UNIVERSITI TEKNIKAL MALAYSIA MELAKA

THE DEVELOPMENT OF PET GPS TRACKER USING LORA

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electronic Engineering Technology (Telecommunication) with Honours.

By

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This report is submitted to the Faculty of Electrical and Electronic Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Electronic Engineering Technology (Telecommunication) with Honours. The member of the supervisory is as follow:

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ABSTRAK

Terdapat banyak kes hilang yang dilaporkan oleh Persatuan Amerika untuk Pencegahan Kekejaman untuk Haiwan (ASPCA) baru-baru ini. Sistem pengesan haiwan kesayangan telah ditindas oleh pemilik haiwan untuk menjaga haiwan kesayangan mereka hilang. Walaupun tracker haiwan peliharaannya sangat popular di kalangan pemilik haiwan peliharaan, tetapi sistem penjejakan haiwan kesayangan selalu mengalami hayat bateri yang pendek dan sukar untuk menerima lokasi haiwan peliharaan dalam jarak jauh. Cadangan projek ini adalah untuk mengkaji dan membangunkan sistem pengesanan haiwan untuk mencegah masalah kehilangan haiwan kesayangan. Teknologi LoRa dan teknologi GPS digabungkan untuk membangunkan sistem penjejakan haiwan dengan kos yang rendah. Sistem penjejakan haiwan kesayangan yang dilengkapi dengan LoRa, yang membenarkan pelacak untuk memantau lokasi haiwan kesayangan apabila haiwan kesayangan dijalankan jauh dari pemiliknya. Sistem penjejakan haiwan ini juga dilengkapi dengan GPS yang akan sentiasa memantau haiwan kesayangan dengan output koordinat ketepatan yang tinggi di bawah semua keadaan. Hasil yang dijangkakan dari projek ini adalah penjejak haiwan kesayangan yang mempunyai jarak jauh yang membolehkan pemilik haiwan peliharaan memantau haiwan mereka walaupun haiwan kesayangan mereka berjalan jauh atau haiwan peliharaan hilang. Penjejak haiwan kesayangan akan dapat mengesan haiwan peliharaan dalam tempoh masa yang singkat dengan output koordinat ketepatan yang tinggi dan mempunyai penggunaan kuasa yang rendah. Sistem pengesanan akan membolehkan pemilik haiwan peliharaan melihat lokasi haiwan kesayangan mereka dalam telefon pintar menerusi aplikasi tanpa menggunakan Wi-Fi dan GSM. Penjejak dilampirkan kepada haiwan peliharaan kerana saiznya yang kecil. Sistem pengesanan ini dapat menjejaki lokasi haiwan kesayangan secara terus menerus di kawasan jarak jauh atau luar bandar dengan penggunaan kuasa yang rendah.

ABSTRACT

There are many cases of pet lost reported by American Society for the Prevention of Cruelty to Animals (ASPCA) recently. The pet tracking system has been demanded by pet owner in order to keep their pet from lost. Although the pet tracker is popular among the pet owner, but the pet tracking system always suffer from short battery life and difficult to receive the location of pet in long distance. The propose of this project is to study and develop pet tracking system to prevent pet lost problem. LoRa technology and GPS technology is combined in order to develop the pet tracking system with low cost. The pet tracking system equipped with LoRa, which allowed the tracker to monitor the location of pet when the pet is run far away from their owner. This pet tracking system also equipped with GPS that will continuously monitoring the pet with high accuracy coordinate output under all condition. The expected outcome of this project is the pet tracker have long-range distance that enable the pet owner to monitor their pet even if their pet run far away or the pet is lost. The pet tracker will be able to track pet in short period of time with high accuracy coordinate output and have low power consumption. The tracking system will allow pet owner to view the location of their pet in smartphone through an apps without using Wi-Fi and GSM. The tracker is attachable to pet due to its small size. This tracking system is able to track the location of pet continuously in long distance or rural area with low power consumption.

DEDICATION

This thesis is dedicated to my parents and family members who give moral support and encouragement during completing this report. I also would like to dedicate to my friends and supervisor that always possibly help me when I have trouble with this project.

