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RFID Based Surveillance System for Preventing Tree Smuggling in Forest

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Abstract **-** From past few years we have been reading in the newspaper about cutting and smuggling of precious trees, these trees are very costly as well as important in the world, trees are used in medical science as well as cosmetic because of huge amount of money is involved in selling of such tree woods, lots of incidents are happening of cutting of trees and their smuggling.. To protect such type of smuggling protecting system need to be developed. In proposed system, In order to detect cutting down of valuable trees immediately we use vibration sensor and continuity sensor, here vibration sensor is used to sense the vibration created during cutting down the trees and continuity sensor check the connectivity between neighbouring trees, buzzer along with RFID and bluetooth is used. When smuggler start cutting the tree, the vibration level of the tree is increased is sensed by vibration sensor then it immediately send alert buzzer to control unit. If the smuggler remove the tag then cut the tree the continuity between the neighbouring trees will be break then also it send alert buzzer to control unit and immediate action can be taken.

Keywords- Vibration sensor, continuity sensor, RFID, ATmega328 Microcontroller, Bluetooth and buzzer.

I. INTRODUCTION

We are forming a system which can be used to avoid the smuggling of trees which would in turn stop the deforestation n and uphold the environmental stability, which would help to solve one of the issues with the Global Warming. In proposed system RFID based wireless technology with sensors are used to prevent the valuable trees with poachers. The suggested system will consist of two different units.

1. Tree Unit
2. Control Unit

Each tree unit consist of microcontroller, vibration sensor, continuity sensor, RFID reader, Bluetooth transmitter and buzzer. There will be one control unit for particular area of forest which consist of microcontroller, bluetooth receiver. The data of different tree unit can be collected by this unit. Every time when smuggler tries to cut the tree, the vibration created by tree is sensed by vibration sensor, continuity between each tree is sensed by continuity sensor, microcontroller is used to establish the processing of data obtained by sensors and for understanding purpose LCD display is attached to each unit. Bluetooth is used to send/receive data wirelessly, short range bluetooth doesn't work on Line of Sight (10m-100m). The very basic requirement of the system is power. In this case, individual unit of system required only 5V battery (In working model adapter gives power of 12V but regulator IC 7805 convert it into 5V, microcontroller works on 5V). But in forest when this setup is used we use battery of 5V to run the microcontroller. This whole process will take maximum few second to take action.

The rest of the paper are organized as follow: Section I deals with brief introduction , with new technique how illegal cutting of trees can be stop. Section II literature review how previous years, experts work on this illegal logging. Section III Materials /components used in new technique. Section IV proposed system .Section V running hardware setup of proposed system. Section VI Working process of proposed system. Section VII Result. Section VIII Conclusion. Section IX Future scope and at last References.

II. LITERATURE REVIEW

Emily Kaldjin et al. (2013) perimeter defence technologies help prevent illegal logging from happening by detecting suspicious activity and gathering information from a particular forest area, which help forest defenders develop an informed intervention plan. These technologies are wide ranging and include unmanned aerial vehicles, sensors and surveillance system, satellite imagery analysis, smartphone applications that aggregate and analyses crowd source data and much more. These technologies can empower local communities, indigenous group and government authorities to protect forest from illegal logging.

Azocleantech et al. (2014) Global Forest Watch 2.0 (GFW 2.0) is a powerful near real-time forest monitoring system,

which will be combining new algorithms, satellite technology, cloud computing, mobile phone technologies, maps and human networks around the world to fight illegal logging and deforestation. It is designed to provide fast, online alerts regarding deforestation happening in remote locations. It will be driven by Google Earth Engine and Earth Builder.

Jonathan Mason et al. (2015) On the ground sensor, Trailguard and Ambush Cam are security system that use visual and thermal camera and infrared into protected area, and immediately transmit these photos to authorities. The devices, which are used to detecting wildlife poachers, are strategically placed at chocked points and in area of known traffic and can help authorities to take immediate action. . The device is paired with an alert system that instantaneously users when a suspect noise is detected. The system is still undergoing development.

Meaghan Parker Formey et al. (2015) Satellite imagery, global forest watch as 70 partner strong initiative convened by WRI is an online forest monitoring system design to improve the accessibility of forest information on a global scale. The premier data set on GFW comes from satellites data analysis performed, detailing annual tree cover change globally at a resolution of 30m by 30m. GWF then integrates this data with complimentary data set on forest concessions, intact forest location and other layers allow the public to submit stories from the field. At all of these features combined allow anyone with an internet connection to track tree cover change in near real time.

