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Design and Deployment of an IoT-Drive Firefighting Robot with Adaptive Fire Extinguishing Agents and GPS Integration

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Abstract:-

This paper reports the design and development of an Autonomous Fire Fighting Robot. The project mainly focuses on developing a robot that can go to places where a fireman has to risk his life and go put off the fire. Fire disasters can occur anytime at any place and result in high losses. Due to the damage of building sand explosive materials, it becomes a major task to save people and to stop a disaster. With such constraint sin the handling of fire, a technological breakthrough that can help to fight the fire utilizing a firefighting robot from which people and properties can be saved from the fire accidents. With the advancement of technology, humans are replaced with robots in life-risking situations. In the proposed system, we develop a robot that automatically detects, navigates, and suppress the fire before it rages out of control. The system automatically detects the fire using the flame sensors attached to the firefighting robot, which will continuously monitor the intensity of the fire. If the value of temperature increases above the predefined value it will send the warning message to the corresponding authority using the GSM module and at the same time robot automatically navigate towards the detected fire. Consequently, the robot moves in the direction to which the temperature recorded to be relatively very high among three flame sensors using an L293 motor driver. Once the robot reaches near the fire, Arduino actuates the relay and the pump will automatically on for the water to be sprinkled through the sprinkler. By implementing the proposed system,any fire disasters can be avoided with a minimal amount of damage to property and risk of human life.

I. INTRODUCTION

Fires can be devastating and unpredictable, causing significant loss of life and property. Traditional fire-fighting methods often involve risks to human life and may not be effective in navigating complex or inaccessible areas. With the advent of the Internet of Things (IoT) and robotics, a new generation of fire-fighting systems can be developed to improve response times, accuracy, and safety. This paper presents the design, development, and implementation of an IoT-based fire-fighting robot system equipped with a water sprinkler and GPS integration. The proposed system aims to provide an autonomous, efficient, and reliable solution for detecting and extinguishing fires in various environments, while also enabling real-time monitoring and navigation through GPS tracking. By leveraging IoT technology, this system has the potential to revolutionize fire-fighting operations and save countless lives.

II. RESEARCH METHODOLOGY

Design and develop the firefighting robot that is utilized to control any disaster caused by fire, instead of Temperature sensors, Motor Driver, Motors, Servo Motor, Water Tank, GPS Module, GSM Module, Relay Module, Water Pump, Water Tank, Alarm, Chassis is used to mount all the components onto it. The power supply is connected to Arduino UNO and the motor driver. Once the fire is detected the robot will approach the fire and extinguish it.

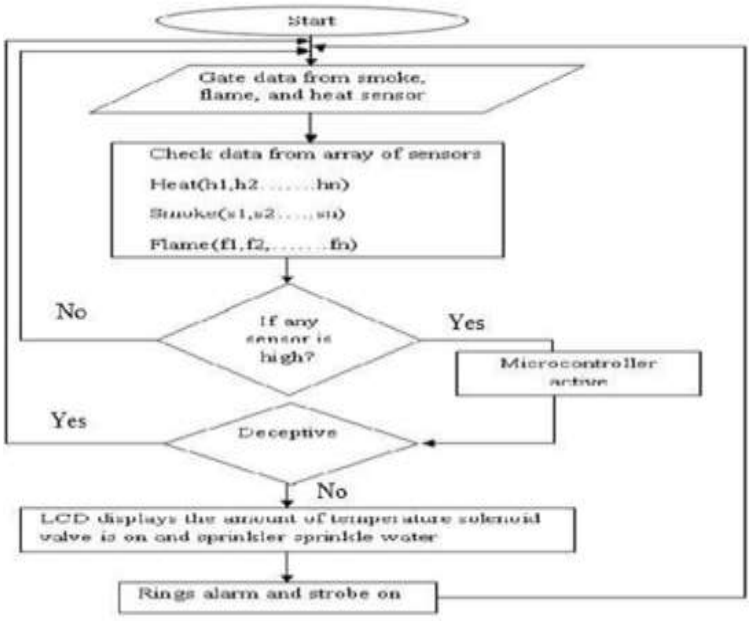


Figure.1 Flowchart of proposed system

Here's the block diagram of our Microcontroller Based Integration of Renewable Energy system. We can clearly describe the working process through this block diagram. Firstly we have two energy sources to supply electricity. One is the Solar and the other is the Wind. Generally Solar is the first priority of supplying the electricity. Our control system continuously monitors the voltage and the current of

both sources. If any unwanted situation occurs such as under voltage of a sources, or power failure of any of those sources, our system immediately switches the supply line to another sources that has no problem and vice versa. If both of the sources lose their voltage to the minimum threshold voltage, it combines the two sources. A voltage stabilizer keeps the output load voltage always stable as the loads need. All processes, voltages, current and current source is shown in a LCD display.

