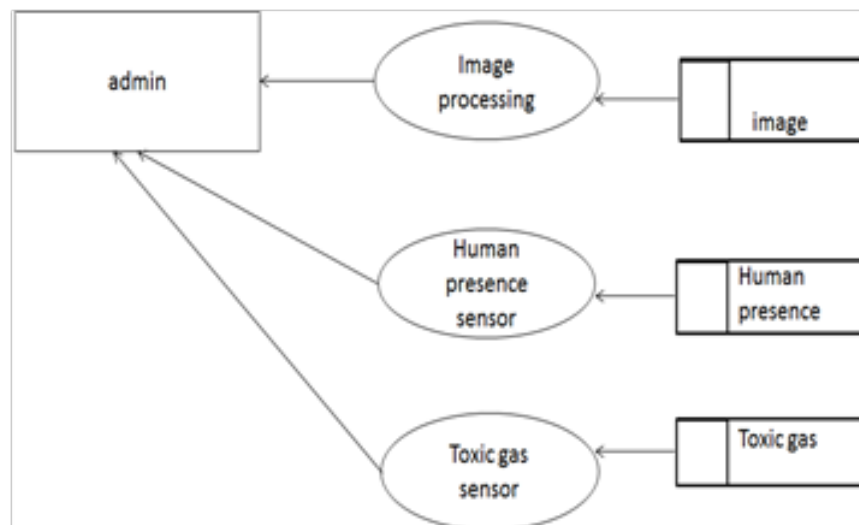


FIGURE 8.6: Viewing details

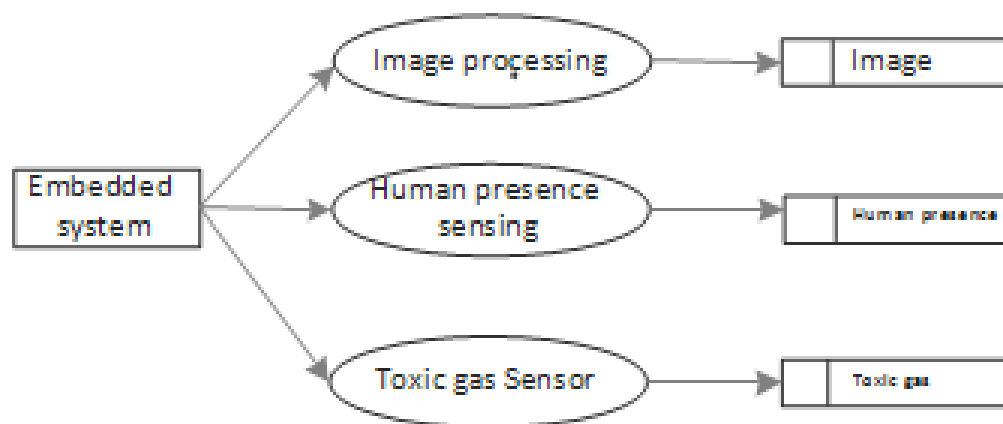


FIGURE 8.7: Embedded system

Chapter 9

IMPLEMENTATION

9.1 Module Description

9.1.1 Hardware modules

- Raspberry pi

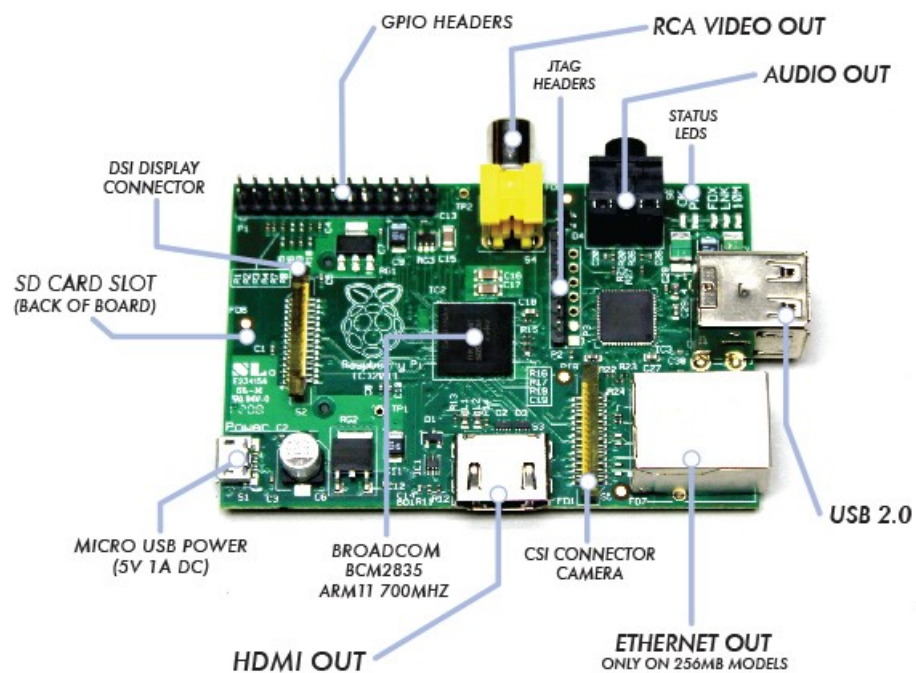


FIGURE 9.1: Details Of Raspberry pi

The Raspberry Pi is a series of small single-board computers developed in the United Kingdom by the Raspberry Pi Foundation to promote the teaching of basic computer science in schools and in developing countries. The original model became far more popular than anticipated, selling outside of its target market for uses such as robotics. Peripherals (including keyboards, mice and cases) are not included with the Raspberry Pi. Some accessories however have been included in several official and unofficial bundles.

- **8051 Microcontroller**

The Intel **8051** is an 8-bit **microcontroller** which means that most available operations are limited to 8 bits. There are 3 basic "sizes" of the 8051: Short, Standard, and Extended. The Short and Standard chips are often available in DIP (dual in-line package) form, but the Extended 8051 models often have a different form factor, and are not "drop-in compatible". All these things are called 8051 because they can all be programmed using 8051 assembly language, and they all share certain features (although the different models all have their own special features).

Some of the features that have made the 8051 popular are:

- 4 KB on chip program memory.
- 128 bytes on chip data memory(RAM)
- 32 bytes devoted to register banks
- 16 bytes of bit-addressable memory
- 80 bytes of general-purpose memory

- **PIR Sensor**

