DEVELOPMENT OF WILDLIFE TRACKING SYSTEM PROTOTYPE

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"I hereby declare that I have read through this report entitle "Development of Wildlife Tracking System Prototype" and found that is has comply the partial fulfillment for awarding the degree of Bachelor of Engineering (Control, Instrumentation & Automation)"

Signature : .....

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: 23/6/2016

"I declare that this report entitles "Development of Wildlife Tracking System Prototype" is the result of my own research except as cited in the references. The report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree"

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Date : 23/6/16

To my beloved father and mother

Abdull Kadir bin Yakub and Salimah binti Aziz

My respectful lecturers

Also my faithful friends

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ABSTRACT

This project is proposed to develop a tracking system prototype for monitoring tiger population in Taman Negara Endau Rompin. This new system uses RF (Radio Frequency) and wireless technology for communication systems with very low power consumption, which can receive small signals at long distances. The user can identify the tiger's mobility in the specified area. The transmitter emits a unique RF signal that represents each number of tiger tagged to the receiver. The assigned authority will determine the suitable range setting for the receiver, based on the frequency that is typically placed in the tiger's tagged collar. The brain of the system used is the Arduino UNO. The processor will identify the tiger's movement based on locked-frequency. Furthermore, the indication of the tiger's location will be available on the field by using LCD Display.

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CHAPTER 1

INTRODUCTION

1.1 Project Background

Tigers are found all through the untamed life ranges in Peninsular Malaysia. Tigers are natural surroundings generalists, starting from peat swamp to little forests inside the ranches to bring down montane woodland. Taking into account the data gathered between year 1991 and 2003, about portion of the Peninsular Malaysia is viewed as suitable for tigers' living space. Distinguishing an exact estimation of the quantity of tigers left in Malaysian timberland is extremely testing. Tigers are exceptionally concealing and once in a while seen. In light of the learning of normal quantities of tigers that can be upheld by tropical woodlands, the need of tigers' vitality, and the former tiger dissemination map, estimation the populace size of Malayan tiger perhaps extends from 500 to 1500 [1].

Tigers require expansive domains to have the capacity to breed effectively which is perhaps stand out or two tigers for every 200 until 300 square kilometers zones. Tigers are completely ensured in Malaysia under the Wildlife Conservation 2010 sanctioning as one of the worldwide perceived jeopardized species. This law prohibits homicide and ownership of tiger parts, implying that nobody is permitted to chase tigers down. A large portion of tigers' prey species, for example, deer and wild pigs are additionally recorded in the law, likewise as secured species, where the chase is just permitted with an approved allow or permit [1].

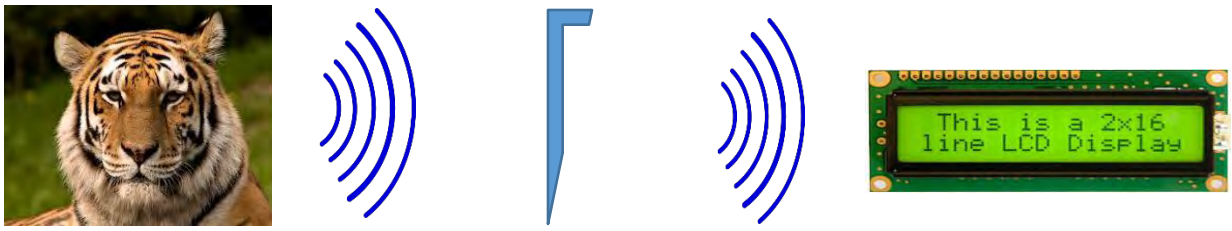
Observation following framework for tigers assumes a key part to comprehend about the species environment where the tigers live and safeguard their normal assets. It is a significant path for people to comprehend where the tigers' living space, encourage

(nourishment assets), and different schedules for one better warning of that zone without hurting the tigers' area [3]. Checking is vital for monitoring the tigers' development designs, living space use, poaching occurrences and breakout. This profitable data has potential points of interest to administration applications, particularly in arranging effective procedures to control the number of inhabitants in tigers in Malaysia [3].

From the foundation examines, one of the strategy executed to track creatures is through cell innovation. This base permit following creatures all through a vast range. The upsides of cell innovation are consistently expanding, particularly in the scope of the system around the globe and the progression propelled speed in information exchange through cell systems. Then again, the cell innovation disadvantages are the mechanical test of decreasing the size space, the clients' interest of diminishing force utilization, and the unpredictability use of diverse cell architectures in distinctive scene [3].

