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Solar Powered Logging Detection Using Mobile Phones

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ABSTRACT: Illegal logging and worldwide trade in illegitimately logged timber is a major setback for a lot of timber producing countries in the globe. There is currently no system for deterrence of illegal logging that provides recurrent and real-time monitoring of scarce forests competent of instantaneous recognition of logging. This thesis introduces our key to this setback, based on real-time scrutiny of sounds from surroundings. The module power-driven by the solar panel is mounted on a tree. The auditory sensors, a part of the module is capable to pick up forest sounds in real time, together with illegitimate chainsaws. As soon as the auditory sensors pick up the sound of a chainsaw, it transmits a vigilant message to the forest ranger; they can know the logging going on in real time and disrupt the loggers sooner than much damage is posed to the forest.

KEYWORDS: PIC microcontrollers, auditory sensors, GSM modem.

I. INTRODUCTION

Illegal logging is harvesting, transporting, dispensation, trade or selling of timber in defiance of national laws. It also applies to harvesting wood from the sheltered areas, exporting endangered tree species and falsifying official credentials. It is estimated that illegal logging in public lands alone causes losses in assets and returns in excess of 10 billion USD per annum.

Illegal logging contributes to deforestation and by extension global warming causes thrashing of biodiversity and undermines the rule of act. Until now, it has been intricate to catch loggers' in-the-act. Often no one even knows deforestation has taken place until it appears on a satellite service and then, of course, it's too delayed. To restrict such smuggling and to save the forests around the globe a few preventive procedures need to be deployed.

We have developed one such system which can be used to restrict this illegal logging. The suggested system consists of three diverse modules- a tree unit, area unit and a main server unit. Few trees will be outfitted with one small electronic unit which consists of microcontroller, sensors in the module. The unit will incessantly sense whether there is any chainsaw acoustics is present. If it is detected the module will send the data to main server using GSM modem. This data can be used by concern forest authorities to take precautionary deed.

II. RELATED WORK

A revise by Interpol show that somewhere between 50% to 90% of logging is illegitimate, contributing to a multi-billion dollar black marketplace for wood. According to the World Wildlife Fund, illegal logging is a major dilemma in the Amazon and Congo Basin, but it's rampant everywhere, from Canada to Latin America to Russia. Illegal logging causes world timber prices to be 7% to 16% less than they should be, according to one report by the American Forest and Paper Association. The World Bank estimated that the global market loses $10 billion annually through illegal logging. Though they only cover 2% of the Earth's surface, the world's rainforests are home to 50% of the animals and plants. A four-square-mile patch of rainforest contains up to 1,500 plants, 750 species of trees, and 400 species of birds, according to the Nature Conservancy. At the current rate, 5% to 10% of rainforests are lost each decade [1]. As rainforests are destroyed, we sink further into a biodiversity crisis.

The idea for Rainforest Connection spurred from a trip White, whose background is in physics and engineering, took to Indonesia to volunteer at a gibbon reserve. At one point, not five minutes from the ranger station, there was illegal logging occurring, and no one was aware of it. Most of the monitoring relies on satellite imagery, surveying by people, or aerial drones, which are useful but often come after the damage is already done [2]. But in this area with no running water, no electricity, and no real roads, there was cell phone service. "This was the front of the game when it

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came to this one aspect, which was real time alerts on deforestations, so we could build it without trying to engage new technology, just by using infrastructure that is there and technology we were largely throwing away," White said.

In 2012, Topher White founded Rainforest Connection, a startup which converts recycled cell-phones into solar-powered listening devices to monitor and protect remote areas of the rainforest. Now an established NGO, Rainforest Connection has helped to stop illegal logging and poaching operations in Sumatra, and the system is being expanded to three more rainforest reserves in Indonesia, the Amazon and Africa. With a background in physics and engineering, White worked as web chief of ITER and co-founded Enthuse, a sports engagement and mobile rewards platform [3]. For Rainforest Connection, he has fashioned a simple device made of discarded cell phones and solar panels that detects and sends alerts when it picks up the sound of chainsaws in protected rainforests, allowing for intervention in real time.

Using mobile phones was a simple choice for White. More than 150 million are thrown away in the US each year, destined to pile up in landfills around the world, leaking toxins and polluting the environment. Most of these rainforests, no matter how remote they may be, have phone service or at least, enough to send data into the cloud and to the village nearby [4]. And mobile technology as a whole is very robust and durable, so it offers a reliable solution for this problem.

