

IOT ENABLED FOREST FIRE DETECTION AND ONLINE MONITORING SYSTEM

(BY USING ATMEGA 328-P MICROCONTROLLER)

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Abstract: It has been found in a survey that 80% losses caused due to fire would have been avoided if the fire was detected immediately. Arduino platform based IoT enabled fire detector and monitoring system is the solution to this problem.

In this project, we have built fire detector using Arduino Uno which is interfaced with a temperature sensor, a smoke sensor and buzzer. The temperature sensor senses the heat and smoke sensor senses any smoke generated due to burning or fire. Buzzer connected to Arduino gives us an alarm indication. Whenever fire triggered, it burns objects nearby and produces smoke. A fire alarm can also be triggered due to small smoke from candlelight or oil lamps used in a household. Also, whenever heat intensity is high then also the alarm goes on. Buzzer or alarm is turned off whenever the temperature goes to normal room temperature and smoke level reduces. We have also interfaced LCD display to the Arduino board. With the help of IoT technology, we have tried to make it smarter by connecting the whole monitoring process to the webpage naming-“ Fire Security System “ created by the PHP tool and controlled by the Arduino programming done in the software- Arduino 1.6.3.

Arduino fire monitoring system serves for industrial purpose as well as for household purpose. Whenever it detects fire or smoke then it instantly alerts the user about the fire through the ethernet module. For this purpose, we are using Arduino Uno which is from Arduino family. Also, the Arduino interfacing with LCD display is done to display the status of the system whether the Smoke and Overheat is detected or not. And Arduino interfacing with Ethernet module is done so that user get to know about the prevailing condition message. It intimates the user about the fire detection. This system is really useful whenever the user is not in the proximity of control centre. Whenever a fire occurs, the system automatically senses and alerts the user by sending an alert to an app installed on user's Android mobile or webpage accessible through internet.

KEYWORDS: Internet of things, Radio Frequency, Transmitter, Receiver, SPI (Serial phase interface), Ethernet shield, Sensors.

I. INTRODUCTION

Owing to a paradigm shift toward Internet of Things (IoT), researches into IoT services have been conducted in a wide range of fields. As a major application field of IoT, Forest fire detection has become one such issue. The havoc due to forest fire has caused serious environmental problems and devastation of flora and fauna. Within the current turbulent global economic, demographic, social and ecologic context, governments, local administrative authorities, researchers and commercial companies or even individuals have to recognize the importance of the resources contained in the forest environment - not only from the perspective of the biodiversity, but also from the point of view of the economic resources which forests enclose. Therefore, any major threat posed to this essential component of the environment should be identified, studied and fought through the most efficient and modern economic policies and technological means. One of the most dangerous phenomena, which jeopardize forests, is represented by forest fires

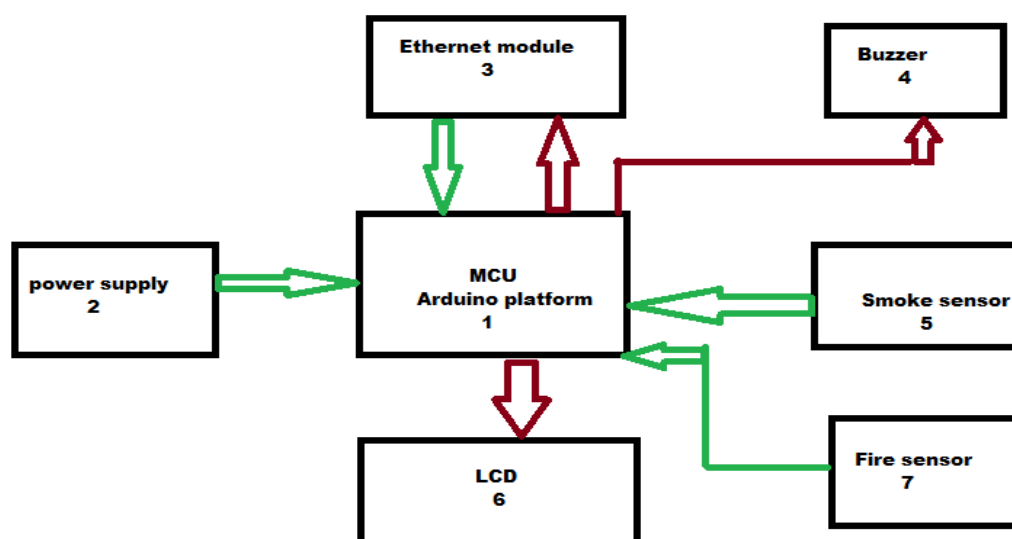
A forest fire is any form of unrestrained fire that erupts in a forested area. Forest fires have proven to be a massive form of destruction for humankind, especially when not countered through appropriate measures and strategies.

