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Fire Protection Using the CNN Algorithm in Mining Areas

M. Seenivasan[1]*, V. Pandiyan[1], K. Renuka[1] and N. Karthick[2]*

[1]Department of Electrical and Electronics Engineering, Kuppam Engineering College, Kuppam - 517425, Andhra Pradesh, India

[2]Department of Electronics and Communication Engineering, Kuppam Engineering College, Kuppam - 517425, Andhra Pradesh, India, karthiee90@gmail.com

Abstract

Fire is generally happening due to climate and human careless in workplace especially like coal mines. It damages the ecosystem and causes destruction of places, and death of humans. Therefore, it is preferred to prevent the occurrence of fire. Compared to the conventional techniques for detecting fires in mining areas, based on RF wireless technology, a wireless sensor network was suggested. As name implies WSN's are the network of wireless sensors, which is used in, automation, habitat monitoring, security and agriculture. This project describes the architecture of a system for temperature detection, humidity and smoke to stop fires that would result in the loss of many natural threats. The ADXL sensor is used to detect the fall down condition of pole in the due to the bad climatic condition and because of landslides. If the fire in the mining area is detected means send information to control room by using wireless RF communication. In addition, used web camera to detect the fire data then fire detected information viewed in PC through wirelessly connected any desk software. The camera and the device are placed in the pole on the workplace. Based on colour, light parameters, fire patterns CNN algorithm it detects the fire on mines, and also smoke sensor is used too to confirm the presence of fire by detecting harmful gases like CO gases.

Keywords: *Fire, Mine, NANO Technology, Sensors, Solar*

1.0 Introduction

In this paper automation process and the safety is the main criteria so, our proposed system will also adapt those places rather than forest to identify the places of fire and also locate the gas leakage in addition to avoid major disaster. Fir accidents in mines may occur due to presence of toxic gas as well as in industries will be lead to greenhouse gases, absorption of carbon, which present in the atmosphere and habitat of many organisms[1]. However, fire is one of the major threat which faced by the workers in the mining areas. In virtually every vegetation zone on Earth, Fire is the primary source of disruption here one of the main issues that have an impact on the flora and leads to a number of environmental issues is fires[2,3]. The Main cause of the fire is human carelessness or climate here WSN technology is one possible solution[4,5]. WSN stands for wireless sensor networks, which are made up of a network of numerous tiny wireless sensors. These sensors identify the threat, convert it to an electrical signal, send it to a remote place for analysis, and then use the findings in various applications. It can implement on any place even in accessible places too[6], the creation of oxygen is greatly aided by plants. The "WSN Based fire Protection System" initiative is thus introduced. There will be two sections for that, the segment and the control section. It is composed of an emitter (TX) and a receiver (RX)[7]. The central concept of this project is the creation of a mobile

**Author for correspondence*

wireless sensor node that functions as a node in a wireless sensing network. These problems have been addressed using a SMART automated device. These modules are available to us thanks to the integration of the newest wireless transmission systems and embedded solutions.

2.0 Literature Review

Proposed Image Processing-Based Fire Detection System Using Statistic Color Model Fire is an undesirable event that could bring a great loss of social wealth and human life. Various alarm systems, such as smoke detectors and temperature sensor-based systems, have been created to prevent these losses. Various automated fire alarm systems have been accessible as technology progresses and instruments such as temperature sensors, cameras and other devices have become more affordable[8]. In conjunction with the lower-cost instruments, web and wireless broadband technologies have evolved, and there are now a variety of systems that allow for low-cost, high-speed data transfer and wireless networking.

Main connection the central concept of this project is the creation of a mobile wireless sensor node that functions as a node in a wireless sensing network. These problems have been addressed using a SMART automated device. These modules are available to us thanks to the integration of the newest wireless transmission systems and embedded solutions. Image processing based fire detection using YCbCr colour model. A group of components known as a fire detection system uses visual and auditory equipment to identify and warn people of a fire. A real-time monitoring system that identifies the presence of fire in mines and gathers images using a web camera placed inside a room is the recommended fire detection system when a fire develops.

