



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

GPS AND GSM BASED LIVESTOCK TRACKING SYSTEM USING ARDUINO

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor's Degree in Electronics Engineering Technology (Telecommunication) Honours

by

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Electronics Engineering Technology (Telecommunication) with (Hons.). The member of the supervisory is as follow:

.....
(MR.WIN ADIYANSYAH INDRA)

ABSTRACT

Current research states that the number of livestock in our country is slightly decreased due to lack of constant monitoring and livestock rustling. Thus, the animal tracking is vital as it provides valuable information including the recent location, movement and feeding patterns of certain groups of animals. Technologies such as Global Positioning System (GPS), Radio Frequency Identification (RFID), Wireless Networking, Global System for Mobile Communication (GSM) and Mobile Computing Systems are being utilized to target specific needs of farmers and also the livestock owners. In this project the location of the animal can be identified using Global Positioning system (GPS) and the received information can be send via Global system for mobile communication (GSM) to the mobile phone with the use of Arduino, a microcontroller board based on the ATmega 32 processor. These systems constantly watch a moving object and report the status on demand by sending the coordinate of the location in real time. These tracking technologies will tend the farmers to better manage their farm land and allowing them to monitor the movement of their livestock throughout the geographical location.

ABSTRAK

Kajian terkini menyatakan bahawa bilangan ternakan di negara kita semakin menurun kerana kekurangan pemantauan berterusan dan pencurian ternakan. Oleh itu, pengesanan haiwan adalah penting kerana ia menyediakan maklumat yang terperinci terhadap sesuatu lokasi, pergerakan dan cara pemakanan ternakan. Oleh itu, teknologi seperti Global Positioning System (GPS), Radio Frequency Identification (RFID), Wireless Networking System (WNS) dan Global System for Mobile Communication (GSM) digunakan untuk keperluan khususnya petani dan juga pemilik ternakan. Dalam projek ini lokasi sesuatu haiwan ternakan dapat dikenal pasti menggunakan Global Positioning System (GPS) dan maklumat yang diterima boleh dihantar melalui Global System for Mobile Communication (GSM) ke telefon mudah alih dengan penggunaan Arduino, sejenis microcontroller yang popular pada masa ini. Sistem ini sentiasa memantau objek yang bergerak dan melaporkan kedudukannya dengan menghantar koordinat lokasi tersebut dalam masa yang sebenar. Teknologi pengesanan akan cenderung para petani untuk mengembangkan bidang pertanian mereka dan membolehkan mereka untuk memantau pergerakan ternakan di seluruh lokasi yang lebih baik dan mudah,;

DEDICATIONS

To my beloved parents Mr. Raja Sigran & Mrs. Saroojama

To my respected lecturers

And not forgetting to all friends

For their

Love, Sacrifice, Encouragement, and Best Wishes

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

GPS	-	Global Positioning System
GSM	-	Global System for Mobile Communication
RFID	-	Radio Frequency Identification
SMS	-	Short Message Service
GIS	-	Geographical Information System
UTC	-	Universal Time Coordinate
FMD	-	Foot and Mound Disease
PC	-	Personel Computer
FTK	-	Fakulti Teknologi Kejuruteraan

CHAPTER 1

INTRODUCTION

1.0 Introduction

This chapter provide a brief explanation on the background, problem statement that lead to the idea of this project, the objective that aim to be achieved at the end of this project, the project scope along with the significance and finally the summary.

1.1 Project Background

„GPS and GSM based livestock tracking system by using Arduino“ is a real-time GPS tracking technology that can be used to better management of farmland. GPS tracking of livestock is not a new technology, surfacing more frequently over the last several years at some European countries, but in Malaysia it is still not practice among the farming industry. Therefore, the livestock owners need to be regularly checked the livestock, fields, and fences where the animals are grazing daily, especially around the sale days.

