Implementation of Radio Frequency as Elephant Presence Detector for the Human Elephant Conflict Prevention

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Abstract

Human conflicts with elephants often occur, along with the narrowing of the elephant habitat due to industrial and residential interests. The negative impacts of human elephant conflict is on a large scale slaughter of elephants. Prevention system for indications of human elephant conflict is absolutely necessary. One of them by monitoring the position of the elephants in their habitat, so the possibility of elephants damage plantations and residential areas can be suppressed.. Wireless technology using radio frequency (KYL 200 L) is expected to be one of the applied technology as elephant presence detector that support the human-elephant conflict prevention. 4 node receivers are mounted outside the habitat boundary, which is often crossed by elephants. A transceiver mounted on an elephant necklace. If elephant walks up to the outer habitat boundary, receiver at the node closest to elephants will send data to the server about elephant's existence, as an early warning to the guards and people around.

Keywords: radio frequency, human-elephant conflict, elephant presence detection

1. Introduction

According to data from the Foundation of the World Wide Fund for Nature Indonesia (WWF-Indonesia), in the last quarter century the estimated population of Sumatran elephants in Riau Province , which has long been a bastion elephant population , a decrease of 84 % to the remaining approximately 210 species in 2007. If this trend continues and the two forest landscapes remaining large , Tesso Nilo and Bukit Tigapulu , not protected then the elephant population Riau will not last much longer and will be locally extinct .

In pulp and paper and palm oil industry is one of the triggers loss of elephant habitat in Sumatra . Development of oil palm plantations encourage human - wildlife conflict , which increasingly more . Young palm trees are favorite food of elephants and elephant damage caused can lead to murder (mostly by poisoning) and arrests . Hundreds dead or missing elephant across Riau Province since 2000 as a result of a variety of catching large animals that are often considered ' pests ' this .

Efforts to prevent human elephant conflict conducted by roving patrols to drive wild elephants back into the forest when the elephant entered the field or garden belonging to the community . But this effort is considered less due to limited human resources than the elephant habitat .

So the need for an early detection system outside the habitats where elephants are able to analyze and monitor quickly and efficiently . In this paper, we will purpose a system of early detection of the presence of elephants out of habitat by utilizing radio frequencies. A transceiver mounted on an elephant necklace, while the receiver is mounted on the receiver node. The data received will be processed by the microcontroller which then will be sent directly using KYL 200 L to the server or passing through other nodes to be forwarded to the server. To be able to work independently nodes, each node will use energy harvesting technology to meet power needs by utilizing sunlight as an energy source. This monitoring system is expected to present an indication of the existence of data in of the form of elephant habitat out .

2. Radio Frequency as Human-Elephant Conflict Prevention

2.1 Human – Elephant Conflict

Elephants are mammals that reproduce by means of delivery, with a gestation period of approximately 22 months. Unlike other mammals, elephants only give birth to one calf in a single pregnancy. With a long gestation period and the number of babies born slightly, making very slow breeding elephants. That makes it very vulnerable elephant extinction, if not the survival of elephants guarded

Elephants are included in the category of plant-eating animals or herbivores that spend 16 hours a day to collect food. [1]. The main meal is elephant grass plus leaves, twigs, fruit and flowers. In the food cycle, elephants only

digest 40% of food eaten and left only 60% of food in the stomach. In one day, an elephant can consume a lot of food. An adult elephant can consume 300 to 600 pounds (140-270 kg) of food per day The narrowing elephant habitat converted to plantations, and habits of elephants which consume a lot of food is the main trigger of human-elephant conflict. Oil palm plantations in the area of the crossing elephants damaged, because palm trees are a favorite food of elephants. However, broken only along the crossing elephants, because biologically, elephants walk through trajectory continues throughout life [2].

Various attempts have been made to prevent conflicts between elephants and humans , among others [3] :

1. Creating a surveillance tower

2. Perform roving patrol habitat

3. Make the guard huts surrounded by a moat

4. Burn the fat mixture , elephant dung and chili .

5. Making electric fence

Another attempts is to move the elephants from their habitat to a new place . But the effort was not successful because the elephants that have been moved will be returned to the original habitat , ecologically because elephants can not adapt to the new environment , so many elephants are running out of habitat and enter the village .

2.2 Related Works

Electric fence as intrusion detection systems such as [4,5] are suittable for securing location as military bases and airport but not suited for protecting elephant fences. Because that fence consume larger power and high cost implementation.

To solve this problem, radio frequency is used. RF is the rate of oscillation in the range of about 3 kHz to 300 GHz , which corresponds to the frequency of radio waves. This system is part of a wireless communication system that is much more efficient than wireline .

