Early Prediction and Control of Forest Fire

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Abstract

Forest fire causes imbalances in nature and endangers biodiversity by reducing faunal and floral wealth. Traditional methods of fire prevention are not proving effective and it is now essential to raise public awareness on the matter, particularly among those people who live close to or in forested areas. So that we designed a project for early prediction and control of forest fire. The existing methods such as Satellite-Based Systems, Optical Sensor and Digital Camera and Wireless Sensor Networks have some problems. So, when a forest fire occurs that is unexpected raise in temperature of that area or large difference compared to nearby areas, our proposed system will do four phases such as measure by using simple temperature sensors to monitor the temperatures of forest. Use microcontroller to report the temperatures to monitoring. To locate use camera and DIP to locate the reporting sensor, in case a forest fire occurs and take necessary measures to stop forest fire.

Keyword- Forest Fire, Satellite-Based Systems, Optical Sensor and Digital Camera Wireless Sensor Networks and DIP

I. INTRODUCTION

Forest fires cause serious health hazards by producing smoke and noxious gases such as Carbon Dioxide, Carbon monoxide, methane, hydrocarbons, nitric oxide and nitrous oxide that lead to serious consequences for local climate. Further impacts: Loss of timber, bio-diversity, loss of wildlife habitat, global warming, soil erosion, loss of fuel wood and fodder, damage to water and other natural resources, loss of natural regeneration. Other losses due to these fires included loss of soil fertility, soil erosion, loss of employment, drying up of water resources, and loss of bio-diversity. The dense smoke from the fires affected visibility. The incidence of forest fires in the country is on the increase and more area is burned each year. The major cause of this failure is the piecemeal approach to the problem. Both the national focus and the technical resources required for sustaining a systematic forest fire management program are lacking in the country. Taking into consideration the serious nature of the problem, it is necessary to make some major improvements in the forest fire management strategy for the country. So, our project was based on "early prediction and control of forest fire".

II. EXISTING METHOD

The most frequently used fire detection and suppression techniques employed by authorities are controlled burning, fire weather forecasts and estimates of fuel and moisture, watch towers, optical smoke detection, lightning detectors which detect the coordinates of the strike, infrared, spotter planes, water tankers, mobile/smart phone calls becoming increasingly common for detecting fires early, and Education through Fire Watch or similar schemes for house owners. Some of the techniques used in fire suppression include Satellite-Based Systems in which Earth-orbiting satellites and even air-floating devices have been employed for observation and detection of forest fires. Optical Sensor and Digital Camera in which two different types of sensor networks are available for fire detection, camera surveillance and wireless sensor network. The development of sensors, digital camera, image processing, and industrial computers resulted in the development of a system for optical, automated early recognition and warning of forest fires. The other one is Wireless Sensor Networks in which the line of sight and the early stage of the fire process problem could be solved with the second type of sensors. A new technology called wireless sensor network (WSN) is nowadays receiving more attention and has started to be applied in forest fire detection.

III. LITERATURE REVIEW

1) Divya Pritam, Jaya H. Dewan., Detection of fire using image processing techniques With LUV color space. Vision based fire detection system have recently gained popularity as compared to traditional fire detection system based on sensors. The popularity and need of video surveillance at residential, Industrial, public and business locations have supported the widespread use of vision based fire detection system. These fire detection systems are based on flame color detection combined with other features such as motion and area of frame. The fire detection system based on LUV color space and hybrid transforms is proposed.