Continuous monitoring of Fires in The Mediterranean Area Using MSG. The Raspberry Pi which is a single-board microprocessor with the size of a credit card, has made it possible to create a range of automated and monitoring systems that use little energy and have faster processing capacity at a lower cost. Development and analysis of the vertical capacitive accelerometer Micro Electro Mechanical Systems (MEMS) technology is the foundation of accelerometers.

3.0 System Design

The above Figure 1 explains the circuit diagram of the

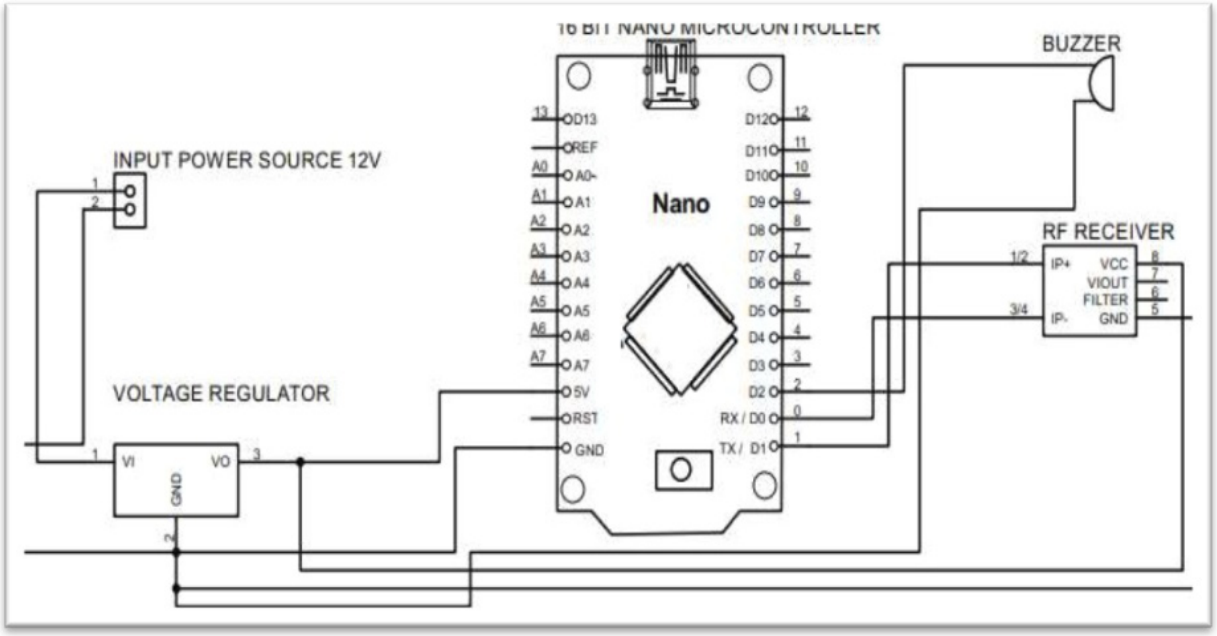


Figure 1. Proposed system circuit diagram- Transmitter portion.