In India there are techniques like solar powered logging detection using android used, but in very few places. It is the emerging technology to save our forest. The scale of illegal logging is difficult to be accurately estimated, but more than half of all logging activity in the most vulnerable forest regions is believed to be conducted illegally. According to the estimates from the year 2006 it costs world governments at least 15 billion USD annually in lost revenue. Despite the work of ecological movements, non-governmental organizations and existence of systems to track export timber products, there is currently no system employed that would provide effective solution to the problem of illegal logging detection existing systems to monitor logging activities we have determined several imperfections of currently used systems. Main improvements of the system we have proposed are fast reaction when logging occurs and permanent monitoring of critical areas in a forest [5].

III. PROPOSED ALGORITHM

In the forest there are sounds like flowing of water, chirping of birds and a peaceful silence, therefore the acoustic signals of logging can be noticed in the forest. Illegal loggers enter the forest with equipment like chainsaw for logging huge number of trees.

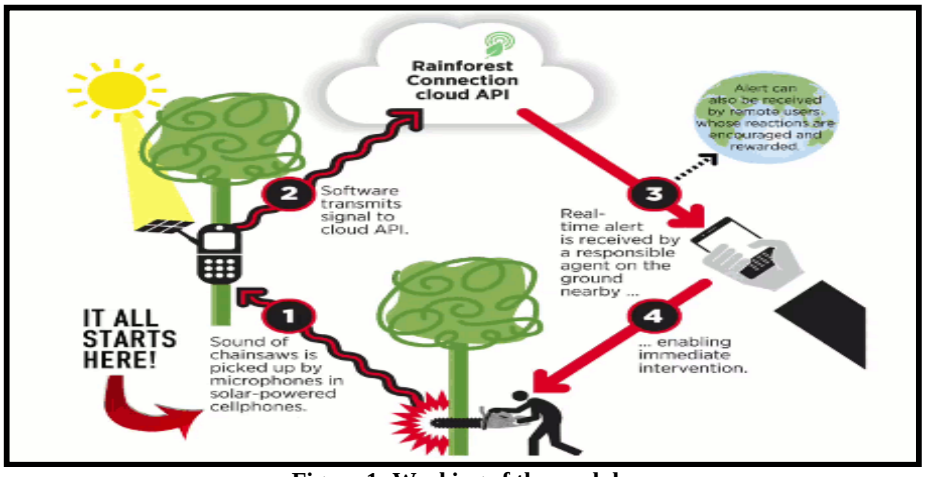

Figure 1: Working of the module

The working of the module is as shown in figure 1. The logger starts his work by turning on the engine of chainsaw. The chainsaw frequency is produced mainly by internal combustion engine with 6000-18000 rpm. The acoustic signals are detected from the ambient environment by a microphone. The microphone which is the input part of monitoring system senses all the acoustic signals. When the chainsaw frequency is detected by the microphone, the monitoring system is programmed in such a way so as to send an alert message to the forest officer or the higher officials who are

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involved in the forest monitoring of that area. The forest officer would go to the located place and interrupt the logger. Once the loggers are interrupted they would not come back as they would know the forest is being monitored.

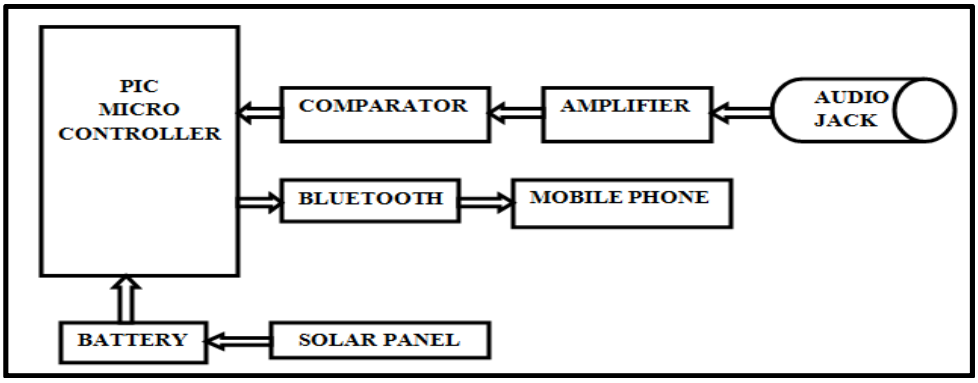

Figure 2: Block diagram of the module

The block diagram of the module is shown in figure 2. Input is taken from the audio jack to receive all the acoustic signals. Microphone is used as the acoustic sensors. The audio jack receives all the acoustic signals and the amplifier amplifies the signal. The comparator is set to a particular voltage using potentiometer. When the incoming signal is greater than the voltage set, it sends logic 1 or high signal to the PIC microcontroller.

