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Short Communication

Forest Activity Monitor

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Abstract

The main aim of the present work is to determine the temperature and humidity of the area where the model will be located. For this particularly I have taken into consideration forests which are prone to wildfires. These wildfires require immediate action and this is where we can use the Forest Activity Monitor or FAM. FAM will inform us about the temperature and humidity of the forest area. This data will be then analysed to determine the rise or fall in the temperature or humidity as hazardous or random fluctuations. The device uses in FAM are DHT11 temperature and humidity sensor along with Arduino UNO and a Wi-Fi module to give us the necessary information. Using components fit for industrial environment, this model can also be used in industries and factories where the manufacturer has to keep a track of the temperature and humidity.

Keywords: Temperature, Humidity, Forest activity monitor, sensor.

Introduction

Nowadays, Forest fires are a significant threat to the environment, wildlife, and human life. Due to drastic climate changes and deforestation many animals migrated from the forest area to residential area which becomes threat to humankind. The significant decrease in number of trees has resulted in an unhealthy and unbalanced environment for the birds and animal's survival in the forest. The main aim of this project is to have a control over these forest fires by keeping a track on them before they destroy our ecosystem to a point at which it cannot be restored. Early detection and prevention are crucial to minimize damage. This project proposes a forest fire detection system using temperature and humidity sensors.

The objectives of this project are to: i. Detect forest fires by monitoring temperature and humidity levels. ii. Develop a system that can alert authorities and nearby residents in case of a forest fire. iii. Provide real-time data on temperature and humidity levels in the forest.

Methodology

The proposed system consists of: i. Temperature and humidity sensors (DHT11) to monitor environmental conditions. ii. Arduino UNO microcontroller to process sensor data and send alerts. iii. LCD display to show temperature and humidity readings. iv. Wi-Fi module (optional) to send alerts to authorities and nearby residents.

Literature survey: Here is a literature survey on forest activity monitoring using IoT, with a focus on applications and technologies relevant to this field:

The Internet of Things (IoT) is referred to as a network of physical objects which includes embedded technology for communication, sense or interacts with the internal states or the external environment[1,2]. Marcu A. E et al. proposes an IoT-based forest monitoring system for wildlife conservation[3]. IoT-based forest health monitoring system[4] uses sensors to monitor forest health parameters, such as soil moisture and tree growth, and sends alerts to foresters via the internet. The system uses sensors to monitor forest activities, such as animal movement and habitat destruction, and sends alerts to conservationists via the internet. The forest activity monitoring system uses sensors to collect data on forest activities, such as animal movement and tree cutting, and uses machine learning algorithms to classify the activities. Wireless Sensor Networks (WSNs)[5] combined with IoT enable monitoring of forest health by measuring soil moisture, temperature, and other critical parameters. Advanced decision-making algorithms help reduce false alarms and optimize energy use.

Forest fire detection system using IoT and drone technology. The system uses sensors and cameras mounted on drones to detect forest fires and sends alerts to authorities via the internet. Low-Power Wide-Area Networks (LPWAN): LPWAN, particularly LoRa and NB-IoT,[6] plays a critical role in IoT-based forest monitoring systems. These networks support long-distance communication in remote forests, enabling real-time data transmission from sensors measuring variables like CO_2 levels, humidity, and temperature. Solar-powered micro-weather stations enhance energy efficiency. IoT for Sustainable Forest Management has been effectively utilized for precision forestry to manage forest operations sustainably.

Forest Fire Monitoring, IoT integrated with machine learning techniques, such as convolution neural networks (CNNs)[7], is employed to detect anomalies and predict forest fires. Systems leverage sensors for temperature, humidity, and smoke detection and can utilize drones equipped with thermal imaging cameras for remote surveillance.

Technologies such as GNSS-RF, LiDAR,[8] and photogrammetry are employed to monitor soil disturbances caused by machinery and track the efficiency of operations. These methods align with the principles of sustainable forest management by integrating environmental, economic, and social dimensions. The use of unmanned aerial vehicles (UAVs)[9,10] with IoT sensors has proven effective for tasks like mapping fire-prone areas and detecting early signs of wildfire using thermal imaging.

