International Journal of Advanced Research

in Electrical, Electronics and Instrumentation Engineering

INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.18

ARDUINO BASED FIRE FIGHTING ROBOT

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ABSTRACT: Nowadays, many incidents related to fire are reported due to natural and unnatural causes that leads to property loss, injuries and worst causes death and also, security and automation are major concerns in our daily lives. The project's goal is to improve house safety by preventing fires from occurring in the home and in the event of an unanticipated or emergency situation. When this happens in a resident's area without the homeowner's knowledge, the user will receive an alert message upon the excessive rise in temperature in the house via short message service (SMS) via GSM module. The design of simple hardware circuit enables every user to use the flame sensor at home as it utilizes by Arduino. This technology can assist users in improving their safety standards by responding quickly in the event of an accidents and this will eventually allow the users to protect their lives and the properties as well from the disasters.

1.1 Objective and Aim Of Work

In the event of a fire breakout, to rescue people and to put out the fire we are forced to use human resources which are not safe. With the advancement of technology especially in Robotics it is very much possible to replace humans with robots for fighting the fire. This would improve the efficiency of firefighters and would also prevent them from risking human lives. Today we are going to build a Fire Fighting Robot using Arduino, which will automatically sense the fire and start the water pump. In this project, we will learn how to build a simple robot using Arduino that could move towards the fire and pump out water around it to put down the fire.

Fig 1. Circuit diagram of firefighting robot
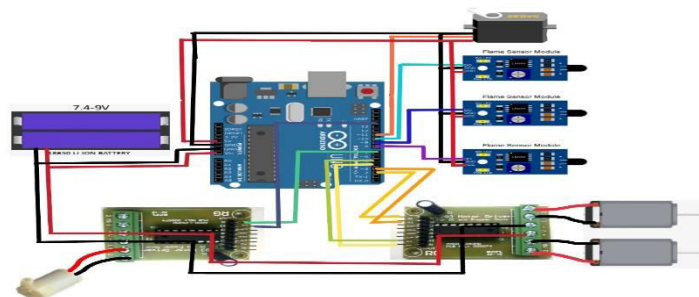
The main brain of this project is the Arduino, but in-order to sense fire we use the Fire sensor module (flame sensor) that is shown below. Fire or flame sensor module as you can see these Flame sensors which is used to detect the fire.

When fire burns it emits this light will be received by the IR receiver on the sensor module. so that if a fire is detected the output pin (DO) will give 0V(LOW) and if the is no fire the output pin will be 5V(HIGH).

So, we place three such Flame sensors in three directions of the robot to sense on which direction the fire is burning. Flame sensor setup on firefighting robot chassis We detect the direction of the fire we can use the motors to move near the fire by driving our motors through the L293D module. When near a fire we have to put it out using water. 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 a servo motor so that we can control the direction in which the water has to be sprayed.

II. LITERATURE REVIEW

J. Reinhart V. Khandwala (2003) was 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 sensor's response, and the navigation algorithm that will enable the robot to find an efficient path in and out of the house model.[5] Lynette Miller Daniel Rodriguez (2003) was all discussing the development of each component of the robot that is designed to find a small fire represented by a flame sensor 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.[6] Sahil S.Shah (2013) was all discussed about design a FIRE FIGHTING ROBOT using Arduino system. A robotcapable of fighting a simulated household fire will be designed and built. It must be able to autonomously navigate through a modeled 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 fire-fighters greatly reducing the risk of injury to victims. The result shows that higher efficiency is indeed achieved using the Arduino system.[7] U.Jyostna Sai Prasanna, M.V.D.Prasad (2013) was design the fire detection system using three flame sensors in the firefighting robot, and program the fire detection and fighting procedure using sensor based method. Thefirefighting robot is equipped with thermistors/flame sensors that continuously monitor the temperature.Ifthe temperature increases beyond the predetermined threshold5 value, warning message will be sent to the respective personnel in the industry and to nearby fire station with the GSM module provided to it.

