Visvesvaraya Technological University, Belagavi.

PROJECT REPORT

on

"SMOKE DETECTOR using RASBERRY PI with GPS modem"

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

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in

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CERTIFICATE

This is to Certify that the dissertation work **"SMOKE DETECTOR using RASBERRY PI with GPS modem"**carried out byHEMA SHREE.G 1CR15EC068, ARVIND.V 1CR16EC403, SATISH.G 1CR16EC429 bonafide students of **CMRIT** in partial fulfillment for the award of**Bachelor of Engineering**in**Electronics and Communication Engineering**of the**Visvesvaraya Technological University, Belagavi,**during the academic year **2019-20**. It is certified that all corrections/suggestions indicated for internal assessment have been incorporated in the report deposited in the departmental library. Theproject report has been approved as it satisfies the academic requirements in respect of Project work prescribed for the said degree.

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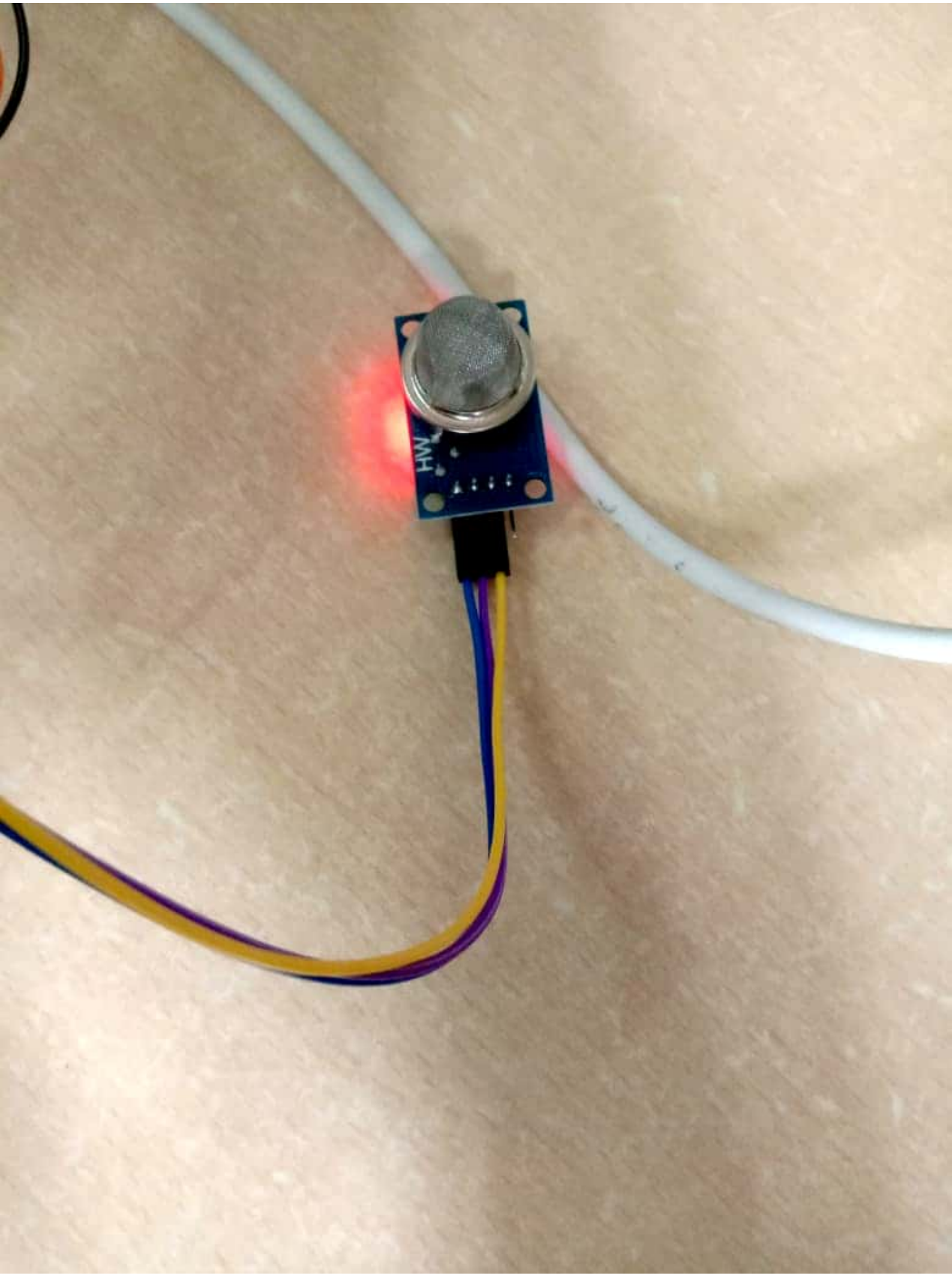
Table of Contents

