

Farm Security System: An Internet of Thing (IoT) Approach in Monitoring Farm Perimeter

Muhammad Aliuddin, B.¹, Nur Shahira, M. A. N.², Lilywati, B.²

¹Fakulti Perladangan dan Agroteknologi, Universiti Teknologi MARA, Kampus Jasin, 77300, Melaka, Malaysia

²Faculty of Engineering Technology, Department of Electrical Engineering Technology Universiti Tun Hussein Onn Malaysia, 86400 Pagoh, Johor

*Corresponding author. Tel.: +60133015200, Email: aliuddin@melaka.uitm.edu.my

Abstract

Nowadays, security either related to human physical or things is really important as the level of crime occurs that involves murderer or thief was very frequently and become increases from time to time. Normally, stealing or burglary always heard to be occurs at residential area but recently this crime also takes place at the farm. As we know, farm located in an opened area which there were a lot of crops and sometimes farmers also left their farming equipment and chemical substances at the farm. Therefore, it becomes targeted place to steal instead of houses because there were large tendency and opportunity not to be seen by peoples when the farmer was not around. Although plants production and farming tools it is not jewel or money but it could be valuables for thieves to steal and make profits illegally. In order to overcome this problem, a security system for a farm is invented to help the farmers from having losses and as well as to reduce the rate of stealing cases in our country. This security farm system project was implemented to be useful in protecting the crops and farm area during the absence of its owner and its specialization was connected with technological features like Global System Multimedia (GSM) and Internet of Things (IoT). Thus, it can be controlled by the farmers from any places and at any time

Keywords: Internet of Thing (IoT), Electric Fence, Mobile Applications,

Introduction

Agriculture plays an essential part in an economy. Their importance cannot be nullified because these crops provide food and raw materials that making employment for a man in this country. Many farmers are today inserting the new technology for their farm that used the machine to replace the human labour in order to improve business in agriculture and increases the quantity and quality of the product. Due to the value of agriculture are towards human society, some untrusted people usually take advantages to the farmer crops like stealing the product. Therefore, security becomes a significant matter where despite that the threat of violence on the farm is not too often, but still can lead liability causes by criminal deeds for example robbery of farm product and equipment (Genever, 2015). Karl-Heinz Erb, through his journal it is stated about good security farming system unauthorised access to farm chemicals and application equipment, are most significant losses to the farms, and greenhouses where plants developed (K. Erb, 2012). This system will help to keep the farm secured, and monitor the highlighted area of farm to reduce the exhaust time to when leaving that area and effort of farmers. The project of the smart farm security system is an advanced technology concept farm that focused on several smart divisions which are electric fencing system, wireless camera and GSM alarm motion detector. It is also included with the lighting system on the electrical fence which only activates whenever it detects the absence of a human. The system was combined on one place and instructed by Arduino Uno and controlled through Global System

Multimedia which is also known as GSM or IoT applications. The project intention is to help the farmers to protect their crops, livestock and equipment from getting damaged by animals and theft.

Materials and methods

The general block diagram of overall security system for this project is shown as figure 1.

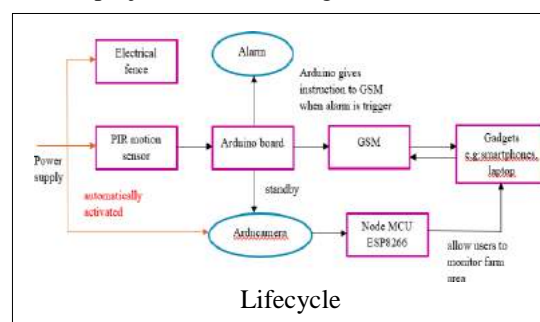


Figure 1: The Mobile Application Development

Figure 2 shows the research on sensing process flow of communication which is significant in order to make the applications went well through several types of modern gadgets nowadays such as smartphone or laptop. In this system, the GSM function as sender tools that sends the information to the user gadgets and need the user to reply an instruction either to continue or stop the triggering alarm while IoT will attach with Arduino camera for monitoring purposes by applications. This project not only trigger an alarm as security steps but also involves electrical fence and camera to monitor the

farm area which can be referred to Figure 3 stands for research on how the process of information being transfer by gadgets to the users is required as below helps to improve the understanding of what will the applications do to make sure that the information fully received by the users.