A passive infrared sensor (**PIR Sensor**) is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view. They are most often used in PIR-based motion detectors. The term passive in this instance refers to the fact that PIR devices do not generate or radiate energy for detection purposes. They work entirely by detecting infrared radiation emitted by or reflected from objects. They do not detect or measure heat. A PIR-based motion detector is used to sense movement of people, animals, or other objects. They are commonly used in burglar alarms and automatically-activated lighting systems.

- **Toxic gas sensor**

A **Toxic gas sensor** is a device that detects the presence of gases in an area, often as part of a safety system. This type of equipment is used to detect a gas leak or other emissions and can interface with a control system so a process can be automatically shut down. A gas detector can sound an alarm to operators in the area where the leak is occurring, giving them the opportunity to leave. This type of device is important because there are many gases that can be harmful to organic life, such as humans or animals. Gas detectors can be used to detect combustible, flammable and toxic gases, and oxygen depletion. This type of device is used widely in industry and can be found in locations, such as on oil rigs, to monitor manufacture processes and emerging technologies such as photovoltaic. They may be used in firefighting.

- **Geared Motor**

A **Geared Motor** is a specific type of electrical motor that is designed to produce high torque while maintaining a low horsepower, or low speed, motor output. Gear motors can be found in many different applications. Gear motors are commonly used in devices such as can openers, garage door openers, washing machine time control knobs and even electric alarm clocks. Common commercial applications of a gear motor include hospital beds, commercial jacks, cranes and many other applications that are too many to list.

