The International Journal Of Engineering And Science (IJES)
|| Volume || 4 || Issue || 7 || Pages || PP -25-29|| 2015 ||
ISSN (e): 2319 – 1813 ISSN (p): 2319 – 1805

Smart Livestock Tracker

[1,] M.K. Nor, [2,] M.S. Masbop, [3,] M.N. Shah Zainuddin, [4,] M.N.M. Nasir, [5,] M.F. Sulaima,
Faculty of Electronics and Computer Engineering, Universiti Teknikal Malaysia Melaka

----------**ABSTRACT**----------
This project is about designing an Android based application that able to track the current location of a farmer's livestock. This application can assist farmer to track their lost or stolen livestock. Currently, farmer needs to manually look for their livestock without any proper assistance. In addition, the process can consume a lot of time and energy. This project is divided into three parts that are online database from Thingspeak.com, GPS Collar, and Android application. The system works strapping a device called GPS Collar around the livestock's neck. Then the current location of the livestock will be collected and uploaded by the GPS Collar to the Thingspeak.com database. Once the location data is successfully uploaded, the livestock location can be viewed with the farmer's Android device. This can be done by fetching the last data that is uploaded to the database. Therefore, this application can reduce the time taken for farmer to track their livestock.

Keywords *- livestock tracking, Android application, GPS Collar, online database, Thingspeak.com.*

Date of Submission: 10 July 2015 Date of Accepted: 30 July 2015

I. INTRODUCTION

Most farmers do not own any dedicated monitoring system for their animals. Due to that, their animals are exposed to danger such as thief and wild animal. Stolen and missing livestock can harm farmer financial. For small and medium farmers, the effect of stolen livestock is more serious compared to commercial farmers. This is because they own only small number of livestock and their main income comes from sales of the animal. Quick cash yield and freely wandering livestock for grazing are some of the reasons why livestock are stolen and missing [1].

To overcome this problem, an application called SMART Livestock Tracker is developed. The SMART Livestock Tracker works with GPS collar. The collar will be strap at the animal neck. The function of GPS collar is to update the location of the animal via GPS.

To locate the location of their livestock, farmer needs to request the location of their livestock through the Android device. Once requested, request data from the device will prompt the GPS collar to provide its current location. Finally, the GPS collar will send its current location back to the Android device. This process will only take less than a minute depending on network speed and coverage.

This application provide better alternative for farmer to track their livestock whether it is missing or stolen. Traditionally, small and medium livestock farmer track their livestock by searching at the former track of their livestock. This consumes a lot of time and the track sometimes can be misleading. Additionally, this app can help farmer to monitor their animal from distance. The location of the animal can provide sufficient data for farmer to know the status of their livestock.

I. LITERATURE REVIEW

2.1 Animal tracking

The function of animal tracking is not limited to locate animal, it also can be used to monitor animal behavior. For researcher, the data from animal tracking can help them to understand how the animal move within local areas, migrate across the oceans and continents, and evolve through millennia. This kind of information can address the environmental challenges such as biodiversity loss, invasive species, climate and land use change, and the spread of infectious diseases. Data from animal tracking over large temporal and spatial scales provides invaluable information to the biologist [2].

Technological developments such as shrinking battery sizes, smaller receiver and transmitter, and improved communication systems have led to various methods for tracking animals. Since 1900, scientists have begun systematically tracking individual animal movements. In the late 1950's the field of animal tracking take another leap when radio transmitter was introduced to track wildlife. The usage of Global Positioning System (GPS) only appears in the early 1990's [3].

There are several things to consider when choosing the method to track animal. Some of the example of parameter that needed to consider are price, size, and amount of ease of data collection. To design an ideal tag, the tag need to be lightweight enough to be safety carried by the animal, have the ability to transmit high-resolution data to a satellite, and affordable to put on many animal.

2.2 GPS Collar

The device is placed at the animal's neck. By placing the device at the animal neck, the device can avoid any potential interference that can come from the surrounding such as grass. The device also can avoid from being broken. This is because the animal neck does not move as much as other animal body part. Equipped with GPS, the collar needed to be comfortable for the animal as a tool to locate the animal. Moreover the design GPS collar must be able to withstand outside environment to avoid it from broken. Wild animal such as Moose, deer, caribou, and elephant are examples of animal that have been fitted with GPS collar over the last decade. Besides that, the collars also have been used with sheep in research on the ecology and management of grazing system [4].

Before the invention of GPS collar, animals are monitored by ARGOS Data Collection and Location System and VHF Radio Signal Tracking. The ARGOS Data Collection and Location System collect environmental data which include ecological, meteorological, hydrological, and oceanographic information. The system consists of earth-based platform transmitter terminals (PTT), polar orbiting Tiros-N satellites, ground based satellite tracking station network, and communication links that transfer data to processing centers. The system error for ARGOS can exceed to 500m. Very high frequency (VHF) Radio signal tracking system consists of battery powered transmitter, receiver, and recorder. The system works by attaching the animal with a transmitter that produces a unique signal. System error for this system can exceed to 500m [5].

