Smart Aerial Patrol for Forest Fire Detection and Prevention

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ABSTRACT

The forest fire is one of the severe problem all over the world. Forest and its surroundings are getting destroyed due to fire. Fast detection and immediate response for forest fire in both daytime and nighttime is necessary to reduce the losses. At present, public hotlines, fire lookouts in towers, ground and aerial surveillance is used as a means for early detection of forest fires. However, accurate human observation is limited by time, location and other factors. To overcome these challenges, our proposed model is planned to implement in the forest area with image processing technology and UAV. In this project, we have proposed a fire detection algorithm based on image processing techniques which can detect the object with the surveillance devices like camera. A colour based segmentation technique was applied based on the results from the first technique and the second technique to identify the region of interest (ROI) of the fire then the environmental Sceneries are captured through the camera and are processed in the Raspberry-pi controller and with the help of UAV fire will be suppressed. The power supply to the controller board is proposed to drive by lithium-polymer battery and the battery is allowed to charge via solar energy.

Keywords: Colour *detection, Raspberry-pi controller, Lithium polymer battery, solar cells, drone with camera*

1. INTRODUCTION

Forest fire has a great impact over years on geographic, ecological systems of world. This change has influence on physical, chemical and biological properties of lakes and rivers which reduce soil erosion and increases greenhouse effects. Since global warming is increasing seasonal rainfall changes, so the sudden change in temperature sometimes causes heat and results in fire. The forest fire spreads rapidly destroying between 3 and 10 million hectares. Although fire at the forest makes way for clean and new forest , it's hard to control the fire spreading to other places that cause danger to mankind and wildlife, therefore immediate detection and prevention is the main thing.

2. METHODOLOGY

2.1 Existing Methodology

Various methods and solutions are being used from the past years to detect the forest fire, but none has positive results fire look-outs are being deployed in many risky areas to detect fire, for humans that are tedious work. As the technology develops new ways like wireless sensor network, land based robots are upcoming solutions, but these solution has many challenges to overcome. Many v video surveillance methods are proposed with the help of IR spectrometer, LIDAR and laser based systems. They have fewer false alarms but they are very expensive and sensitive too. Land based surveillance has limited coverage; satellite systems are very efficient for large hotspots requires huge investment. Aerial vehicles with man are usually large and expensive but pilot safety should be considered.

2.2 Proposed Methodology

Unmanned Aerial Vehicle (UAV) is gaining large popularity in this segment also a cheap and real time option. UAVs with smart functioning will be the best option to continuously monitor fire at the forest for developing countries. An autonomous UAV integrated with the sensing technology will overcome the existing methodology. These autonomous UAV will be able to surveillance the hazardous and risky areas which cannot be monitored with the help of mankind. Many researches is carried out in this UAV section.

Our research is to develop an autonomous UAV which will monitor the fire at the forest in real-time.Our proposed system consists of UAV with flight controller and a Raspberry Pi 3b+.Variousdata's are collected from the sensors, camera, these data is processed by the processor and alert is sent to then base station

3. SYSTEM ARCHITECTURE

We aim to develop a system which can process all the data within the system and only alert is sent to the base station. The system and its subsystems are explained below:

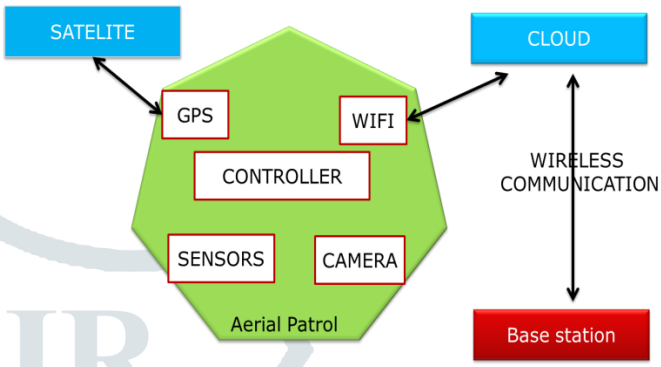

Fig.3.1: Block diagram of proposed system

i. UNMANNED AERIAL VEHICLE (Uav)

The UAV (Aerial patrol) is configured with camera and sensors which are controlled by Raspberry pi 3 Apart from this raspberry pi 3 there is another controller which is used to control UAV i.e., Flight controller. The flight controller consist of different sensors like barometer to measure air pressure to maintain constant flight, GPS for navigation system, Accelerometer and gyroscope sensors to maintain position of UAV.

ii. Controller

Raspberry pi 3 is used as a main controller for the patrol. Various sensors like DHT12, smoke sensors and ultrasonic sensors are used to monitor temperature, humidity, harm full gases respectively. These sensor datas are accessed by raspberry pi controller and processed to detect fire and also acts as a medium to transmit and receive data from ground station.

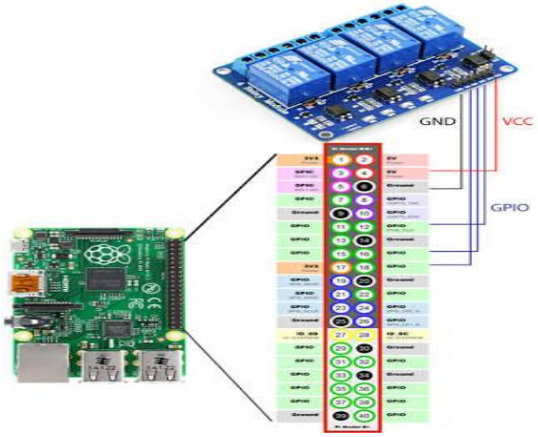

Fig 5.Pin diagram of raspberry pi-3 to relay model

iii. Solar system

Solar energy is excessively available in environment that can harvested with proper equipment. The solar energy is very popular because of its portability nature. The power conversion mechanism in photovoltaic modules has reduced the size of the panels ,the increase in power electronics devices has made engineers to make more compact device and more output. MPPT algorithm are newest and power full controllers which gives maximum output so this is used widely in solar industry and domestic purpose.