9.1.2 Software Modules

- **Windows 10**

Windows 10 is a personal computer operating system developed and released by Microsoft as part of the Windows NT family of operating systems. It was first released on July 29, 2015.[7] Unlike previous versions of Windows, Microsoft has branded Windows 10 as a "service" that receives ongoing "feature updates". Devices in enterprise environments can receive these updates at a slower pace, or use long-term support milestones that only receive critical updates, such as security patches, over their ten-year lifespan of extended support.

- **Raspbian OS**

Raspbian OS is a Debian-based computer operating system for Raspberry Pi. Since 2015 it has been officially provided by the Raspberry Pi Foundation as the primary operating system for the family of Raspberry Pi single-board computers. Raspbian was created by Mike Thompson and Peter Green as an independent project. The initial build was completed in June 2012. The operating system is still under active development. Raspbian is highly optimized for the Raspberry Pi line's low-performance ARM CPUs

- **SD card formatter**

SD card formatter formats SD Memory Card, SDHC Memory Card and SDXC Memory Card (respectively SD/SDHC/SDXC Cards) complying with the SD File System Specification created by the SD Association (SDA). It is strongly recommended to use the SD Memory Card Formatter to format SD/SDHC/SDXC Cards rather than using formatting tools provided with individual operating systems.

- **Picamera**

The **Picamera** Module is a great accessory for the Raspberry Pi, allowing users to take still pictures and record video in full HD

- **The Unarchiver**

The Unarchiver is a free data decompression utility, which supports more formats than Archive Utility[1] (formerly known as BOMArchiveHelper), the built-in archive unpacker program in OS X. It can also handle file names in foreign character sets, created with non-English versions of other operating systems.[2] The latest version requires Mac OS X v10.3.9 or higher. The Unarchiver does not compress files.

- **Xming**

Xming provides the X Window System display server, a set of traditional sample X applications and tools, and a set of fonts. It features support of several languages and has Mesa 3D, OpenGL, and GLX 3D graphics extensions capabilities.

- **Python**

The **Python** Software Foundation (PSF) is a 501(c)(3) non-profit corporation that holds the intellectual property rights behind the Python programming language. We manage the open source licensing for Python version 2.1 and later and own and protect the trademarks associated with Python. Support other Python conferences around the world, and fund Python related development with our grants program and by funding special projects.

- **Open CV**

Open CV(Open Source Computer Vision) is a library of programming functions mainly aimed at real-time computer vision. Originally developed by Intel, it was later supported by Willow Garage and is now maintained by Itseez. The library is cross-platform and free for use under the open-source BSD license

- **SciPy**

SciPy is an open source Python library used for scientific computing and technical computing. SciPy contains modules for optimization, linear algebra, integration, interpolation, special functions, FFT, signal and image processing, ODE solvers and other tasks common in science.

Chapter 10

TESTING

This section describes the testing procedure, starting with the testing methodology and then continuing with the tests performed on the system.

- Testing is a process of exceeding with the internet of finding an error.
- A good test case is one that has a high probability of finding an undiscovered error.
- A successful test is one that uncovers undiscovered errors

10.1 Testing Methodology

The most natural and customary way of verifying any piece of work is just to operate it in some representative situation and verify whether its behavior is as expected. In general it is impossible to test it under all possible operating conditions. Thus it is necessary to find suitable test cases that provide enough evidence that the desired behavior will be exhibited in all remaining case. Testing is a critical activity in software engineering and should be performed as systematically as possible by stating clearly what result one expects from it and how one obtains these results. On the contrary, often in practice, testing is performed in an unstructured way without applying any criterion.

There are two approaches to testing:.

1. White box testing

This is testing software using information about the internal structure of the software. It tests what the program does. The test is being carried out to check the internal structure of the software. The test is carried out successfully and the internal structure of the software meets the required criteria.

2. Black box testing

Testing a piece of software as a black box (also called functional testing) means operating the software without relying on any knowledge of the way it has been designed and coded. It tests what it is supposed to do. The Programs run successfully against task assigned.