The PIC microcontroller is powered by the battery. Battery is charged by the solar panel. The PIC microcontroller is programmed to send a serial data to the Bluetooth. The Bluetooth transmits message to the mobile. This mobile in turn sends an alert message to the predetermined number through GSM

IV. PSEUDO CODE

Step 1: Initialise the input pins.
Step 2: if
noise is detected and flag=0, then increment the counter and set the flag and go to step 3.
noise is not detected set flag=0, and go to step 1.

Step 3: Check
if (count> 85)
increment count1 and go to step 4.
else
set count1=0, and go to step 1.
end
Step 4: if (count1=2)
Chainsaw sound is detected send a alert message and go to step 5
else
set count=0, and go to step 1.
end

Step 5: End.

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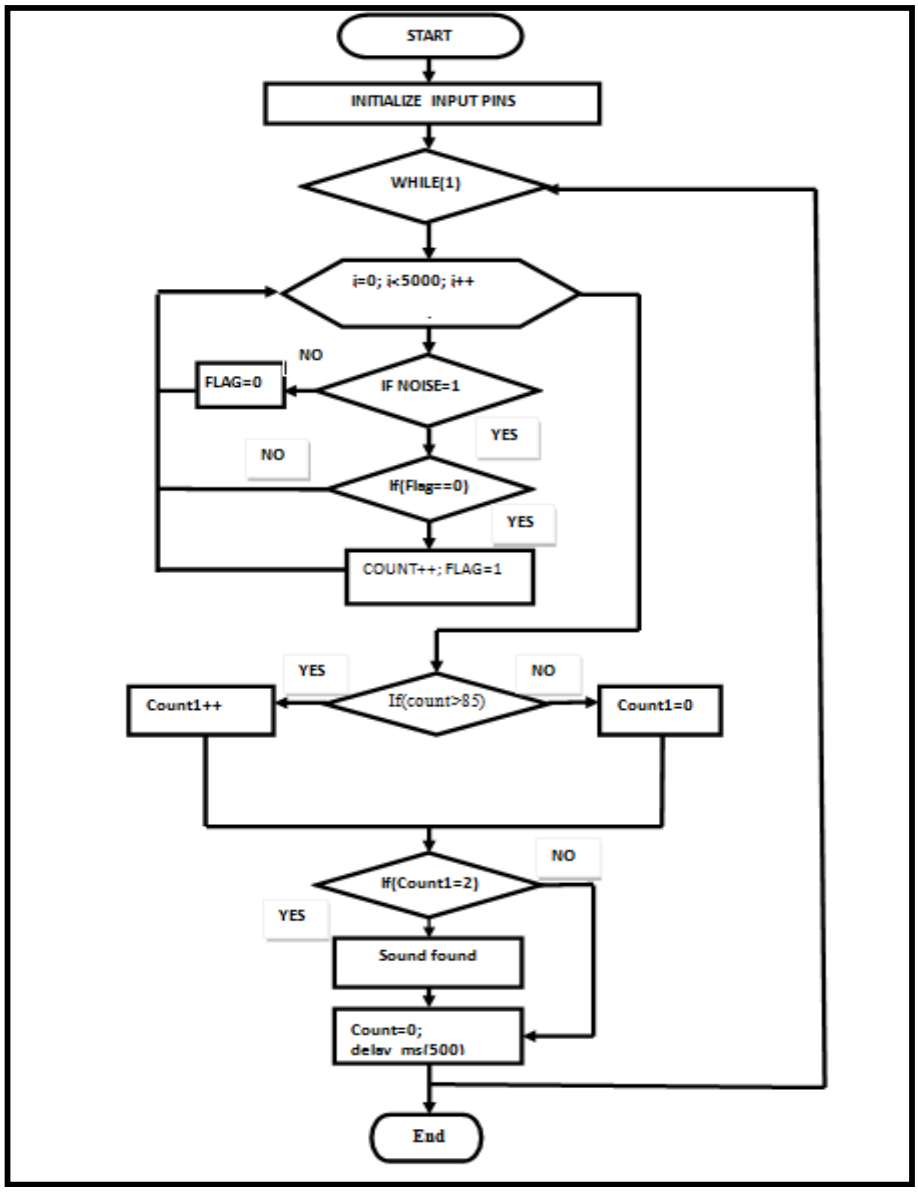

Figure 3: Flowchart of the solar powered logging detection module

V. SIMULATION RESULTS

For a Transformer of 12-0-12 V voltage and a current rating of 1A, a W08M bridge rectifier, a capacitor having the ratings 25V, 1000µf, 0.1µf and a LM7805 voltage regulator the output power supply of 5V and 1A is obtained.