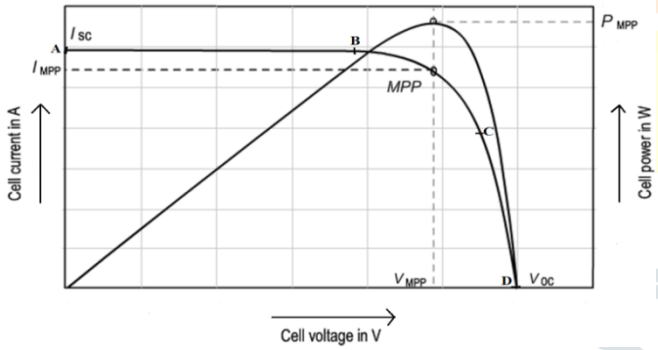

Fig.3.2: I-V and P-V characteristic curve of the PV cell

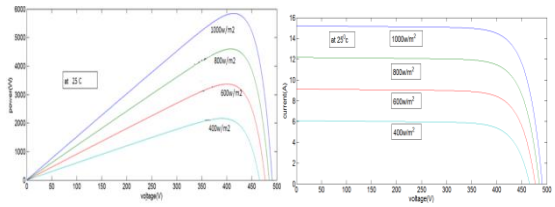

FIG.3.3: Variation of P-V & I-V curve with Solar irradiation

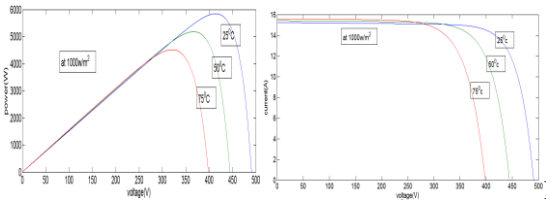

FIG.3.4: Variation of P-V& I-V curve with temperature

Solar chargers are one of the important parts of solar systems which are required to monitor and control the power flowing within battery and the loads, and also ensure the proper charge and discharge of battery.

Pulse Width Modulation (PWM) is the most effective means to achieve constant voltage battery charging by switching the solar system controller's power devices. Some of the advantages of this technique are

a. Ability to recover lost battery capacity
b. Increase battery charge acceptance
c. Maintain high average battery capacities
d. Equalize drifting battery cells
e. Reduce battery heating and gassing
f. Automatically adjust for battery aging

iv. Battery

The batteries used in UAVs should store large amount of energy with weighing less weight so that the UAV can be powered for a long time. Lithium polymer batteries will be the good choice as they are light in weight which can ensure more flight time of the UAV. The series connection of panels is used if high voltage required and also parallel connection gives more current.

4. Result and Conclusion

Our proposed system detects the fire very fast and prevents it from spreading to surroundings. This integration of various sub systems as mention in this paper has made our project unique and new approach to detect fire at forests in a faster way and immediate response. In future work, integration of other sensors and developing strong algorithm will differentiate among other objects and can provide an accuracy of 98% .the increase in components capacity will increase the lifting capacity of fire suppressors.

5. REFERENCES

1. Harjinder Singh," Forest Fire Detection using Wireless Sensor", International Journal of Scientific & Engineering Research, Volume 7, Issue 7, July-2016
2. Antonio Molina-Pico, David Cuesta-Frau, Alvaro Araujo, Javier Alejandre, and Alba Rozas, "Forest Monitoring and Wildland Early Fire Detection by a Hierarchical Wireless Sensor Network",Journal of Sensors Volume 2016,Article ID 8325845, 8 pages
3. U. Arun Ganesh, M. Anand, S. Arun, M. Dinesh, P. Gunaseelan and R. Karthik, "Forest Fire Detection Using Optimized Solar – Powered Zigbee Wireless Sensor Networks", International Journal of Scientific & Engineering Research, Volume 4, Issue 6, June-2013
4. MOHAMED HEFEEDA "Forest Fire Detection Using Optimized Solar Powered Wireless Sensor Networks",International Conference on New Frontiers of Engineering, Management,Social science and Humanities",February-2018.
5. Jennifer Yick, Biswanath Mukherjee, DipakGhosal., " Forest Fire Protection by Advanced Video Detection System-Croatian Experiences", Split, Croatia, 2006
6. Sensirion The Sensor Company, SHT10 – Digital Humidity Sensor (RH&T), [Online], Available at: http://www.sensirion.com/en/products/humiditytemperature/humiditysensor-sht10/
7. MikroElectronika, EasyBee3 Board, [Online], Available at: http://www.mikroe.com/add-on-boards/communication/easybee3/\
8. Wikipedia, the free encyclopedia, RS-232, [Online], Available at: http://en.wikipedia.org/wiki/RS-232
9. Seebamrungsat, et. al. ,2014] " Fire Detection in the Building Using Image Processing ", Third ICT International Student Project Conference 2014 [.