

# Initial Plan - Tracking Poachers using The Internet of Things [BLE]

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## Project Description

In this project I will use Internet of Things technologies to develop a solution to track the movements of poachers to help understand how poaching gangs travel around the jungle. This solution is being developed with the intention for it to be deployed in the Kinabatangan Wildlife Sanctuary in Sabah, Malaysia in the summer of 2019.

Dr Goossens, Director of the Danau Girang Field Centre stated "We need to increase the size and protection of forest corridors to protect wildlife in Sabah." [1] This project aims to address this issue to provide information about the inner most parts of the jungle; due to the density of wildlife and the lack of technological infrastructure there is less known about how these poaching gangs operate. The aim of this project is to give the relevant authorities a way to track these poachers and ultimately reduce poaching activity.

To approach this problem we will use Bluetooth Low Energy (BLE); this is a suitable technology for the scenario as it addresses the issue of the lack of a continuous power source in the jungle, BLE beacons can run on batteries for up to 4 years[4] depending on how they are configured. BLE beacons are also relatively cheap compared to alternatives, this is important the project has to be feasible to implement in Malaysia .[3]

## Project Aims and Objectives

- Develop a working receiver
- Develop working BLE beacons which send a small packets stating the time and location of the beacon
- Understand what variables that effect Bluetooth low energy
  - I will conduct an experiment on a road which is similar to the roads in the jungle to research the variables effecting Bluetooth LE. I will aim to test the effects of the following on battery and range[2]:
    - \* Obstructions - Density of trees in the area
    - \* Height of the beacon on the trees
    - \* Speed of vehicle
    - \* Antenna power
    - \* Size of Packet
    - \* Weather (Wet weather has been shown to effect BLE)
- Design casing to house Bluetooth beacons.
- Extend Traccar to work as the database and mapping product.
- Implement the project in the Kinabatangan Wildlife Sanctuary in summer.

## Work Plan

There are 2 ways in which I could approach this problem:

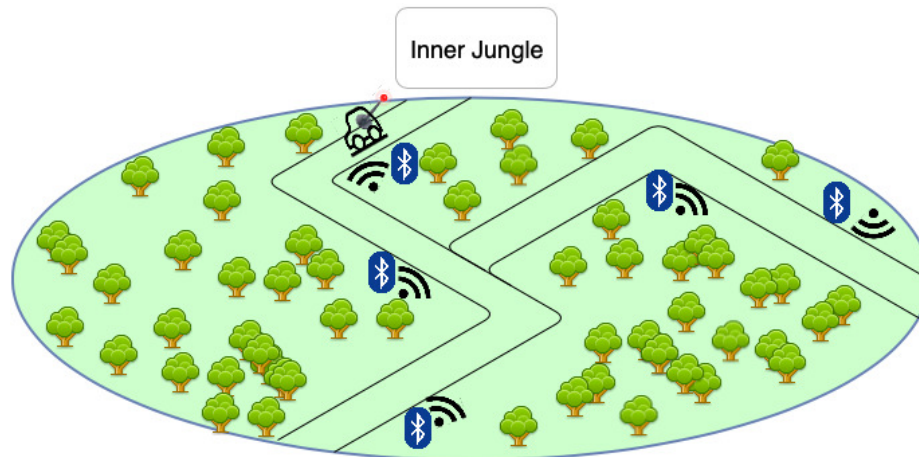


Figure 1: Receiver on the car and BLE beacons in the jungle

Figure 1 shows an implementation which places beacons in various locations around the jungle. Receivers will be placed on vehicles by informants, as the vehicle is in the range of a beacon the beacon will push a message to the receiver, this message will contain the ID of the beacon and a time stamp. These transmissions will be sent from every beacon which the vehicle has been in the range of. When the poachers leave the jungle and travel into a zone which has GPRS signal the receiver will send a SMS to a device outside of the jungle.

The main problems with this approach are:

1. The receiver needs to know when it is in an area with GPRS signal to send the SMS. I can not find any resources regarding this so this will be a problem to overcome.
2. There are many different variables that can affect the reliability and range of BLE. To get reliable results I need to test these variables to ensure that every time the vehicle passes a BLE beacon a connection is made.

