Large Scale Farm Land Monitoring System using IoT

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Abstract - Several important issues are affecting the large scale farm environment due to farm land fire and tree cutting. This Survey proposes an intelligent farm environment monitoring solution based on analogical and digital sensors, Zigbee and MQTT. Parameters such as fire, tree tilt value etc. are monitored with sensors. The user's accessibility to the collected data is ensured via Internet and a mobile application that allows the user to receive notifications and also buzzer will on, whenever fire, or illegal deforestation are detected. The Farm environment monitoring solution is addressed to public and private farm owners as well as to national environmental and disaster response authorities.

Key Words: Arduino UNO, Fire Sensor, Tilt Sensor, Zigbee, Buzzer,

1. INTRODUCTION

Trees act as primary consumer in a forest. Without tree no animal will exist. Trees play the major role in ecosystem as animals cannot able to maintain food chain as well as food web without them. They help them to breathe pure oxygen, as we all know that plant releases oxygen during the process of photosynthesis. Trees clean the soil and hold the soil, control noise pollution and act as a wind breaker. Climate control, weather sway and atmospheric air purification are most important factors for human existence. Trees and soils help to regulate temperatures. Because of the selfish nature of the human being the wild animal and forest are destroying. In order to overcome this drawback we need a warning system must be developed. This system that was surveyed on sends the related information to the server room. Buzzer is used for alerting. This involves the detection of fire in the farm land as well as detection tree cutting and message is being sent to the server room. Each unit is built with a series of sensors that monitor environmental parameters. Data acquired by the system, and subsequently processed, is sent to a dedicated server

2. RELATED WORK

In [1] Design and Development of Forest Fire Monitoring Terminal, proposed by Wu Fengbo, Lv Xitong and Zhang Huike in 2018. The forest environment monitoring system consists of 3 parts: data acquisition node, monitoring terminal and environment monitoring data server. Multiple data acquisition nodes and monitoring terminals implement data transmission from the data acquisition node to the monitoring terminal through zigbee. Through GPRS and remote sever for data exchange. The limitation in this work was that the main controller used in this process was STM32 which requires more power consumption since batteries are used it may cost more for the usage,

In [2] Drone-Based Forest Variables Mapping Of ICOS Tower Surroundings, proposed by Jorgen, Jonas, Nilsson and Franssen in 2018. A standard small four-rotor drone is used as a platform for a multispectral camera to accuratel collect 3-Dimentinal data about the forest canopy, data used to produce maps of forest variables. These maps proved to be very valuable input for the development of new models for the exchange of green-house gases in boreal and hemi-boreal forests. Mapping farm using drones is not an economical alternative for most operational applications in forestry and environmental monitoring due to limited area covered

In [3] Monitoring System for Forest Fire Based on Wireless Sensor Network, proposed by Yinigli Zhu, Lingqin Xie and Tingting Yuan in 2012. It was Based on the background of Forest fire monitoring, Which consists of 4 parts: sensor-node, sink-node, transmission network and monitoring system. The sensors will collect the data and is sent to the monitoring terminal via transmission network then according to the data type actions can be performed. The CC2531, a kind of SOC chip is selected as the nucleus of the wireless network node and the zigbee protocol is chosen as the communication protocol. The fire in the same region cannot be monitored as the sensors used are less efficient, the system uses satellite image therefore thickness of the sky clouds reduces the efficiency.

In [4] Agent based data collecting in a forest fire monitoring system, proposed by Ljiljana Bodrožić, Darko Stipaničev and Maja Štula in 2009. In this system captured images are processed by the agents. An agent has to sit in front of the screen and observe the each activity of the forest. According to that particular action will be taken. This technology requires 24 hours surveillance and a special agent should be placed who monitors the area and requires CCTV which is not a cost efficient mechanism.

In [5] Forest fire monitoring with multiple small UAV's, proposed by David W. Casbeer, Randal W.Beard, Timothy W. McLain in 2005. It consists of multiple drones, each drone is specific to a particular region of the forest and based on the

activities it detected sends the data to the server. In sever this data will be processed by using Image processing algorithm. The limitation is that efficiency is less, cost increases as land of the farm or forest increases and requires bulk amount of electricity.

In [6] The Identification of Forest Fire based on Digital Image Processing, proposed by jiang XIAO, Jie LI and junguo ZHANG in 2009. The system is based on the continuous image sampling provided by CCD camera. The images are obtained from the configuration characteristics, dynamic characteristics and color info of specific region. The characteristics, recognition algorithm will check all the suspected object flame pixel value of the proportion of red. The disadvantage is that the problem is more difficult as the result of thick trees, interacting branches and changing weather.

In [7] A Forest Fire Monitoring System Based on GPRS and ZigBee Wireless Sensor Network, proposed by Guozhu Wang, Junguo zhang and Wenbin li in 2016. Wireless network implementation scheme oriented to fire monitoring is presented based on the GPRS. The environment info is collected by zigbee network and transmitted to server. A monitoring center is required for this system and remote locations cannot be reached due to the less efficiency of the zigbee.

In [8] Dynamic real-time infrastructure planning and deployment for disaster early warning system, proposed by Huan Zhou, Arie Taal and Spirous Koulouzis in 2018. An effective nature disaster early warning system of the re-lies on widely deployed sensors, stimulation based predicting components, and a decision making system. The algorithm used here is partial critical path. This method is used to identify areas suspected of forest fires occurrence is proposed. To identify areas suspected a kind of disaster is a non-linear problem that is difficult to asses and predict and the algorithm has a lack of resource allocation which is the basic facility for any monitoring system which has been proposed earlier.