This system is used in various kinds of applications, in another sense. For example, biologists can monitor the behavior of the animals that are in their habitat, researchers can monitor the environmental pollution of the environment, farmers can monitor soil fertility, geologists need a system to monitor seismic activity, even in the military was in need of a system that are able to monitor an area that is difficult to achieve. The whole human activities require monitoring system., Monitoring the radio frequency requires: transceiver, wireless modules, and PC. All components will establish a monitoring system that is capable of displaying the data characteristics of the sensor used, wirelessly..

Research for intrusion detection using RF systems is [6, 7], which use bridge and GSM to communicate each other. The disadvantage of this systems is not effective to operate in poor GSM connectivities area.

2.3 Purpose Methods

In this research, we use radio frequencies in an early detection systems of elephants presence which out of habitat. A transceiver mounted on an elephant necklace, while the receiver is mounted on the receiver node. The data received will be processed by the microcontroller which then will be sent directly using KYL 200 L to the server or passing through other nodes to be forwarded to the server. To be able to work independently nodes, each node will use energy harvesting technology to meet power needs by utilizing sunlight as an energy source.

3. System Design

The elephant presence detection mechanism is shown in figure 1.
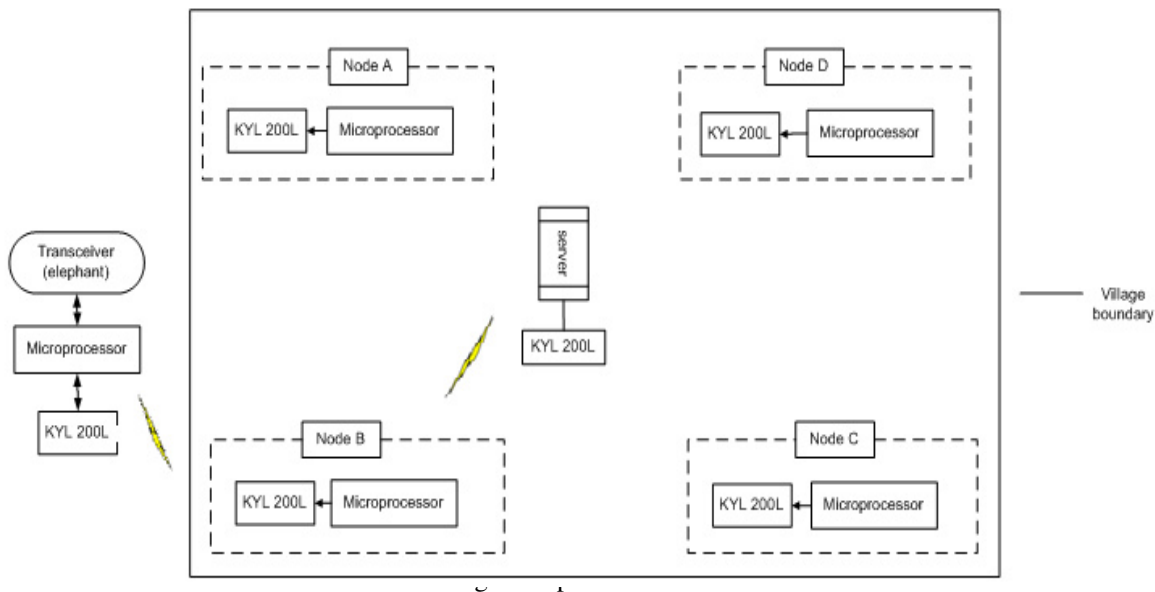
The step in the detection process are as follows :

1. Energy source for the transceiver and receiver using a solar cell for each system .

2. 4 node receivers are mounted outside the habitat boundary, which is often crossed by elephants.

3. KYL-200L transceiver from a necklace shaped as a radio transmitter connected to the ATtiny microcontroller. The necklace is mounted on an elephant's neck. solar cell as an energy source, its size adapted to the size of an elephant necklace

4. If the transceiver has been installed on the elephants, emit radio waves, the receiver node consisting of KYL-200L, which is placed on the boundary of the village will receive the signal wave. Node closest to the elephant that will receive the signal.

5. Radio waves received by the receiver (node) closest to the elephants, and then forwarded by the initial node to other nodes using 200L KYL.

6. RF then forwarded to the server, the monitoring center data for display on hyperterminal.

7. The receiver also contained mikrocontroller ATTiny that will process the data that has been transmitted by the transceiver and received by the receiver.

8. These nodes using MESH system. In principle, the initial node that receives radio waves continue to other nodes, and on a computer server located in elephant habitat supervisor.