List of Figures



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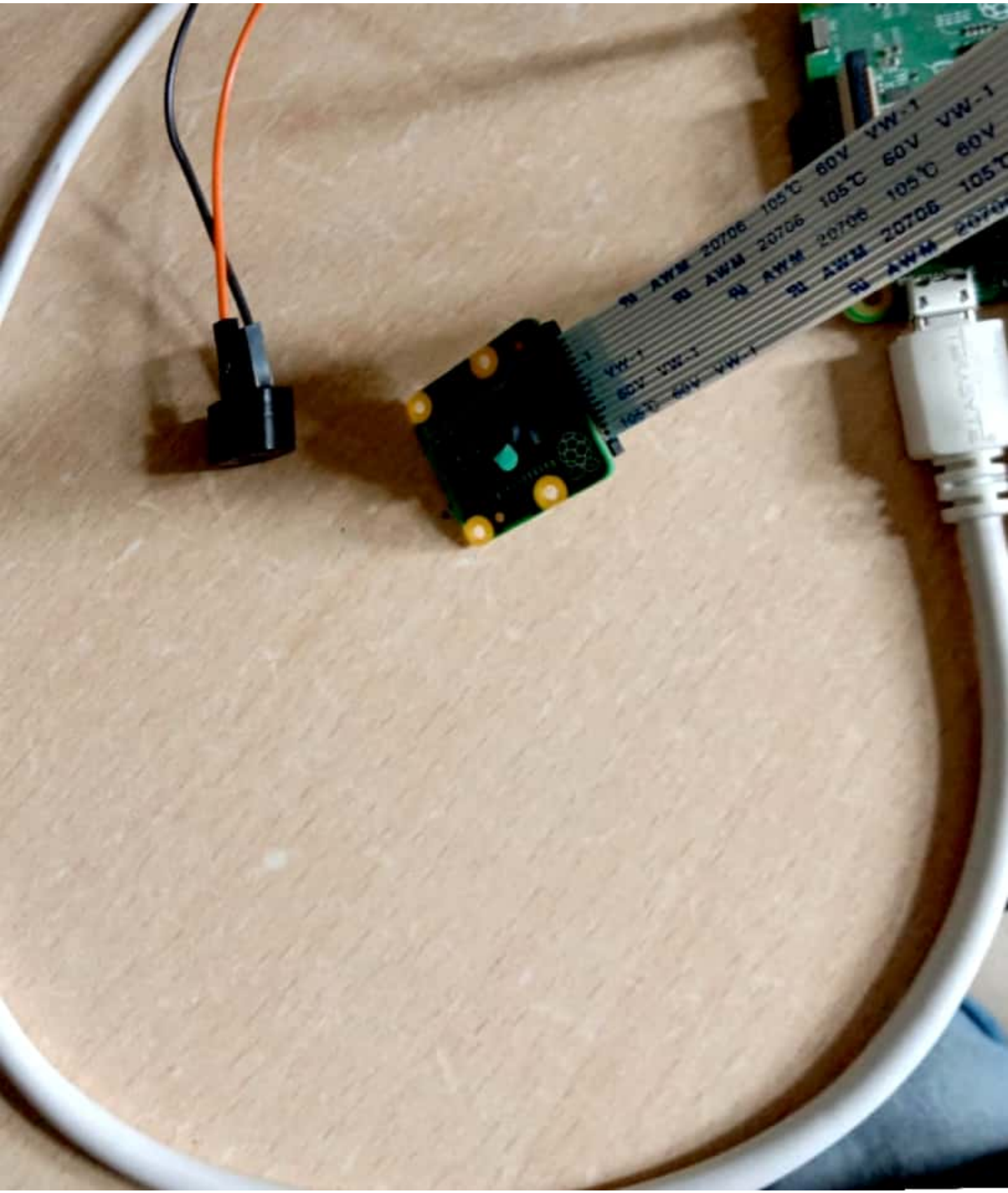

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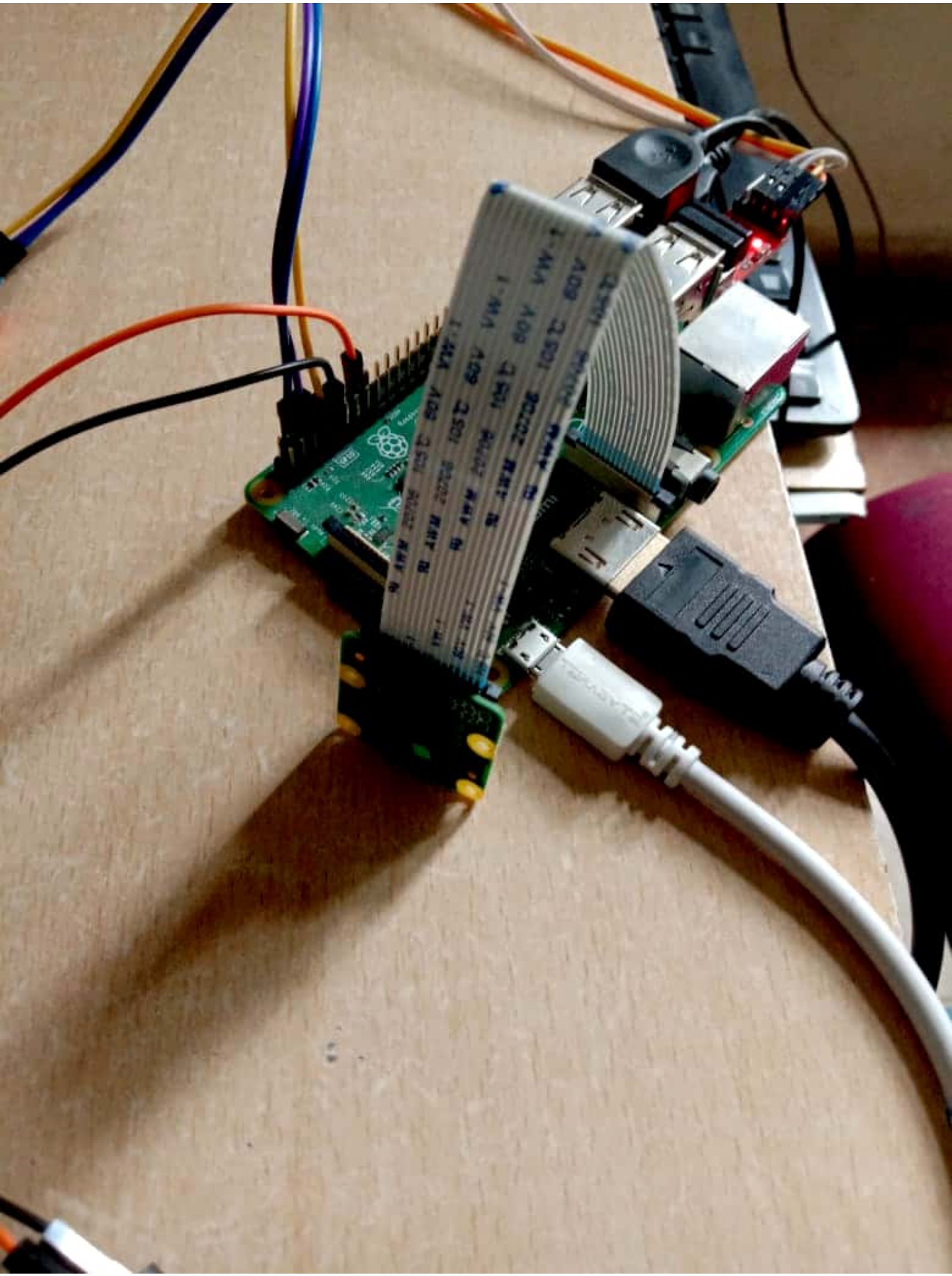

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ABSTRACT

The main Intention and Idea for developing this project or device is to create a public awareness and warning about the effect of tobacco smoke consumption on oral health of both kind of people's such as smokers and non-smokers. The study we are going to do according to the concentrated spaces like no smoking zones and public spaces.