DHT11 is a Humidity and Temperature Sensor[11]. It generates calibrated digital output. DHT11 can be interfaced with any microcontroller like Arduino, Raspberry Pi, etc. and obtain instantaneous results. DHT11 is a low-cost humidity and temperature sensor which provides high reliability and long-term stability. It is mouldable and waterproof. In this project, we will build a small circuit to interface Arduino with DHT11 Temperature and Humidity Sensor. DHT11 is a part of DHTXX series of Humidity sensors. The other sensor in this series is DHT22. Both these sensors are Relative Humidity (RH) Sensor. So, they will measure both the humidity and temperature.

Table-1: Table contains specifications of operating system[12].

Operating Voltage	5V
Recommended Input Voltage	10V
Input Voltage Limits	6-20V
Analog Input Pins	6 (A0 – A5)
Digital I/O Pins	14 (Out of which 6 provide PWM output)
DC Current on I/O Pins	40 mA
DC Current on 3.3V Pin	50 mA
Flash Memory	32 KB (0.5 KB is used for Bootloader)
SRAM	2 KB
EEPROM	1 KB
Frequency (Clock Speed)	16 MHz

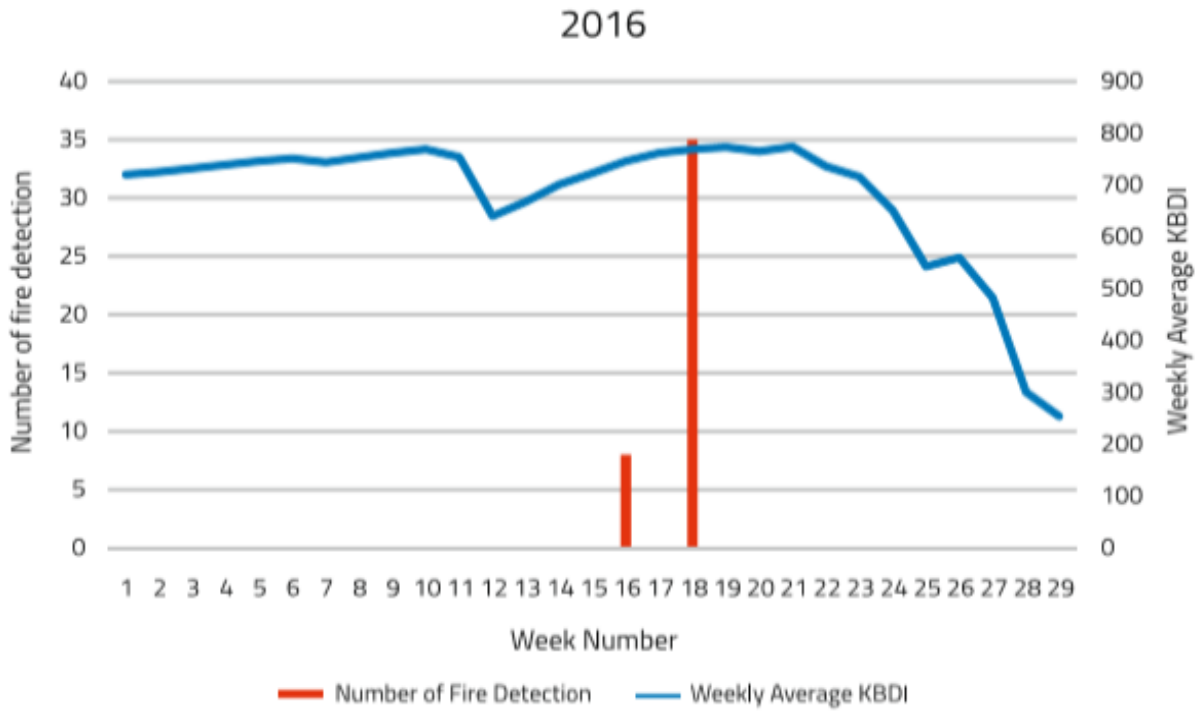


Figure-1: In some recent studies, the rate of fires was observed and plotted against a graph shown on a weekly basis how many fires occur. The black line shows the Keetch-Byram Drought Index. Drought is also an important or major factor leading to forest fires which is why humidity sensing is needed[11].