3. Unit Testing

This is the first level of testing. In this different modules are tested against the specification produces during the design of the modules. Unit testing is done during the coding phase and to test the internal logic of the modules. It refers to the modules. It refers to the verification of single program module in an isolated environment. Unit testing first focuses on the modules independently of one of another to locate errors. After coding each dialogue is tested and run individually. All necessary coding were removed and it was ensured that all modules are worked, as the programmer would expect. The logical errors found were corrected so, by working all the modules independently and verifying the outputs of each module in the presence of staff, I observed that the program was functioning as expected. In unit testing

- Module is tested to ensure that information properly flows into and out of the program under test
- Local data structures are examined to ensure that data stored temporarily maintains its integrity during all steps in algorithm execution.
- Boundary condition is tested to ensure that module operates properly at boundaries established to limit or restrict processing.
- All independent paths through the control structures are executed to ensure that all statements in the module have been executed at least once.
- Error handling paths are also tested.

4. Integration testing

Data can be lost across an interface: one module can be adversely affected on another; sub functions when combine may not produce the desired major functions. Integration testing is a systematic testing for constructing the program structure. Conducting the tests is to uncover errors associated within the interface. The objective is to take unit tested to modules and build a program structure. All the modules are combined and tested as a whole. Here correction is difficult because the vast expenses of the entire program complicate the isolation of causes. Thus in the integration testing step, all the errors uncovered are corrected for the next testing steps.

- (a) Low – Level modules are combined to form clusters .
- (b) The cluster is tested
- (c) Drivers are removed and clusters are combined moving upward in the program structure.

5. Alpha Testing

A series of acceptance tests were conducted to enable the users to validate requirements. The suggestions, along with the additional requirements of the end user were included in the project

6. Beta Testing

It is to be conducted by the end – user without the presence of the developer. It can be conducted over a period of weeks or month. Since it is a long time consuming activity, its result is out scope of this project report. But its result will help to enhance the product at a later time.

7. Validation Testing

This provides final assurance that the software meets all the functional, behavioral and performance requirement. The software is completely assembled as a package. Validation succeeds when the software functions in a manner in which user wishes. Validation refers to the process of using software in live environment in order to find errors. During the course of validation the system failure may occur and sometimes the coding has to be hanged according to the requirement. Thus the feedback from the validation phase generally produces changes in software.

8. Output Testing

After performing the validation testing, the next step is output testing of the proposed system since no system could be useful if it does not produce the required output in a specific format. Asking the users about the format required by them, tests the output generated are considered into two ways. One is on screen and another is printed format. The output format on the screen found to be correct as the format was designed in the system design phase according to the user needs. For the hard copy also, the output comes out as the specified requirement by the user. Hence output testing does not result in any correction in the system

Chapter 11

RESULT

From a proper analysis of positive points and constraints of the system it is inferred that the system is working as per the objectives of the system. Installation and maintenance of the system is cost effective and takes less time. The system-user interface is user friendly and does not require specialized training or skills to operate it

The system has been designed to substantially enhance the performance by ensuring smooth running of emergency service (like fire force). The implementation of the system is done in such a way that it not only paves way to emergency situations.

The system monitors the current status of hazardous place and detect the toxic gas and human motion presence. It will also help to take the authority necessary safety measures. Thus this system is practically feasible economically viable, and reliable in nature. It is robust as well as easy to handle and quite simple to be understood and brought in use by the masses. Summing up the system can show that the system with its ready to apply technology and cheap installation charges invariably finds its application in our hazardous rescue system. An improvisation of the system and subsequent modification of the system can serve our purpose as when needed in near future

Chapter 12

PERFORMANCE AND EVALUATION

The system uses sensor for monitoring the gases which are highly toxic to human. Here PIR sensor is also used to identify the human presence. The data's are send through Bluetooth modules which are very efficient and also it will reduce the cost of the system. Telemetry can dramatically reduce the victims of disaster and natural calamities, especially people trapped in remote areas. The system will also ensure the safety of the rescue team. Considering the performance graph indicate the efficiency of the systems.