The Argos System are one of the new innovation for following and observing creatures. The Argos System is created to track creatures in its environment in extensive territories. This framework depends on satellites, which around 850km over the Earth surface. It can geometrically build up the area of the transmitter, speed, light power, action example and others. The precision of the decided area relies on upon different elements, for example, vegetation spread, area use, stormy day, and incline were distinctive. These advantages accompany huge issues. Regular neckline disappointments, high cost which frequently brings about weaker study outline

In this proposed venture, the transmitter joined at the tigers' collars will transmit the sign to the recipient, in which the collector will tally what number of tigers arrive in that specific area by utilizing counter plan. The Liquid Crystal Display (LCD) will demonstrate the quantities of the tiger at the specific territory. The Peripheral Interface Controller (PIC) will incorporate the info/yield (I/O) field gadget framework together with nearby planetary group which are the fundamental force source at the posts. Figure 1.1 beneath demonstrates the square chart correspondence arrangement of adding to the following framework for tiger populace.



Transmitter (worn on the tiger's collar) transmits the signal to the station's poles

The poles consist of receiver (Rx) will receive the transmitter's signal and powered by solar system. Intel Galileo will integrate the systems as an input.

LCD display will show the total number of tigers at the particular zone an attached at the poles

Figure 1.1: Block Diagram of Communication System for Wildlife Tracking System.

1.2 Objectives

The objectives of this project are listed as below:

a) To identify suitable range setting and communication module for the tracking system prototype.
b) To design tracking counter scheme enable to identify mobility of tigers
c) To develop a tracking system prototype, enable to locate tigers 'mobility in defined range.

1.3 Motivation

Nowadays, the number of tigers' population in the world has been declined. This situation has led to the need effort to protect the endangered animals, in this case the tigers. In Malaysia, the Endau Rompin National Park in particular, is the chosen suitable wildlife reserve to conserve the tigers' population. Currently, there is no effort to carry out the real time surveillance monitoring for tiger conservation in Malaysia. It is difficult for the authorities at Endau Rompin National Park to track and monitor the tigers'

population at the wildlife reserve. The Wildlife Conservation Society (WCS) Malaysia needs an effective solution that can visually monitor illegal activities regarding to tigers' mobility. If the surveillance monitor shows the illegal incidents do occur, the WCS staff need to be informed quickly so that the relevant Endau Rompin National Park authority can be assigned to stop the illegal activities regarding the endangerment of tigers' population. Apart from the low cost, the project is designed to ensure the wildlife to survive thus increasing wildlife populations

1.4 Problem Statement

Populations of wild animal in the present are at worrying level. The importance of tracking the tigers is to make sure the numbers of tiger will not decrease. This project is to facilitate the responsible parties to ensure that no accidents occur in wild animals in the forest. Since the poles will be placed in the forest, it is difficult to obtain resources. Therefore, the circuit used must be low power consumption. The hills, trees, are the main challenges to determine the suitable communication range in the forest. The distance between transmitter and receiver must be concern. The existing system is to costly and high risk to be stolen. The processor that will be using must be programmed to count the amount of the tigers at particular areas. There is no device to identify the tigers and the movement of the tigers. Therefore, to overcome this problem, a product called the Development of wildlife tracking system is designed for the purpose of tracking the tigers' population at Endau Rompin National Park.

1.5 Scope

The range distance from the transmitter and the receiver need to be defined according to the tigers' territory's in Endau Rompin National Park. A 12 volts solar power panel is chosen to power up the control and transmitting system in the specify area in Endau Rompin National Park. A 12 volts battery is chosen to stabilized the input of solar system The size and weight of collar attached to the tigers will be varied

according to the age and physical of the tigers. A 2x16 panel LCD display to be use to show the numbers and the movement of tiger. However, the range that being used in this project is not yet consider the actual range of Endau Rompin because the RF module that used in this prototype is short range type only.

CHAPTER 2

LITERATURE REVIEW

2.1 Overview

Wildlife tracking system is developing to provide real time display status of tiger population in particular area. The pursuit gets to be less tagging so as to demand the creature with radio transmitter to find them oftentimes. On the other hand, the more serious issue is the wildlife remain un-tended to that impact the proficiency of information gathering. There are various reasons whys it is troublesome and not prudent to visit the site habitually. Firstly, concentrating on the species without maintaining a strategic distance from human contact is incomprehensible. Human visit regularly or unsettling influence will influence the species from various perspectives. Furthermore, to monitor creature action oblivious after sunset will turn out to be more experience. At last, it is tedious, as well as cash serious occupation to monitor the creature movement and additionally its encouraging living space without utilizing devoted advantageous sensor organizing gear.