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LIST OF SYMBLO

MHz	Mega Hertz
km	Kilometre
mA	Mile Ampere
kbps	Kilo bit per second
kHz	Kilo Hertz
V	Voltage
mm	Mile metre

LIST OF ABBREVIATIONS

GPS	Global Positioning System
GSM	Global System for Mobile Communication
LoRa	Long Range
IoT	Internet of Things
ISM	Industrial, Scientific and Medical
WAN	Wide Area Network
BLE	Bluetooth Low Energy
WiFi	Wireless Fidelity
LPWAN	Low Power Wide Area Network
SNS	Social Networking Service
GCM	Google Cloud Messaging
SNR	Signal to Noise Ratio
GNSS	Global Navigation Satellite System
RSSI	Received Signal Stength
LoRaWAN	Long Range Wide Area Network
TTN	The Things Network
RFID	Radio frequency identification
WSN	Wireless Sensor Network
IP	Internet Protocol
MAC	Medium Access Control
AVL	Automatic Vehicle Location

GIS	Geographic information system
WC	Wireless Communication
USB	Universal Serial Bus
PC	Personal Computer
EEPROM	Electrically Erasable Programmable read-only Memory
GLONASS	Global Satellite Navigation System
HTTP	Hyper Text Transfer Protocol
GCP	Google Cloud Platform
LiPo	Lithium Polymer
CMD	Command Prompt
APP	Application

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

The Global Positioning System, or widely known as GPS is a global navigation satellite system that made up of at least 24 satellites. The early GPS technology was designed primarily for military use. The GPS was used to locate the location of enemy in order to prevent the sudden attacked from enemy. In the 1980s and 1990s, the use of the military was obvious, but the public's curiosity about GPS technology was scarce. In 1996, President Bill Clinton determined that the system could become a citizen and military asset and issued a policy directive calling for a public system that would benefit daily users. The policy adjusts GPS technology for ordinary people, such as fleet managers, who can see the advantages of using the technology to monitor their cars. In the 1990s, additional modifications were made to GPS technology and equipment. This includes policies for individual users and easy access to changes.

Nowadays, GPS tracking system is becoming popular in human live. They use GPS tracking system to monitor and track the location of the moving object. The GPS can be work in whole day and function in all the weather condition. The cost for the GPS is lower than others navigation systems. Due to the low cost, GPS can be easily to integrate into many technologies such as tracking system and cell phone. There are many pet lovers take their pet as a part of their family. To prevent pet from lost, most of the pet lovers using the GPS tracking system to monitor and track their pet.

Internet of Things (IoT) technology is a technology that transfers data to an object via the internet in real time. The devices connected to the internet require manual adjustment to exchange data, but IoT can exchange data without any adjustment. LoRa technology is one of the IoT technologies that used in the development of the GPS tracking system. LoRa is stands for Long Range Radio which is a new wireless protocol that provides long range, low power and secure data transmission for Internet of Things (IoT) application. It was developed by Cycleo of Grenoble, France, and acquired by Semtech company in 2012. LoRa can be used for wireless connection to the cloud of sensor, gateways, machines, devices, animals, people and so on. It able to detect an object's location up to 15km until 20km. LoRa uses unlicensed spectrum in the ISM bands with the radio frequency like 169MHZ, 433MHz, 868MHz and 915MHz. Due to the bandwidth limitation, LoRa- based networks has lower cost than a network based on other protocols. LoRa technology with low energy consumption can make a very cost-effective IoT infrastructure. LoRA technology has also highly security from end devices to application servers, thus it also supports for the outdoor application. According to (Hayati and Lora, 2017), LoRa technology was chosen as the primary communication platform because of its better WAN coverage. LoRa technology has the advantage of scalability feature. This feature enables stakeholders to add or decrease infrastructure as necessary.

1.2 PROBLEM STATEMENT

Recently, people regard pet such as dog, cat and so on as their friends or even family members due to their accompany. Pet lovers care for their pets like children who care for them. However, the problem of lost pets and pets been stolen still happening. This is because pet easily lose their sense of direction once they are far ways from home

and someone stolen the pets to sell it to unsuspecting person. Since 2007, the American Kennel Club has noted that the dog stealing report has increased by 31% in recent years. According to the American Society for the Prevention of Cruelty to Animals (ASPCA) that posted in Newsletters on 2017, there are one out of seven owners lost their pets like dog and cat in the past five years. When the pet has been lost, pet owner will be grieved. To prevent the pet lost, pet owner use GPS tracking system to track their pet's location.

According to the (Hadwen *et al.*, 2017), most of the tracking system has the issue with battery life. This problem brings a lot of inconvenience to pet owner. The pet owners need to charge the tracker before use, but some of the tracker still cannot function for long period although the tracker has fully charge. In addition, most of the GPS ftracker uses BLE or Wifi as the communication device. However, these communication devices do not have long range distance. Pet owner are enabled to bring their pet to field for a walk, but pet owners will difficult to monitor or track the location of their pets.

Pet GPS tracker usually must be small, low power consumption and long-range distance. To develop the tracker with small component is quilt complicated because the component is small and easily misplaced. The component is costly cause to spend much money to buy the component for every session.

1.3 OBJECTIVE

The objective of this project is:

1. To study the functionality and the method used in the Pet GPS tracking system.
2. To develop the Pet GPS tracking system by using LoRa.
3. To analyze about the performance of the tracking system.