Loretta Cheung et al. (2015) Unmanned aerial vehicles, better known as drones have endless non-military applications including wildlife conservation, traffic and forest carbon stock measurement. For example, has been exploring the use of drone to monitor and enhance patrolling of the countries protected area. Drones are using to map their territory and detect illegal logging and mining activities. Drones are used to stopped illegal logging, we use drone (mounted with GPS) to fly over the forest and capture a large number of high resolution images. Then we use photogrammetry techniques to stitch those images and create a 2D map and 3D model of the entire forest area. We also capture an aerial video to get the bird's eye view of the forest.

Adele Peters et al. (2016) DNA testing has been used on black market timber in the past–in a case in 2015, for example, when a sawmill owner was convicted of trading illegal wood, scientists used DNA analysis to identify the exact stumps of the tree that had been cut down. But it can also be used at a broader level; by mapping how the genetics of a particular species of tree changes by region, it's possible to identify where particular timber came from. the Forest Service suspects that a particular batch of wood was illegally harvested, it can test a sample to compare to the reference library. Knowing that this process exists may help deter tree poaching.

Edward Mitchard (2016) There are now many forest preservation initiatives. This system tend to rely on occasional satellite survey data for monitoring (if their success is monitored at all). Satellite data is great for mapping big clearings, but misses the small-scale removal of the most valuable trees, for example by illegal loggers. Furthermore, a good cloud-free image is often not captured and analysed until well over a year after the event, too late to prevent the loss. Providing communities with smartphones has the potential to revolutionise such projects by fixing the monitoring problem. Modern smartphones contain a sophisticated set of sensors that make them ideal forest monitoring tools: they have GPS sensors, good cameras and accelerometers.

Rohith et al. (2017) Imagine a forest officer or a farmer getting an alert on his mobile phone whenever somebody tries to cut a sandal wood, rosewood or any other high-value tree in his jurisdiction land. This smart forest intervention, the result of a collaboration between scientists from Institute of Wood Science and Technology (IWST), Bengaluru, and Hitachi India, a private firm, could go a long way in not just saving trees, but also nabbing the culprits. The system, which runs on Internet of Things (IoT) technology, includes a small smart device installed on the tree that needs to be secured. Whenever the tree faces any threat of chopping, cutting or uprooting, the device, which is water and weather resistant, sends an alert to the cell phone of the user via cloud.

III. MATERIAL USED

Vibration sensor unit- vibration sensor are sensor for measuring, displaying and analysing linear velocity, displacement, proximity or acceleration. Vibration however subtle sign of machine by human sense it is a telltale sign of machine condition. Vibration sensors have proven to be versatile tools for the measurement of various processors. They are used for quality assurance, process control and for research and development in many different industries. Since then, this measuring principle has been increasingly used and can be regarded as a mutual technology with an outstanding inherent reliability. It has been successfully used in various applications, such as in medical, aerospace, nuclear instrumentation and as a pressure sensor in a touchpads of mobile phones.

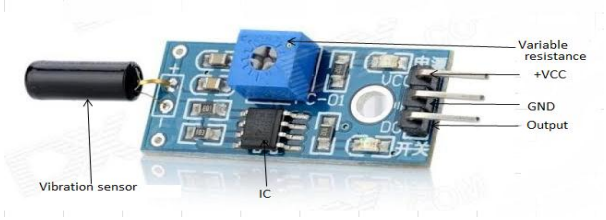

Figure 1. Vibration sensor unit

RFID Tag- Radio Frequency Identification uses electromagnetic fields to automatically identify and track tags attached to objects. The tags contain electronically stored information, it is a wireless, contactless, data collection technology similar to barcode. Passive tags collect energy from a nearby RFID reader interrogating radio waves. Active tags have a local power source such as battery and may operate hundreds of meter from the RFID reader. Unlike barcode, the tag need not need line of sight of the reader, so it may be embedded in the tracked object.

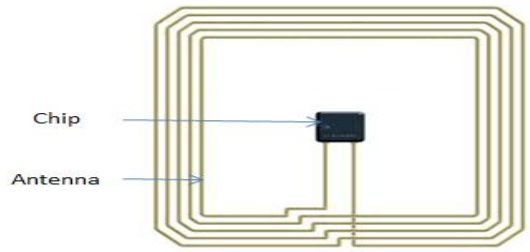

Figure 2. RFID tag

Bluetooth- Bluetooth is a wireless technology used to transfer data between electronic devices. The distance of data transmission is small in comparison to other mode of wireless communication. This technology eradicates the use of cords, cables, adapters and permits the electronics devices to communicate wirelessly among each other. Features of Bluetooth are it is less complication, less power consumption, available at cheaper rate, robustness.