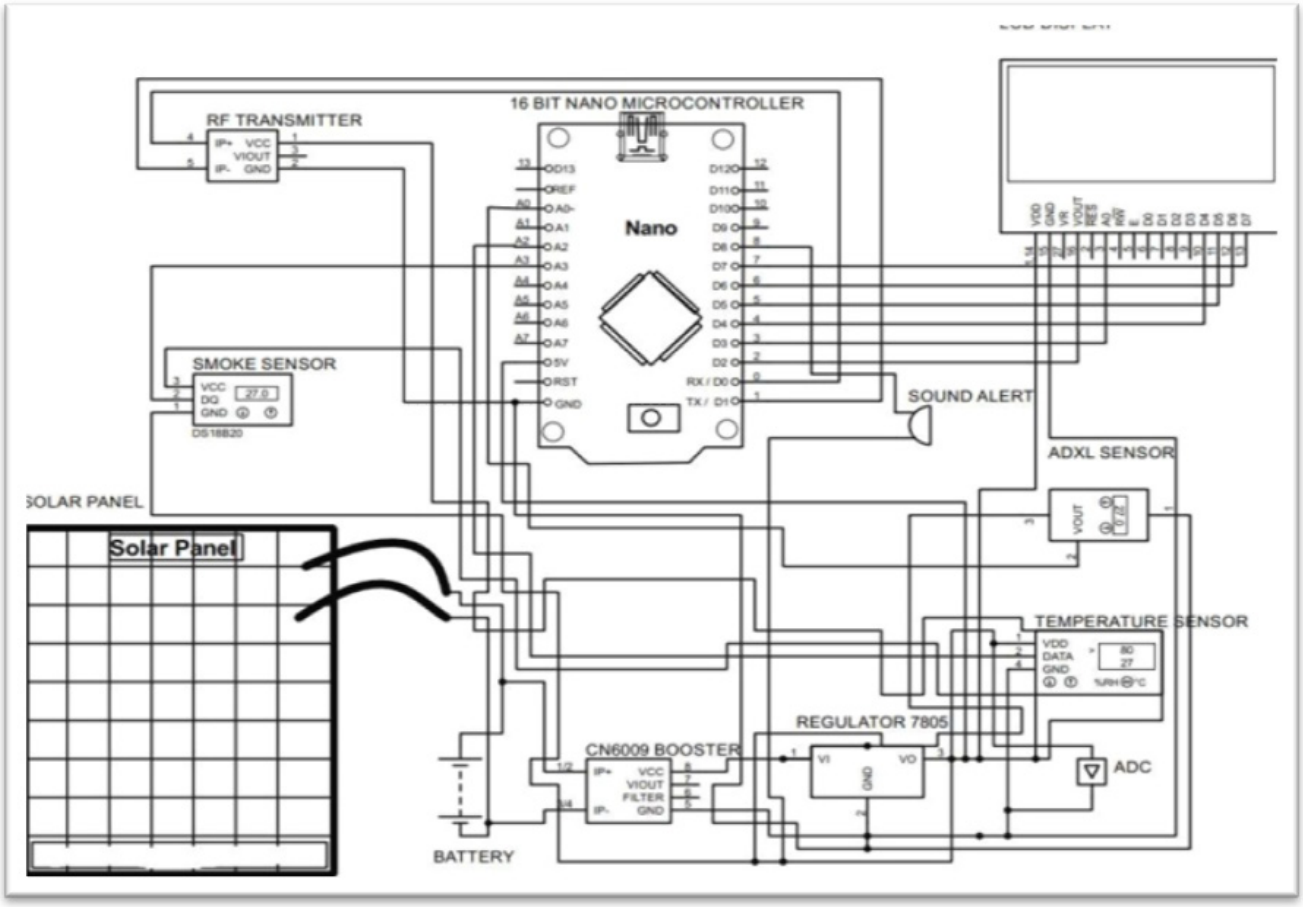


Figure 2. Circuit diagram for the suggested setup.

proposed project along with transmitter part and receiver Part and receiver, the main purpose of the transmitter part is to send the signal to the receiver part which present on the server room. The main components on the transmitter part of the proposed system is the ADXL sensor, LM35 temperature sensor, MQ2 smoke sensor, RF transmitter, Solar panel, LCD display, web camera, Voltage regulator and a sound buzzer. The circuit diagram of the proposed project with transmitter part and receiver Part the main purpose of the transmitter part is to send the signal to the receiver part, which presents on the server room. A web camera is used for the surveillance purpose. The sound buzzer informs during fire happen in the area of mines or fall down of the pole.

- The electrical energy from the solar panel is stored in the battery before being attached to the booster output pins and booster input pins. These pins are then connected to the regulator, which changes the voltage from 12 volts to 5 volts, and to the controller. The ADXL sensor contains three pins. The VCC pin is connected to a power supply. The GND pin is grounded.
- The VCC pin is connected to the power source, and the temperature sensor data pin is connected to the controller's analogue pin. The connector for GND is grounded.
- The VCC pin is wired to the supply, and the smoke sensor data port is wired to the controller analogue pin.
- Digital pins d2, d3, d4, d5, d6, and d7 of the controller are attached to the data pins of the LCD

display. Supply pin is linked to VCC, Where the VCC connector is attached to ground.