In this study, we improve smoke detection approach based on frame movement by analyzing the characteristics of smoke and also an alternative method known as Tapping method. Background and different modeling methods are used to detect moving objects in every frame accurately.

Sequentially, the image was converted to binary mode, and while undesirable lightness pixels are removed from the image.

The first feature depends on the standard deviation of the object, and the second one measures image transparency. Experimental results show that the suggested algorithm can achieve a high detection rate of smoke approach to 92%.

The Indian (COPTA) Act 2003 sections aims to reduce tobacco smoke effects . Awareness and compliance to COPTA are key to achieving its intended outcome

chapter 1

INTRODUCTION

Smoke detection some time represents an early sign of most smokes. It is important to monitor air infection and its effects on human health; therefore, an effective method to detect smoke is necessary. The flame or smoke usually represents the first alarm that a smoke gives it. Flames may not be visible at monitoring cameras if the flames appear at a long distance far away or they are obscured by obstacles, such as buildings. the sensor device is an effective indicator of a smoke but identifying smoke in images is difficult because it lacks a specific shape or colour pattern.

The device used colour and saturation information in order to detect smoke in images. In general, a greyish colour of smoke is reasonably reliable. Smoke information is used for early smoke detection systems; therefore, smoke features are detected when smoke exhibits low heat and low saturation. earlier smoke detection algorithm is based on image processing for early smoke alarm systems. The algorithm depends on a chromatically effect which is based on static decision rule, while diffusion-affected by

dynamic decision criterion. The static decision relies on the greyish colour of smoke, and the dynamic decision rule is based on the spreading attributes of smoke, such as smoke disorder and growth rate. The greyish colour is described using the intensity component of the HSI colour system. Kopilovic et al. observed that irregularities occur in the motion of the objects because of the non-hardness of smoke. They applied a multilevel optical flow computation and the entropy of the motion distribution in the Bayesian classifier to detect the special motion of smoke.

Simone Calderara proposed a system able to smoke detecting by using means of the motion segmentation algorithm and both Wavelet Transform energy coefficients and image colour properties were used to detect process. Where the energy is analysed using the wavelet Transform coefficients evaluating its temporal evolution. The colourproperties of the objects are analysed accordingly to a smoke colour model to detect if colour changes in the scene are due to a natural variation or not and the adoption of a two contributions likelihood measure solves most of the emerged problems of each chosen feature and boosts up significantly the detection process Here, we propose new

techniques to implement in video to provide optimized results in smoke detection.

Section 1.1 EFFECTS OF SMOKING ON NON-SMOKERS

Figure 1.1 No Smoking Sign

Over time, secondhand smoke has been associated with serious health problems in non-smokers:

- Lung cancer in people who have never smoked.
- More likely that someone will get heart disease, have a heart attack, and die early.
- Breathing problems like coughing, extra phlegm, wheezing, and shortness of breath.

Secondhand smoke is especially dangerous for children, babies, and women who are pregnant:

- Mothers who breathe secondhand smoke while pregnant are more likely to have babies with low birth weight.
- Babies who breathe secondhand smoke after birth have more lung infections than other babies.
- Secondhand smoke causes kids who already have asthma to have more frequent and severe attacks.
- Children exposed to secondhand smoke are more likely to develop bronchitis, pneumonia, and ear infections and are at increased risk for sudden infant death syndrome (SIDS).

The only way to fully protect non-smokers from the dangers of secondhand smoke is to not allow smoking indoors. Separating smokers from non-smokers (like “no smoking” sections in restaurants), cleaning the air, and airing out buildings does not get rid of secondhand smoke.

section 1.2 PROPOSED SYSTEM

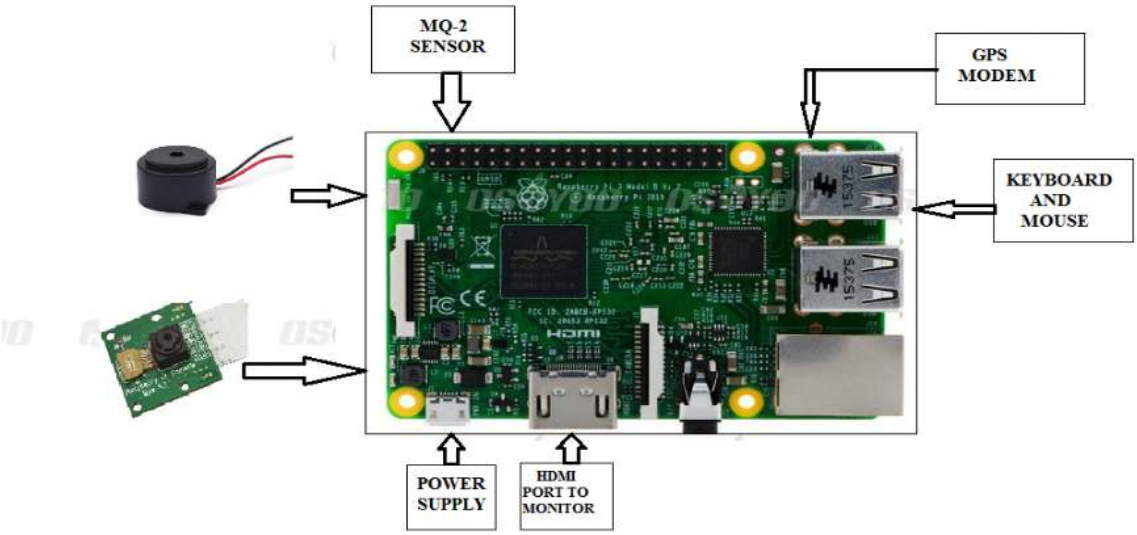


Figure 1.2 block diagram

According to this basic block diagram , we are going to implement the connections of components and ports. as smokes begin, the characteristics of smoke or flame are difficult to identify; however, as the intensity of smoke increases, the identification of properties becomes easy. Determining the characteristics of smoke is performed by image analysis. All the objects in the image are identified by changing the movement.

