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Design and Implementation of Autonomous Fire Fighting Robot and Monitoring Through Raspberry Pi Controller

S.Keerthana[1], G.Shamini[2], S.Ugenthar[3], Dr.R.Arivahahan[4]

Department of Electrical and Electronics Engineering, SRM Valliammai Engineering College, Kattankulathur, Tamilnadu, India

ABSTRACT: Firefighters have a vital role to play, but they also work in a hazardous environment. It is expected of this robot to locate a fire before it is big. It might be used to work with firefighters to lessen the likelihood of victims being injured. Hardware and Software are the two components ofrobot creation. For drive systems, robots have two DC motors. As feedback to the robot, various sensors such as ultrasonic sensors, flame sensors, DHT11 sensors, MQ2 sensors, MQ135 sensors, and so on are connected to RASPBERRY PI. To determine the robot action gain from sensor inputs,the programming section use the PYTHON programming language.

KEYWORDS: Fire Robot, Raspberry PI, Python, DC Motor, DHT 11 sensor,MQ2 Sensor, MQ135 Sensor

I.INTRODUCTION

Fire, smoke and flames are one of the leading hazards which are affecting everyday life around the globe. In recent times fire safety has become an important issue for both residential and industrial areas. In Bangladesh, fire incidents kill 233 people and injure about 5,000 every year. Fire causes losses of properties and goods worth Taka 4,834 crore per year. In last six years alone,the estimated loss due to fire incidents is about 29000 crore. Extinguishing a fire is a destructive procedure. To prevent more damage and to evacuate the victims to a safer position away from the danger zone, firefighters must be able to rapidly turn off the fire and extinguish it safely.

The technological gap between fire and machinery has now been bridged, allowing for extra efficient and effectives fire extinguishing solutions. Our proposed robotics system is basically an autonomous system which detects and extinguishes fire. The first and the most important part is todetect fire correctly. Failure to detect fire may lead to great damage. Robots are programmed to locate fire before it spreads out of control. One day, robots may be able to assist firefighters in reducing the chance of hurting victims. Fire Robots is a game about a fictional firefighter who savespeople and puts out fires. Fire-fighting robots move autonomously over the field, attempting to saveas many victims as possible while also extinguishing the fire within the time limit.

II. LITERATURE SURVEY

Title: Fire Extinguishing Robot using Arduino
Authors : AbdülkadirÇAKIR ,Nyan Farooq Ezzulddın Year: 2017
Description:
In this analysis, the aim of the mobile firefighting robot application is to search for a fire created in some way with a flow chart in the labyrinth, and to extinguish the fire when a fire is found with the help of a fan. A number of mechanical and electronic components were provided for this purpose, and a mobile robot was assembled. In order to perform the intended functions, the constructed robot was eventually programmed. Touch video is being used (such as a camera, etc.).

Title: Fire Extinguishing Robot using IoT
Authors : E Author - Prof. Sankalp Mehta , Sujata Tupale , Shilpa Kappalguddi, Sangharsha Madvanna , Rakshanda Patil
Year: 2017 Description:
The fire extinguishing robot that detects fire based on IoT. The purpose of the system proposed is to control the robot through an android application. The robot will patrol the prescribed area. The firefighting robot is wirelessly connected

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with the Node MCU. If a node senses fire, it will alert the Central Node MCU which will give information to fire safety officers and activate robots to perform firefighting actions and start the pump to extinguish the fire.

Title: Fire Fighting Robot
Authors:Sapkal Saraswati, Mane Bharat, Prof.V.U.Bansude, MakhareSonal Year: 2018
Description:

This robot mainly deals with the capturing images, videos, keeping systematic review of temperature, notifing fire, identification of the things that block the way and maintain internet server from android based mobile which has been connected wirelesly to this robot. Some of the major devices used here are sensor-IR, temparature, smoke, micro controller chip, motors, display screen, signalling buzzer, phone etc...The passive IR based sensor it as an ability to observe the presence of human being or else any animals within its range and signals the controller. Another sensor used is centigrade detecting sensor, by using this it will get to know the hotness of the surroung area. components used hereare cost effective, consumption of low power, no noise ofelectrical parts, light weight, highly sensitive to observationand reduction of space consumption. the important advatage of this robot can controlled automatic or manual mode.