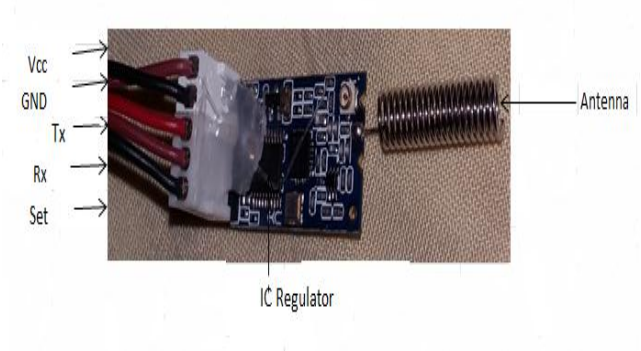

Figure 3. Bluetooth

MICROCONTROLLER ATmega328

The ATmega328 is a single chip microcontroller created by Atmel in the mega AVR family. It has a modified Harvard architecture 8 bit RISC processor code. The ATmega328 is commonly used in many projects and autonomous system where a simple low power, low cost microcontroller is needed. Perhaps the most common implementation of this chip is on the popular Arduino development platform namely the Arduino Uno and Arduino Nano model. ATmega328 is 28 pins narrow dual in line package, 32 pins thin quad flat pack.

Figure 4. Microcontroller ATmega328

IV. PROPOSED SYSTEM

We have developed /a model to restrict the smuggling of trees where human being are not able to provide security. Such system can be deployed in the forest where costly trees are growned and require proper protection. The proposed system consist of two sections namely tree unit and control unit. Sensors are fitted in the tree unit secretly and controlling section consist control unit in which buzzer is fitted. Tree unit consist of microcontroller, vibration sensor, continuity sensor, bluetooth and 5volt battery to run the microcontroller. If any person tries to cut the particular tree, then the vibration level of the tree is high. The vibration sensor triggers the microcontroller while its value exceeds its threshold value. Continuity sensor is used to link all the trees in a network. If the tree is cut down without any vibration then we are able to find out it with this continuity sensor. In our proposed system, bluetooth is used to send/receive information wirelessly.

V. HARDWARE SETUP

To demonstrate the scenario of tree smuggling in a protected forest environment the below hardware setup is made.

Figure 5. Hardware setup

VI. WORKING

In the tree unit, vibration sensor, continuity sensor, RFID tag and bluetooth are connected to a microcontroller. The block diagram of tree unit is shown in Fig.6. In control unit, microcontroller, bluetooth and buzzer are connected. The block diagram of control unit shown in Fig.7. When the smuggler starts cutting the tree, vibration created by tree sensed by vibration sensor and RFID receives the tag details

of the tree and send signal to control unit via bluetooth. Then this control unit receives signal from the tree unit and send alert buzzer to forest officer and forest officer check the system (computer) which sensor is disturbed. Work flow is shown in Fig.8. There connected a continuity sensor to each tree, this sensor checks the connectivity between neighbouring trees. If the smuggler removed this tag and then cut the trees, then its continuity breaks between them. So, this will send alert to the control unit via bluetooth and this control unit will alert the forest officer and the forest officer can monitor the location of the tree using GPS. During the installation of RFID tag on the tree at that time location of the tree is taken using GPS module and the details is saved in the computer database. So, the forest office can track the exact tree location and restrict the tree illegal smuggling.