Smoke can be determined by the characteristics of its main parts. First, we convert input into a sequence of frames and determine objects of moving areas in an image by subtracting the frames to find all objects in each frame. Motion detection is also used, In addition to converting the image to HSV colour, we also use

models to analysecolour and intensity smoke candidate features. Furthermore, we remove or reduce undesirable lightness pixels and track the objects that meet the threshold and conditions. The standard deviation was calculated for each colour component (RGB) of the colours of the resulting object. We adopt the highest values and compare them with the characteristics of smoke to determine whether smoke is present.

chapter 2

LITERATURE SURVEY

Feinuiyuan proposed a fast accumulative motion orientation model based on integral image for video smoke detection. This model is able to mostly remove the disturbance of artificial lights and nonsmoke moving objects by using the accumulation of motion. This model combined with chrominance detection can correctly detect the existence of smoke.

JayavardhanaGubbi proposed a novel method for smoke characterization using wavelets and support vector machines. The results are good with limited false alarms rate. This proposed technique is evaluated for its characterization properties using motion segmented images from a commercial surveillance system with good results.

Yaqin Zhao proposed presents a novel smoke detection method of early forest fire video using CS Adaboost algorithm. Firstly, motion regions are extracted from two adjacent frames by a proper background model which can avoid false positives of some static factors which distract, such as blue sky and gray leaves. Then, a CS

Adaboost algorithm is used to identified smoke regions using centroid movement by means of smoke flutter, image energy on the basis of wavelet transform coefficients and color information between a reference smoke color and the input frame.coefficients and color information between a reference smoke color and the input frame.

A good and robust smoke detection technique based on image information. Firstly we extract moving objects of images as smoke candidate area in a pre-processing. Because smoke has a characteristic pattern as image information, we perform smoke patterns as appearence. Here we use texture analysis to extract feature vectors of images. To classify take-out dynamic objects are smoke or non-smoke, we use support vector machine(SVM) with texture features as input features.

Calderara et al. provided good state-of-the-art smoke detection in large indoor environments such as houses and outdoor areas. Their method is based on wavelet transform energy functions as well as image color properties. For classification, a Bayesian approach was applied with adaptation of a possibility function to energy ratio and color information. The authors concluded that a detection rate of smoke events achieved 100% but the false alarm rate was one

event every fourteen day during the day and two events every three days during the night surveillance conditions.

In work, Histograms of Oriented Gradients (HOGs) and Histograms of oriented Optical Flow (HOFs) were constructed in order to constructed the spatiotemporal descriptor for each "smoke" block from five neighboring frames. Then the SVM classifying was done. These research were continued by Ko et al and Barmpoutis et al.

For improvement in the smoke detection accuracy, Yang and Zheng proposed to use the Adaboost algorithm for smoke detection and classifier based on back propagation in NN. The Adaboostalgorithm include multiple NNs as a set of strong classifiers. The topology architecture of each NN includes 22 input nodes, 22 hidden nodes, and one output node. This approach provided an accuracy rate of 95.66% and false positive rate of 8.62%.

The first mapping was based on a feature vector as the concatenating histograms of edge orientation, edge magnitude and the LBP, color intensity, and saturation. As a result, many multi-scale divisions are generated by changing block sizes and partition schemes in order to produce the shape-invariant features.The

second mapping was built using statistical features (mean, variance, skewness, kurtosis, and Hu moments) calculated from block features. Then the AdaBoost algorithm was used to select the discriminative shape-invariant features from a feature pool.

The brief survey demonstrates different approaches. One can see the best results, when smoke is considered as a changing behaviour texture with the special properties in the spatiotemporal domain.

Chapter 3

HARDWARE

Section 3.1 Raspberry Pi 3 model B

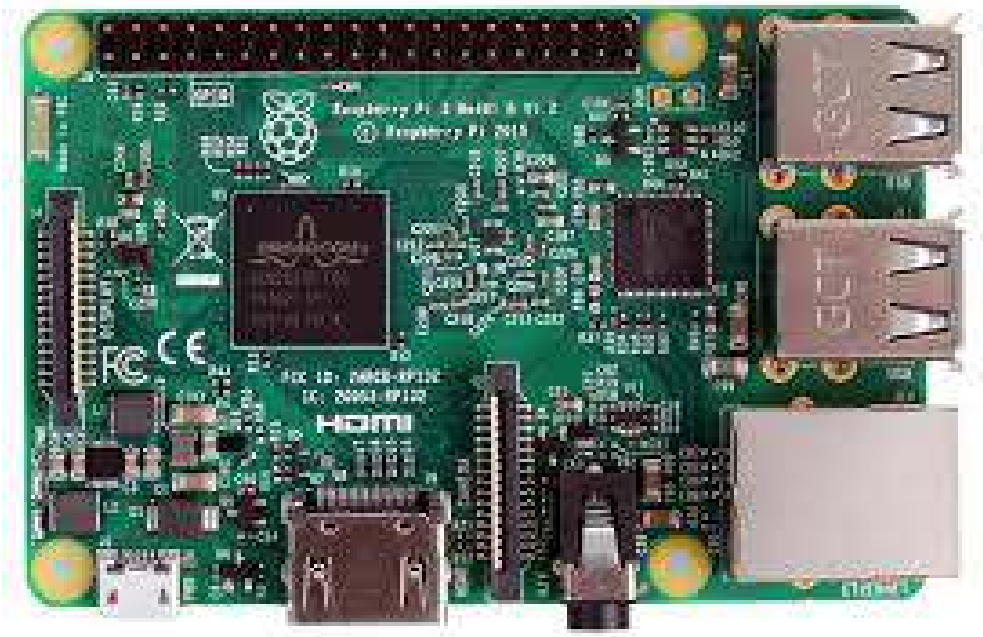


Figure 1.3 raspberry pi 3 module.

Raspberry Pi is a small single board computer. By connecting peripherals like Keyboard, mouse, display to the Raspberry Pi, it will act as a mini personal computer.Raspberry Pi is popularly used for real time Image/Video Processing,IoT based applications and Robotics applications.

Raspberry Pi is slower than laptop or desktop but is still a computer which can provide all the expected features or abilities, at a low power consumption.

The operating system for this module is preferred as Ubuntu Linux OS . The CPU speed of Raspberry Pi varies from 700 MHz to 1.2 GHz. Also, it has on-board SDRAM that ranges from 256 MB to 1 GB.

Raspberry Pi also provides on-chip SPI, I2C, I2S and UART modules.

There are different versions of raspberry pi available as listed below:

- Raspberry Pi 1 Model A
- Raspberry Pi 1 Model A+
- Raspberry Pi 1 Model B
- Raspberry Pi 1 Model B+
- Raspberry Pi 2 Model B
- Raspberry Pi 3 Model B
- Raspberry Pi Zero

Section 3.2 Camera

Figure 1.4 Raspberry Pi camera module.