Currently, there is no device to track tigers in Endau Rompin. The challenge is to develop the system in Endau Rompin is the condition of the landscape itself because National park Endau Rompin is very thick tropical rainforest.

2.2 Research Background

This project is design to develop tracking system for wildlife specifically to tiger in Endau Rompin. Nowadays, there is no proper equipment to track the tigers in Endau Rompin. The importance to track the tiger is to make sure the number of tigers is not

decrease and the tigers will be preserved so that the future generations of both wildlife and human can enjoy it. It is fundamental to take activities to shield natural life from annihilation. Thusly, it is guaranteeing their survival, as well as the assorted qualities of the biological system. Therefore, it will enhance the natural wellbeing of the earth.

There are a lot of example on development of tracking system for wildlife. Not only for the tiger species but also it is required another endangered species such as Sumatran rhinoceros, tapir, gaur, milky stork and others as shows in Figure 2.1.

Figure 2.1: Tapir is one of the endangered wildlife in Malaysia [8].

One of the approach to track wildlife is by using footage [9]. This system uses a CONDENSATION Particle filtering frame work in United Kingdom. the periodic model of animal motion based on relative positions over time of trackable features at significant body points. Furthermore, this system introduces techniques for maintaining a multimodal state density within particle filter over time to enable consistent tracking of multiple animals. This system detects relative head movement, wings pattern, capture animal movement characteristic using marked up features points on the animal over several training frames.

Another method to tracking wildlife is by using small unmanned aerial vehicle [12]. Traditionally, the researchers have to physically go into the field with the antenna to try pin point the Very High Frequency (VHF) signal coming from the animal collar as

illustrated in Figure 2.2. This traditional approach could take the entire day to locate a single animal. To enhance, this project used small fixed wing aircraft drone with a simple radio on board. The drone flying with an automated mission. Once the drone received the signal, it will be recorded and used to create heat map that shows the collar position.

Figure 2.2: Traditional VHF tracking approach.

In [6], wildlife will be tracking by using Radio Frequency Application (RFID). RFID is a wireless technology created for object or living beings by using identification by using tags. RFID architectures are combining of RFID tags and readers. Tags are embedded together with radio antenna for wireless communication. There are two types of RFID tags, passive tags and active tags. Passive tags are power source independent because its only operates during receive the energy from the reader. Meanwhile, the active tags use their own power source in order to transmit the signal to the reader.

The Argos System [13] as illustrated in Figure 2.3, was created to track animals in large area by using satellite. The system depends on Argos Satellite which located 850 km above the earth. Besides that, this system able transmit data from the satellite to the end user which is good for recovery data. In south Russia, the Argos transmitter collar was installed to saiga antelopes.

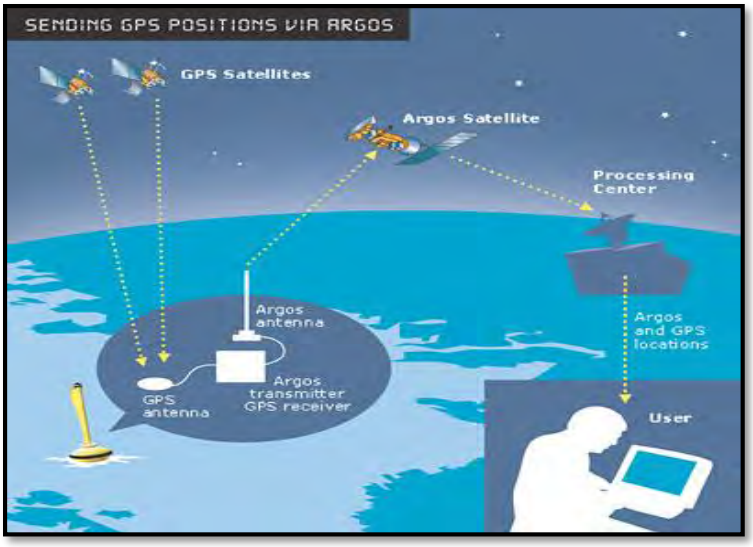


Figure 2.3: How Argos System works [13].

Global Positioning System [14] is a space-based route network that gives area and time data in every single climate condition, anyplace on or close to the Earth where there is an unhindered observable pathway to four or more GPS satellites. By applying the satellite route worldwide situating framework (GPS) to acquire exact area data gives an amazing chance to overcome a number of the issues related with customary radio-telemetric or mapping systems [10].

