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Forest Monitoring and Traveler's Safety Gadget Using WSN and IoT

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***Abstract*: Human life is always under threat for one's who live or travel near forest areas. It is important to safe guard the life of human by taking necessary actions. It is also equally important to save life of animals from fire accidents occurring in forest regions naturally or by human errors and also hunting is a major threat to animal also illegal deforestation is matter of concern, so in order to overcome the above situations a solution must be developed by technology. This project involves the use of image processing concept to detect the presence of humans at boundaries of restricted area. Cutting of trees can be detected by installing sensors on trees and also a region will be covered by fire and smoke sensors to detect the fire accidents occurring at the particular region of forest. Travelers safety device is developed and given to people on check post who are entering the forest areas where mobile phone signals do not cover the area and communication is not possible but via wireless safety device an emergency alert can be triggered during rescue situation to the control room, the safety device can also be used during trekking to locate in which part of forest the traveler is travelling using wireless technology.**

***Keywords*: WSN, IoT.**

1. Introduction

Research on WSN's began sometime in the 1980s, and only Since 2001 wireless sensor networks generated an increased Interest from industrial and research perspectives. This is as the current availability of inexpensive miniature components, with little power supplied as processors, radios and sensors that were often integrated into a single chip. (SOC-system on one chip). Today WSN technology has become an integral part of any developing country as it is being used nowadays as the primary monitoring system in various applications. WSN eliminate the hazards associated with the wiring systems and make data measurement and monitoring process much easier and cost effective. Rapid growth in technology during years has made a remarkable changes in life style of urban areas, but when it comes to rural and especially areas falling under forest region where humans reside are still lagging with the safety and are living their life under the threat of wild animals.

Also highway route connecting between many places go through the reserved forest area where safety is nil and also mobile phone communication is not possible due to low signal coverage and in most places wild animals enter on the highways and create life threatening situation to the travelers. Most of the time travelers are lost in dense forest during trekking and fail to locate themselves on map hence a safety device is developed to help the travelers in all the aspects in forest area. It is also a responsibility of human to conserve the forest and protect the animals from illegal activities like deforestation and hunting animals, also protect the nature from fire accidents occurring naturally or by human errors, to overcome such situation fire and smoke sensor are installed and safety device is used to notify any illegal activities noticed by traveler during journey.

2. Literature Review

Akshat Jain, Shraddha Basantwani, Owais Kazi, Yogita Bang "Smart surveillance monitoring system" IEEE 2017 International Conference on Data Management, Analytics and Innovation (ICDMAI). Surveillance at boundaries using PIR sensor can provide false output due to movement animals, birds, plants and tree branches during wind so to overcome this problem we are using camera and image processing concept to detect humans.

Mohammad Jane Alam Khan, Muhammed Rifat Imam, Jashim Uddin, M. A. Rashid Sarkar "Automated firefighting system with smoke and temperature detection" IEEE 2012 7th International Conference on Electrical and Computer Engineering In the present work, we fabricated an automated firefighting system with locally available components. The system can response in presence of smoke and high temperature. If any or both of smoke and temperature above a certain limit are sensed, the alarm goes on warning and the valve of a water spraying nozzle opens to extinguish the fire. The presence of smoke and temperature is sensed by the change of resistance of a LDR or a NTC accordingly. A latch circuit is incorporated to make the alarm continuous. The system is effective and as well as cheap.

Lamir Shkurti, Xhevahir Bajrami, Ercan Canhasi, Besim Limani, Samedin Krrabaj, Astrit Hulaj "Development of ambient environmental monitoring system through wireless sensor network (WSN) using NodeMCU and WSN monitoring"

IEEE 2017 6th Mediterranean Conference on Embedded Computing (MECO) In this paper we have developed a system for web based environment monitoring using the WSN Technology. WSN sensor nodes transmit data to the cloud-based database via Web API request. Measured data can be monitored by the user anywhere from internet by using the Web Application which one is also compatible for mobile phones. If the data measured by sensor node exceeds the configured value range in Web Application, Web Application sends a warning e-mail to users for improving environmental conditions.