- The RF transmitter gadget consists of 4 pins. VCC pin is connected to supply. Ground is attached to GND pin. For transmitting and receiving data, TX and RX 2 pins are attached to the controller. Buzzer has 2pins. Positive pin is connected to controller digital pin; negative pin is grounded.
- The entire reception circuit is controlled by a Nano controlling board.
- In RF, receiver device VCC pin is connected to supply, GND pin is connected to ground and remaining pinare connected to Nano controller RX and TX pin for data receiving.

4.0 Implementation

The below Figure 3 shows the block diagram of the hardware of the project in this the operation can described as, when electric power from the solar panel will store in

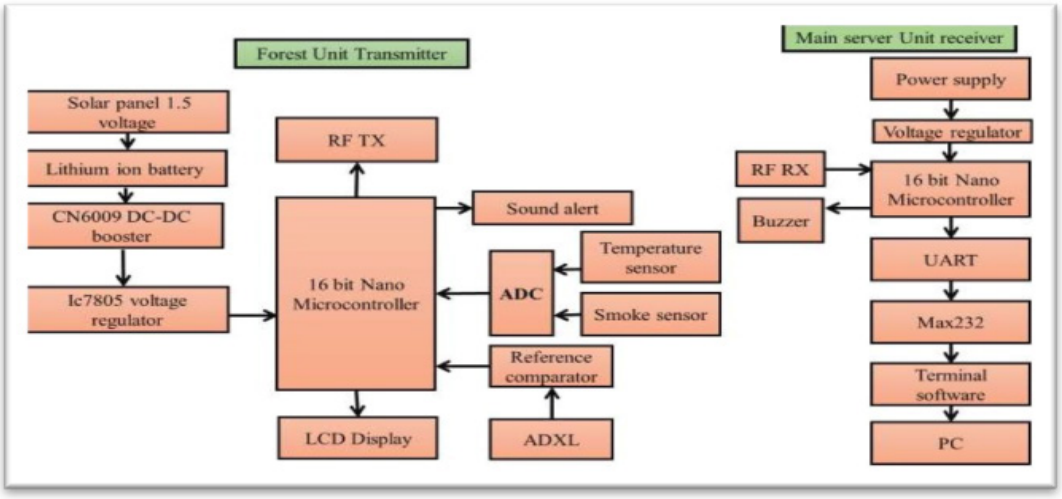


Figure 3. Block diagram proposed system's hardware part.

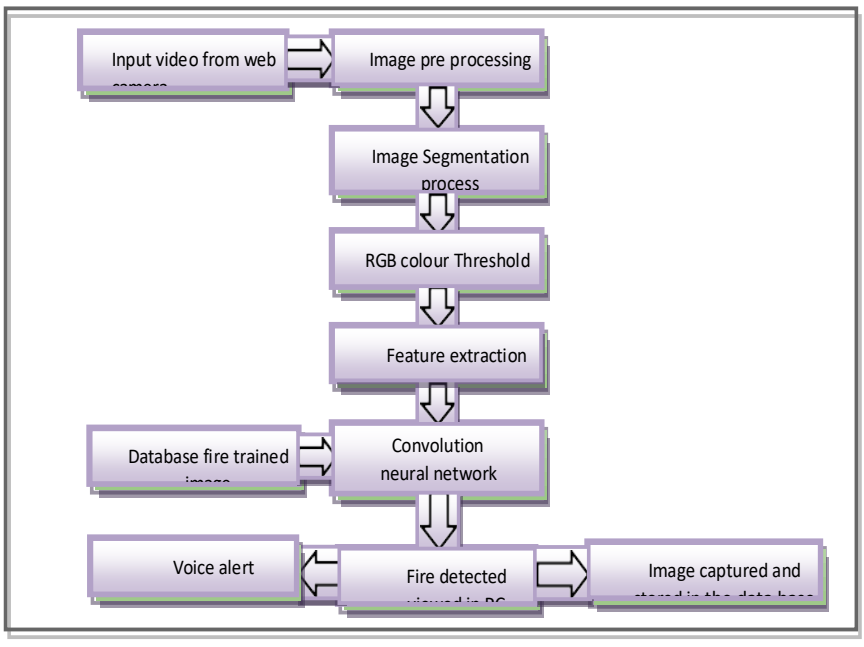


Figure 4. Block diagram proposed system's software part.

the battery booster pins, which connected to a regulator, which converts the voltage from 12v to 5v, and then to the controller.

