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Autonomous Fire Extinguishing Robot

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ABSTRACT: In the recent years the number of fire accidents are rapidly increasing which includes industrial accidents, wildfires etc., The occupation of fire Service is a risky one and the value of human life is very much important. This robot helps to make the fire operation easier where a fire serviceman cannot handle the critical situations. There are many autonomous firefighting robots designed but the implementation number is very less especially in India. The basic firefighting robot process is to detect and extinguish the fire automatically. The system consists of an ultrasonic sensor, flame sensor, driver circuit interfaced with Arduino uno microcontroller. It extinguishes the fire by pumping water from the tank. We can also use this fire extinguishing robot in hazardous and more populated areas to extinguish small flames before it spreads to other places. The main function of this autonomous robot is to locate and extinguish the fire as soon as possible. The components used in this robot are interfaced with the Arduino UNO microcontroller by using the software Arduino compiler. By considering the risky occupation of fire fighters and their lives and a recent increase in large the number of fire accidents happening daily this robot will definitely help the firefighters and to the society.

KEYWORDS: Monitoring; Extinguishing; Rescuing; Human Detector; IoT

I. INTRODUCTION

In the evolution of the technology, the robots are noticeable one. The robots are classified into many types like preprogrammed robots, humanoid robots etc.,Among that autonomous robots are one type of a robot which is designed to perform a specific task without the help or intervention of humans. Now a days there is a increasing number of fire accidents happening daily in industries, hospitals, forests etc., In that situations the human fire fighters and the people or animals who stuck in the fire are at the stage of losing their life. During fire accidents there are some places where fire fighters cannot go and extinguish the fire and there is a possibility of injured peoples completely surrounded by the fire. Many losing their life at that critical situations. So, extinguishing the fire, monitoring the environment and rescuing the injured people is necessary and should be needed for every fire accident. This is our aim of project. Our autonomous fire extinguishing robot is aimed to design with the above three features. The industries had a high range of having fire accidents so, we develop our firefighting robot primarily for industries. In our project we use an Arduino uno microcontroller, flame sensor,ultrasonic sensor, driver circuit, DC motor, PIR sensor, voice playback board and servo motor for operation. The basic firefighting, robot process is to detect and extinguish the fire automatically. The flame sensor senses the fire and the ultrasonic sensor is used for obstacle detection or free path navigation. Here we use a pyroelectric motion sensor and voice playback board as a human detector.Once the fire is detected, the Pyroelectric Infrared sensor and voice playback board gets activated automatically, PIR sensor used to detect the motion and the voice playback board records the sound. It happens simultaneously when the robot extinguishes the fire. The information of motion and sound with direction are being recorded by the robot during the fire accident will sent to the monitoring system of the industry. It can be done by using IOT (Internet of Things). The all components are interfaced with the Arduino UNO microcontroller. This method of handling is very useful for extinguishing the fire and for rescuing the people. This makes the robot more efficient.

II. RELATED WORK

In paper [1] Here the user controllable fire fighter robot consists of wireless camera, a water tank with gun used for extinguishing fire. RF remote control used to control the operation through RF signals to the receiver circuit.

In paper [2] Robot operations are controlled by the android app. Fire detection done by using two sensors namely smoke sensor and temperature sensor. Fuzzy logic control algorithm is used in unknown environment.

In paper [3] This Arduino fire fighter robot extinguish the fire by remote handling. A gas sensor can be used to detect the fire and the Bluetooth Technology used for the communication purpose.

In paper [4] Gas and temperature sensor used for fire detection. The robot is completely guided by the fireman by using android mobile phone. The camera was fitted on the robot to analyze the current situation by fireman.

In paper [5] The controls placed on the RF transmitter. The robotic system is controlled by RF wireless communication. The 8051microcontroller used for the operation.

III. COMPONENTS REQUIRED

A. *SOFTWARE REQUIREMENT:*

- Arduino IDE software compiler version 8.1 is opensource software and it's easily available for operating systems like MAC, windows, and Linux runs on the java platform that comes with inbuilt function and therefore the commands that play a significant role for debugging, editing, and for compiling the code within the environment. The IDE environment mainly has two basic parts: Editor and therefore the complier where former is employed for writing the desired code and later is employed for compiling and uploading the code within the given Arduino UNO module.

B. *HARDWARE REQUIREMENT:*

1. Arduino UNO atmel328pu:

This Arduino UNO atmel328pu microcontroller is used to interface with all other components of a system. It has six (A0-A5) Analog pins and 14 digital I/O pins. The clock frequency is 16MHz.

2. Flame sensor:

Flame sensor used to detect the presence of fire.

