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Solar Powered Fire Fighting Robot

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ABSTRACT: A fire episode is a disaster that could cause the loss of life, property hurt, and durable debilitation to the affected loss. The rule objective of this adventure is to design a firefighting robot. This robot is stacked with a water huge hauler and a pump controlled through far-off correspondence to sprinkle water. The robot is mounted with 2 sensors and 2 motors and has a limit of recognizing the fire-slanted locales with the help of the sensors. It beats any obstacles using an ultrasonic sensor. It makes a sign climate of caution and showers water (or) CO2 by pumping it from the tank or chamber mounted on the underside of the robot. Here battery can be charged by including daylight controlled charger as well as by a power supply.

KEYWORDS: Flame Sensor, Ultrasonic Sensor, Servomotor, Mini DC Submersible pump, DC Motor, Arduino UNO, Solar Panel., LIPO solar charger**.**

I. INTRODUCTION

One of the main boundary in fire calamity is life, i.e. lives lost in saving someone else life. . A fast response to detect the fire can avoid many disastrous things.Fire fighting is the act of extinguishing destructive fires.
A fire man should have the option to stop fire rapidly and securely stifle the fire, forestalling further harm and salvage casualties to a more secure area from the peril. Studies on the use of humanoid robots are actively carried out to minimize firefighters' injuries and deaths as well as increase productivity, safety, efficiency, and quality of the task given. Our task as engineers was to design and build a prototype system that could autonomously detect and manually extinguish a fire. Also aims at minimizing air pollution.

Advanced mechanics is one of the quickest developing designing fields of today. Robots are intended to eliminate the human element from work escalated or risky work and to act in an unavailable. A robot is a robotized gadget that fills roles credited to people or machines entrusted with the tedious or adaptable arrangements of activities. Numerous investigations have shown that robots can be advantageous in medicine, rehabilitation, salvage activity, and industry. Robots can be separated into a few gatherings, for example, robots, Telepresence robots, Mobile robots, Autonomous Robots, and Android robots. Telepresence robots are like a robot with the fundamental contrast of giving criticism from video, sound, and other data. Hence telepresence robots are generally utilized in many fields requiring observing capacity, for example, in kid nurseries and training, and on further developing more seasoned grownups' friendly and day-to-day exercises the intercession of individuals. The mobile robot is intended to explore and do assignments with the intercession of individuals. Meanwhile, independent robots can play out the errand autonomously and get the power from the climate, instead of android robots which are worked to mirror people.

This project is proposed for firefighting robot. We have planned an autonomous robot that can extinguish the fire with the help of fire sensors and endeavors to cover the fire by shooting water through a water outlet which in turn joined or picked by the robot's chassis. What's more, it can similarly recognize Infront Obstacles by using sound waves (I.e., an Ultrasonic sensor). The standard limit of this robot is to transform into a computerized help vehicle, made to perceive and douse fire using a water siphon. There are a few existing kinds of vehicles for firefighting at home and quenching woodland fires. Our proposed robot is intended to have the option to deal with its own or be controlled from a distance. By utilizing such robots, fire distinguishing proof and protection exercises should be possible with higher security without putting firemen in high gamble and risky circumstances. As such, robots can diminish the requirement for   firemen   to   get   into   perilous   circumstances.   Furthermore, having a minimized size and programmed control additionally permits the robot to be utilized when a fire happens in little and restricted spaces with unsafe conditions, for example, burrows or thermal energy stations.

II. RELATED WORK

Generally the Fire fire fighting robot which are been deployed in the indoor or outdoor surroundings are working with the help of several microcontrollers like PIC,8051,8086 etc.,.So this above mentioned microcontrollers are little bit slow as compared to an ardunio in terms of effeciency, Speed, Ease of use and portability.That's the reason why we have come up with an autonomous robot with the help of an arduino .In Fire Extinguishing Robot, we mean to construct a framework that could quench a little fire by detecting and moving to the area itself.Sometime postpone in the appearance of firemen prompts various consequences.The Fire Extinguishing robot constantly screens the climate and douses it immediately.