This 5V is enough to power the microcontroller. If the fire occurs due to CNN algorithm the web camera detects as fire based on the pattern and the color of the fire. The smoke sensor will detect the presence of CO gas near places, after the presence of the smoke it will start to give sound alert, this signal is passes to the server room by RFTX transfer circuit. On the receiver room the signal will receive by the RFRX sensor this will pass to the the microcontroller will pass to the software by UART protocol through Max232 IC chip the output information then will show on the PC software.

The above Figure 4 shows the software part of the project which deals with the image processing technic to identify the fire in the real time by comparing with the trained images. Where the CNN Algorithm is used for image processing which is explained in the above Figure 4.

5.0 Result



Figure 5. Transferpart side of the pole.

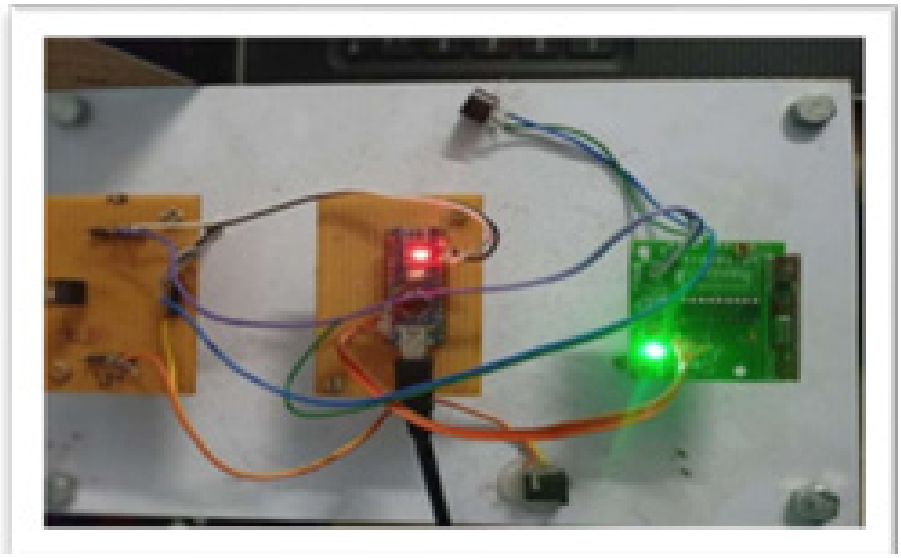


Figure 6. Receiver part side of the pole.

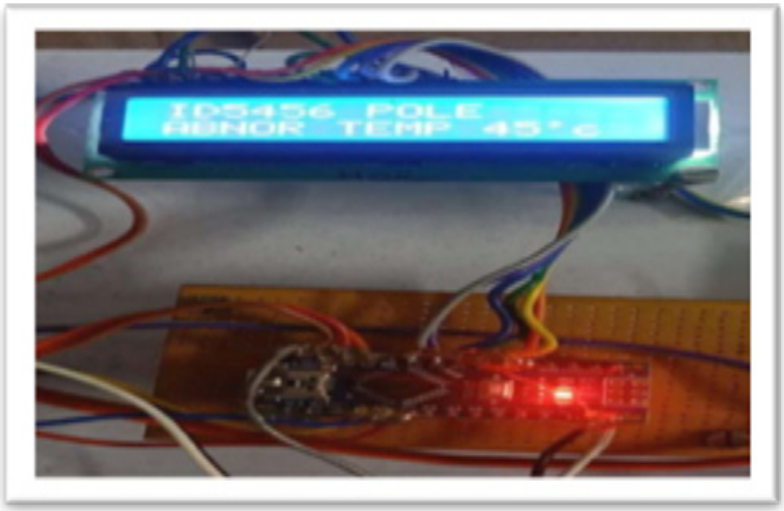


Figure 7. Abnormal temperature output detected by the temperature sensor.