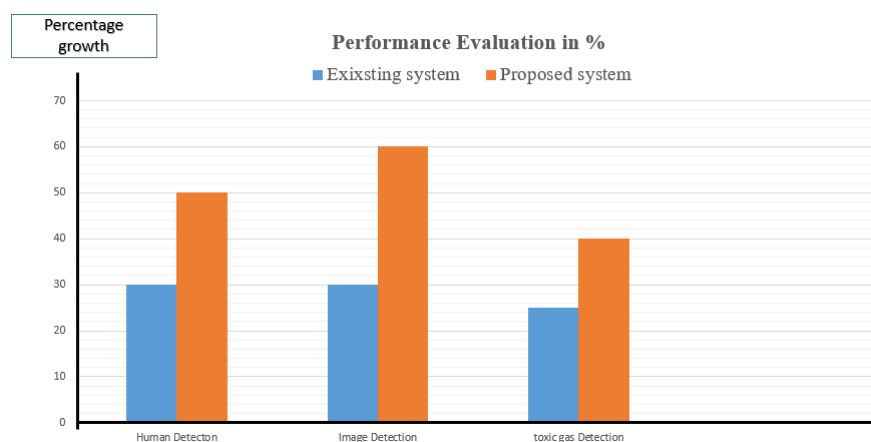


FIGURE 12.1: performance and evaluation

Chapter 13

SCREEN SHOTS



FIGURE 13.1: Raspberry pi connection

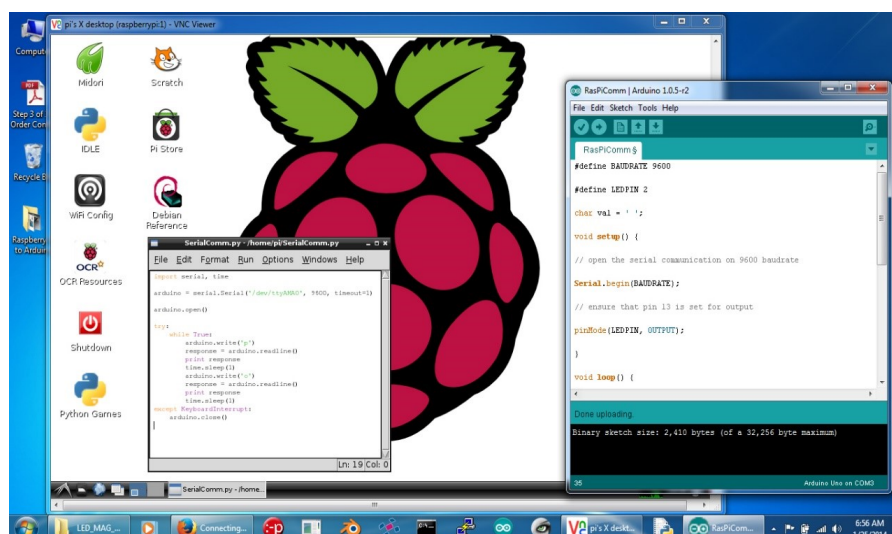


FIGURE 13.2: Raspberry pi with computer

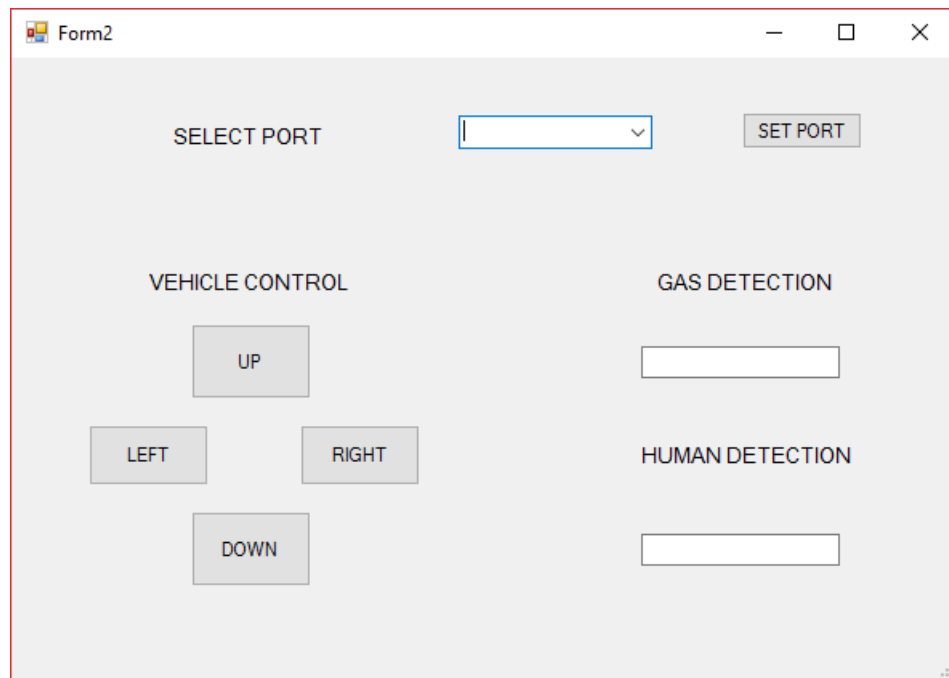


FIGURE 13.3: Controlling system

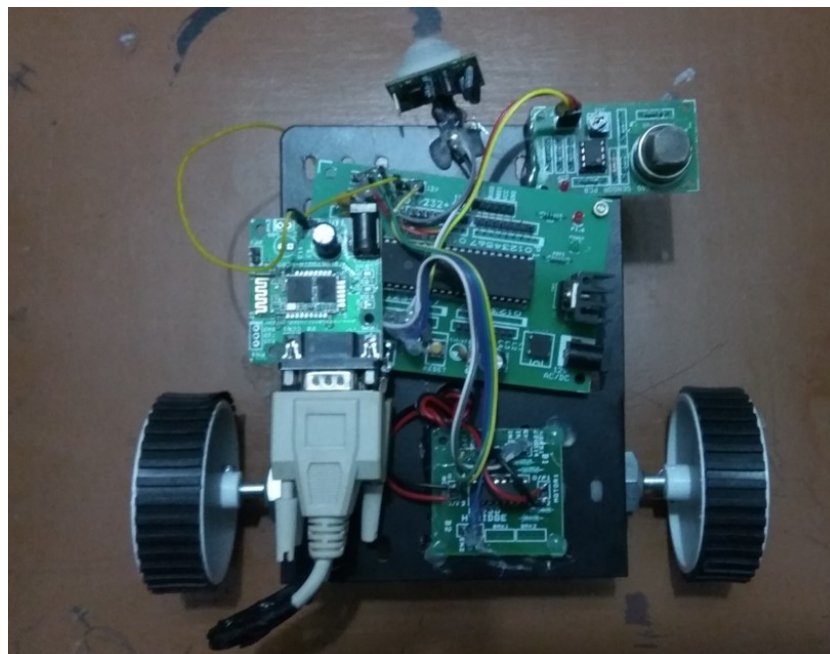


FIGURE 13.4: Telemetry system



FIGURE 13.5: Raspberry pi with Picam

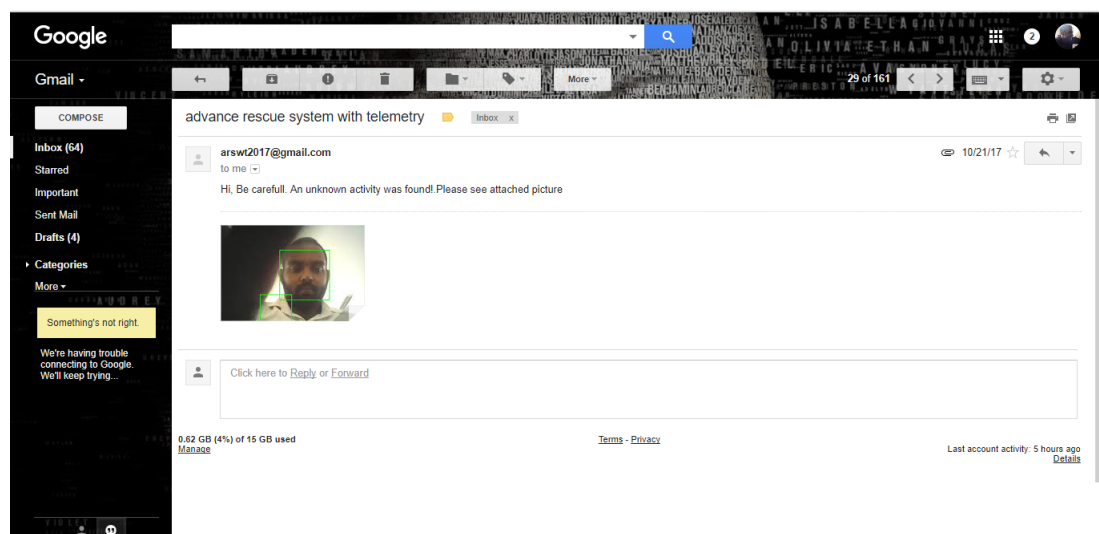


FIGURE 13.6: Images attaching to mail

Chapter 14

CONCLUSION

The system will detect the human presence as well as the toxic gas presence at the place where disaster occurred. Monitoring these details will help the authority to get knowledge about the current status of the hazardous place so that they can take necessary precautions to save human life. This system has described the design and implementation of a wireless sensor network in global industrial monitoring using Raspberry Pi. It prevents