A.Tree Unit

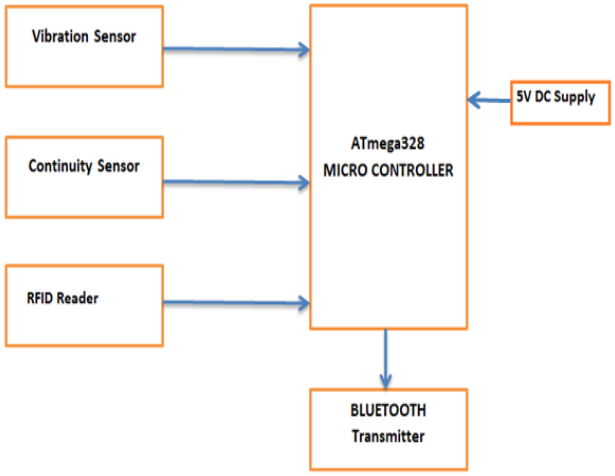

Figure 6. Block diagram of tree unit

B. Control Unit

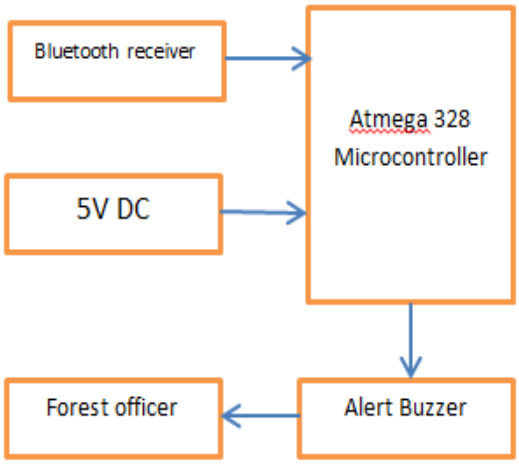

Figure 7. Block diagram of control unit

C. Flowchart

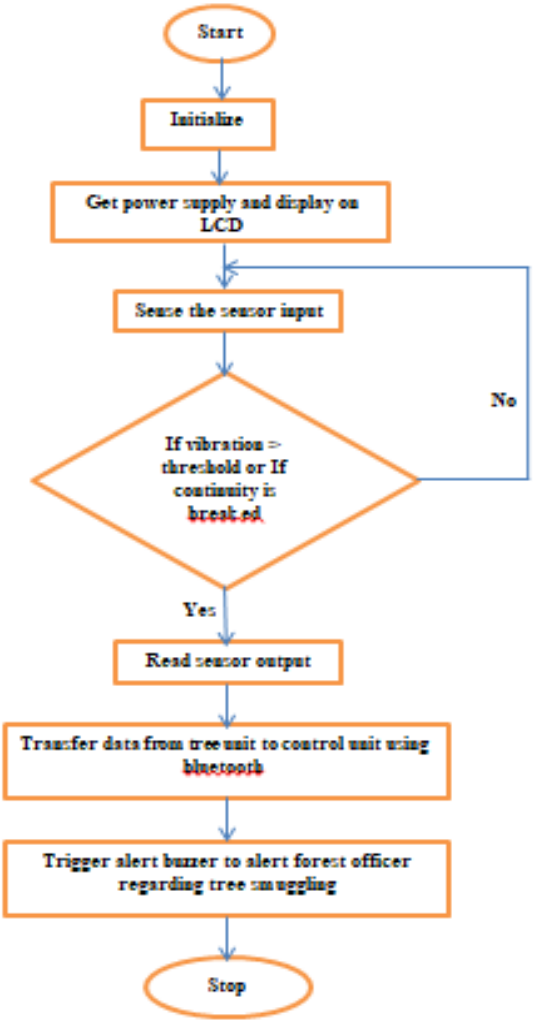

Figure 8. Work flow of the proposed system

VII. RESULT

Two distinct units are placed in proper location for performing the experimental test. Stroke or hammering has been given and it is been detected by tree unit. Further processing of signal is done by control unit via bluetooth, buzzer is attached with each unit, buzzer indicate that particular tree is undergoing non bearable pressure.Forest officer immediately open the Google map in background, it will show overall analysis of tree in tabular format with exact location of smuggling. This system can work before logging and it is useful in dense forest area. RFID tag is used in proposed system with the help of this forest officer will get the detail of the trees wirelessly. It is a time consuming process, forest officer should not walk through the forest all the time, whole forest can be protected wirelessly. This system is the best system to stop illegal logging in forest area.

Location Tracker

Area	No. of trees	Trees in well condition	Affected trees	Name of trees	Latitude	Longitude	Signal
Area1	120	120	0		28.25361	77.23588	
Area2	240	240	0		28.25146	77.23568	
Area3	360	360	0		28.25325	77.23125	
Area4	350	350	0		28.25465	77.23698	
Area5	310	309	1	T 210	28.25689	77.23568	
Area6	290	290	0		28.25654	77.23475	
Area7	300	300	0		28.25689	77.23965	
Area8	390	389	1	T 300	28.25365	77.23457	
Area9	320	320	0		28.25698	77.23426	

Figure 9. Output window

VIII. CONCLUSION

The purpose of this model is to save valuable trees in the forest. Because of huge amount of money involved in selling of such tree woods lots of incidents are happening of cutting of trees and their smuggling. Here we have developed a system which prevents the smuggling of valuable trees and save the money of nation. This system consists of two different units Tree unit and Control unit. The vibration sensor and continuity sensor detect the smuggling activity at the tree unit. The control unit is located for particular area of forest and it receives the event detected signal from tree unit and passes it towards the main unit which is located at forest control office and the forest officer initiate preventive action.

IX. FUTURE SCOPE

1. In future we use GSM, instead of using bluetooth because in bluetooth range is limited while in GSM range is unlimited.
2. We can install hidden camera along with setup to capture the real time activities.
3. In proposed system we install RFID tag in each tree with unique id. But in future we fenced the whole forest with sensors, if the boundary is disturbed / or break the sensor it send alert to the forest officer. And only those person get permitted in the forest who have their ID card in which RFID is installed with all the details of that person.

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