EE2044-Electrical Mesurements and Instrumentation

SMART FOREST FIRE IDENTIFICATION AND PREVENTION SYSTEM

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Introduction

Forest fire is also known as a wildfire which will cause to create an uncontrolled fire in forest areas. Global warming reports that between 2002-2016 almost 4,225,000km^2 area was burned due to forest fire [1]. One of the solutions to forest fire is Forest Fire Identification System with usage of sensors.

This is focused on early detection, monitoring, and fast response to the forest fire. Due to the usage of the sensors in the system it will continuously check the allocated area for signs of fire ignition or spread. Upon the fire detection, it will spray the Carbon Dioxide (CO_2) to avoid the fire spread and alert the relevant authorities.

The importance of the Forest Fire Identification System is to safeguarding the lives, properties and natural ecosystems. Also, enabling the fast response and early detection this system can minimize the air pollution, loss of biodiversity and financial problems.

Background and context

There are multiple approaches already have been made to identify the forest fire in an early stage. Video Surveillance System is most generally utilized for identification of wildfire [2,3]. Visual cameras which are set on towers are used in this approach. The pictures which are got from cameras are processed through MATLAB then. But the reliability of the pictures due to the high false caution rate is low and the high cost are the issues in this system. Some implementations use satellite implementations. However, the mists enormously influence the framework [2,5,6]. Images taken from satellites have also been used in detecting fire but due to low spatial and temporal resolution of satellite images the detection gets delayed [7]. Determining the location of the fire flames by using instruments like Osborne Fire finder is another approach. [7,8]. It is more progressive than a camera but the distance to fire may affect the accuracy of the system. There is another approach that has been made which is a combination of wireless sensor networks and artificial neural networks. It has been used in research on forest fire detection [7]. Needing a lot of processing power and high-power consumption at a node level are disadvantages of this approach.

Therefore, it is a need of low cost, low battery power using, high accuracy, simple, wireless, and portable smart forest fire identification system which we are going to propose in here.

Objectives

The objectives of the Forest Fire Identification System are,

- Real-time monitoring has the capability to identify the fire ignition and spreading by using the temperature sensor, humidity sensor and smoke sensor and fire identification sensor.
- Automated response will spray the Carbon Dioxide (CO_2) gas to the area where the fire started.
- Automated alerting system used to notify the relevant authorities regarding forest fire detection.

Project Scope

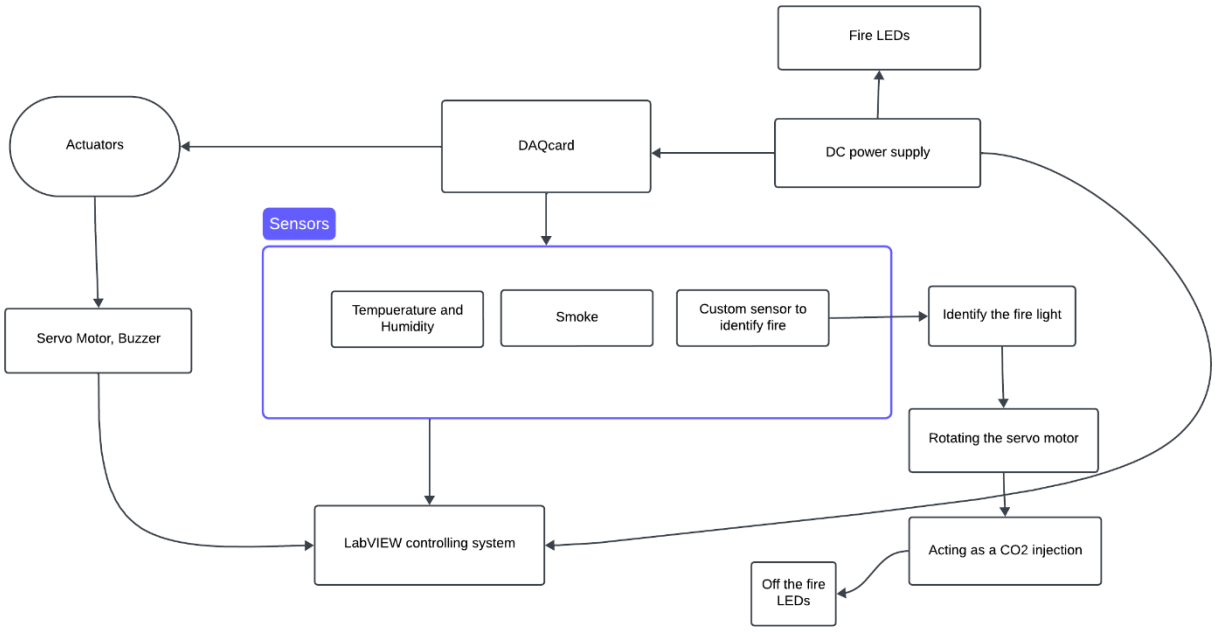
The scope of this project is to design and implement a cost-effective, scalable, and reliable system for early detection and prevention of forest fires using LabVIEW software. system will utilize a combination of sensors, including humidity, smoke, and temperature sensor, to monitor environmental conditions and detect signs of fire. Software like LabVIEW enables us to combine these sensors visually and more efficient way with the real time measurable sensing data. Upon detection of the fire, the system will release carbon dioxide to suppress the fire and notify the nearest fire stations. Notifications are the only

way that fire stations and the project collaborate; there is no real-time coordination between fire station staff or technology. By using CO2 to extinguish fires, human safety is given priority. The project's financial constraints have an impact on the sensors and component choices.