2) Mingyi Zhu, Jiamin Zhang., Design of Fire Detection and Alarm System Based on Intelligent Neural Network. Its principles are measurement of the concentration of smoke particles in the monitored space air, while the detectors are often installed in places other granular material presence of these particles and smoke particles are sometimes difficult to distinguish, which makes the system information obtained cannot judge and distinguish.
3) Chi Yuan, Khaled A. Ghamry, Zhixiang Liu, and Youmin Zhang., Unmanned Aerial Vehicle Based Forest Fire Monitoring and Detection Using Image Processing Technique. This paper presents a forest fire monitoring and detection method with visual sensors onboard unmanned aerial vehicle (UAV). Both color and motion features of fire are adopted for the design of the studied forest fire detection strategies. This is for the purpose of improving fire detection performance, while reducing false alarm rates. Indoor experiments are conducted to demonstrate the effectiveness of the studied forest fire detection methodologies.
4) Dr.M.P Sivaram Kumar, Shyamala.R, Priyanka.G, Sneha., Predicting the Forest Fire Using Image Processing. In this paper, we examine the problem of early fire detection using images of different parts of the forest areas. Our approach is based on image pre-processing and segmentation of images is produced using the segmentation methods. A new approach is used to extract the features using histogram of gradient (HOG) by extract the features such as gradient, angle, magnitude and the support vector machine (SVM) are used to recognize patterns for classification is shown.
5) Qiang Yan, Pei Bo, and Zhao Juanjuan., Forest Fire Image Intelligent Recognition based on the Neural Network. The experiment results show that the method outperforms in terms of the recognition rate, recognition speed, and the Anti-jamming capability compared with the traditional fire recognition method. Thus, the results illustrate the validity and the generalizability of the method.

IV. METHODOLOGY AND RESULT

Our project includes the following methods. They are divide forest area under observation into ‘n’ zones. Each zone consists of Digital Camera, GSM & SENSOR (IR based), Laptop, microcontroller & LCD. Each sensor monitors ‘M’ Sq Ft. Sensors report to microcontroller. Information is then sent to monitoring station using GSM. Monitoring station evaluates for any abrupt and large deviation in temperatures.

- Micro controller (ATMEL)
- Digital Camera
- GSM modem
- Fire Sensor (IR based)
- Laptop
- LCD
- Stepper motor
- Power supply
- RS232

A. Block Diagram

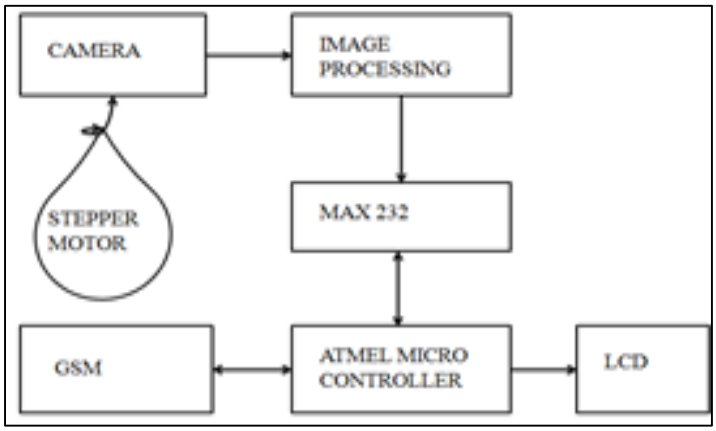


Fig. 1: Block diagram of proposed system

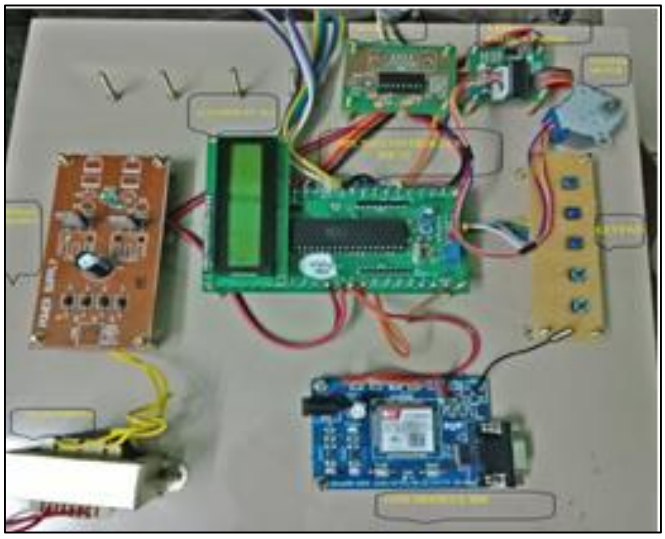


Fig. 2: Hardware Model

- MAT LAB 2014 A
- PROTEUS 8.0

The Image processing of the image is depicted in fig 3. The accuracy of the output values were send to the GSM of the hardware and with MATLAB software. The simulation result of the design is depicted in fig 4. The accuracy of the output values were compared to the output reading of the hardware and with proteus software. The working and generation of messages obtained from the GSM module is illustrated in the sample output window of the proteus software in fig 4.