III. LITERATURE SURVEY

A Hassanein, M Elhawary, current methods applied in firefighting are inadequate and inefficient relying heavily on humans who are prone to error, no matter how extensively they have been trained. A recent trend that has become popular is to use robots instead of humans to handle fire hazards. This is mainly because they can be used in situations that are too dangerous for any individual to involve themselves in. In our project, we develop a robot that can locate and extinguish a fire in a given environment. The robot navigates the arena and avoids any obstacles it faces in its excursion.[1]

Satya Veera Pavan Kumar Maddukuri proposed robot can be materialized very economically, which constitutes six integral modules which include its structure, obstacle avoidance & driver system, control system governed by a microcontroller, fire detection system, remote supervising system, Global System for Mobile communication module. In autonomous mode, when juxtaposed with a smoke detector, it takes lead as it can quench the fire at its inception than sitting tight for an object to smolder and create smoke. It voluntarily detects, navigates itself, and extinguishes fire without any human aid, thus saving the lives of many individuals. It also sends the emergency .
Warning signal alerts to the security personnel on duty and within reach fire station through the rooted GSM module. In semi-autonomous mode, this robot was designed to act upon voice commands as well as from a general user interface developed on the touch screen. This robot has added the feature of operating in groups by communicating between them.[2]

Kristi Kokasih developed an intelligent tank robot to put out fires. Tank robots are made from acrylic, plastic, and aluminum, model is an IOT based firefighting robot that detects fire. After being informed the authorities can start visualizing the fire location and can communicate with people stuck with a help of an automatic receiver installed. Instructions can be given to the robot regarding its movement, turning on its water pump or carbon dioxide pump depending on fire type through long distances. The fire type and carbon-monoxide level are known using the sensors installed that provide a graph to make the analysis. The analysis is also useful to further give information to safety authorities regarding the number of poisonous gases inhaled over some time by the occupants of the affected area so they can take appropriate actions to undo the harm.. [3]

Md Anowar Hossain and Himaddri Shakhar Roy proposed a fire-fighting robot that can be used as a supplementary to the firefighters in critical situations. To function in this robot, a flame sensor, a gas sensor, an IR sensor, and a temperature-humidity sensor has been used. The flame sensor is used to detect the fireplace at the same time as the gas sensor informs about the presence of flammable gases, the Passive Infrared Sensor confirms the presence of a human, and the temperature-humidity sensor sends statistics about the temperature and humidity of the locality. The robot can run in both manual control systems and autonomic control systems. This paper discusses the detail and top working condition of a fire-fighting robot and recapitulates an IoT-based communication system to monitor the fire-affected area using Wi-Fi and also discusses the elaborate functions of each module and the implementation of the system. All the data are sent to the cloud server for further investigation. The proposed firefighting robot has been used for many experiments and proper evaluation has been done based on its performance. It has an excellent performance to extinguish a fire in an emergency.[4]

J J Jijesh, Satya Srikant Palle, Dileep Reddy Borla Fire protection robot is therefore intended to assist individuals using the autonomous system in any damaging burned situation. The use of various sensors like ultrasonic, fire, smoke, and motion sensors increases the robot's capabilities. The gripper is mounted onto the robot to clear the obstacles in the way of the victims. The use of an IP camera improvised the robot functionality by providing bi-directional

communication between the controlling area and the burnt area. The robot is further improvised using the BLYNK application which is linked to the microcontroller ESP32 via Wi-Fi SoC to provide alert messages to the person on duty and the residents.[5]

H. P. Singh Controlled industrial fire fighting mobile robot developed by H.P. Singh et al. The article describes the structure and design of the mobile fire fighting robot. The system contains two optically isolated DC motors. The robot performs analog-to-digital conversion of the data provided by the infrared sensors. Five infrared sensors are used. Two sensors control the robot's movement and three sensors for flame detection. The fire extinguisher consists of a D.C water pump and a water tank. The basic topic of the article is feeling the fire and how to put it out. This infrared sensor is used as an entrance sensor that detects the infrared rays coming out from the fire. The microcontroller controls the fire suppression system and all the process or operation is controlled with the help of a mobile application. [6]