The analog signal from the recorded sound of the chainsaw is amplified. The frequency detected was around 3 kHz as shown in the figure 4.

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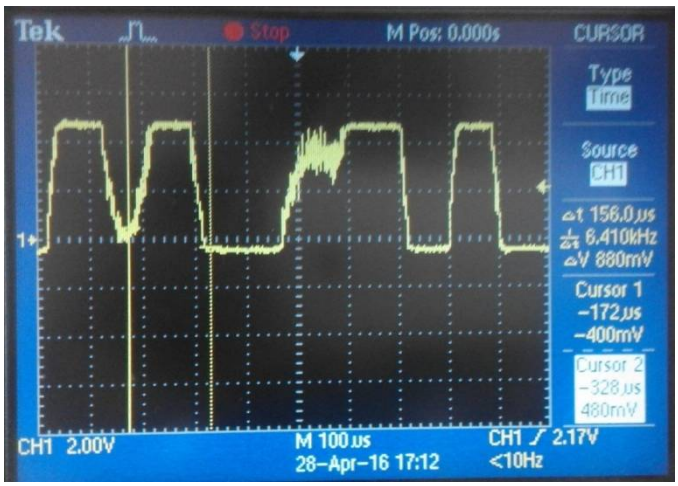

Figure 4: Amplifier output

The reference voltage is set to 3.8 V and only when the amplified signal is above 3.8 V, a high signal is sent to the RB0 pin of the PIC microcontroller. The figure 5 shows peak to peak voltage of 5.44 V, that is, this signal is sent to the PIC microcontroller pin.

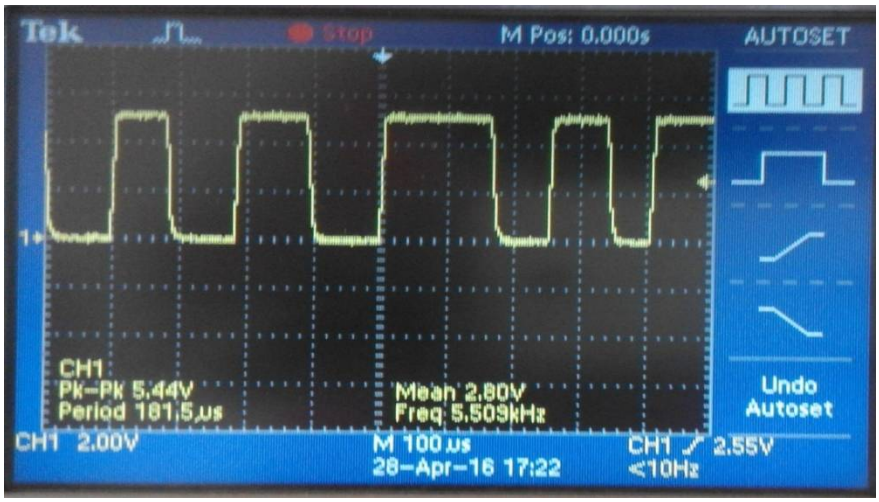

Figure 5: Comparator output

VI. CONCLUSION AND FUTURE WORK

In this thesis, the difficulty regarding illegal logging activities and the monitoring system that is alleged to be competent of solving the problem by early recognition of logging has been described. The scrutiny is performed on existing systems designed to facilitate scrutiny of logging activities. The results of this analysis lead to the design of effective solution of the solar powered logging detection using mobile phones module. The possible spread of module, which would create a wireless sensor network throughout the forest, would lead to better environmental sustainability by protecting of existing forest. Modular design of the system permits extension of system functionalities by adding new modules.

The image processing method can be used in future to recognize the people who are occupied in illegal logging. This method is just to make sure that the loggers do not flee by the time the forest officer reaches the preferred scene. Some features like GPS receiver can be used to locate where illegal logging takes place. This eases the forest officer's work in ruling out the exact location and reaching the position as soon as possible.

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BIOGRAPHY

Vidya K M is an Assistant professor in the Electronics and Communication department, Srinivas Institute of Technology, Mangaluru. She received Master of Technology (MTech) degree in 2013 from CMR Institute of Technology, Bengaluru, India. Her research interests are VLSI and Embedded system, networking and image processing.

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