2.3 Tracking Mechanism

A large number of method for the development in wildlife tracking system. One of the example is by using Radio Frequency Identification. The larger part of RFID labels being used today work in the 124.2-135kHz. the labels, particularly for farm animals, can be embedded under the skin of animals or may be clamps on ear alongside other more unmistakable labels for animals distinguishing proof [3].

RFID generally divided into Low Frequency (LF) frameworks by and large have a working scope of somewhere around 1 and 3 meters, however low power levels can be

utilized and subsequently LF frameworks are more worthy for permitting. LF frameworks are likewise more fitting for use in dangerous environment because of the low power levels. Another point of interest of LF frameworks is not at all like numerous other programmed identification frameworks, including RFID framework working at the top end of the frequency range. they do require viewable pathway between the transponder and the per user radio wire as shown in Figure 2.4 .

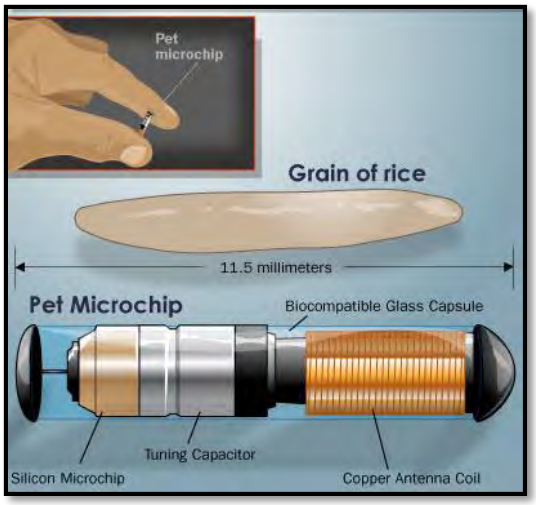


Figure 2.4: Application of Passive RFID Tags That Suitable for Pets [3].

High frequency (HF) frameworks are accessible with working scopes of 30 meters or more. in any case, to acquire this reach, high power levels must be utilized. high frequency framework is less worthy universally because of authorizing troubles. moreover, the capacity of these frameworks to peruse transponder through solids is constrained, what's more those frameworks working at the top end of the frequency range require observable pathway between the transponder and the per user unit [5, 6, 11, 15].

However, active tags are costlier on the grounds that they are more unpredictable. They involve a microchip, a radio transceiver, an antenna and need batteries. The RF gives RFID its strength but is also its weakness, and potentially also one of the

disadvantages of RFID because can only work if there's enough RF signal strength illustrated in Figure 2.5.

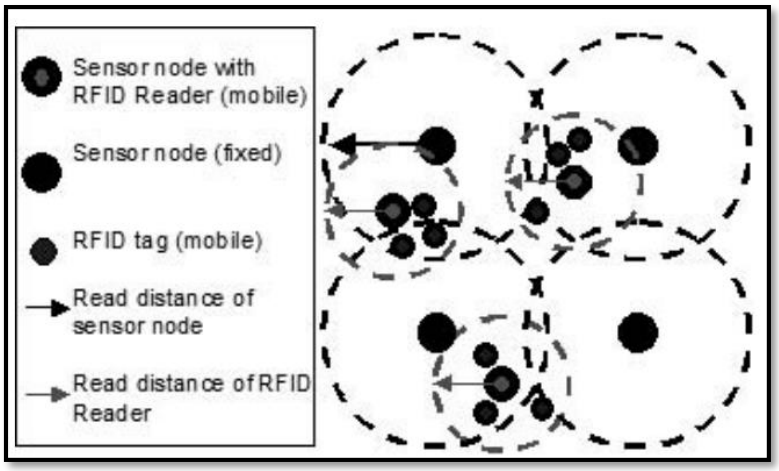


Figure 2.5: Short Range Tags in RFID System [3].

Another method to track wildlife is by using Global Positioning System (GPS). GPS is generally used to worldwide track the animals, and normally work together with the others strategies as shown in Figure 2.6 [8]. In information adaptability. The primary challenge is that GPS-based gadgets can record hundreds, or now and again thousands, of areas per animals every day, and upgrades in computerized information accumulation is expanding the volume of information accessible from individual animals. Likewise, as the expense of this innovation diminishes, the quantity of checked people will expand, which will build the volume of information [11]. Late multi-sensor gadgets open up the information volume by requests of extent furthermore entangle the information structure. To handle this expansive measure of information reliably, a persevering and extensive information stockpiling ability is required [16].