Swati Deshmukh consists of a machine capable of detecting a fire and extinguishing it. The fire fighting robot can move forward and backward and can turn left and right. As a result, firefighters can operate the robot over a long distance, and there is no need for humans to be near the fire area. Light-dependent resistors are used for fire detection. These resistors are very sensitive devices and are capable of detecting very small fires. Robots provide security in homes, buildings, factories, and laboratories. It is an intelligent multi-sensory security system that contains a fire fighting system in daily life. [7,8]

Sahil .S.Shah developed a robot fireman. A fire fighting robot is an integrated system onboard. The prototype system is designed to detect and extinguish fires. It aims to reduce air pollution caused by fires. The robot is designed to detect a fire in a small floor plan. Fire suppression tasks are broken down into smaller tasks. Each task is performed most suitably. There is a high chance of a fire breaking out in the industry or a remote area. Because For example, in cotton mills, garment factories, fuel depots, etc., electric leakage can lead to embarrassment. This is also the worst-case scenario, causing heavy losses not only financially but also destroying the area around it. Robots are the emerging solution to protect human life and their wealth and environment. The goal here is to design a FIRE RESISTANT ROBOT using embedded systems. The robot navigates room by room step by step, finds a fire in a room, approaches the fire at a fixed distance, and then extinguishes the fire. [9,10]

J. Reinhart V. Khandwala was discussed the 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 response of the sensor, and the navigation algorithm that will enable the robot to find an efficient path in and out of the house model. [11]

Lynette Miller Daniel Rodriguez was all discussed 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.
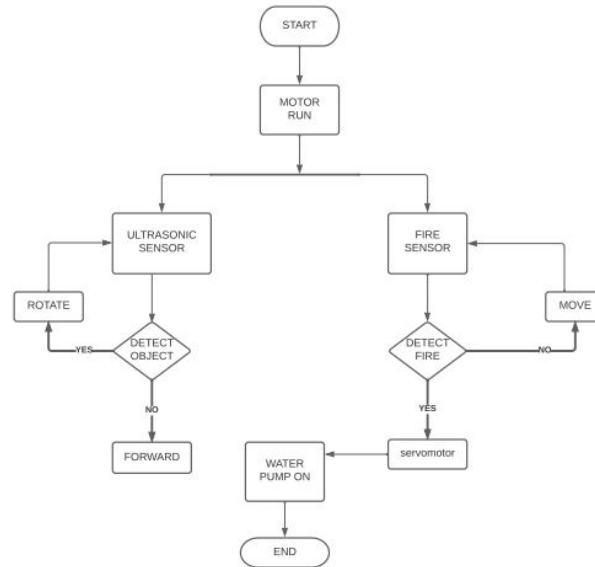
IV. FLOW CHART

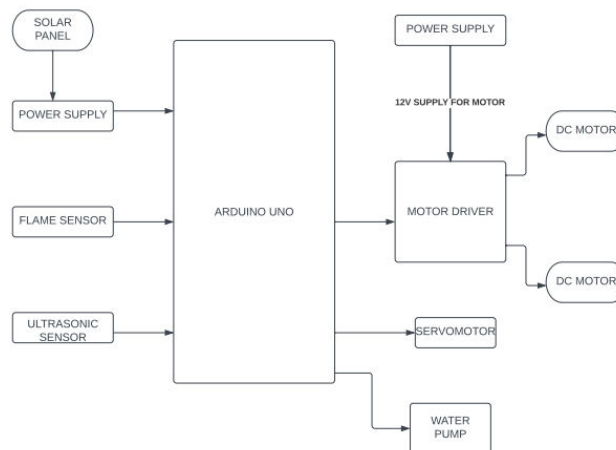**Fig 1**:Flow chart of the proposed system