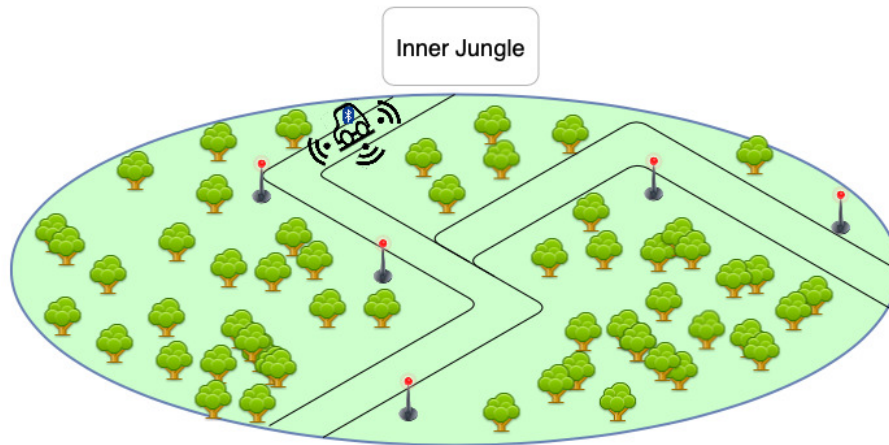


Figure 2: BLE Beacon on the vehicle and the receivers in the jungle

Figure 2 shows a different idea where the BLE beacon is placed on the vehicle and the receivers are placed in various locations around the jungle roads. The beacon will push a message to the receivers as the vehicle passes the receivers.

The main problems with the second approach is:

1. I will be using an Arduino microcontroller to make my receiver. These microcontrollers often work for less than 7 days, this would mean that the batteries of the receivers in the jungle would have to be replaced weekly. This is unlikely to be feasible as it would create a lot of work for the jungle staff.
2. Sending the data collected by the vehicle to the server will not be possible as the BLE beacon will not have SMS capabilities, this problem could be addressed by creating a BLE beacon on an Arduino, this would result in both the beacon and receivers having very short battery lives. The beacon could push the message to the individual receivers but this would mean someone would have to collect the device to collect the data from in the jungle which would again create a large workload for the jungle staff.

For the reasons discussed I will be implementing the first approach where the the receiver is on the vehicle and the BLE beacons will be placed on the road as approach 1 has smaller problems to overcome and will not create a lot of work for the jungle staff so is more likely to be maintained in practice.

After the SMS is sent to the device outside of the jungle we need to develop a way to visualise the data to make sense of it. I will aim to create a mapping software to do this, I intend to do this by extending 'Traccar' which is an open source software which can be found at: <https://www.traccar.org>. This application currently tracks the GPS from a smart phone and maps the location. To extend this to be suitable for this project I will need to use the mapping and

reporting features but find a way to take in the data from the SMS and visualise the locations onto the map. I believe this will be the most challenging part of the project and will take a significant amount of time to understand and implement.

## Time plan

- Network: Week 1-4 (February)
  - Research: Week 1
  - Develop receiver: Week 2
  - Develop beacon: Week 2
  - Develop beacon message: Week 3
  - Develop sending SMS: Week 3
- Extend Traccar: Week 5 - 9 (March)
  - Understand code: Week 5-6
  - **First Review Meeting: Week 6**
  - Extend code to fit purpose: Week 6-8
  - Test: week 8
  - Write up: Week 9
- Casing: Week 9-10 (April)
  - Design casing: Week 9
  - Print casing: Week 10
- Test infield: Week 10-11 (April)
  - **Second Review Meeting: Week 10**
  - Design experiment: Week 10
  - Conduct experiment: Week 10-11
  - Write up: Week 10-11
- Write up: Week 11-14 (April/May)
  - Proof read and improve what has already been written: Week 11
  - Analysis: Week 12
  - Conclusion/Abstract: Week 13
  - Proof read and improve: Week 13-14
- Submit: Week 14

I have made this time plan giving myself reasonable time buffers to ensure that I can complete the work in case I get stuck at certain points in the project.

I expect that extending Traccar will be the most time consuming and difficult part of the project so I have added a review meeting to hopefully get advice to solve the issues which I may have. I have also given myself the most time for this aspect of the project. I have added the second review meeting in week 10 as by this time most of the technical parts of the project will be complete. This is to discuss what I have done well and what I have not done so well. I have planned this in week 10 as it gives me enough time to fix what i need to improve.

A lot of the skills required for this project such as developing on a microcontroller is new to me so I have also allowed time to understand the technologies to avoid falling behind on the plan.

## Conclusion

To conclude, this project will use BLE beacons sending messages to a receiver which I will develop through a Ardunio microcontroller. This receiver will then send an SMS to a computer outside of the jungle. This computer will then upload the data to a program I will be extending from Traccar which will map the data which has been collected from the vehicle. The mapped data can then be used by the relevant authorities to understand how and when poachers move around the jungle.

This project is undoubtedly going to be difficult and will take a very long time to complete. I have tried to suitably plan my time to ensure I can both complete the project and ensure it is done to a high standard. Initially it is imperative that I get the BLE beacon as soon as possible to start developing milestone 1 of the project. By completing the less challenging parts of the project quickly I will allow myself more time for the more difficult milestones.

# Bibliography

- [1] AsiaOne. Poaching threatening rhino and buffalo at wildlife sanctuary, 2015.
- [2] Exam Cram. Variables that effect bluetooth signal (COMPTIA), 2009.
- [3] Libelium. BLE guide.
- [4] /www.beaconzone.co.uk/. BLE Beacon Example.