Methodology

The project's approach is using a variety of sensors strategically to identify and stop forest fires using LabVIEW which use to DAQcard control and communication. The main sensors that are used include temperature and humidity, smoke, and a custom sensor to identify fire. For the simulation purpose we use LEDs as fire. We use LabVIEW software to input necessary environmental conditions. In the actual scenario, the low humidity might be a sign of a significant risk of fire, the humidity sensor is used to track the amount of moisture in the surrounding air. Since smoke particles in the air are frequently the first indication of a fire, the smoke sensor is a crucial instrument for early fire detection. Since a quick spike in temperature may be an indication of a fire, the temperature and humidity sensor are used to track changes in the surrounding temperature and humidity. Additionally, IR sensor is also used to pin the accurate location. Upon detection of a fire, the system will release carbon dioxide in the affected area to suppress the fire and notify the nearest fire stations for immediate action [9].This methodology is not only effective but also scalable and can be adapted to include other sensors as needed, making it a versatile solution for forest fire prevention [10].

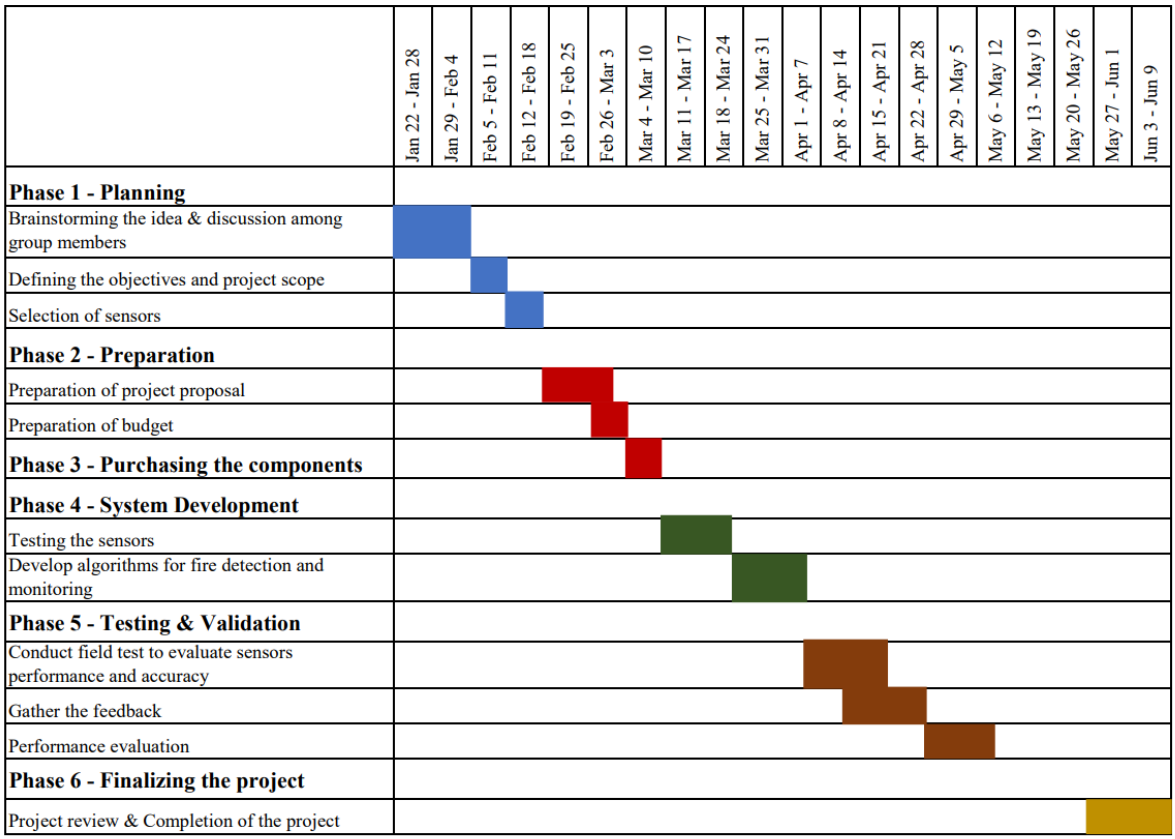
Proposed block diagram



Justification for the Chosen Methodology

Cost is the main reason these sensors were chosen instead of camera modules. Camera modules can confirm a fire visually, but they are much more expensive and would not be practical for widespread use in forested areas. However, the selected sensors may be widely used and are reasonably priced, allowing for thorough coverage of the forest region. Utilizing these sensors also conforms to study results that indicate the efficacy of sensor-based systems in the early identification of fires.

Project Timeline



Conclusion

Forest fire is a major threat to the environment and biodiversity and human lives as well. It also increased global warming and CO2 emission. In this proposal we propose a LabVIEW controlled system which can identify and prevent fires when it occurs. This project has major differences than existing products and projects which has significant advantages.

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