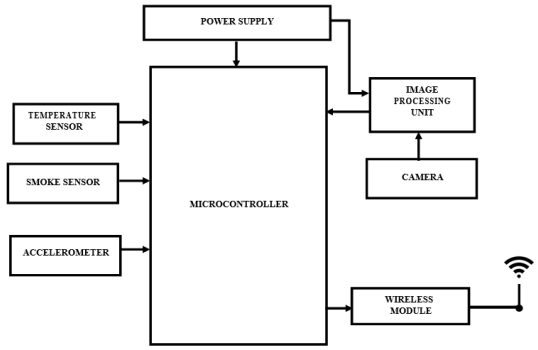

Fig. 1. Forest Monitoring Unit (Zone Device)

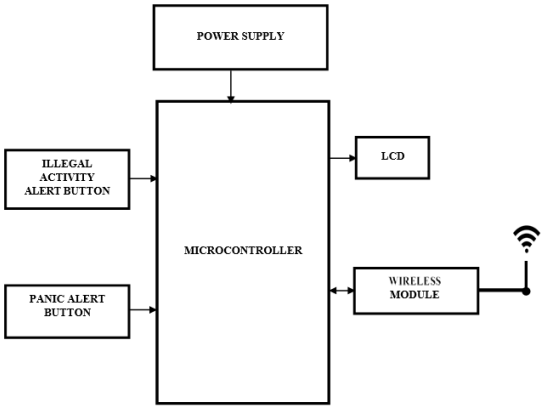

Fig. 2. Traveler's Safety Gadget

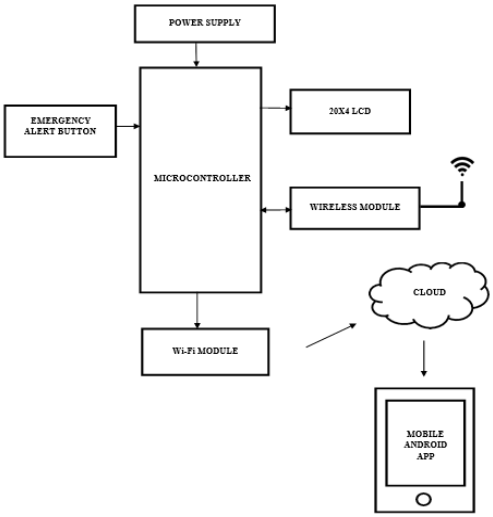

Fig. 3. Control Room Unit

An end to end system is developed for safety of animals and humans, the proposed system i.e., the project consists of 3 major modules are listed and explained as follows.

1) Forest Monitoring Unit (Zone Device).
2) Travelers safety gadget
3) Control room unit

A. Forest Monitoring Unit (Zone Device)

To achieve forest monitoring unit, we require 4 zone devices which is installed at 4 different parts of forest. Below are the monitoring parameters from each zone.

1) Boundary monitoring system

Boundaries of restricted area is monitored for trespass of humans via image processing concept. Detection of human is implemented via image processing by analyzing the captured images from the camera which is installed on the boundaries, any trespass found during monitoring process an alert is triggered to the control room to take necessary action.

2) Fire detection unit

Forest is virtually divided into various zones and installation of fire and smoke sensors are done. Continuous monitor of smoke and fire parameters is conducted and if any of the parameter is triggered then an alert is sent to the control room unit to send a fire and emergency services to that particular zone for rescue.

3) Tree cutting detection unit

Deforestation being a major issue, so to monitor tree fall an accelerometer and tilt sensor is installed on trees so that tree cutting can be monitored and an alert can be triggered to the control room unit.

B. Traveler's safety device

In many parts of forest mobile phone communication is not possible due to low signal coverage, travelers might have high risk of life threat when no communication is possible when they needs help. So to overcome this problem a traveler's safety device is developed and is handed to the traveler at the entrance check post of the forest so that under any life threat situation encountered, one can press the button and alert the control room for help. The device can also be used to notify the control room by pressing button if any illegal activity like tree cutting or hunting etc., being noticed by the traveler on his journey. Also the device has a trekking mode to help the traveler locate himself on which part of forest he is traveling in.