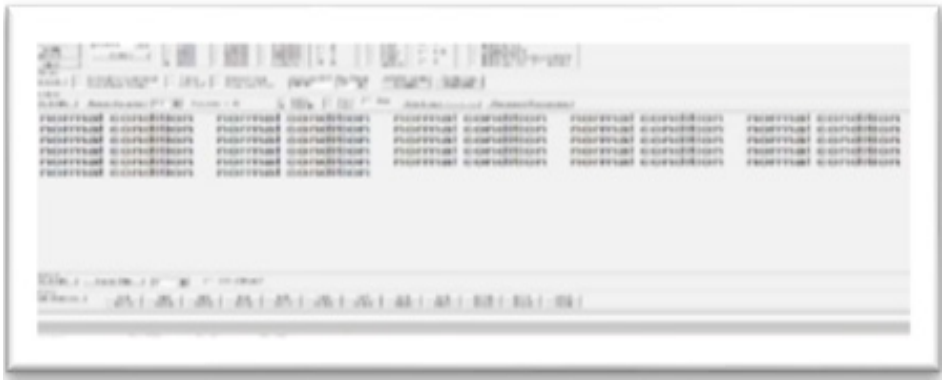


Figure 8. Software output under normal condition.

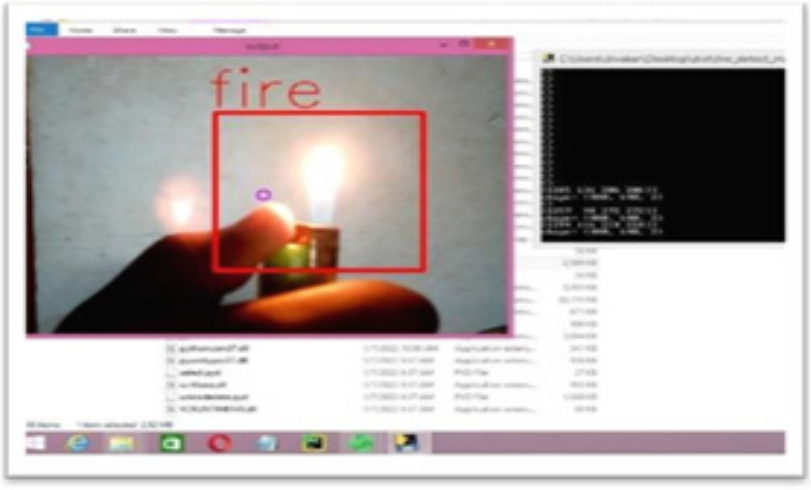


Figure 9. Fire detection output.

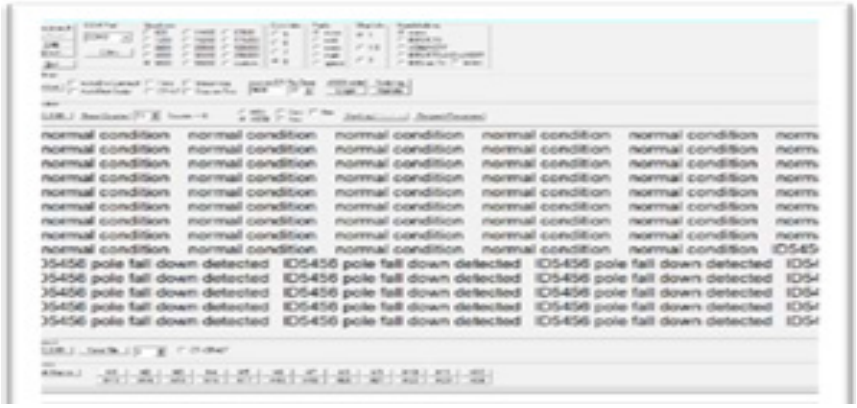


Figure 10. Software output under pole fall down condition.

6.0 Conclusion

The most crucial objectives in fire detection are real-time, accurate fire detection and location, which are accomplished by open CV, microcontroller boards, and sensors. The most recent wireless device implementation was made to function as a server for getting the status of fires. That is to continuously inform the officials about the fire situation in the mines. This was made feasible by the RF module in the embedded device. However, sensors constantly watch the fire condition. Hence, it's a WSN to protect the people working in Coal mines from fire.

7.0 References

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