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.

Features

- 5MP sensor
- Wider image, capable of 2592x1944 stills, 1080p30 video
- 1080p video supported

- CSI

The camera consists of a small (25mm by 20mm by 9mm) circuit board, which connects to the Raspberry Pi's Camera Serial Interface (CSI) bus connector via a flexible ribbon cable. The camera's image sensor has a native resolution of five megapixels and has a fixed focus lens. The software for the camera supports full resolution still images up to 2592x1944 and video resolutions of 1080p30, 720p60 and 640x480p60/90. The camera module is shown below:

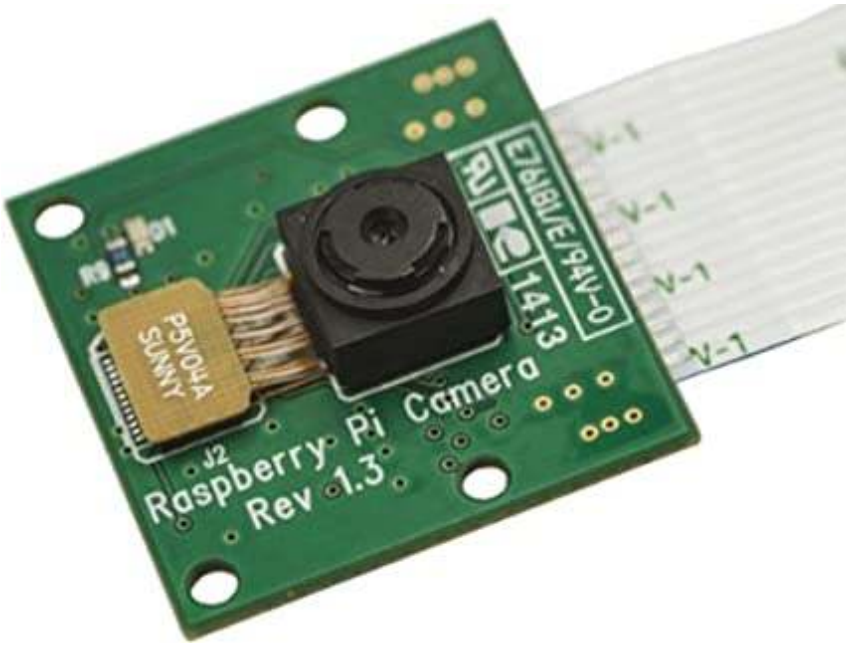


Figure 1.5 camera with 5mp

- The flex cable inserts into the connector situated between the Ethernet and HDMI ports, with the silver connectors facing the HDMI port. The flex cable connector should be opened by pulling the tabs on the top of the connector upwards then towards the Ethernet port. The flex cable should be inserted firmly into the connector, with care taken not to bend the flex at too acute an angle. The top part of the connector should then be pushed towards the HDMI connector and down, while the flex cable is held in place.
- Update the SD card

In order to use the camera you must be using a recent operating system that knows that the camera exists. The easiest way to do this is to grab the latest Raspbian image from the RaspberryPi.org site and create a fresh SD card.

Section 3.3 GPS module with RS232 Port

Figure 1.6 GPS module.

Global Positioning System (GPS) makes use of signals sent by satellites in space and ground stations on Earth to accurately determine their position on Earth. Radio Frequency signals sent from satellites and ground stations are received by the GPS. GPS makes use of these signals to determine its exact position. The GPS itself does not need to transmit any information.

Using the speed of the signal, the distance between the satellites and the GPS receiver can be determined using a simple formula for distance using speed and time. Using information from 3 or more satellites, the exact position of the GPS can be triangulated.

The GPS receiver module uses UART communication to communicate with controller or PC terminal. Before using UART on Raspberry Pi, we should configure and enable it.

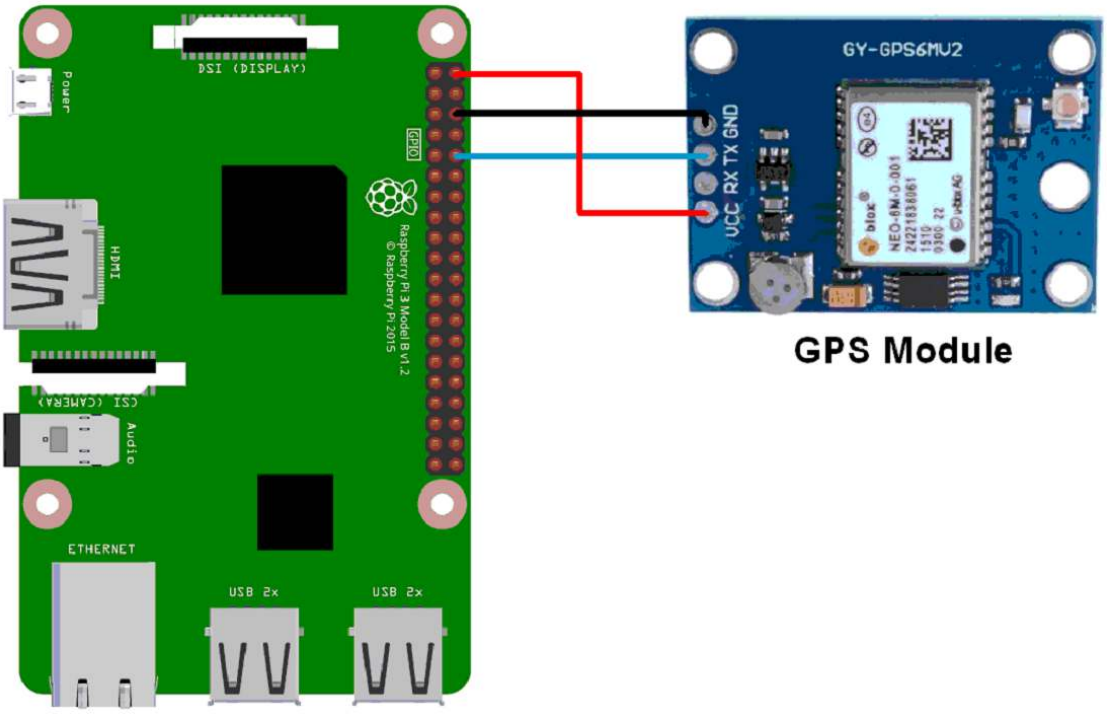


Figure 1.7 interfacing diagram of gps module.