In [9] Forest monitoring system using sensors, wireless communication and image processing, proposed by Yogesh Deshpande, krishi savla, Crispin, Shivani and Jahnavi patel .This system used to monitors the condition suitable and collect data such as temperature, humidity, wind, soil etc.. The thermal imaging camera is used to collect thermal images of various areas of the forest. This will help in detecting forest fires as well. The image processing technique used here will collect the different angles of farm or forest and using the image process technique the forest fire is detected. Here high resolution cameras are required and large number of sensors should be made use of because of the reason that infrared sensors are of less efficient and relatively more cost.

In [10] Early forest fire detection using radio acoustic sounding system, proposed by Yasar gunerin sahin and Turkur Ince. This system shows that remote thermal mapping of a particular forest region by proposed system could be potential solution to the problem of early detection. The system is simply based on the rule that warm air rises rapidly, and if temperature map of the air immediately above the trees is periodically created, sudden temperature changes can be immediately identified. The solution has been studied at conceptual level but not being implemented and tested under real operating conditions.

3. METHODOLOGY

The proposed system consists of two modules. The sender module and receiver module. The sender is with a embedded technology that includes that sensors and Arduino. The wireless communication is through zigbee. The receiver receives the sender signal through zigbee and continuously monitor the data received. This system deals with tracking system and monitoring of large scale farm accidents. Finally, the information is shown on the PC/Mobile phones of the user.

Sender:
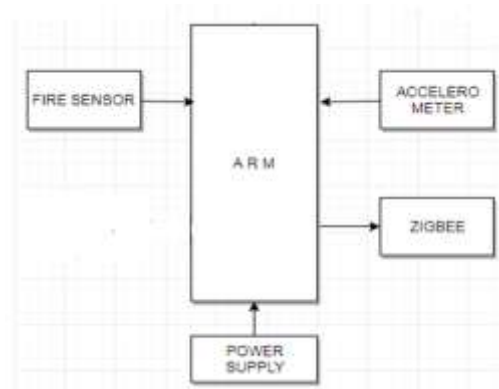
In this system a wireless sensor network paradigm for real-time farm land fire and conservation detection. The wireless sensor network can detect and forecast farm land fire, and also falling of trees more promptly. This project mainly describes the data collecting and processing in wireless sensor networks for real-time farm land fire and conservation detection. A neural network method is applied to in-network data processing.

The fire sensor is used to detect the fire in the forest and it will return digital value to arduino UNO board. If it detect the fire then it will return binary '0' to arduino board otherwise it will return binary '1' to arduino board. And another sensor we have used is accelerometer sensor. This sensor is used to detect the tilt value of the tree so that it is easy to detect the tree cutting based on tilted value. It measures the acceleration along x,y and z axis. It gives analog voltage as output(based on tilt value) so it will connected to analog port of the arduino board.

Receiver:
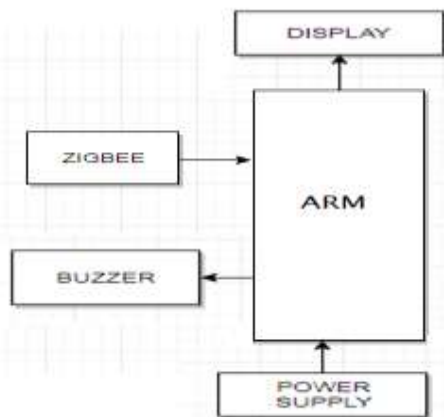
In order to detect fire in the farm land caused due to forest fire, unattended campfire etc we use a flame sensor which consists only receiver and is used to detect the brownish colored flames.

For detection of tree cutting, tilt sensors are used. They are used to check the amount of bending of trees. There is a certain threshold value set, if the bending crosses this threshold value then the tree is considered to be falling or cutting. These are the sensors that change in resistance depending on the amount of bend in the sensor.

A model broker is implemented on one of the station, and it acts as a medium between the user and the model unit setup. To achieve the desired functionality, and also for security and debugging reasons, it was decided that each model unit would have a dedicated MQTT topic. Thus, if a tree cutting or fire event is detected, the model unit device near the event will send a message to its dedicated MQTT topic. The user will have access to an MQTT client that is subscribed to the same topic that the model unit specified unit has issued the message. By using different topics for each model unit, the user will know exactly which unit (when there are multiple units involved) has detected a hazard or service needs.

4. CONCLUSION

The forest fire can be defined as the uncontrollable fire on lands covered all by timber, grass, grain etc. Forest fire can be caused naturally or by humans. Most of the systems analyzed in above section are either too expensive for an average user or are designed at a conceptual level with no actual physical implementation. Designing a vial and practical smart system for forest monitoring proved to be challenging, as the system needed to be energy efficient, weather- proofed, capable to work in harsh environmental condition and able to communicate efficiently when placed in remote areas. The constraints were solved or partially solved, by using a low-power, IOT specific device , an IOT and M2M orientated communication protocol (MQTT), specially designed algorithms, Python programs, and

Android applications. This prototype can be improved in many ways by adding a solar panel, converter and battery; using more energy efficient electronic devices; implementing more efficient classification algorithms. If this pattern continues for the next 100 years then we can except our climate scientist to prevent any of this types of natural disaster.

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