2.3 Android operating system

Regarded as one of the most widely used mobile operating system nowadays, Android is a mobile operating system that based on the Linux kernel. This operating system is developed by Google. The operating system is designed mainly for smartphones and tablets. Android become the fastest growing mobile operating system due to its open nature. Its open source nature has allowed the software developers to easily modify and adding feature in it. As much as 1.5 billion applications and games were downloaded monthly from Google Play [6].

This powerful development framework user allowed software developers to create their own application for wide range of devices. The key features that Android have are; Dalvik virtual machine, Application Framework, Optimized Graphic, Integrated browser, SQlite, GSM Technology, Bluetooth, 3G, Edge, Camera, Wi-Fi, GPS, and Media Support. Android also provide Android Software Development Kit (SDK) to their developers. This can assist the developer to develop better software. Inside the Software Development Kit, there are; a debugger, documentation, libraries, sample code, tutorials, and a handset emulator based on QEMU (Quick Emulator) [6].

2.4 Database system

The demand for data management has triggered the database technology. Data management refers to how the data is coded, organized, stored, classified, protected, and detected. It is the fundamental of data processing. With the help from rapid growth of computer hardware and software, data management has developed through three phases: labor management, files system, and database system [7].

There are several very important steps when designing a database system. First, the designer should analyze the system and understand the relationship between them. Then, the designer needs to fully mobilize the interest of the user and not the designer him/herself. The active involvement of the user indicates that the database is designed well. Next the designer should take the scalability of the system into account and make it easy to modify. The step need to be consider because the application environment always evolving. Besides, new technology will come to push for greater need of the application. But it must be noted that the changes in application environment and the emergence for new demand cannot overturn the original design and cannot disturb the current application programs and data greatly [7].

Even though the designer designs the database with a good scalability, the designer needs to accept that the scalability of the system is always limited. Not all expansion of the original design can meet the latest requirements demand [7].

A new database design needs to be started if the original database design does not able to expand according to the latest application environment. Nevertheless, designer should consider the current application of the database. Based on the designer consideration, the new database should allow user to have smooth transition from the old system to the new one [7].

II. METHODOLOGY

The study helps to clearly understand the concept, approach and certain terminology that revolve around the project. Four related works are chosen for literature review. The related works were chosen based on their technique, approach, and objectives. The database will be built at Thingspeak.com. The data from the GPS collar will be uploaded to the database and then the database will send the last data uploaded to the Android application, Tracker ON.

The development of both GPS collar and Android application are done separately. This is because, both task are connected only to the database. For GPS collar, the task that is required to accomplish is to link the collar to the database. While for Android application development, the task does not limited to program code but also designing user interface of the application.

As soon as GPS collar and the Android application are working, the system will be tested. The relationship of each part is shown in Fig.1.

Figure 1: Relationship between each parts

III. RESULT AND DISCUSSION

4.1 Result

Fig.2 shows how the data in the database is stored. From the figure, there are two chart; Latitude and Longitude. Latitude chart represent the latitude data of the GPS collar while Longitude chart represent the longitude of the GPS collar. Data from this database can be accessed individually by placing the mouse at the desired date.

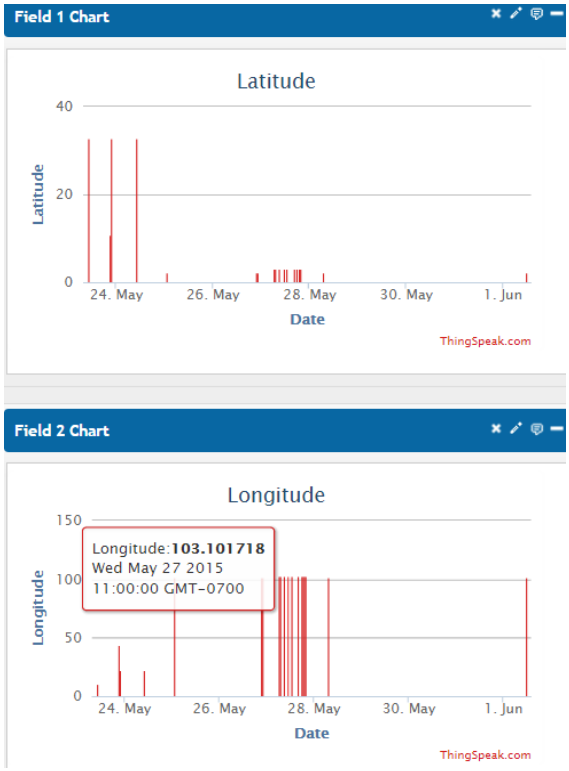

Figure 2: Stored data in Thingspeak.com database

The Android application that was developed will show the last data that was uploaded by the GPS collar to the Thingspeak.com database. The location of the livestock can be located by filling the Latitude and Longitude fields. Fig.3 shows how the location of the livestock will be displayed inside the application. The red marker indicates the livestock location.