2.1 Arduino(ATmega328) :

Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 Analog inputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USBArduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.
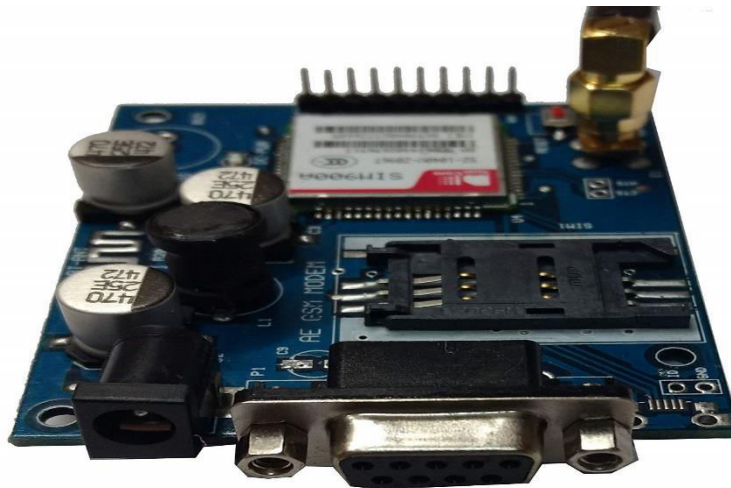
2.1 Components required :
Hardware description
### A] GSM Module:

GSM is a digital cellular network system for voice and data communication. gsm is nothing big system but made of few small Systemwhich are MS(mobile system),BSS(base station sub system) NSS(network and switching system, OSS (operating sub system).


B] Flame sensor:

Infrared radiation sensitive sensor on yg1006 NPN photo transistor YG 1006 is sensitive to infrared radiation in the wavelength range of 760 nm to 1100nm and move. 60 degree detection angle detect fire and activate buzzer.1.Flamesensor is kept at certain distance away from fire to avoid damage 2.Detect flame from distance of 20cm.3.Adjustable
sensitivity 4.Operating voltage 3.5-5v.
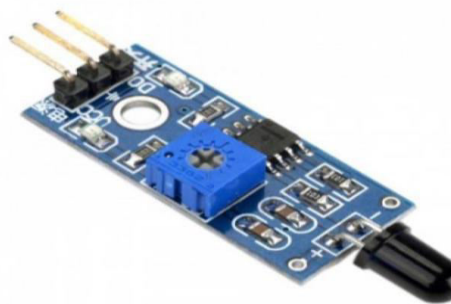
L293D driver IC :
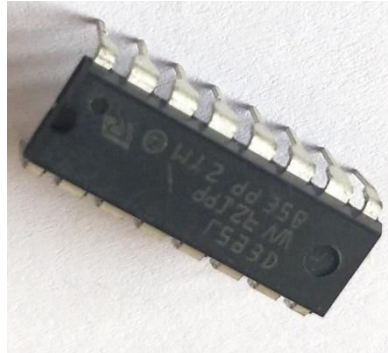
- Can be used to run Two DC motors with the same IC.
- Speed and Direction control is possible Motor voltage
- Vcc2 (Vs): 4.5V to 36V Maximum Peak motor current:
- 1.2A Maximum Continuous Motor Current: 600mA Supply. Voltage
- Vcc1(VSS): 4.5V to 7V Transition time: 300ns (at 5Vand 24V) Automatic Thermal shutdown is available in 16-pin DIP, TSSOP, SOIC packages

D] Servo Motor:

A servo motor is a rotary actuator that allows for precise control of angular position. It consists of a motor coupled to a sensor for position feedback. It also requires a servo drive to complete the system. The drive uses the feedback sensor to precisely control the rotary position of the motor.