This project consists of advanced devices with today’s electronics technologies, such as Global Positioning System (GPS), Global System for Mobile Communication (GSM), Arduino and other electronic devices that enable to achieve greater value and services by exchanging data. The mentioned devices will be mounted on livestock, mainly on the leader of livestock herd to know the location of the herds. With the help of the mentioned devices, the livestock owners will get message (SMS) containing the coordinate (Longitude and Latitude) of the livestock location at their mobile phone. Then, they can use this coordinate on the map to find the exact geographical location of the livestock. Nowadays many website providers

have online maps and the most famous one is Google Maps. Therefore, by displaying them in a web browser using Google Maps, they can identify the precise location of their livestock.

This project will be mounted at the livestock neck as a belt. The GPS modem in the system will help to get the coordinates of the livestock location parameters like Longitude and Latitude from Satellite. While, the GSM modem in the project helps to send the parameters to a particular mobile number via SMS. Finally, the SMS will help the farmers to exact the location of the livestock. The project will be attached to the animal body, so that when the animal moves from one location to another, the GPS coordinate will change and it will be intimated using the SMS.

This livestock tracking project is fast and convenient as compared to other systems with the use of Arduino and it also does not require human attention, because it is completely self-independent and automated system.

1.2 Problem Statement

The main foundation of Malaysian's economy, livestock husbandry plays a vital role in the economy and export revenues of our country. According to the Market Access Secretariat Global Analysis Report, which presented in 2014 by FAOSTAT Agricultural Production, the number of livestock has increased from year 2008 until 2010, and then it was decreased in the year of 2011 and 2012. This situation is due to some factors, such as the country economy, lack of constant monitoring on livestock and mainly livestock theft which can be mentioned as the most significant rural crime which makes the livestock owners to incur financial loss, loss of future breeding and herds. The livestock hustlers are getting bolder and sophisticated by day in the country. According to Leah Brazell, the livestock theft is hard to be prevented without constant supervision. There is a need for tracking livestock movement using today's technology due to improve the management of livestock and pasture, relating to livestock husbandry. Without a proper monitoring and tracking, the livestock can breach pasture fences and roam far away in any direction, which makes very hard to locate them visually when owners plan to return

them to stables. Thus, this project, allowing the farmers to monitor the movements and special activities of the livestock, that can be provide information that can give a multiple benefits.

1.3 Objective

The objective of this research is deeply concentrated on aspect as listed below:

1. To study the system of tracking and monitoring of the livestock movement
2. To design a tracking system to reduce the rate of livestock theft
3. To apply the GPS and GSM technology in farming industry

1.4 Project Scope

The scope of this project mainly focuses on a tracking system which using today's technology. It is very useful for livestock producers, and large producer with a need to keep track of lots of animals. The project consists of Arduino, GPS and GSM module to track the livestock. The similar system can be also used to track vehicle, pet animal and even the kids. Thus, this is a multipurpose project that can be widely used by everyone. But for the short time, this project is design and applies for only tracking purpose of livestock, but in the future this system can be used to monitor the health parameter of livestock in one herd by adding sensor or RFID. This project deeply concentrated on telecommunication technology, because the devices that going to be used are function to transfer information from one destination to another. The diagram below shows the basic idea of the tracking project.

1.5 Project Significance

The „GPS and GSM based livestock tracking system using Arduino“, is very useful project for those who needs to track. In case of highly rate of livestock theft,

the substantial economic losses can be avoided if an effective animal tracking system is implemented at every location . Besides that, by this project the livestock owners can save their time of monitoring the livestock, because this project will give the precise location of the animals. In spite of that, the losses that occurred by the outbreak of an infectious animal disease also can be preventing by this project. This is because this project provides animal movement information in time which can prevent the disease spread from one herds to another. Apart from saving the time, by this project the livestock owners also can obtain benefit in term of cost by reducing the financial losses.