Title: Development of Fire Fighting Robot
Authors : Nor Samsiah Sani, MI Yusof, Mohd Aliff, Azavitra Zaina Year: 2017
Description:

The front and back portion of moving object is covered by couple of wheels and it support the robot to balance. The body part can make turn of anti clock and clock wiseabout (0- 360)degree rotation. The outer body is covered with the protecting shield or plate manufactered from (acrylic)metal. It can with stand up to an some extent of 200 kelvins. Major sensors were placed in front portion of the device, depending up on there supremancy in the area of work, allocation of the parts are placed. As per this project the important piece of this robot is water-pump .The mixture of saop (foam) or water are used to suppers the fire. when a fire has detected by flame sensor the motor automatically stops at some parrallel distance and sprinkles the water. the camera which has been mounted can also notice the fire ,intern video can be seen in smart phone.

Title: FIRE FIGHTING ROBOT
Authors : Sahil S.Shah, Vaibhav K.Shah, Prithvish Mamtora and Mohit Hapani Year: 2018
Description:

The objective of this device is to decerease the cause of air pollution and also subconsciously notice and supress fire. Basically this robot follows the strip line and moves. when a disturbance is set up a way it can cross the path way and moves forward. Secondly it as lidar and reciever ,depending upon the identification fire these things helps to move the motor towards fire. After the wipe out of fire the robot will comeback to his native place. We can also make use of CO2 in place of fire suppressing agents like water and detergants. The reduction in consumption of fluent use of power in battery is the boan to this project

III. PROPOSED TOPOLOGY

The Block diagram of Autonomous fire fighting robot and monitoring through Raspberry picontroller is shown in Figure 1. The main elements are: Environmental Process Parameter MeasuringSensors, Raspberry pi, Camera, DC Motor. The Environmental Process Parameter measuring sensorsare: Temperature and Humidity (DHT 11 Sensor), MQ2 Sensor, MQ135 Sensor, Flame Sensor, Ultrasonic Sensor. The measured Environmental Process Parameters are applied to the Raspberry piMicrocontroller which is connected with the computer, Mobile phones or Tablets.

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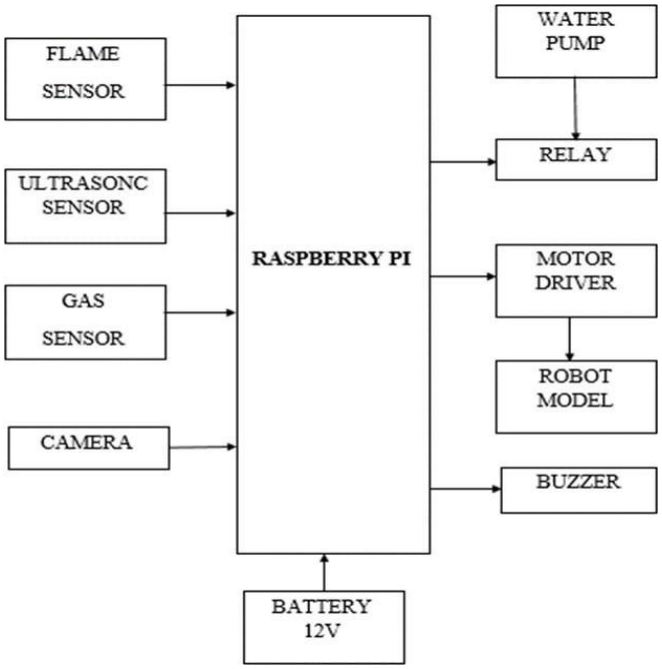

Fig 3.1 Basic Block of Proposed System

IV.IMPLEMENTATION OF AUTONOMOUS FIRE FIGHTING ROBOT

This system basically a moving robot it moves with the help of dc motor driven by dc motor driver and finds the fire, poisonous gases and hazardous gases with the help of different sensors. If any above consequences were detected system will automatically alerts the perspective sensors and remedies will be taken immediately.

