Fire-Fighting Robot for Industrial Purposes

7 authors, including:

Fardeen Mahbub
American International University-Bangladesh
21 PUBLICATIONS   **38** CITATIONS

SEE PROFILE

Shouherdho Banerjee Akash
American International University-Bangladesh
15 PUBLICATIONS   **34** CITATIONS

SEE PROFILE

Rashedul Islam
American International University-Bangladesh
18 PUBLICATIONS   **36** CITATIONS

SEE PROFILE

Sayed Abdul Kadir Al-Nahiun
American International University-Bangladesh
14 PUBLICATIONS   **30** CITATIONS

SEE PROFILE

Some of the authors of this publication are also working on these related projects:

DESIGN OF A MICROSTRIP PATCH ANTENNA FOR THE DIAGNOSIS OF EARLY-STAGE BREAST, BRAIN, AND LUNG CANCERS & TUMORS USING 5G FREQUENCY BAND View project

Fire-Fighting Robot for Industrial Purposes View project

Fire-fighting Robot for Industrial Purposes

Fardeen Mahbub, Shouherdho Banerjee Akash, Rashedul Islam, Sayed Abdul Kadir Al-Nahiun, Dewan Mahnaaz Mahmud,
MD. Arifur Rahman Moon, Anika Tasnim, Nahid Parvez, Debobrata Chakraborty

Department of Electrical and Electronics Engineering, American International University-Bangladesh (AIUB)
Dhaka, Bangladesh
mahbubfardeen1998@ieee.org

Abstract— **Extinguishment and the detection of fire are the hazardous work that puts the life of a fire fighter in risk. With the help of a fire fighter robot we can perform this job in fire bended area to avoid unwanted incidents. This paper illustrates the simulation and implementation of a firefighting robot which was prepared with basic fighting materials which will automatically sense the fire and start the water pump over the flame. This implemented robot consists of flame and gas sensors that are placed in different positions, were used in order to detect the fire and smoke respectively. Once the source of the fire is detected, the flame sensor quickly extinguished the fire by using the fire extinguishing system. Furthermore, the robot also consists of a container on the top of the servo motor so that the path of water spraying can be controlled. Also, two DC motors were used to drive the motors for the movement during operation mode for accomplishing the goal.**

Keywords— *Firefighting Robot, Arduino UNO, Sensors, Water Pump, Industry*

I. INTRODUCTION

A robot is a robotized gadget which performs works as a rule ascribed to people or machines entrusted with the dull or adaptable arrangement of activities. Various examinations have indicated that robot can be useful in medication, restoration, salvage activity and industry. The robot can be separated into a few gatherings, for example, Tele-robots, Telepresence robots, Mobile robots, Autonomous robots and Androids robots. A telepresence robot is like a telerobot with the principal distinction of giving criticism from video, sound and other information. The versatile robot is designed to explore and complete errands with the mediation of people. In this paper, a firefighting robot is proposed. The primary capacity of this robot is to turn into an automated help vehicle, created to look and quench the fire. Our proposed robot is intended to have the option to chip away at its own or be controlled distantly. This robot is intended for use in outrageous peril territories, for example, planes fires, handling production lines, substance plants or atomic reactors. In this examination, a conservative and little fireman robot has been created. This robot is named Fire Fighting Robot, which is the short type of Rescue Robot. This robot can dodge deterrents, look and douse the fire. Moreover, this robot can expand the profitability, wellbeing, effectiveness and nature of the errand given. The robot is more minimal and more adaptable contrasted with Thermite and Fire Fighting Robot.

II. LITERATURE REVIEW

Aliff, Mohd, et al. have built a firefighting robot to extinguish the fire to escape the risk. Therefore, to eliminate obstacles on the route, a powerful controller is used to control and eliminate obstacles and to execute the process automatically. The mechanism is designed to detect a fire and to stop at the highest distance from a fire where a person is controlling a robot using a monitor using a smartphone or remote computer. Ali et al. also built a firefighting robot to extinguish a fire using a water pump. The tone sense was used in this gas sensor and the robot was later navigated using the display to hit the target [1]. Rakib Sarkar has created a firefighter to locate and extinguish the flames. The robot is then constructed of 'Rashed Tree' wood and will have a water storage capacity of 1L. They used the Arduino controller to identify the fire and to extinguish the fire. The identity of the fire would depend on the distance of the fire with the wavelength of the light as the threshold [2]. There has been a lot of study on robotics leading to the advancement of robotics in numerous applications. This robotic application has a larger range of prototypes and sophisticated technology is used. The purpose of this work is, therefore, to provide firefighting robots to support the public by sensing a fire and to respond quickly to prevent significant loss of human life, construction or some kind of property.

