ARDUINO BASED AUTONOMOUS FIRE FIGHTING ROBOT

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ABSTRACT: This is the firefighting robot that detects the fire in place and emerges the person around there also it extinguishes the fire. In race with technology it is automated rover kind. It also can be manually operated according to mode of operation. In the event of explosion or fire in tanks it eventually helps fire fighter by settling the fire at the core also it settles the spreading of fire in hazardous area. It will have many lives fire fighter who eventually take risks during fire accident. This firefighting robotic system is powered by Arduino Uno development board and with manual control. It consists of the Flame sensor mounted on a DC motor for obstacles detection and free path navigation, it is also equipped with the fire flame sensor for detecting and approaching fire it also makes use of water tank and spray mechanism for extinguishing the fire. Water spraying nozzle is mounted on DC motor to cover maximum area. Water is pumped from the main water tank to the water nozzle with the help of pump. This water pump needs driver circuit as it consumes a lot of current, much more than the controller provides. There is a manual control which can be controlled using our android mobile phone with Bluetooth technology. It is a movable robot that consists of gas sensor for detecting the fire, gear motor and motor driver for the movement of the robot, relay driver for pump control and a Bluetooth module which are used for the detecting and extinguishing the fire. Usually, the robot moves at a steady speed. When the gas sensor detects the fire in the environment, the signal indicating the presence of fire will be sent to the Arduino through which the extinguishing is done. In the extinguishing process, whenever the detection of fire is

positive the robot will stop at the place of fire occurred and starts the pump and sprinkle water through a sprinkler until the Fire is put off. The entire control is achieved using Arduino which is interfaced with the android mobile via Bluetooth module, so that the control of the robot can be made from an android mobile as well.

Keywords: Bluetooth technology, Motor driver & Arduino INTRODUCTION

Nowadays, machinery and robotic design become important in helping human. This Fire Protection Robot was design to help people in any destructive burnt situation where this robot can extinguish burnt area immediately using autonomous system. This autonomous system will be designed using programming in PIC18F4550 and others additional circuit.

WHY DO WE NEED ROBOT?

The real reasons why mechanical technology will be the technology of our future, and a fundamental one? While the democratization of robots is rendering them more present in our day by day lives, a great many people have still blended sentiments about what's to come. Numerous whole-world destroying films have portrayed a future where either the robots are annihilating the people or subjugating them. Maybe a couple (or even none) have done the inverse.

OBJECTIVES

To study a robot which can search, detect and extinguish burnt area immediately and develop a program using PIC18F4550 to control the movement of the robot. To design the robot that includes the flame sensor to detect the fire and extinguish automatically. To analyze how the robot performance to detect the angle of burnt area in front of the robot and detecting burnt area in $0m \sim 2m$ in radius.

SCOPES

The robot detecting burnt area in $0m \sim 2m$ in radius.Robot detect fire event, and use extinguish to fight the fire source and the Bluetooth connected to the programmable device.The robot can turn 360° and then robot can extinguish fire at angle 30° from the fire extinguisher nozzle. The robot can extinguish fire from petrol, gasses and electrical appliance.

PROBLEM STATEMENT

The security of home, laboratory, office, factory and building is important to human life. We develop security system that contains a fire protection robot using sensor. The security system can detect abnormal and dangerous situation and notify us. First, we design a fire protection robot with extinguisher for the intelligent building. Besides, Human had difficulties to detect the small burnt cause by electrical appliances. The late time user takes to extinguish the fire. User may take a late time to extinguish fire like finding the water source to extinguish fire when want to extinguish the fire. The fire difficulties to detect the small burnt area and location that is hard to be reach by the user. Sometimes tough fire extinguished for example spaces are hard to see. Besides is cost the loss suffered in the event of fire slow to act.