2.2 Working of firefighting robot –

   In this project, we have used the three flame sensors that continuously monitor the temperature. If the temperature increases beyond the predetermined threshold value, then Arduino receives this signal, then it sends the signal to the gsm module and one l293d motor driver IC.
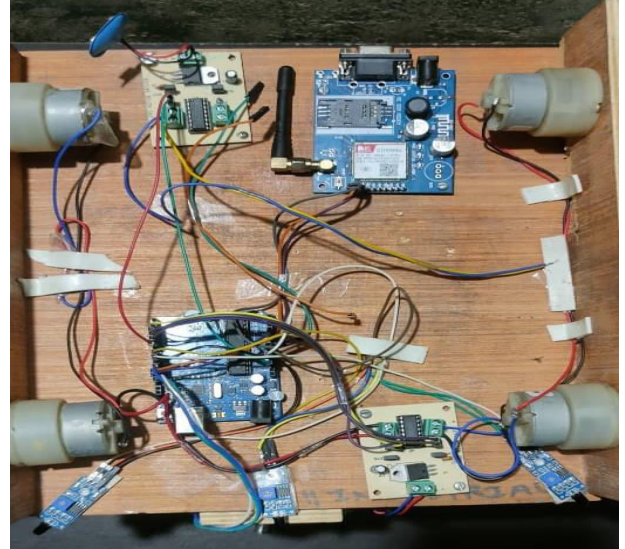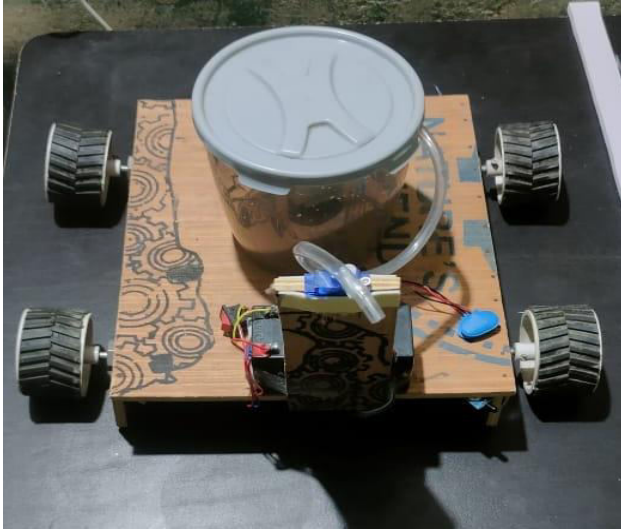
In GSM fire warning message will be sent to the respective personal mobile number with the GSM module provided to it and then the Motor driver IC send command to the robot moves to the direction to which the temperature is recorded to be the relatively maximum among the three sensors and extinguishes the fire with water pump provided to it. After extinguishing the fireit comes back to its initial position.

3.1 APPLICATION:
- Can be used in server rooms.
- Extinguishers fire where probability of explosion is high.
- Usable in power plant control rooms, captain bridges, flight control centers.

3.2 ADVANTAGE:
The fire detecting robot helps in following ways:
➢To detect the exact direction of the fire source.
 ➢ Capability of sensing accurately with increased flexibility.
➢ Reduce human effort.
➢ Reliable and Economical.

3.3 DISADVANTAGE:
➢ No monitoring system for the vehicle.
➢Not sensitive to weather conditions.
➢ No remote control for the robotic moment.
➢Our system used only for less than 3.5 kg application.
➢It is not used to put out large fires.

3.4 FUTURE SCOPE:
The amount of knowledge is always growing, and so are the difficulties that society is striving to address in the process. It is anticipated that the current will pave the way for further improvements in this area in the near future. Another option for further customizations is to replace the sensors with a camera, which will enhance accuracy while also resolving the issues that have emerged with the sensors in the first place.

III. CONCLUSION

The Fire Fighting Robot is effective enough to fight against fire on a small scale. It can sense fire flame better at darker places. It is made as a preventer robot. Because it can detect fire instantly and can extinguish it before spreading. This sensory based robot may be a solution to all fire hazards. Various sensors like flame sensors have been incorporated in this robot. If the fire is detected, a water spraying mechanism is triggered to extinguish the fire. With enough funding and scope, this design of robot can also fight against large fire with larger reserving capacity and an improved sensing unit can provide even an earlier detection of fire at all circumstances. As a conclusion, the project entitled "Fire Fighting Robot" has achieved its aim and objective successfully.