Fire-fighting robot can be easily and conveniently used and operated automatically when any fire incident occurs in educational, industrial and hospital areas to save human life. Fire-fighting Robot comprises of numerous sensors and motors, and has small in size, less in weight, with rechargeable batteries, in result it requires less space. Prototype provides us greater efficiency to detect the flame, temperature and gas presented in the affected area. The extinguisher robot effectively extinguishes fire before it becomes uncontrollable and gives threat to life. Fire-fighting robot also successfully move away if any obstacle detected on the path using ultrasonic sensors.

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V. HARDWARE AND SOFTWARE IMPLEMENTATION

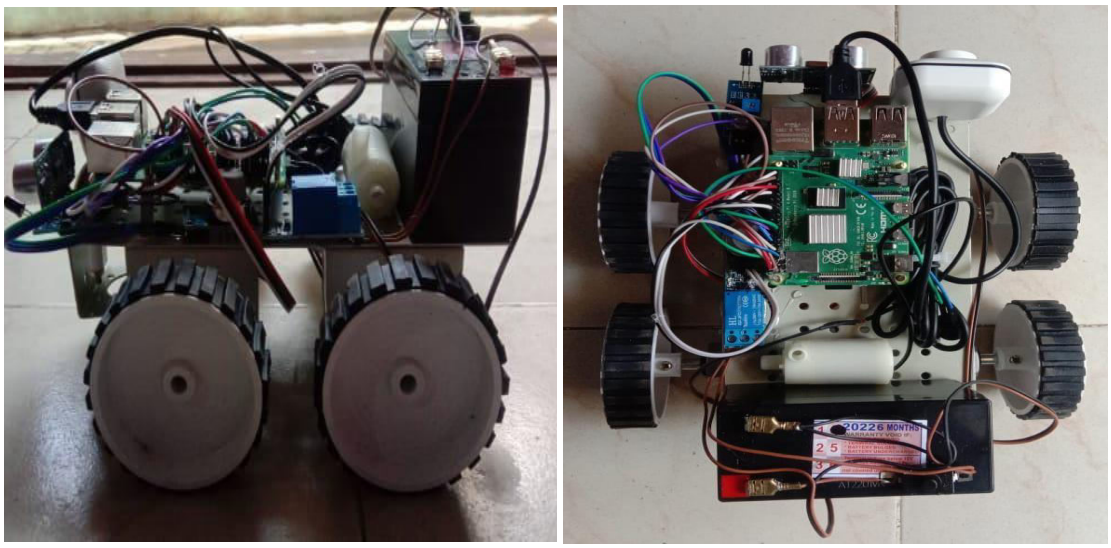

Fig 5.1 Hardware setup

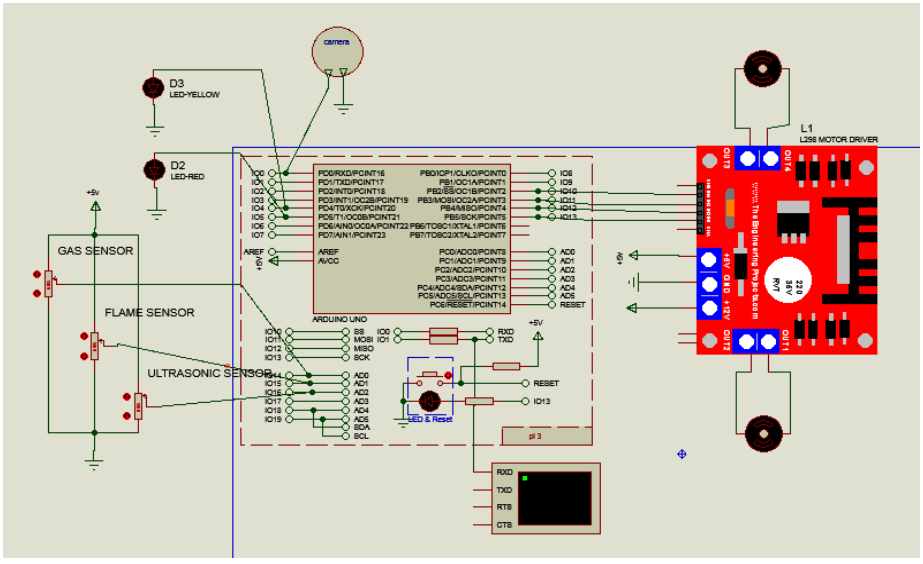

Fig 5.2 Simulation Diagram

Simulink is a graphicals programmings environments for modellings, simulatings, and analysings multidomain dynamical systems developed by MathWorks. Its main interface consists of a graphicals blocks diagrammings tools and a sets of blocks collections that can be customised. Simulink is a multidomains simulations and Models- Baseds Designs tool that is frequently useds in automatics controls and digitals signals processing. To examine and initially validate the theoretical analysis, simulations are run using PROTEUS software.