V. BLOCK DIAGRAM

Fig 2: Block diagram for the proposed system

We're working with an Arduino. It has a large number of input and output ports. When a smoke sensor detects combustible gases or smoke, it is connected to either of the Input ports and the output is set to high. Temperature sensors are used as input to the Arduino, and the output is connected to the DC motor pump's input. Ultrasonic sensors are used to identify impediments on the path and are supplied as input to Arduino and output to servo wheels, motors to change the road's direction, and detect the motion of the human body and any objects. They are given as input and output to a buzzer to create an alert. The buzzer is wired to a relay and an Arduino, which works as a switch to turn on and off. When a fire is detected, the Dc motor pumps water to extinguish it. The servo wheels are moved towards the direction of the fire using a motor driver.

VI. CIRCUIT DIAGRAM
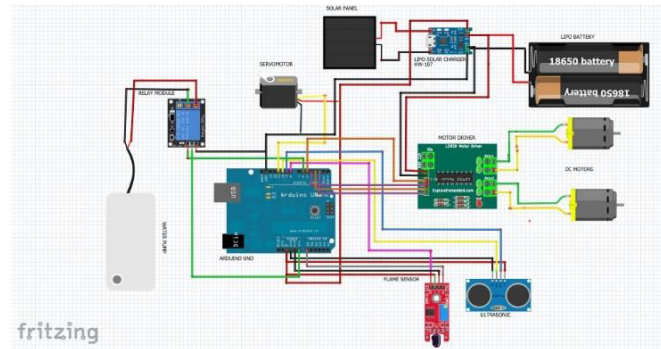
VII. PROPOSED SYSTEM

As per National Crime Records Bureau (NCRB), it is assessed that more than 1.2 lakh passings have been caused in view of fire mishaps in India from 2010-2014. Despite the fact that there are a ton of safety measures taken for Fire mishaps, these regular/man-caused debacles to do happen every so often. In case of a fire breakout, to save individuals and to extinguish the fire we are compelled to utilize HR which are undependable. With the headway of innovation particularly in Robotics supplanting people with robots for battling the fire is a lot of conceivable. This would work on the effectiveness of firemen and would likewise keep them from endangering human lives.So to improve the efficiency of fire fighters and would prevent them from risking their life in the fire disater we are going to build an autonomous Fire Fighting Robot using Arduino, which will automatically sense the fire and start the water pump.The main brain of this project is Arduino, but to **detect a fire, we use a** fire sensor module and to detect the direction of the fire we can use the motors to move near the fire by driving our motors through the **L293D module**..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 a **servo motor** so that we can control the direction in which the water has to be sprayed and we can also use this servo motor to detect the hurdels in front of the robot vehicle and this process of detection can be done by using an ultrasonic sensor. And lastly a temperature sensor and a smokesensor can be used to maintain approximate distance while ejecting the water through the pumplet..Autonomous fire fighting robot is an self controlled robot ,which can be used to helps in fire accidents to over come them . In most of the critical cases their is an human death, loss of physical property and permanent disability to victims .The main aim of doing this project is to design the robot which can search, detect and extinguish the fire with help of water attached to the chassis of the robot.The design and implementation of the proposed project can be shown in result and analysis part can be explained in steps.
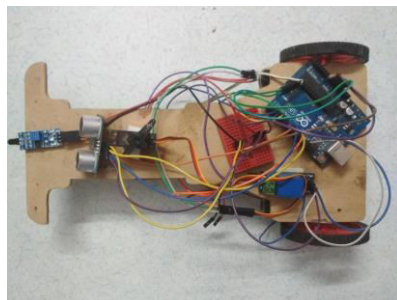
VIII. RESULT & ANALYSIS

**Step 1:** Assembly of the project kit for Solar powered Fire fighting robot
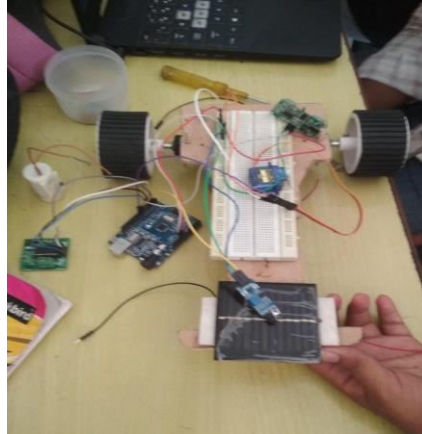
The above Picture is taken after the assembly of all the constituent components required to develop the solar powered fire fighting robot.