9. When elephant detected, server will turn on the alarm, as an early warning, so that people can determine precaution

3.1 Detection Systems in Transceiver and Receiver

 KYL 200 L is used for communication both in transceiver and receiver. This type is low power consumption with coverage area 2-3 Km [8]. Figure 2 shown transceiver mechanism and it implementation in elephant's necklace.
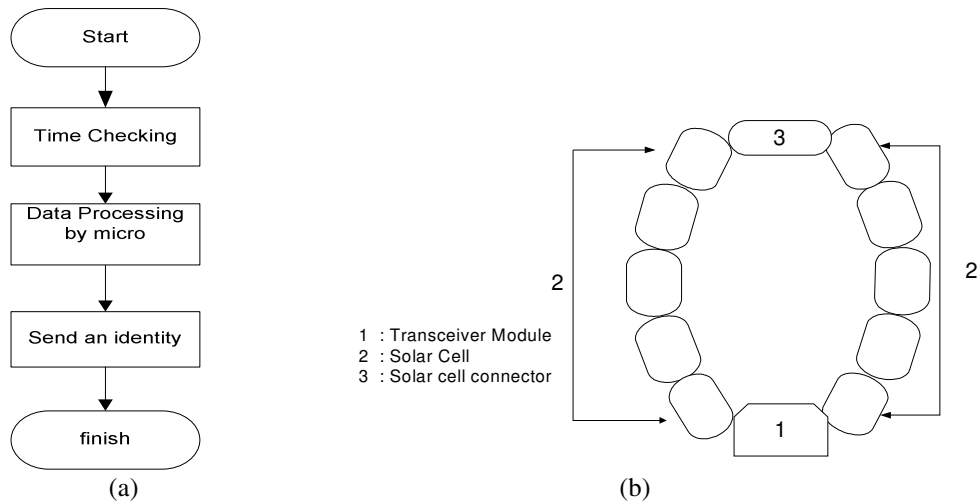
1 : Transceiver Module
2 : Solar Cell
3 : Solar cell connector

(a)   (b)

Fig. 2. Transceiver Design (a) flowchart systems (b) implementation in necklace

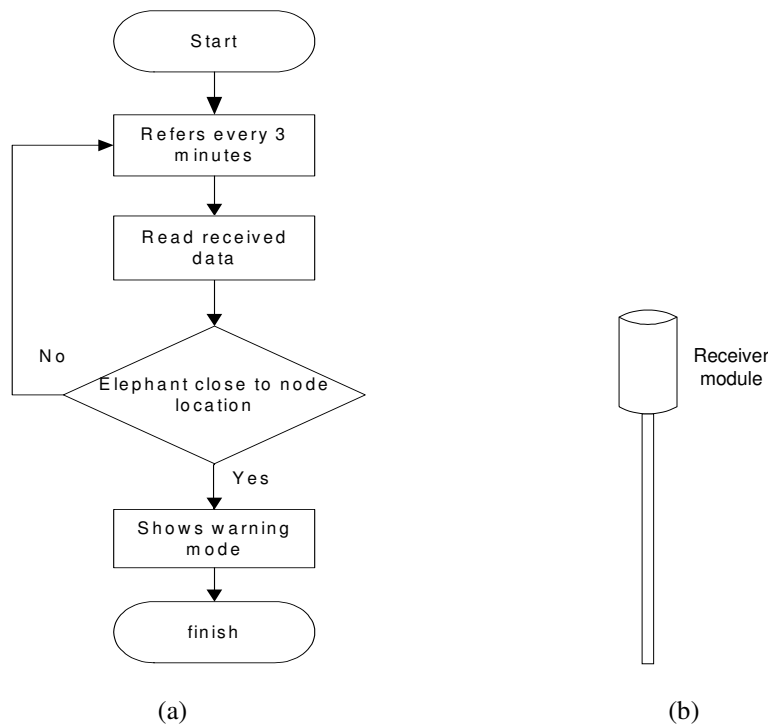Figure 3 shown receiver mechanism and it implementation in node.

(a)   (b)

Fig. 3. Receiver Design (a) flowchart systems (b) implementation in node

4. Conclusion

The novelties of our purpose system lie in sensing and communication mechanisms, and the ability to monitor remotely. A transceiver mounted on an elephant necklace, while the receiver is mounted on the 4 receiver node. The data received will be processed by the microcontroller which then will be sent directly using KYL 200 L to the server or passing through other nodes to be forwarded to the server. To be able to work independently nodes, each node will use energy harvesting technology to meet power needs by utilizing sunlight as an energy source. This monitoring system is expected to present an indication of the existence of data in of the form of elephant habitat out

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