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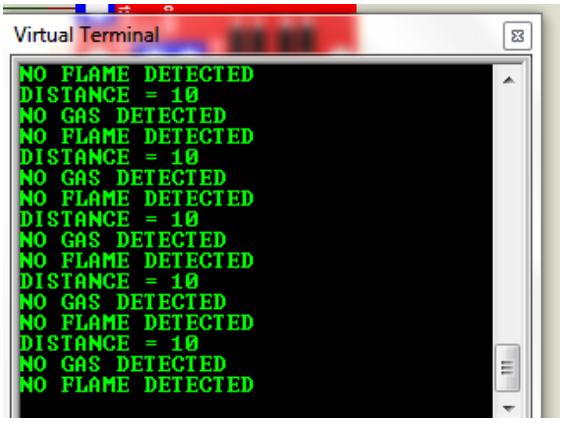
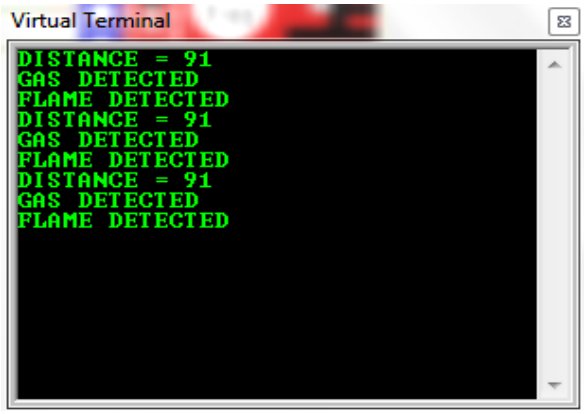
VI. RESULTS AND DISCUSSION

This is the output result obtained from the simulation which is run in PROTEUS software,here one of the output result shows that the presence of flame ,gas in the environment by fire and gas sensors. If there is no presence of flame and gas it will shows that no gas and flame which is shown above in one of output results.





VII. CONCLUSION

We have successfully designed and interfaced our fire-fighting robot with different sensors. Since the video of the environment live streamed by the camera to the user produces a delay of around 20milliseconds, the robot can be used to handle real time with different intensities is not appreciatedand can be fatal so in future usage of fire extinguisher is proposed. If the environment is badly affected then due to high humidity webcam may not produce clearer video of the surrounding and relying only on sensors can be used which by reading the heat signature of the objects finds out the regions in fire.