Section 3.4power supply

The Raspberry Pi 3 is powered by a +5.1V micro USB supply. Exactly how much current (mA) the Raspberry Pi requires is dependent on what you connect to it. We have foundthat purchasing a 2.5A power supply from a reputable retailer will provide you with ample power to run your Raspberry Pi.

The power requirements of the Raspberry Pi increase as you make use of the various interfaces on the Raspberry Pi. The GPIO pins can draw 50mA safely, distributed across all the pins; an individual GPIO pin can only safely draw 16mA. The HDMI port uses 50mA, the camera module requires 250mA, and keyboards and mice can take as little as 100mA or over 1000mA! Check the power rating of the devices you plan to connect to the Pi and purchase a power supply accordingly.

Back powering

Back powering occurs when USB hubs do not provide a diode to stop the hub from powering against the host computer. Other hubs will provide as much power as you want out each port. Please also be aware that some hubs will back feed the Raspberry Pi. This means that the hubs will power the Raspberry Pi through its USB cable input cable, without the need for a separate micro-USB power cable and bypass the voltage protection. If you are using a

hub that back feeds to the Raspberry Pi and the hub experiences a power surge, your Raspberry Pi could potentially be damaged

Section 3.5 Buzzer

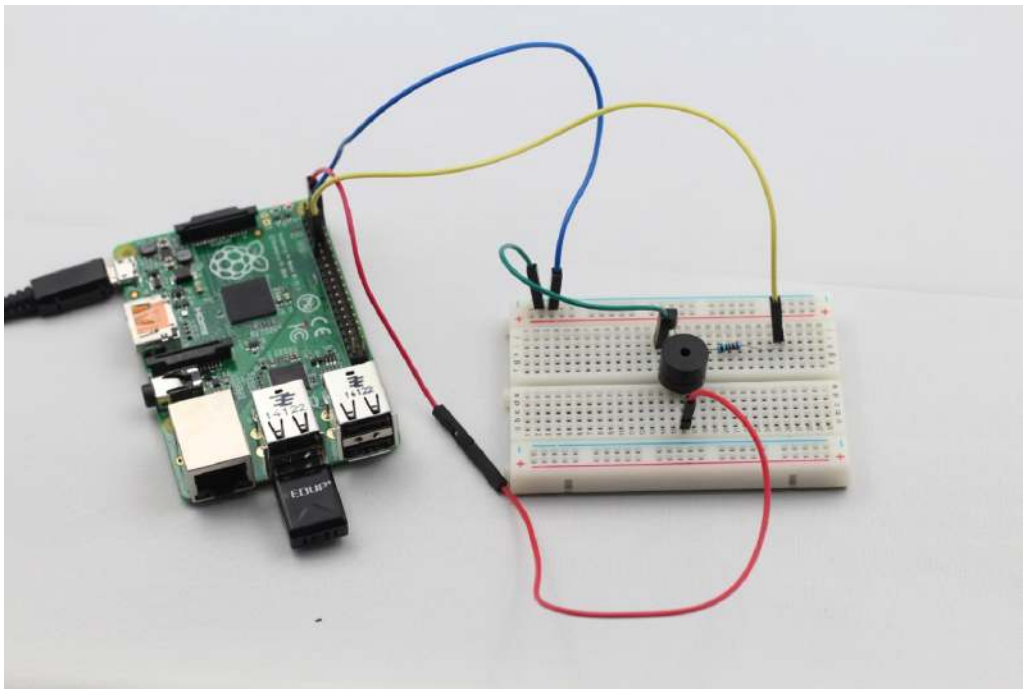


Figure 1.8 interfaced buzzer.

As a type of electronic buzzer with integrated structure, buzzers, which are supplied by DC power, are widely used in computers, printers, photocopiers, alarms, electronic toys, automotive electronic devices, telephones, timers and other electronic products for voice devices. Buzzers can be categorized as active and passive ones (see the following picture). Turn the pins of two buzzers face

up, and the one with a green circuit board is a passive buzzer, while the other enclosed with a black tape is an active one.

Figure 1.9 buzzer

The difference between an active buzzer and a passive buzzer is: An active buzzer has a built-in oscillating source, so it will make sounds when electrified. But a passive buzzer does not have such source, so it will not beep if DC signals are used; instead, you need to use square waves whose frequency is between 2K and 5K to drive it. The active buzzer is often more expensive than the passive one because of multiple built-in oscillating circuits.

In this experiment, an active buzzer is used. When the GPIO of Raspberry Pi output is supplied with low level (0V) by programming, the transistor will conduct because of current

saturation and the buzzer will make sounds. But when high level is supplied to the IO of Raspberry Pi, the transistor will be cut off and the buzzer will not make sounds.

Section 3.6 MQ2 sensor

Figure 1.10 smoke sensor .

The MQ-2 smoke sensor reports smoke by the voltage level that it outputs. The more smoke there is, the greater the voltage that it outputs. Conversely, the less smoke that it is exposed to, the less voltage it outputs.

The MQ-2 also has a built-in potentiometer to adjust the sensitivity to smoke. By adjusting the potentiometer, you can change how sensitive it is to smoke, so it's a form of calibrating it to adjust how

much voltage it will put out in relation to the smoke it is exposed to.

We will wire the MQ-2 to a raspberry pi so that the raspberry pi can read the amount of voltage output by the sensor and output to us if smoke has been detected if sensor outputsa voltage above a certain threshold. This way, we will know that the sensor has, in fact, detected smoke.