Step 2: Mobility in design of the Solar powered Fire fighting robot


The above picture is taken after mounting development board or design on wheels of the robot chasis to make the an fire fighting robot without solar panel.

Step 3: Verifying and Uploading the required code from the laptop to the Arduino UNO micro controller.
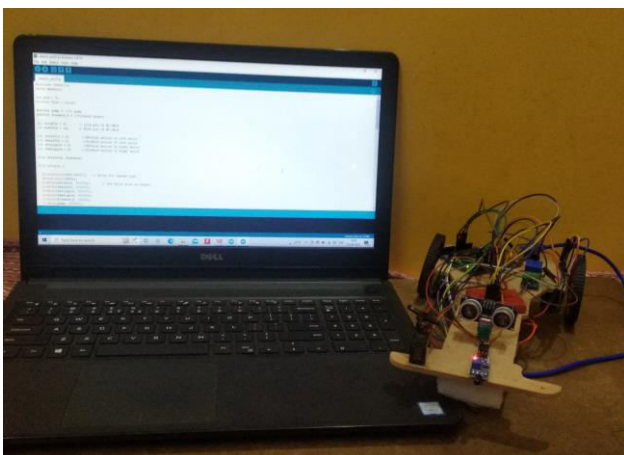
The above picture is taken While uploading the code to the Arduino UNO board with the help of a usb to Arduino UNO cable.

Step 4: Monitoring the distance of the robot vehicl**e**
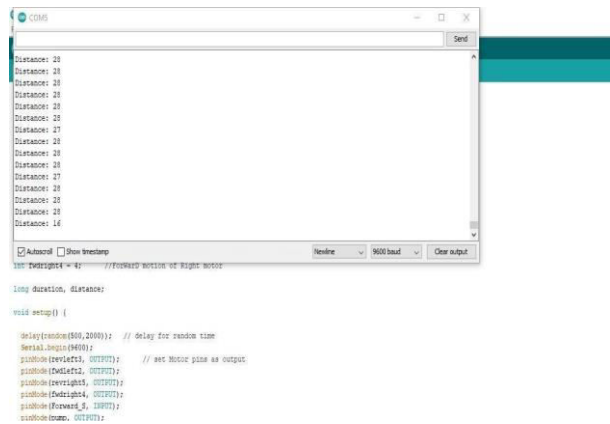
The above snapshot is taken while monitoring the distance of the robot from an obstacle.These process can be done using an ultrasonic sensor which have ability to transmit sound waves and receive echo signal back at a specified time duration.Here to monitor the distance we need to give power supply from the laptop which can provide a 5v supply to activate the Arduino board.

Step 5: Obstacle or Object detection using ultrasonic sensor.
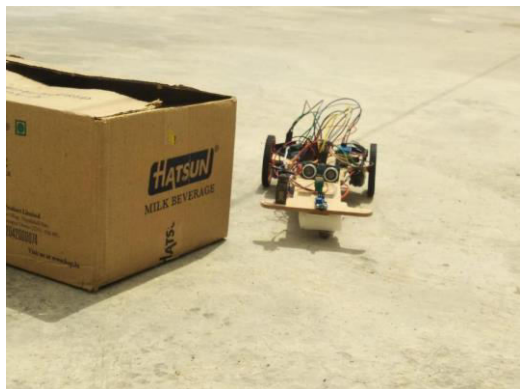
The above picture is taken during the detection of obstacle using the ultrasonic sensor which helps the robot to tilt or turn left from the inclined direction.

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