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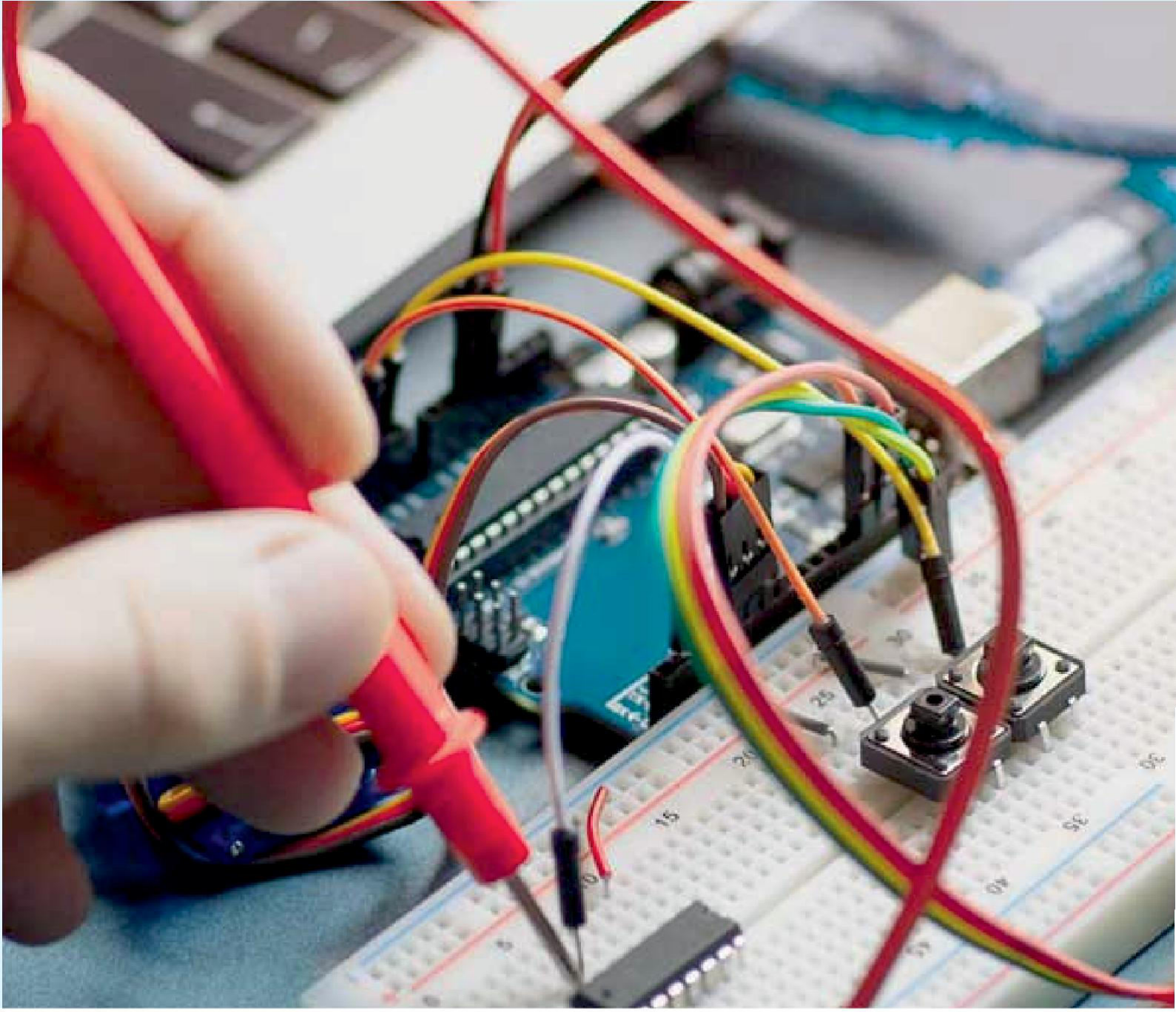

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