Therefore, an IoT-based Forest fire detection system is proposed to detect the fire by monitoring the values of CO₂ level and temperature. In this project, we have built fire detector using Arduino Uno which is interfaced with a temperature sensor, a smoke sensor and buzzer. The temperature sensor senses the heat and smoke sensor senses any smoke generated due to burning or fire. Buzzer connected to Arduino gives us an alarm indication. Whenever fire triggered, it burns objects nearby and produces smoke. In this project, we have built fire detector using Arduino Uno which is interfaced with a temperature sensor, a smoke sensor and buzzer. We have also interfaced LCD display to the Arduino platform. With the help of IoT technology, we have tried to make it smarter by connecting the whole monitoring process to the webpage naming-“ Fire Security System “ created by the PHP tool and controlled by the Arduino programming done in the software- Arduino 1.6.3.

AIM OF THE PROJECT

“TO DETECT THE FOREST FIRE AS EARLY AS POSSIBLE BY MEASURING THE LEVEL OF TEMPERATURE AND CO₂ LEVEL”

II. GENERAL BLOCK DIAGRM



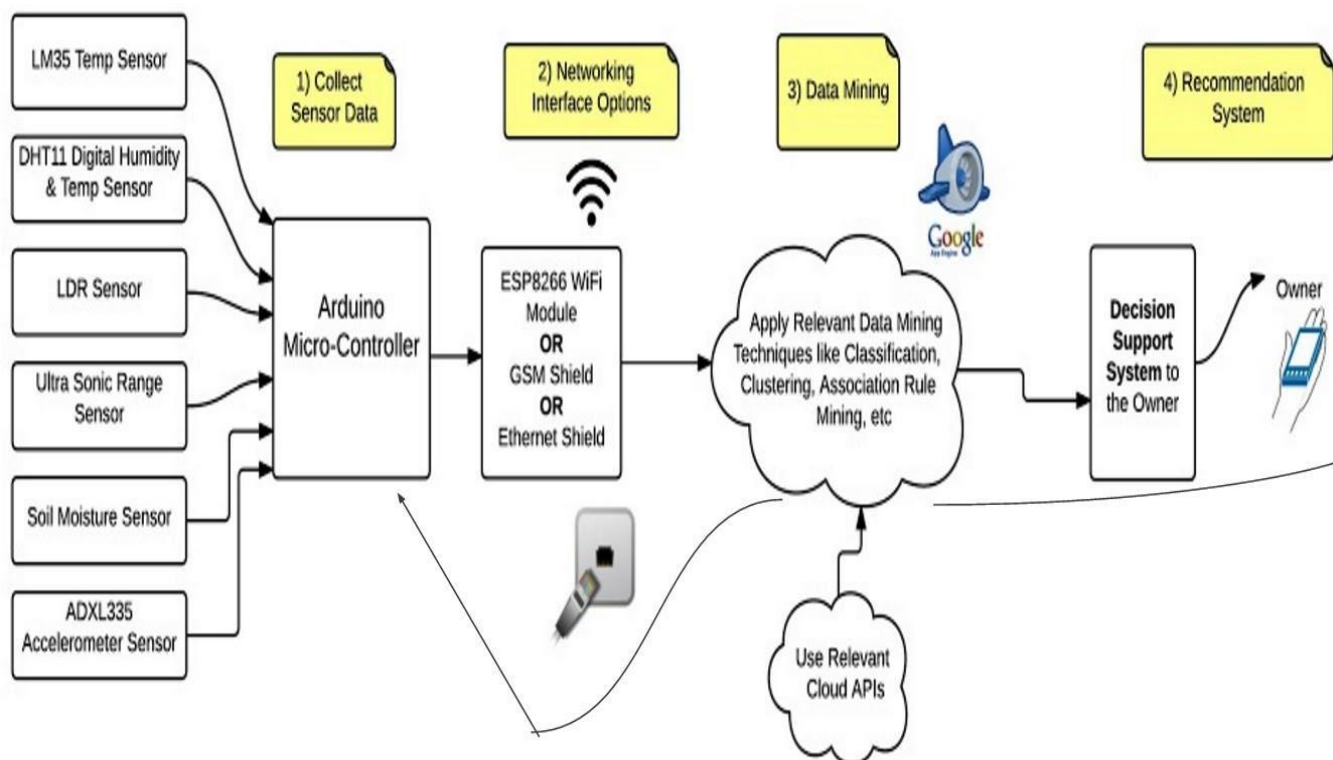
III. HARDWARE COMPONENT

- ARDUINO UNO MICROCONTROLLER
- RF MODULE (RECEIVER AND TRANSMITTER)
- GAS SENSOR(MQ6)
- TEMPERATURE SENSOR(LM35)
- ETHERNET SHIELD
- LCD(16*2)
- ROUTER
- PCB(Printed Circuit Board)
- TRANSFORMER
- VOLTAGE REGULATOR
- BUZZER

WORKING OF PROJECT :-

To understand the working of the project, we need to first go through the basic system architecture of the IoT enabled system as shown in figure given below.