LITERATURE SURVEY

J. Reinhart V. Khandwala (2003) was et all discussed about design and the implementation of the fire fighting robot. The key design elements of the robot to be discussed include: the assembly and construction of the robot hardware, the processing algorithm based on the sensors response, and the navigation algorithm that will enable the robot to find an efficient path in and out of the house model. Lynette Miller Daniel Rodriguez (2003) was all discusses the development of each component of the robot that is designed to find a small fire represented by a light emitting diode in a model home and extinguish it. This paper will talk about each component of the robot from the start signal to the robot platform to the line following and room finding and finishing with the fire detection. Sahil S. Shah (2013) was all discussed about design a FIRE FIGHTING ROBOT using embedded system. A robot capable of fighting a simulated household fire will be designed and built. It must be able to autonomously navigate through a modelled floor plan while actively scanning for a flame. The robot can even act as a path guider in normal case and as a fire extinguisher in emergency. Robots designed to find a fire, before it rages out of control, can one day work with firefighters greatly reducing the risk of injury to victims. The result shows that higher efficiency is indeed achieved using the embedded system. U. Jyostna Sai Prasanna, M.V.D. Prasad (2013) was design the fire detection system using four flame sensors in the fire fighting robot, and program the fire detection and fighting procedure using sensor based method. The fire fighting robot is equipped with four thermostats/flame sensors that continuously monitor the temperature. If the temperature increases beyond the predetermined threshold value, buzzer sounds to intimate the occurrence of fire accident and a warning message will be sent to the respective personnel in the industry and to nearby fire station with the GSM module provided to it. Swati A. Deshmukh (2015) was all discussed about the fire detection system using sensors in the system, and program the fire detection and fighting procedure using sensor based method

MATERIALS AND METHODS INTRODUCTION

As discussed earlier, the Block Diagram consists of several components which are used for the control and interfacing of the android controlled fire-fighting robot. The Main components that are used in this firefighting robot are given below. In this project, a smoke sensor is used to detect the occurrence of the fire in the surrounding environment. Actually here a smoke sensor is connected to a circuit which produces an analog output when the fire is detected. This analog output is connected to the Arduino pin as interrupt signal. A motor driven program or a part of it is written in the interrupt service routine which is executed when the sensor output is high (interrupt signal to Arduino). A water sprinkler mechanism is connected to the shaft of the dc motor, which will sprinkle the water and extinguish when the fire is detected by the sensor.



FIGURE: 1 BLOCK DIAGRAM

Methodology Flowchart

A Mmethodology is a collection of methods, practices, processes, techniques, procedures, and rules. In project management, methodologies are specific, strict, and usually contain a series of steps and activities for each phase of the project's life cycle. They're defined approaches that show us exactly what steps to take next, the motivation behind each step, and how a project stage should be performed.



FIGURE 2: METHODOLOGY FLOWCHART

The methodology flowchart during the progress in completing the Arduino Based Autonomous Fire Fighting Robot. The methodology flow chart first starts the project and then analyze the project depends the objective and scope project. Describe the literature review of the project and define the implement of the methodology part. The system can be categorized into three parts at the methodology. First part mechanical part, second part is hardware part and last part the system is software part. Than combine the three of part and then testing for the complete flow system. The progress of designing an Arduino based autonomous fire fighting robot will be discussed in detail. Therefore, this chapter deals with the actual design and construction of the system.

EXPERIMENTAL SETUP AND PROCEDURE INTRODUCTION

The need for a robot or a device that detects and extinguishes fire on its own is long past due. Fire accidents originate when someone is either sleeping or not at home or due to some carelessness in laboratories, stores etc. By inventing such a device, humans as well as property can be saved at higher rate with minimum damage caused by the fire. As instrumentation engineers, our task was to design and build a prototype system that could autonomously detect and extinguish a fire and also aims at minimizing the air pollution. The possibilities of fire are at any remote area or in an industry such as in garments go down, cotton mills, and fuel storage tanks, electric leakages may result in terrible fire & harm. To the worst case of accidents, fire causes heavy loss both financially and by taking lives. These robots are the best possible way, in orders to guard life of humans, surroundings and wealth. It can navigate alone actively and scan the presence of fire and extinguish t. In cases this robot can be used as an emergency device. It is designed in such a manner that could identify the fire as soon as the fire catches and extinguish before the fire spread out and cause heavy damage. The firefighting robot will have future scope that it can work with firefighters, which greatly reduce the danger of injury to victims. It is an innovative work in the field of robotics that operates towards a sensible and obtainable access to save the lives and prevents the danger to property.