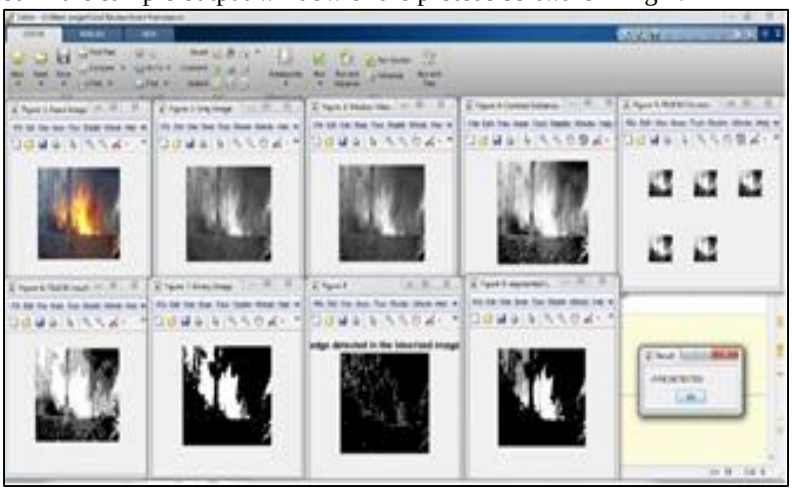
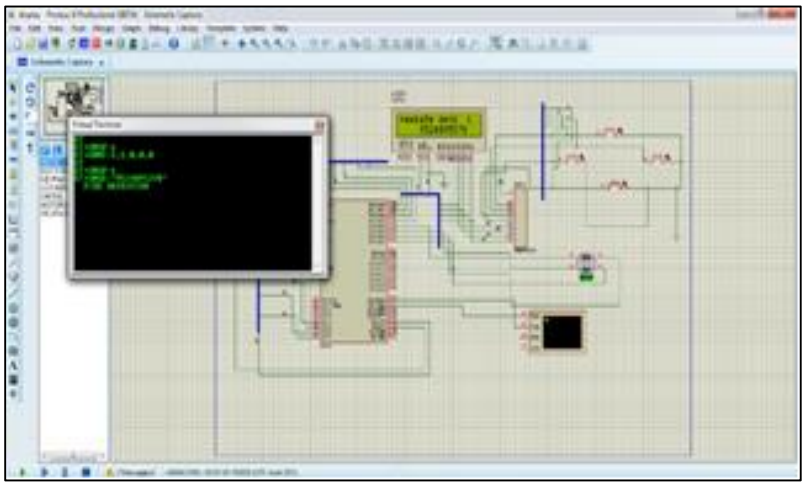


Fig. 3: MATLAB Output



The transmitted data were displayed in the mobile device. These values help the forest officer to take a further actions regarding forest fire.

V. CONCLUSION

This paper implemented a simple algorithm and can withstand high temperature. Rugged, cost-effective, easy installation process. Easy to fetch the data from Image using DIP. No expert knowledge required to understand data from the Camera. All the components like temperature sensor and GSM are easy to interface and economical. This project can be used to monitor and schedule the fire in the forest more efficiently.

VI. FUTURE WORK

The developing a sensor which is of multifunctional is mandatory. Using of small satellites like MICROSATELLITE, OR PICOSATELLITES. A group of small satellites are installed so that each small satellite is used for various purposes. If installing a Laptop in the forest becomes a problem, then the detection of forest fire can be done only by using the GPS and the TEMPERATURE SENSORS & also SMOKE SENSORS.

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