The concentration of a gas is given in PPM (parts per million). One difficulty of the MQ-2 is that a single analog value is given with which the gas content in the air has to be calculated for the various supported gases. However, the sensor must be configured for this purpose. Since this manual is also applicable to another Raspberry Pi gas sensor,the procedure is as follows:

First, we have to see the data sheet of the respective module, which contains a diagram:

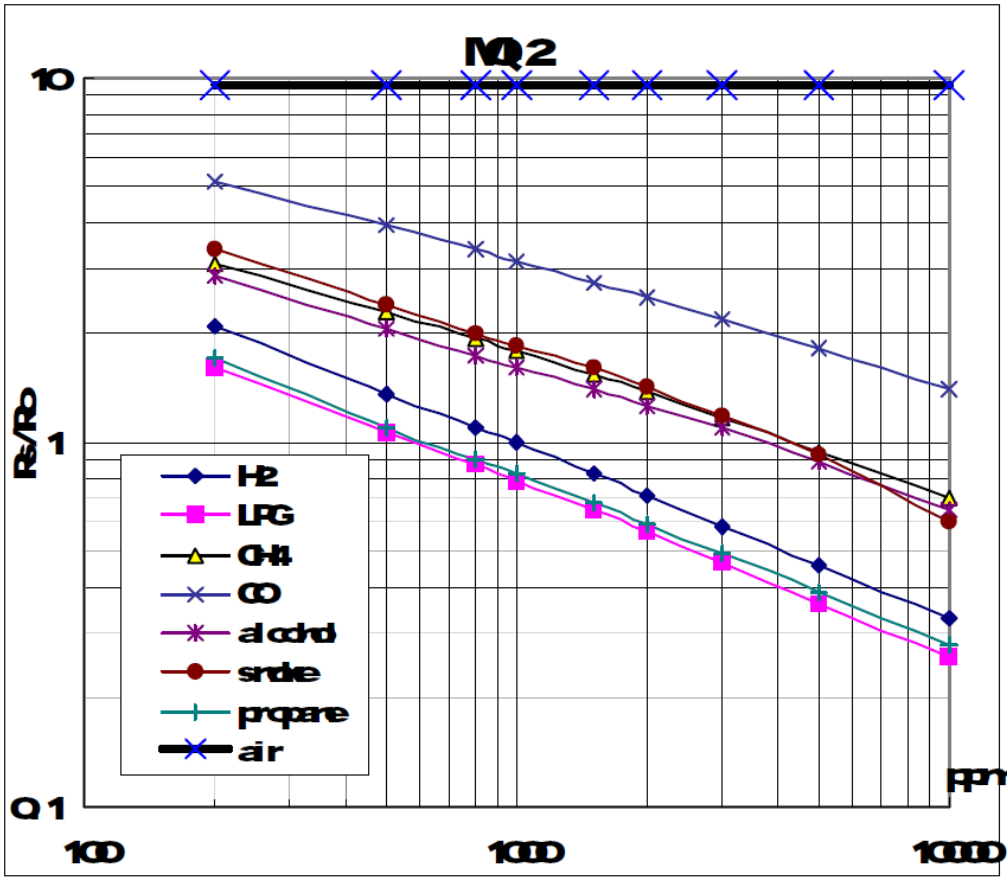


Figure 1.11 data sheet of specified value.

However, the scaling of the values is not linear but logarithmic to the base 10 (log). so, the first stroke on the X axis is 200, then 300, etc. The first stroke after 1000 is 2000, etc. The distance between is linear. The idea behind this scriptfor calibration and reading is to

create a straight line and calculate the amount of gas (in ppm). To do this, we need two points to calculate the slope.

Let us take the example of LPG. We therefore take the point P1 (x = 200, y = ~ 1.62) and P2 (x = 10000, y = ~ 0.26). To calculate the "real" values, we apply the ten logarithm. Using the two-point form, we can calculate the slope, which in our case is -0.47 (link to the calculation). With the slope and the calculated logarithm from the left point (x = 2.3, y = 0.21), we can now determine the straight line.

Chapter 4

SOFTWARE

Section 4.1 Python 3

Python is a general-purpose interpreted, interactive, object-oriented, and high-level programming language. It was created by Guido van Rossum during 1985- 1990. Like Perl, Python source code is also available under the GNU General Public License (GPL). Python is named after a TV Show called ëMontyPythonís Flying Circusí and not after Python-the snake.

Python 3.0 was released in 2008. Although this version is supposed to be backward incompatibles, later on many of its important features have been backported to be compatible with version 2.7.This tutorial gives enough understanding on Python 3 version programming language.

- **Python is Interpreted** − Python is processed at runtime by the interpreter. You do not need to compile your program before executing it. This is similar to PERL and PHP.

- **Python is Interactive** − You can actually sit at a Python prompt and interact with the interpreter directly to write your programs.
- **Python is Object-Oriented** − Python supports Object-Oriented style or technique of programming that encapsulates code within objects.
- **Python is a Beginner's Language** − Python is a great language for the beginner-level programmers and supports the development of a wide range of applications from simple text processing to WWW browsers to games.

Subsection 4.1.1 Characteristics of Python

Following are important characteristics of python −

- It supports functional and structured programming methods as well as OOP.
- It can be used as a scripting language or can be compiled to byte-code for building large applications.
- It provides very high-level dynamic data types and supports dynamic type checking.
- It supports automatic garbage collection.

- It can be easily integrated with C, C++, COM, ActiveX, CORBA, and Java.

Subsection 4.1.2 Applications of Python

As mentioned before, Python is one of the most widely used language over the web. I'm going to list few of them here:

- **Easy-to-learn** − Python has few keywords, simple structure, and a clearly defined syntax. This allows the student to pick up the language quickly.
- **Easy-to-read** − Python code is more clearly defined and visible to the eyes.
- **Easy-to-maintain** − Python's source code is fairly easy-to-maintain.
- **A broad standard library** − Python's bulk of the library is very portable and cross-platform compatible on UNIX, Windows, and Macintosh.
- **Interactive Mode** − Python has support for an interactive mode which allows interactive testing and debugging of snippets of code.
- **Portable** − Python can run on a wide variety of hardware platforms and has the same interface on all platforms.

- **Extendable** − You can add low-level modules to the Python interpreter. These modules enable programmers to add to or customize their tools to be more efficient.
- **Databases** − Python provides interfaces to all major commercial databases.
- **GUI Programming** − Python supports GUI applications that can be created and ported to many system calls, libraries and windows systems, such as Windows MFC, Macintosh, and the X Window system of Unix.
- **Scalable** − Python provides a better structure and support for large programs than shell scripting.

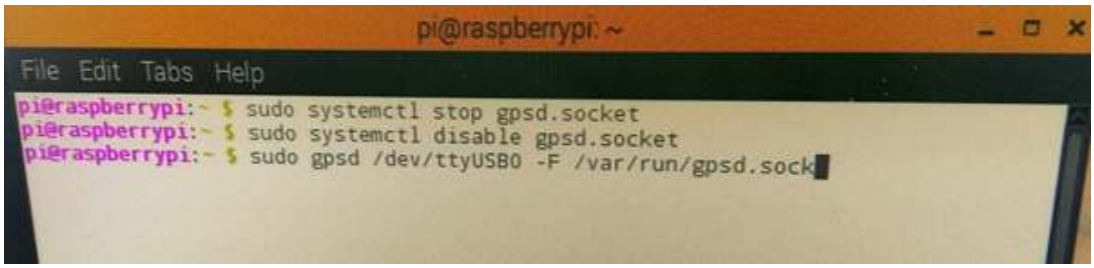


Figure.1.13 Commands used to run the raspberry pi.