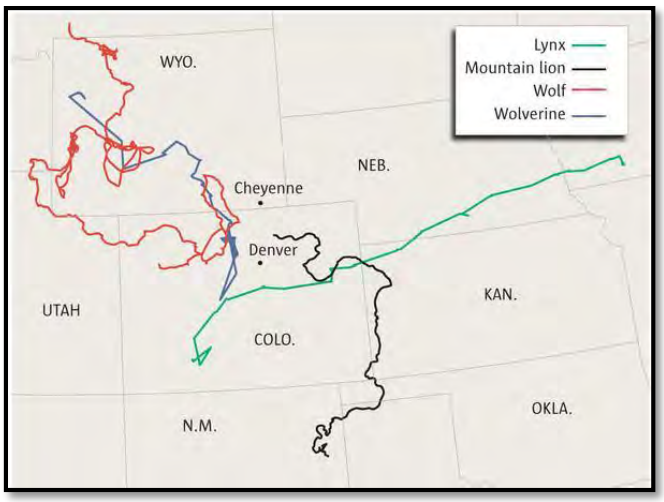


Figure 2.6: Example of tracking wildlife by using Global Position System (GPS)[8]

In GPS, Heterogeneity of utilizations are the perplexing way of development biology infers that GPS information ought to be envisioned, investigated and broke down by an extensive variety of particular errand arranged applications (e.g. for mapping, spatial measurements and reporting). This requires a product structural engineering that backings the coordination of distinctive programming instruments. Its expansion into natural life examination has extended the conceivable outcomes for concentrating on the spatial environment of creatures to the degree that this effective cooperative energy in the middle of science and innovation is quickly forming the order of biology [17].

However, GPS required high initial expenses. Moderately fleeting and relevant to well evolved creatures the measure of a wolf or bigger or to winged animals on which sunlight based cells can be utilized. While GPS works the world over, and regularly to meter precision, there are sure areas where it doesn't function admirably. For instance, a ravine amidst a woodland such as in Endau Rompin; or in the event that you are encompassed by tall structures (frequently alluded to as an urban gorge). At these areas the sign may bounce and definite area may be hard to determine [9].

Another method of the tracking system is tracking animals by using footage. As shown in Figure 2.7, this approach is interesting where the information of the animal is

directly got from the picture. For example, quantity of animals, animal species, the movement of animals and others.

In this way, it is easier to keep track of multiple animals over many frames of an image sequence is obviously critical factor. It is good to be able to detect the identity of the animals such as zebra and tiger at remain stationary. The limitation of this approach is when if the animal moves quickly, it will cause the image to become blurry and less clear [8].

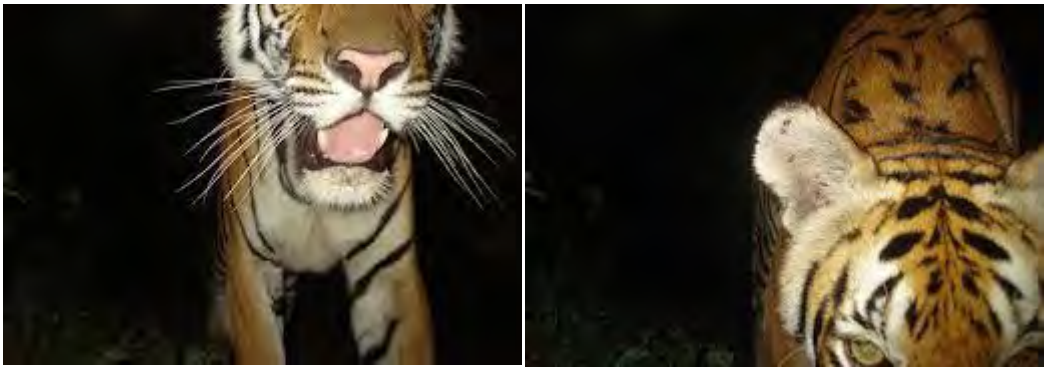


Figure 2.7: Tiger's footage in forest [8].

ARGOS gives genuinely worldwide following scope, with close continuous redesigns of position accessible. Once sent, areas procured from the tag are handed-off specifically to the client, implying that no work is involved in following the creature. This has the included advantage that there is no natural surroundings aggravation either.

The location accuracy of ARGOS tracking tags is poor compared to Very High Frequency and GPS tracking. The most extreme degree of viable following regions fluctuate somewhere around 50 and 300 km2. This blocks the utilization of customary VHF following on colossal species, for example, wild canines. Satellite using so as to follow gives genuinely worldwide area estimation space based recipients. The disadvantage of the satellite following framework is the expense of acquiring information