III. BASIC IDEA OF THE PROJECT

Robotics has gained popularity due to the advancement of many technologies of computing and non-technology making humanoid is easier and comfortable. In this project, the software implementation of a fire-fighting robot has been made using the Proteus 8.9 Professional and Arduino IDE software. It has term that has since been used refer to a machine that performs works to assist people or work that humans which find difficult or undesirable. The fire-fighting robot is design to search for a fire in a small floor plan house of the specific dimension. The robot will be beneficial as it will automatically detect the fire itself with its sensors and be the first to put it out. This will exclude the valuable times waiting for the fire rescue team and will also reduce the damage to a great extent. These robots are capable enough to perform repetitive tasks more quickly, cheaply and accurately than humans.

TABLE I. Components of the Project

Equipment	Quantity	Used For
Arduino UNO	1	Execution of the Project
DC Motor	2	To move the Robot
L293D	1	To drive the Motor
Flame Sensor	3	To sense the flame
Gas Sensor	1	To sense the smoke
Resistor	2	Safety purposes of LEDs
LED	2	For Indications
Servo Motor	1	Controlling the direction of the container in the Robot
DC Pump	1	To Spray water over flame

The block diagram that has been followed for the implementation of this project is showed on Figure 1.
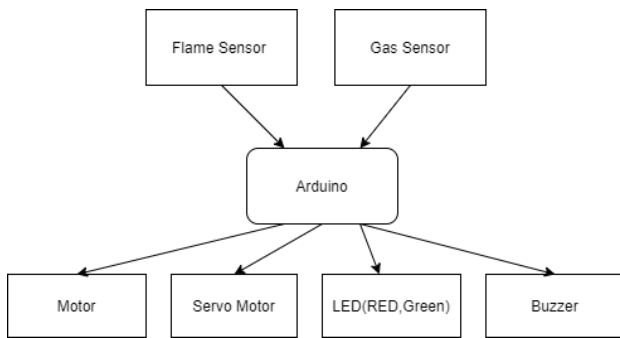
Figure.1. Block Diagram

IV. SOFTWARE IMPLEMENTATION

As per showed on the simulation, at first, in the Proteus Professional 8.9 software, the Arduino, Flame sensor and Gas sensor were placed. After that, we have placed the DC Motor, L293D Motor driver and Servo Motor in the same manner. After making all these placements, the connections were made on the Arduino UNO. Also, the flame sensors and gas sensors were provided with a 5V supply and the L293D were connected with a 12V supply. Moreover, TX and RX were connected to the virtual terminal. Once it is done, the code was provided as the input to the Arduino UNO and the desired outputs were successfully obtained. Figure 2 shows the safe mode of the robot and figure 3 shows the operating mode of the robot.
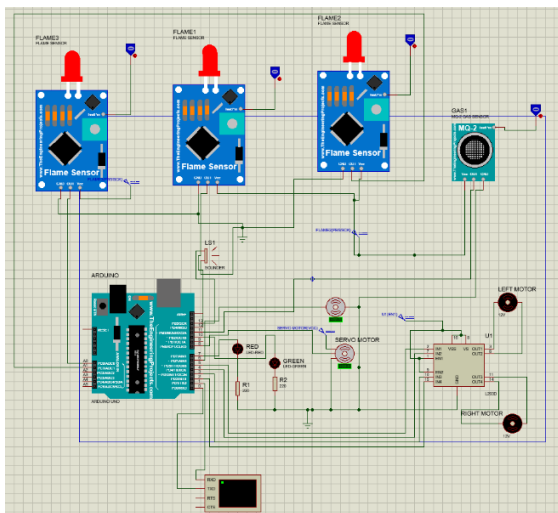

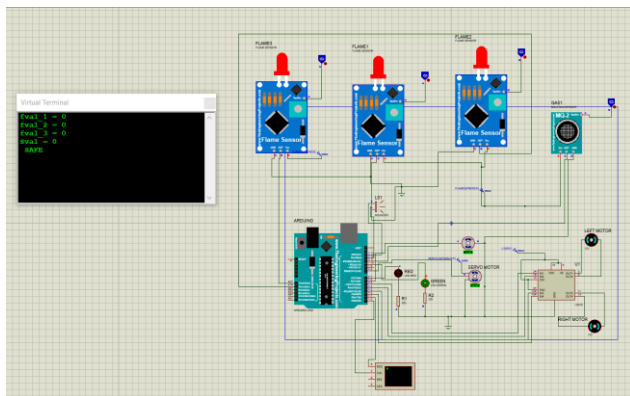Figure.2. Operational Circuit
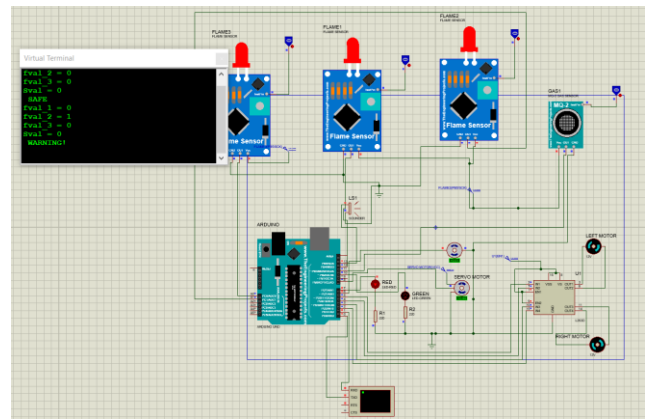