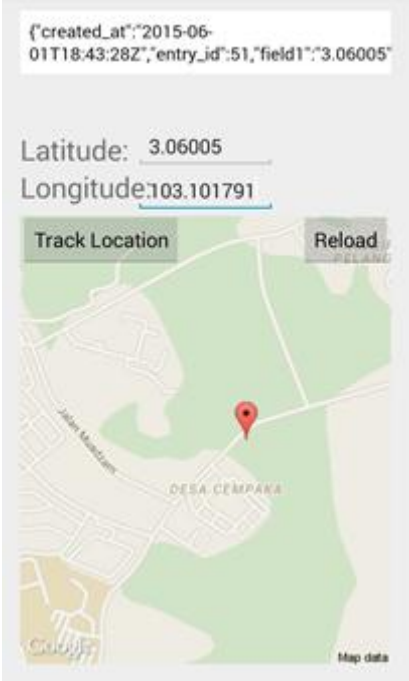

Figure 3: Livestock's location inside the application

4.2 Discussion

4.2.1 Thingspeak.com database

Thingspeak.com is a website that provides free database hosting. The website is dedicated for the developer of Internet of Things (IoT). Currently the data is displayed in the column chart. Unfortunately, Thingspeak.com does not support table form for displaying the data at the moment. In addition, there is no query mode in the website. Query is like a filter option. Without query user unable to find specific desired data.

Users need to handle the database by themselves since the website does not provide administrator support. Tasks like adding variables and deleting database need to be done by the user. One of the advantages of using Thingspeak.com database is that it provides flexibility for the user. As long as the user is connected to the internet, the user can access the database anywhere they want.

Nevertheless, for better data management the user needs to have individual's own dedicated database. Since Thingspeak.com is a public site, the database is prone to security threat. If dedicated database is developed, the data inside the database will be more secure. Besides user can add some of the features that are unavailable with Thingspeak.com.

4.2.2 GPS Collar

Since the collar needs to have an internet connection, the battery of the GPS collar drains more quickly. Currently the program will try to upload the location data if the current location is not equal to past location. Even though the data will be more accurate if greater balance between frequency of the data that is uploaded and location error can be achieved in order to have longer battery life. Table for sensitivity of GPS data is shown in the Table 1.

Table 1: Sensitivity of GPS data

Decimal place	Sensitivity
First	Up to 11.1km
Second	Up to 1.1km
Third	Up to 110m
Fourth	Up to11m
Fifth	Up to 1.1m
Sixth	Up to 0.11m

Table 1 shows the sensitivity of GPS data. From the table, a good GPS collar or device needs to be able to detect at least to the fifth decimal places. The GPS collar that is used for this experiment is able to detect at up to six decimal place. This indicates that the device is sensitive enough to use for this project

4.2.3 Android application

This application is developed to simplify the user task of tracking the location of their livestock. With this application, user does not need to go through the trouble of accessing the database at their device. Last data that was uploaded by GPS collar will be fetched automatically by this application.

Since this application is designed to the current location of the livestock, the old data will not be stored and will be overwrite automatically once new data is received. The data that was received which is in JSON format is not properly displayed. User need to scroll the application in order to view the data. Moreover, user need to enter the data manually which can lead to typing error.

Based on the tested device, the time for the application to load is quite fast. This is due to light work load when the application initialized.

IV. CONCLUSION

As conclusion, a system that is capable of monitoring the location of the livestock was successfully built. The system works by uploading the current location to the database from the GPS collar via internet connection. The data then is saved in the database that is created at Thingspeak.com. The location then can be viewed by using Android device.

This Android application was develop using Android Studio. Android Studio is an integrated development environment (IDE). The code program was written in JAVA and to request for the location, HttpPost class was used.

ACKNOWLEDGEMENTS

The authors would like to thank Universiti Teknikal Malaysia Melaka (UTeM) for the financial supports given through Short Term Research Grant.

REFERENCES

[1] P. Kibambe Mashoko Nkwari, S. Rimer and B.S. Paul, "Cattle Monitoring System Using Wireless Sensor Network in Order to Prevent Cattle Rustling," *International Information Management Corporation*, pp. 1-10, 2014.

[2] Martin Wikelski, Roland W. Kays, N. Jeremy Kasdin, Kasper Thorup, James A. Smith, and George W. Swenson, Jr, "Going wild: what a global small-animal tracking system could do for experimental biologists," *The Journal of Experimental Biology*, pp. 181-186, 2007.

[3] Movebank Organization, "What is animal tracking?," 13 December 2014. [Online]. Available: https://www.movebank.org/node/857

[4] Eugene D. Ungar, Zalmen Henkin, Mario Gutman, Amit Dolev, Avraham Genizi, and David Ganskopp, "Inference of Animal Activity from GPS Collar Data on Free-Ranging Cattle," *Rangeland Ecol Manage, pp. 256-266*, May 1999.

[5] Ahmed El-Rabbany "Introduction to GPS," in *Introduction to GPS, London, England*: AH, 2002, ch. 1, pp.1–10.

[6] Rajinder Singh, "An Overview of Android Operating System and Its Security Features" *Int. Journal of Engineering Research and Applications*, pp. 519-521, Feb. 2014.

[7] Xuedong Jiang, and Guoji Song, "The Database Design for the Control Equipment Management System" *2012 3rd International Conference on System Science, Engineering Design and Manufacturing Informatization*, pp. 261-264, Oct. 2012.