- Detection range 0-1m

- Bandwidth 760-1100 nm

- Temperature -25 to 85 degree Celsius

3. Ultrasonic sensor HC-SRO4:

The purpose of ultrasonic sensor is to provide free path navigation.

- Detection range 3-400 cm

- Frequency 40 kHz

4. HC-501 pyroelectric Infrared (PIR) motion sensor detector:

This sensor is used for motion detection.

- Distance range 300-700 cm

- Detection angle less than 140 degree

- Temperature -20 to 80 degree Celsius

5. servo and DC motor(60rpm)

6. Voice playback board (APR33A3):

It is used for sound recording.

- Recording length 340-680 sec

- 16-bit digital audio processor

7. L298N motor driver

IV. WORKING

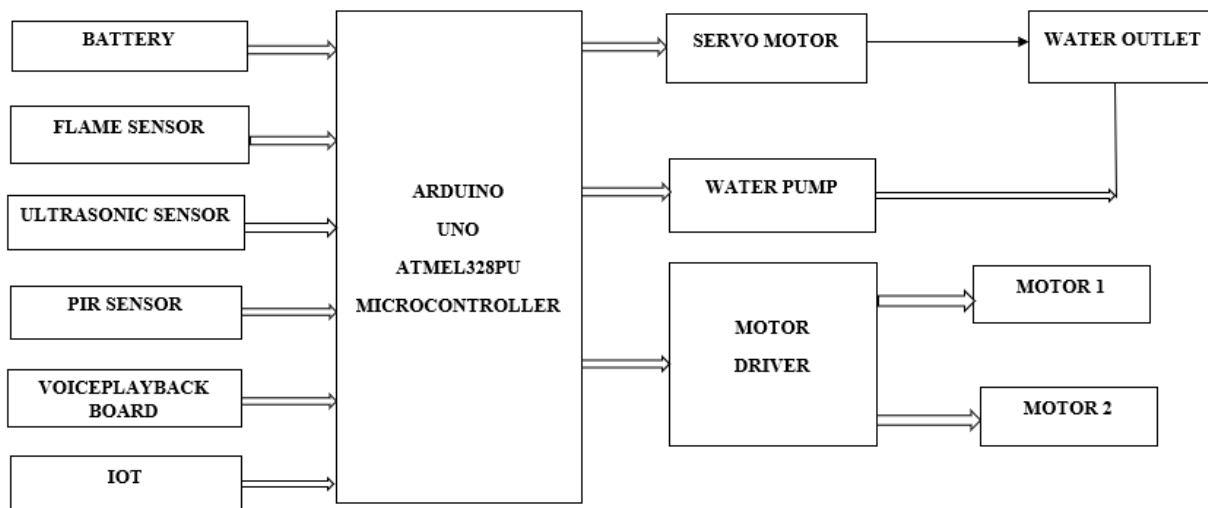The proposed block diagram was shown below

fig 1. Block diagram of proposed system

The ultrasonic sensor is used to detect obstacles and also for free path navigation. When the fire is detected by using flame sensor, the pump motor (DC motor) gets started to pump the water to extinguish the fire. To ensure that the water is sprinkled to all possible directions the servo motor is fitted to the water pump. The servo motor has sixty Revolutions per minute. Once the detection of fire is confirmed by flame sensor, the pyroelectric motion detector (PIR) sensor and voice playback module gets activated automatically without any external control. The robot can travel the risk areas during fire accident where fireman can't. The movements or motions and the sound around the robot was continuously recorded. This method was exceedingly help to find the people who stuck in the fire and in some times they can't able to speak due to smokes created by the fire or they were surrounded by the fire, unable to move other places. At that time this information from the robot is sent to the industrial /monitoring system through wireless signals using internet of things (IOT). At that time, the fireman using this information to take necessary actions faster. Simultaneously the robot also extinguishes the fire as soon as possible. We can also control the robot by using laptop/computer. After extinguishing the fire, the flame sensor does not detect any fire, at that time the PIR sensor and voice playback board goes to normal mode. Depending upon the direction of fire, the robot moves forward/backward and left/right by using two motors (motor 1& motor 2). L298N motor driver circuit runs the motor.

V. RESULTS

fig 2. Robot monitoring the Environment

fig 3. The LCD Display shows temperature& smoke value and distance of the object

fig 4. Motion detection

fig 5. The robot extinguishes the fire

VI. CONCLUSION

Thus, our robot able to monitor the environment, extinguish the fire, help for recuing it can be used in manufacturing industries, schools, colleges, hospitals, shopping areas etc., this robot saves the life of injured people and fireman and also the reduces the risk. So, this robot is efficient and economically affordable to implement.

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BIOGRAPHY

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