Figure 3. Safe Mode Operation

Figure 4. Operating Model


```
fire_fighting

#include <Servo.h>
Servo myservo;

int flame1 = 12;
int flame2 = A0;
int flame3 = A1;
int smoke = 11;
int red = 7;
int green = 10 ;
int busser = 13 ;


int pos =0;

int LM1=4;//left motor
int LM2=5;
int RM1=3;//right motor
int RM2=2;


int pump =6;

void setup ()
{
  pinMode (flame1, INPUT) ;
  pinMode (flame2, INPUT) ;
  pinMode (flame3, INPUT) ;
  pinMode (smoke, INPUT) ;
  pinMode (red, OUTPUT) ;
  pinMode (green, OUTPUT) ;

  pinMode (busser, OUTPUT) ;
  Serial.begin(9600);//braud rate

  myservo.attach(8);

  pinMode(LM1, OUTPUT);
  pinMode(LM2, OUTPUT);
  pinMode(RM1, OUTPUT);
  pinMode(RM2, OUTPUT);
  pinMode(pump, OUTPUT);

}

void loop ()
{
  int fvall = digitalRead (flame1) ;
  int fval2 = digitalRead (flame2) ;
  int fval3 = digitalRead (flame3) ;
  int sval = digitalRead(smoke);
  Serial.print("fval_1 = ");
  Serial.println(fvall);
  Serial.print("fval_2 = ");
  Serial.println(fval2);
  Serial.print("fval_3 = ");
  Serial.println(fval3);
  Serial.print("Sval = ");
  Serial.println(sval);


  if (sval == LOW and fvall == LOW and fval2==LOW and fval3== LOW)
  {
    Serial.println("---- SAFE ----");

    digitalWrite(LM1, LOW);
    digitalWrite(LM2, LOW);
    digitalWrite(RM1, LOW);
    digitalWrite(RM2, LOW);
```

Figure 5- Implemented Code

V. RESULT AND DISCUSSION

In this project, a Firefighting Robot have been implemented for industrial purposes. All the fundamental wall follower action such as moving forward, turn left, and turn right function flawlessly successfully maintained. When the flame sensor or smoke sensor triggered then display have showed warning and the motor started to run and reached the

fire area then the servo motor and water pump have started. Then the fire was stop. And the display also showed safe mode. After going to the build project, the project was built. The simulation was run and the desired output was obtained. Proper snapshot of the results was attached individually. Overall, an autonomous firefighting robot has been successfully built. Finally, the objectives of this project were achieved. [3]

VI. FUTURE WORK

Flame sensor and gas sensor were attached to detect the fire in this firefighting robot. Ultrasonic sensor can also be attached to detect any object around the robot to avoid any collision with other objects. The user will be alleviating the fire using remote control from the distance is evolved in the robot exhibiting ability to identify the fire places automatically and ability to extinguish fire remotely at certain distance. To determine distance manually it can be monitored by using camera and controlled by any remote device.

VII. CONCLUSION

From the simulation results, the putting out fires robot has accomplished its point and target effectively. The robot is created to help firemen in their obligation. It has invaluable highlights, for example, the capacity to identify the position of fire, smother it and increment the information about fire conduct from the occurrence zone. Sensors, motors, pumps of smaller size and required very less space in this procedure. This robot will diminish the danger of injury for firemen and potential casualties and decrease the monetary losses which increment significantly as fire duration increases. The robot can be utilized in a spot that has a little passageway or in little spaces since it has a smaller structure.

REFERENCES

[1] Aliff, M., Yusof, M., Sani, N.S. and Zainal, A., 2019. Development of firefighting robot (QROB). *Development*, *10*(1).

[2] Rakib, T. and Sarkar, M.R., 2016, May. Design and fabrication of an autonomous firefighting robot with multisensor fire detection using PID controller. In *2016 5th International Conference on Informatics, Electronics and Vision (ICIEV)* (pp. 909-914). IEEE.

[3] Wan Hasan, W. & Sidek, Mohd & Shafie, Suhaidi & Marhaban, Mohammad Hamiruce. (2010). Fire Fighting Robot.