1.6 Summary

In nutshell, this chapter covered the background, problem statement, objectives, scope and also the project significance of this tracking system. In the background, the overall project information was described in detail, such as the process and the devices that used. The problem statement of this project is more focus to the issues of livestock theft and the problem that faced by the livestock owner such as the financial loss, loss of future breeding and herds. Then it moves to the objectives, where it explains the main purpose of the project to be carried out. In the scope the hardware which used was mentioned along with the basic idea of the project in the form of block diagram. Finally, the project significance, demonstrated the benefits of tracking system and the advantages against the society especially the livestock owners.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

The literature review can be defined as the collection of a critical and comprehensive evaluation of information in a specific area of study that published. This chapter gives a general understanding of findings of the tracking system, details of components, conclusions, recommendations and thereby brings out the strength and weaknesses. This chapter helps in identifying the gaps, scopes for further work and generalized the concepts in the existing body of knowledge.

2.1 Livestock Crime in Malaysia

The high dependence of the majority of the rural citizens for their livelihoods on agricultural is very clearly observed in many countries, including Malaysia. International comparisons derived from FAOSTAT showed that the number of livestock continued to increase over the period of 2006-2010. Then, in the year of 2011-2012 the number of livestock especially cattle and goat were slightly decreased. Among the reasons cited for the decrement of cattle and goats are the poor productivity, heat stress suffered by the imported cattle and goat, high pest and disease burden afflicting, poor quality feed from native grasses, lack of constant monitoring and most importantly livestock rustling.

Livestock (head)	2008	2009	2010	2011	2012
Cattles	873,327	882,666	893,531	836,910	768,403
Goats	428,263	477,480	514,233	496,194	476,431

Sheep	125,988	131,258	136,285	123,475	126,412
Buffaloes	130,775	131,230	127,152	125,900	123,313

Table 2.1: Research of FAOSTAT Agricultural Production on the rate of livestock in Malaysia, February 2014.

There are many traditional ways to protect the livestock from the factors that mentioned above, such as maintain good records of the cattle, make sure all the cattle have their own identification (tags), do a regular physical count, keep an eye out for any suspicious activity and many more. But these methods will consume time and energy of the livestock owners. Instead of doing that, in many western countries advanced tracking system was developed to track the livestock. But in our country, this system is still not practice widely in farming sector. Therefore, the need for constant human observation to tracks or monitors animals, people, vehicles and other objects can be eliminates.

2.2 Previous System and Existing Technologies

There are many existing technology that have been used for tracking purpose. The tracking system widely used to track and monitor vehicle, animals, people and others. Many researchers have worked in this field to develop the tracking and monitoring system with the help of various embedded electronic devices.

(Modi Nirav.D et al, 2014) developed a vehicle tracking system using GPS (Global Positioning System) technology, along with GSM network, digital mapping and specialized tracking software to allow the user to see their vehicle's location, speed of the vehicle and other features through the computer. Apart from that, the Geographical Information Systems (GIS) was also used in the project where it described as general-purpose of the computer-based technologies which functioning in handling geographical data in digital form. It used to capture, store, manipulate, analyze and display diverse sets of spatial or geo-referenced data (Burrough and McDonnell, 1998). This tracking system uses the ARM controller for better

performance. According to (Kumari and Malleswaran, 2010), the ARM7 based microcontroller is very useful to developed real time based tracking and monitoring system.

Apart from that, (Abha Damani, Hardik Shah and Krishna Shah, 2015), in their research of Global Positioning System for Object tracking, says that, GPS and GSM based model are very useful for routing and tracking of mobile vehicles in a large area outdoor environment. As per their statement, these modal has benefits identifying the theft vehicle and also develop the routing and tracking in transportation, by the use of some special hardware such as ARM processor. According to them, one of the benefit of this system is, it can analyzed all aspects in real time and historically by captured and stored the information for future use. But, the problem is that it requires large size of database to store all the data. In this project they used the AVL tracking system, which is an advanced method used to track and monitor any remote vehicle equipped through GPS satellite. The AVL system is a combination of GPS and GIS that provides an actual geographical real time position of each vehicle. There are many advantages in AVL and some of its are, AVL contains execution of Startup routine, Logs of Tracking Server and Pointing out current location of vehicle, which can be easily track and can get the accurate information of the vehicle.