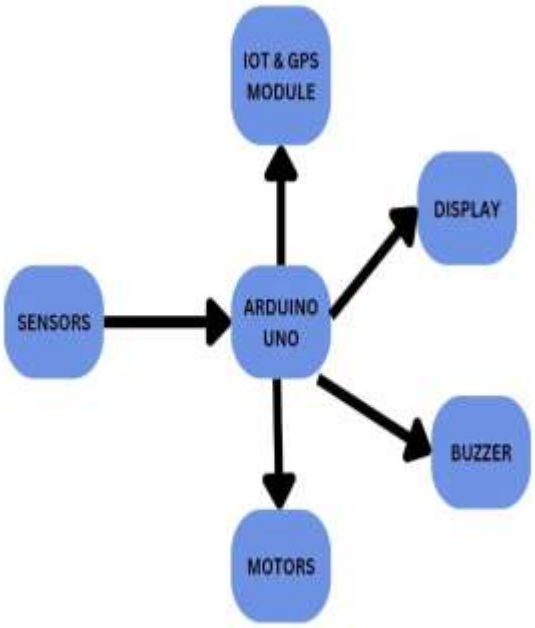
III. COMPONENTS RATING

Component	Value
Atmega 328P microcontroller	+5v,40mA
Li-ion Battery	3.7-4.2v
DC Motor	12v 6500RPM
Buzzer	5-12v
LCD (MIS-00010)	4.7-5.3v
Flame Sensor	3-5.5v
Relays	6v,12v,24v
GPS Module	

IV. MODELING WORKING

The full system runs in Auxilary power source.At first, if there is any kind of smoke detection in the building, the smoke sensor will be acitivated if the smoke is in range (ADJUSTABLE).Then it will pass the signal to Arduino UNO. Arduino UNO will provide the output to buzzer, solenoid gas valve, also to air ventilation system. After getting the signal buzzer & air ventilation will be turned on and the solenoide gas valve will cut the gas services throughout the building. Now if there is any kind of fire detection in the building the flame sensor (ADJUSTABLE) will pass the signal to Arduino UNO. Again Arduino UNO will provide the output to relay to cut the main electicity line and will give power to the emergenc sservice light. For extra support the GSM module will inform the nearest fire service through sms & phone call. At the time of a fire disaster, the robot will be triggered to deploy an appropriate fire extinguishing substance based on the type of fire. The robot will use extinguishing agents such as CO2, foam, or dry chemicals to suppress the fire effectively, depending on the situation and fire classification. This ensures a more suitable and effective response to different types of fires, minimizing damage and enhancing safety. When the detectors dosent detect Fire or smoke, the process will shutdown after 5 min (ADJUSTABLE).

V. BLOCK DIAGRAM



VI

The overall aim of this project was to develop a Microcontroller base fire detector with automatic Adaptive Fire Extinguishing Agents for industrial application, by following the methodology proposed at the beginning we meet the objective planned. We made the study for the proposed hardware requirements. We also identified the required software along with their specification and make the analysis with them. Then we conquer a meaningful simulation and prototype result. During the study of the project we were able to design the general structure successfully, write the C langue and compile it using Ardiuno IDC effectively and achieve the required result by simulating the system using proteus tools. After the simulation we write Arduino code for proto type and we make the connection to gate the desired result.

In general, our system can check continuously the occurrence of fire in all suspected places of industry and take action within a short time around 10s to extinguish it.
Finally, depending on the availability of farther advance technologies, this type of project for automatic fire protection could be further improved to save materials from damage and reduce time taken to protect industries from fire.
It is recommended to UOG workshop and labs, chemical industries, production industries and other industries to implement and use this system which can solve and avoid many accidents and materials losses due to the fire. Each working place needs to have one or more systems, depends on the size of that place
In the future, increasing the range of specifications of the components used makes it more compact and reliable which can be implemented effectively in the place such as malls, industries, houses, building complexes, schools, colleges, etc

VII. REFERENCES

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