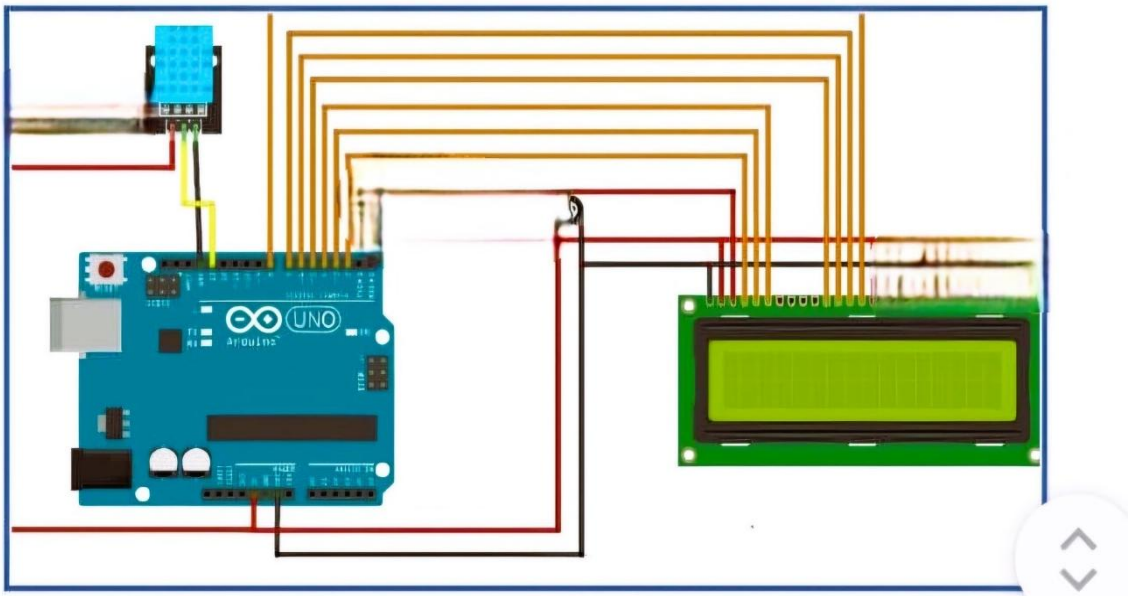
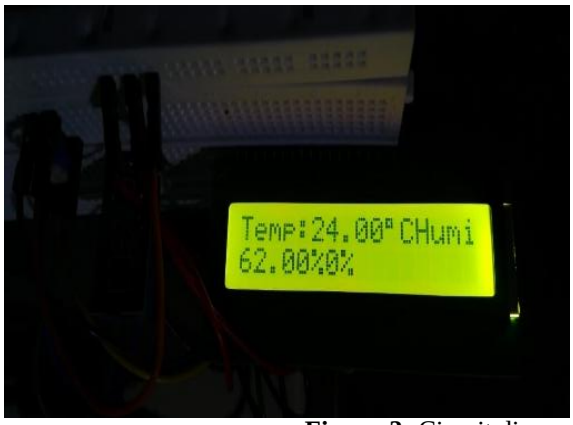


Figure-2: Circuit Diagram[13].



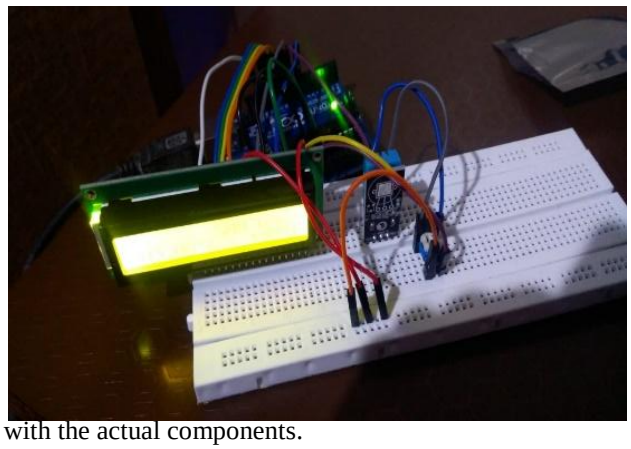


Figure-3: Circuit diagram with the actual components.

Results and Discussion

The prototype system displays temperature and humidity readings on the LCD display. When the temperature exceeds a certain threshold, the system sends an alert to authorities and nearby residents. Same process is implemented for the fire detection, when flame increased and information will be conveyed to the authorities. So, by using this technique we can protect the forests, wildlife and keep a track of change in the weather conditions like drought, monsoon, summers etc.

Conclusion

The proposed forest fire detection system is a low-cost and efficient solution for early detection and prevention of forest fires. The system can be improved by adding more sensors and features, such as GPS and camera modules.

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