ADVANTAGES

- Image Processing in smoke detection is the ability to serve large and open spaces.
- Raspberry pi has higher specification.

CHAPTER 5

EXPERIMENTAL EVALUATION

5.1 EXPERIMENT

In order to facilitate the subsequent data processing, we needplentyofdatatoverifythereliabilityofMQ-2.Firstofall, we need to collect the smoke concentration.

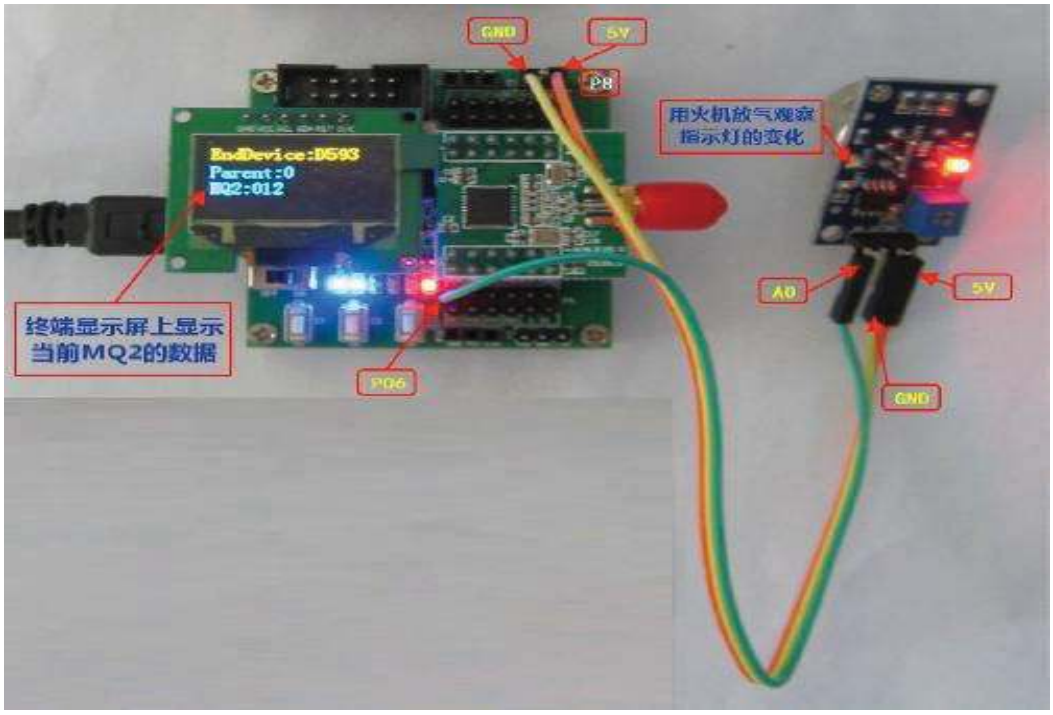


Figure7. Physical wiring diagram

The electrical conductivity increases with the increase of the concentration of combustible gas, when the MQ-2 gas sensor is in the combustible gas environment. We connect the circuit as of MQ-2 connects with rasiberry pi.wecanreadthesmokeconcentrationvalueThedataiscollectedevery5 seconds.

We obtained a series of smoke concentration data, through the measurement indoor and outdoor. We select 400 sets of data from all of the experimental data. The output of MQ-2 in smoke.

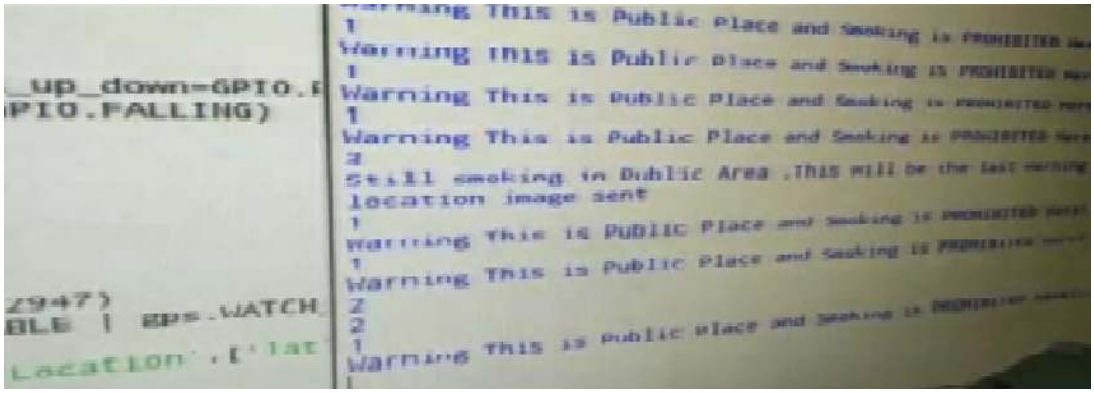
RESULTS AND DISCUSSION

In this study, when smoke detector sense the cigarette smoke by the person smoking in the public places(nearby school, hospital, transport terminal..), first it gives an warning to a person who is smoking and also if they don't care about the warning(buzzer's sound).Secondly by camera it captures the picture of that person and send to the nearest police station.

By GPS modem it tracks the person's approximate location(latitude and longitude) and the data sent to the nearest police station (through wireless medium such as mail or message)

Figure. 1.12 output image

Location:latitude: 12.931916667 , longitude: 77.583526667



CONCLUSIONS

This paper proposed a smoke detection algorithm which is free from sensors as the ordinary smoke detection systems contain. The objective of this paper was to create a system which would be able to detect smoke as early as possible from a live image feed. System is expected to detect smoke while it is still small and has not grown to mammoth proportions. Also, the hardware is minimal and has been already existent in places, thus saving capital. It also saves cost by getting rid of expensive temperature and heat sensors etc. Based on the results produced, the system has proven to be effective at detecting smoke. This system is an amalgamation of various smoke detection algorithms.

CHAPTER 6

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