C. Control Room Unit

Control room unit receives all the alert information from zone devices and traveler's safety gadget via wireless and display on LCD. Alert information regarding fire accidents, human detection at boundaries, tree fall received from zone devices inside forest are displayed and also alert information regarding panic and illegal activity received from traveler's gadget are displayed. All the alerts will be further pushed to cloud using IoT Implementation so that monitoring can also be done from head office using Android App.

3. Result

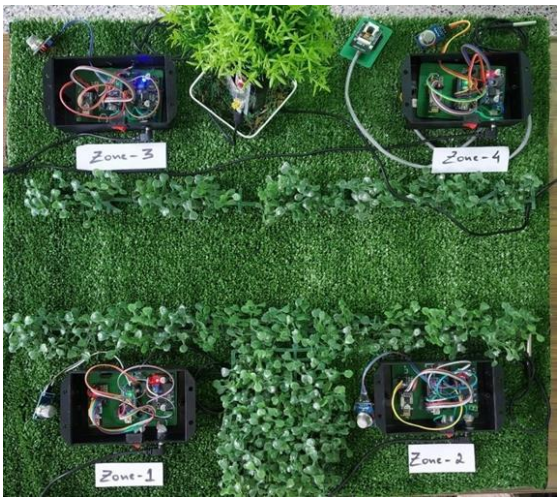

Fig. 4. Boundary Monitoring System

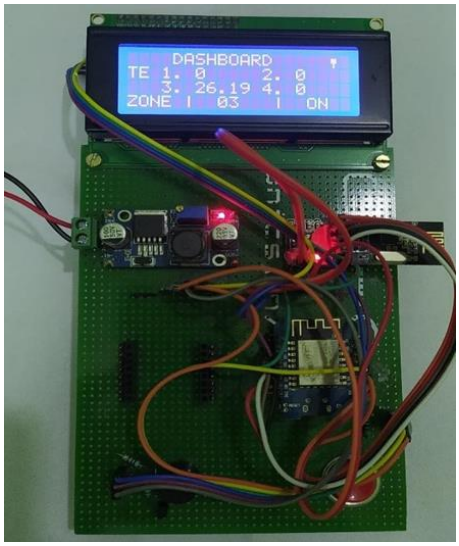

Fig. 5. Control Room Unit

Fig. 6. Travelers Safety Gadget

4. Conclusion

The proposed project involves virtual division of forest into 4 different zones and each zone is installed with sensor unit and wireless node to monitor the tree fall and fire/smoke accidents at the particular zone. As soon the zone detects any abnormalities in monitoring parameters, the zone sends an alert to control room unit via wireless technology. Control room unit is equipped with wireless device and microcontroller including LCD to display alert messages. Forest boundaries are installed with camera which is used as input for image processing and it detects human face using image processing algorithms and when human face is detected then an alert is provided to control room unit. The system also includes traveler's safety device/gadget which is handed over to person who is entering the forest region at the entry check post, the safety gadget has panic button which is pressed to alert for help from control room during panic situation, the gadget also has illegal activity alert button which is pressed by person when he notices any illegal activity during his journey in forest region. The gadget has wireless device which is connected to control room unit and zone devices, traveler can also locate himself with the help of gadget when lost in forest which will show him the zone which he is present in.

5. Conclusion

As the technological changes or new requirement from user to enhance the functionality of product may require new version to introduce. Although the System is complete and working efficiently, new modules which enhance the system functionality can be added without any major changes to the entire system. By keeping this ability of the product 1 mind, an incremental process model has been used to design and develop the system. These are as follows:

1. The proposed system can be further enhanced in dividing the forest in subzone under specific zone to obtain a better tracking of traveler safety device.
2. The proposed system can be further enhanced in monitoring the behavior of wildlife which will be useful data for Ethology study section.
3. The proposed system can be further enhanced in connecting multiple smart phone to traveler safety gadget which will be helpful for multiple person traveling together.
4. The proposed system can be further enhanced in monitoring the weather and climate condition at parts of forest where the data will be used for Metrological study section.
5. The proposed system can be further enhanced in monitoring different source of water bodies like lake, pond, well etc. situated at different parts of forest, these data will be helpful for hydrology study section.

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