Apart from the GPS and GSM module, the RFID also widely use in the tracking and monitoring system. According to (Hazrullizam, 2008), from his research on development of tracking system using Radio Frequency Identification (RFID), stated that the RFID provides a unique serial number for identification of an object, relying on storing and remotely retrieving data using RFID tags or transponders. The ability of RFID to track the moving object quickly gained attention. Many monitoring system are using the RFID, because the interrogator, and an antenna packaged with a transceiver and decoder helps to emit the signal activating the RFID tag so that it can read and write data on it. But in the case of long distance between objects RFID is not applicable. But still in many countries the RFID system is use widely example the Livestock Identification and Trace-back System at Botswana, where it used to capture data on individual cattle and their owners, and transmits it

directly to a central database. As in the June 2006, a huge number of cattle had been inserted with the bolus throughout that country and it became as the "world's largest livestock tracking, monitoring and management system using RFID technology" (Burges, 2000).

Apart from GPS, GSM and RFID, there were also other devices used previously in order to track and monitor objects. According to (Andrew Markham, 2004) from his research of Wildlife tracking and telemetry system, introduced the ZebraNet (deployed in 2004) to decrease the effort involved in obtaining animal tracking data where this system equipped with a radio transceiver, which function to allow the tags to support two way communications, where it can transmit and receive the data. Besides that, the collars of one animal shared tracking data with another with forming a wireless network. Thus, this system can obtain data from many animals tracking collars, but the information can be obtained by downloading from only a few. ZebraNet is an excellent proof of concept that wireless networks can be used in the wild to transfer information.

2.3 Recommended Project Design

There are few project designs was suggested before for this livestock tracking system which is livestock neck collar, ear tag and ear plug. But after considering the pros and cons the neck collar design was selected in this project.



Figure 2.1 :Livestock neck belt

2.4 Hardware Overview

2.4.1 Global Positioning Satellite (GPS)

According to (Pankaj Verm et al, 2013), Global Positioning Satellite (GPS) is one of the technology that used in a huge number of application today especially in tracking and keeps regular monitoring on something. According to (Abha Damani et al, 2015) GPS modules are popularly used for navigation, positioning, time and other purposes especially for military. (Nina Spitzer, 2009) in her statement mentioned that, the GPS is using one way transmission where it only can transmit one-way signals back to Earth and the atomic clock in each satellite enables it to transmit precise information regarding someone's or something's location and current time. A receiver will pick up these signals and calculates the distance to at least four of the satellites. With this information, the GPS can calculate the current location of the objects and then look that up on its map. Therefore, in this project the GPS will be continuously move with the livestock and will calculate the coordinates of each position and communicate with GSM device in order to send message to the livestock owners.



Figure 2.2 : Object Track by 3 GPS Satellites around the Earth

According to (Janne Sundell, 2012), the GPS module has an antenna and a receiver which send the location information to the GSM module. With the help of GSM module an ordinary SMS short message will be send to the receiver via GSM mobile phone network. The receiver can be a personal computer (PC) equipped with a GSM modem, commercial Internet server which able receiving short messages, GPS–GSM mobile phone, or an ordinary GSM mobile phone. There are many types of GPS example Copernicus, SUP500F, MN5010(uMini), LS23060, DS2523T and EM-406A. Each of the GPS has different chipset, antenna/hardware configuration and so on.

For this tracking process many GPS module was analyses and one of the inexpensive device that has been found is GY-NEO6MV2 GPS Module. According to (Windell Oskay, 2013), this module consists of a small PCB 25mm x 35mm size and it has a separate ceramic antenna which connected by a small lead which is 25mm x 25mm in size. The small button-cell battery in the module is to provide backup to the GPS chip and a small EEPROM connected to the GPS chip which can store configuration. The board has four connectors VCC, GND, TX (Transmit) and RX (Receive) and can be powered by the 5V supply on Arduino boards since it has a small regulator to provide the 3.3V needed.

This type of GPS module uses the NEO-6 module series which is the stand-alone GPS receivers with high performance u-blox 6 positioning engine. These flexible and cost effective receivers offer numerous connectivity options in a miniature 16 x 12.2 x 2.4 mm package. Their compact architecture and power and memory options make NEO-6 modules ideal for battery operated mobile devices with very strict cost and space constraints.