MECHANICAL PART DESIGN

This sub-topic will discuss about the mechanical part design of the Autonomous Fire Fighter Robot. The body kit is used to protect the electronic circuit from the any obstacles especially liquid where it may cause the electronic circuit malfunction. The designing of robot body kit were based on ideas below: Base on the functions that the robot will perform, Determine where to place the internal components that will necessary to make the robot operational, Minimize the weight of load that the robot carrying to reduce the power needed by the robot, and Minimize the gravity centre for easy to spot the stability point while static or moving condition. The microcontroller validates the SMS and then perform specific task on the device.

MECHANICAL DESIGN STRUCTURE

This robot contains two wheels at rear side and one free wheel at front side. The free wheel used to stabilize the robot and use to rotate the robot 360° .







FIGURE 3: MECHANICAL DESIGN STRUCTURE

| | CODE FUNCT | TION |
|---|------------|--------------------------|
| | А | IR sensor |
| | В | ARDUINO UNO |
| | С | DC Motor |
| | D | Motor Driver |
| | Е | Water Pump |
| | F | Robot Chassis |
| | G | Relay Module |
| | н | Hose |
| | I | Buzzer |
| | J | Bluetooth Module |
| | K | Nozzle |
| 1 | L | Battery |
| | М | Front Wheel (Free Wheel) |
| | N | Back Wheel |

For the main structure of the robot, to get the preferred movement and speed, it has two wheels at rear side and two wheels at front side. The wheels have the ability to stabilize the robot and make rotation until 360 degrees. The flame sensor was installed at front of the robot to detect the fire respectively.

SOFTWARE ARCHITECTURE

To program Arduino UNO R3, there is a need for the open source Arduino IDE software that the card manufacturer company written. This is a software programming that is written by Java language which is used to program the Arduino cards and for downloading the Arduino cards to Arduino cards. It contains a text editor used for writing code, a text console, as message area, a tool bar with buttons for the common functions and for a series of menus. It consists of an editor which uses the Wiring/ processing language, commands that supports the utilities for the projects and resemble the C language in some cases. The programming work can easily be performed by making the necessary settings and definitions in the IDE program. It connects to the Arduino hardware to upload programs and communicate with them.

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FIGURE 4 SOFTWARE ARCHITECTURE WORKING

The main brain of this project is arduino but in order to sense fire, we use the fire sensor module or also know a flame sensor, when fire burns, it emit a small amount of infra red light, this light will be received by the IR receiver on the sensor module. So, we place such sensors in such direction of the robot to sense on which direction the fire is burning. We detect the direction of the fire we can use the motors to move near the fire by driving our motors through the motor driver. When near a fire, we have to put it out using water. By using a small container. We can carry water, a 5V pump is also placed in the container and the whole container is placed on top of DC motor, so that we can control the direction in which the water has to be sprayed.

CONCLUSION

The designed robot can be easily controlled by sending the commands to the micro controller. Here we successfully developed the "ARDUINO BASED AUTONOMOUS FIRE FIGHTING ROBOT". Robot detects flame at the site where the robot exists.

The movement of this robot vehicle is controlled by MCU as per the program. This robot is help full in those areas where natural calamity and bomb explosions where occurred. These commands can be observed by using Attention commands and acceptable action is taken. If fire is detected with the help of sensors, MCU operates the water pump mechanism through relay circuit. The main aim of this paper is to design a semiautonomous electronic IoT based firefighting robot which can replace the traditional human firefighters and prevent them from the danger of firefighter. The robot sends message to controller and will take emergency precautions to eliminate the danger for firefighters.

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