BASIC SYSTEM ARCHITECTURE OF THE IoT ENABLED SYSTEM:-



Working of it can be explained in 5 steps. They are:-

- Employing Sensors serving as Data acquisition centre-

Temperature sensor and smoke sensor are employed that need to be placed at certain distances so that a look can be kept on the entire forest area in order to detect the ignition alarming temperature and the level of carbondioxide gas(CO₂). These sensors will send the signal or the information to the microcontroller. These will all sense changes in the environment and react automatically in the event of an emergency. New innovations in automatic initiating devices use cameras and computer algorithms to analyse visible effects of fire and movement in ways that other detection devices can't. Number of fire sensors are to be employed in practical situation that are needed to be placed at certain distances so that a look can be kept on the entire forest area.

- Collection of data by the IC embedded in the arduino of the Transmitter circuit :-

The IC ATmega 328-p (microcontroller) embedded in arduino platform present in the transmitter circuit receive the data sensed and collected by the temperature sensor and gas sensor. Then, the controller performs the programmed action to it and pass them to the transmitter for transmitting the data to the receiving station.

- Transmission of the data by the transmitter :-

On receiving the data from the controller, transmitter transmits the data to a certain range where the receiver station is optimized to be employed . Microcontroller is the central part of the hardware circuit; it controls and enables the functioning of the entire circuit, here transmitter circuit in this case.

- Receiving of the data by the Receiving station:-

On receiving the data from the transmitter circuit , the receiver sends the data to the controller IC of the attached arduino uno embedded in the receiver circuit in digital form making the controller possible to do the programmed actions for the monitoring of temperature level and CO2 level for fire detection.

- Display of the levels of temperature and CO2 level in webpage accessible through locally created network:-

When the data regarding the temperature and the CO2 level are processed in the IC of the receiver circuit's arduino which is programmed with different library functions of the Ethernet shield interfacing making it possible to create a webpage in the locally created network naming —Fire Security Systeml by the help of router . The arduino **ethernet shield** R3 (assembled) allows an arduino board to connect to the internet. It is based on the Wiznet W5100 **ethernet** chip (datasheet). The Wiznet W5100 provides a network (IP) stack capable of both TCP and UDP . Arduino Ethernet Shield 2 connects your arduino to the internet in mere minutes. Just plug this module onto your arduino Board, connect it to your network with an RJ45 cable with features like:-

- Operating voltage 5V (supplied from the Arduino Board)
- Ethernet Controller: W5500 with internal 32K buffer
- Connection speed: 10/100Mb
- Connection with Arduino on SPI port

Apart from the above, an alarm circuit has been made just to facilitate the Fire security team to locate the vulnerable part as soon as possible.

This fire alarm circuit will give alarm only when the levels of the temperature will cross the preset value.

Stages of Designing:-

The whole designing of this IoT enabled forest fire detection and monitoring system has been mainly categorized into 4 parts :-

- Interfacing and programming of LCD with Arduino
- Interfacing and programming of Receiver and transmitter with Arduino
- Interfacing of Ethernet Shield with Arduino and creating SIP environment by programming.
- Connecting of sensors with transmitter

IV. CONCLUSION

Early warning and immediate response to a fire breakout are the only ways to avoid great losses and environmental and cultural heritage damages. Hence, the most important goals in fire surveillance are quick and reliable detection and localization of

the fire. It is much easier to suppress a fire when the starting location is known, and while it is in its early stages. Information about the progress of fire is also highly valuable for managing the fire during all its stages. Based on this information, the fire

fighting staff can be guided on target to block the fire before it reaches cultural heritage sites and to suppress it quickly by utilizing the required fire fighting equipment and vehicles.

REFERENCES

- [1] Çelik T., Demirel H., 2009. Fire detection in video sequences using a generic color model, Fire Safety Journal, Volume 44, Issue 2, pp. 147-158
- [2] Cetin A.E., A Khan M.B., Toreyin B.U., and Aksay A., 2004. Characterization of motion of moving objects in video, US Patent-20040223652.
- [3] Akyildiz IF, Melodia T, Chowdhury KR (2007) A survey on wireless multimedia sensor.
- [4] Fernández-Berni J, Carmona-Galán R, Carranza-González L (2008) A vision-based mon system for very early automatic detection of forest fires. In _First Int. Conf. on Modelling, Monitoring and Management of Forest Fires_, Toledo (Spain), 161-170.
- [5] Fernández-Berni J, Carmona-Galán R, Carranza-González L (2009) A VLSI-oriented and power-efficient approach for dynamic texture recognition applied to smoke Conf. on Computer Vision Theory and Applications_, Lisbon (Portugal), 307-314.
- [6] Inderpreet Kaur "Microcontroller Based Home Automation System With Security" IJACSA Vol. 1, December 2010 and Exploring C for Microcontrollers: A Hands on Approach By Jivan S. Parab.
- [7] Exploring C for Microcontrollers: A Hands on Approach By Jivan S. Parab.