people from dangerous situations like fire accident, high voltage, high current, etc. From financial standpoint, missing, damaged, or malfunctioning can be reduced and has proven to be a trusted and increasingly applied solution in commercial settings, saving operating expenses and most importantly, human lives. We implemented the algorithm to enhance an image in different enhancement degree using the raspberry pi. It was found that the algorithm developed for the raspberry pi executes successfully and gives a very colorful image.

In future instead of using raspberry pi 3B we can use raspberry pi 3b+ or more advanced version which can perform multiprogramming in python more efficiently. So with that the whole system can be performed using a single raspberry pi. By this the size of the system can be reduced.

Bibliography

- [1] Ajinkya Patil¹, Mrudang Shukla². *Implementation Of Classroom Attendance System Based On Face Recognition In Class*. IJAET, Vol. 7, Issue 3 July, 2014.
- [2] G.Senthilkumar¹, K.Gopalakrishnan², V. Sathish Kumar³. *Embedded Image Capturing System Using Raspberry Pi System*. Volume 3, Issue 2 March–April 2014 Page 213.
- [3] PratimaBhagat,kishoriBirdawadc, KomalAmle. *Rescue robot for hazardous coal mines*. International Journal of Technology and Science, Issue-2, Vol.1, May 2014
- [4] Alfredo Gardel Vicente, Ignacio Bravo Munoz Jose Luis Lazaro Galilea and Pedro A. Reveng del Toro. *Remote Automation Laboratory Using a Cluster of Virtual Machines*. IEEE Transactions on Industrial Electronics, vol. 57 no. 10, pp. 3276–3283, 2010.
- [5] T.S.Kumar Reddy; G.Balasiva Krishna. *Hazardous gas detecting rescue robot in coal mines*. International Journal of Mechanical and Production Engineering, ISSN:2320-2092, volume2, Issue-5, May-2014.
- [6] K. Galatsis, W. Wlodarsla, K. Kalantar-Zadeh and A. Trinchi *Investigation of gas sensors for vehicle cabin air quality monitoring*. vol. 42, pp. 167-175, 2002.