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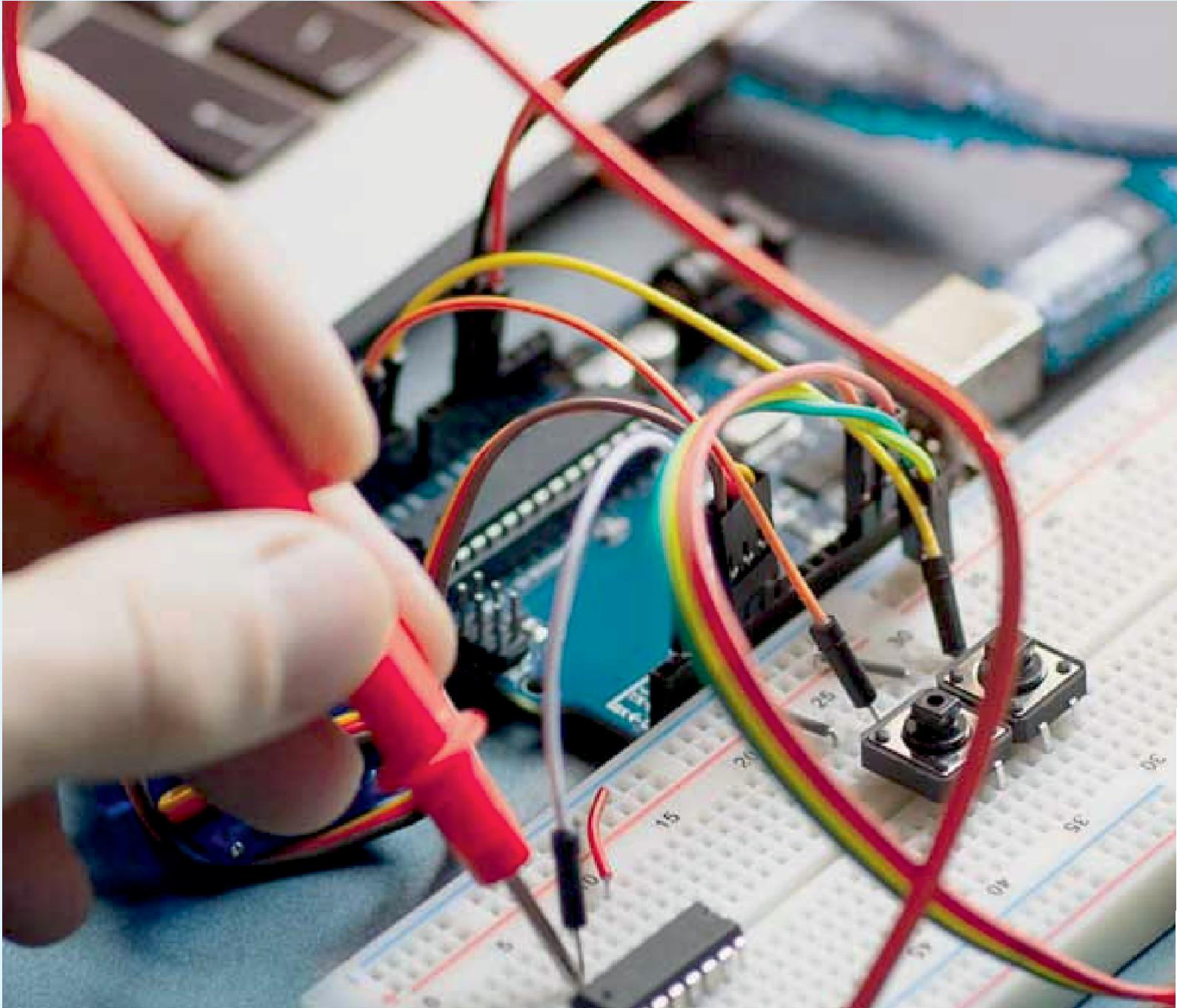
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