LoRaWAN GPS Asset Tracking System

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Introduction

The economic and social costs of theft crime can significantly impact a person's sense of security, safety and emotional well-being. As a consequence of these criminal events, it becomes more important than ever to reunite the owners with the stolen property.

This project aims to produce a LoRaWAN based GPS tracking system that tracks an object's position using The Things Network.

The IoT Ecosystem

The IoT device is developed around the microcontroller board Arduino Pro Mini 5V. It is used for its flexibility, low-cost, and small size. The microcontroller connects through jump wires to the Ublox Neo-6M GPS module, which connects to its antenna. The data received by the GPS module is broadcast by the RFM 95 Transceiver using LoRaWan technology. A 500 mA Lithium-ion battery powers the IoT device. The attached charging port is used to recharge it without disconnecting the battery. All components are residing on two mini breadboards.

The LoRaWAN technology is an open standard developed by LoRa Alliance that has vital features required to develop this IoT tracking device. Low energy consumption, long-range communication, built-in security, GPS-free positioning are the features required for this project.

The Things Network is a key provider of LoRaWAN networks. Their LoRaWAN Network Server powers the network and the gateway located within the Department of Computer Science at Bangor University.

The Gateway forms the bridge between the IoT tracking device and The Things Network. The Device uses the low power network LoRaWAN to connect to the Gateway. In contrast, the Gateway uses a high bandwidth network like Wi-Fi or Ethernet to connect to The Things Network to broadcast the data.

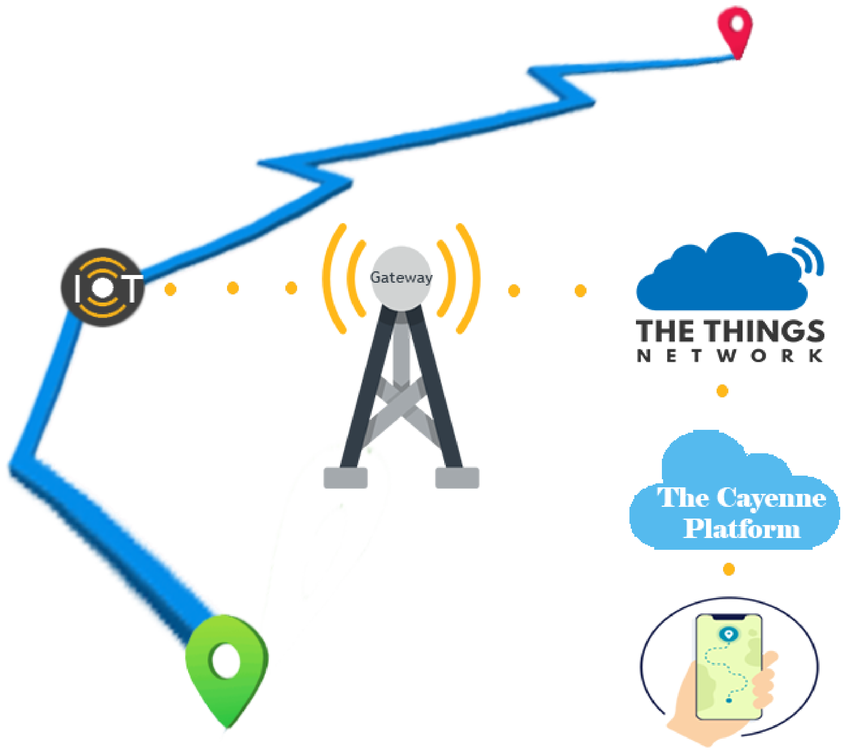

Fig. 1: The IoT Ecosystem

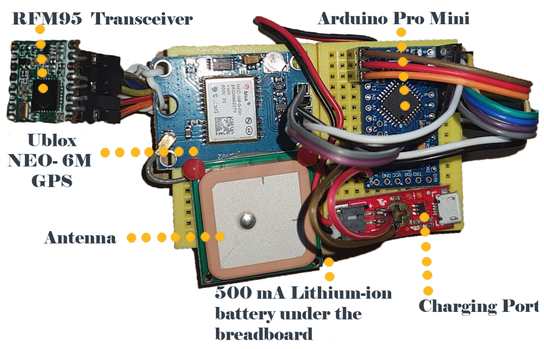

Fig. 2: Prototype v1.

Procedure & Results

The TheThingsNetwork serves as a registration point for the gateway and an integration point for the LoRa GPS Tracker node's data packets.

A first sketch(program) is uploaded to the Arduino microcontroller to activate the GPS Tracker via the ABP (Activation By Personalisation) method.

Once the LoRa communication is established, it will send ten bytes as ten separate packets. A second sketch is uploaded for reading the fixed GPS location data.

A decoder within the Things Network console decodes the receiving bytes from the GPS tracker and then broadcast them to be stored and interpreted to the Cayenne platform.

The decoded bytes represents the longitudinal and latitudinal degrees. This is used to pinpoint approximately where the GPS tracker is located based solely on its coordinates.

Future Work

IoT Security using Blockchain

Blockchain is a distributed database technology that allows creating tamper-resistant records. Using blockchain to store IoT data would add another security layer that hackers would need to bypass to get access to the network.

Adding an **Accelerometer sensor** will allow the GPS tracker to monitor for movement or signs of tamper and send an event notification alerting the user.

A geofence for a real-world geographic area could be dynamically generated—as in a radius around a point location using the GPS to trigger an alert or even an action to a mobile device when the GPS tracker enters or leaves the virtual boundary.