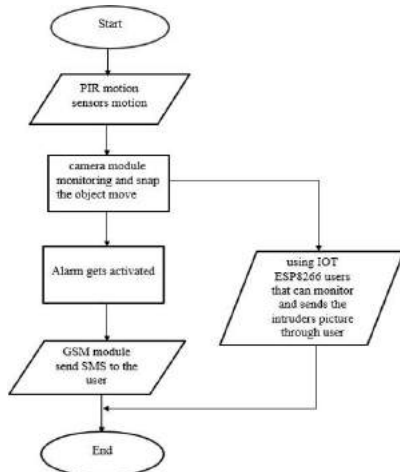


Figure 2: Flowchart Sensing

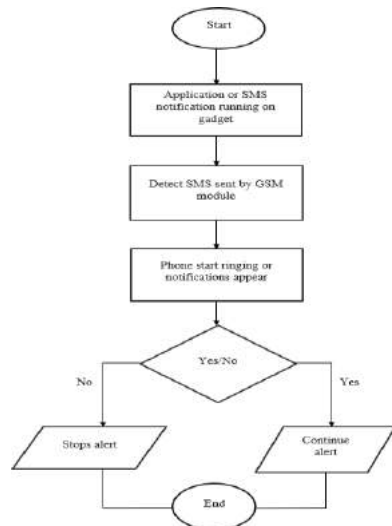


Figure 3: Flowchart for User

Results and discussion

The power supply is the most significant things on any electric and electronics project. In this part, the voltage and current used for circuits are measured to achieve the best voltage and current need to be used for the whole circuit to function which consists of an electrical gate, GSM alarm detection circuit and camera. Table 1 shows the amount of voltage and current used for each part of the farm security system.

Table 1: Amount of Voltage and Current Measurement Record

Type of circuit	Measurement	
	Voltage	Current
Electrical fence	6V	1.92 X 10 ⁷ a
GSM alarm motion detection circuit	16V	3.209a
Arducamera	3.3V	0.007a

For this project prototype, written coding set the distance can be measured from two until eighty cm far from the sensor itself, but in a real situation, this alarm motion detection circuit can detect up to 7m long. Since the sensitivity of PIR motion sensor is very high as it can detect any motion in front of it, therefore, this system is attached or together with a camera which can capture picture and do a video to look the real things disturb the crops or enter the farm without permission. The distance measurement helps the owner to know how far the danger on his farm through the short message system by GSM after the alarm is triggered by a motion sensor. Figure 3 below shows the constructed circuit of GSM alarm motion detection while Figure 4 shows the production output form (GSM send message and make a phone call to designated number).

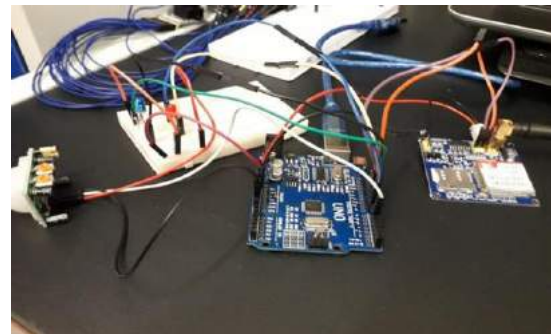


Figure 3: The constructed circuit of GSM alarm motion detection

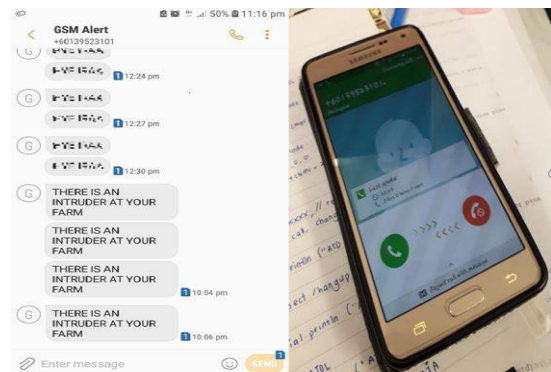
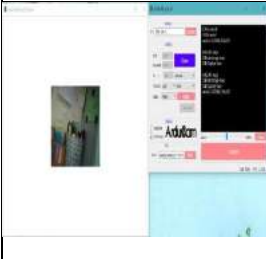
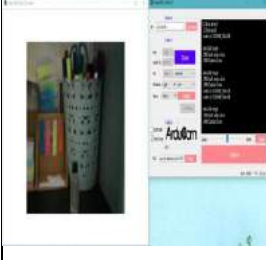
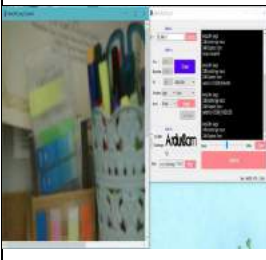


Figure 4: The production output form (GSM send message and make a phone call to designated number)

The camera in this farm security system helps to detect and identify the image of someone or animals that try to bring harm towards owner farm. It also makes the owner easy to trace and takes action to save the unwanted incident to happen on their farm. Thus, the clear resolution of the image is necessary (Mendoza, 2016). In this project, a type of OV2460 Arducam mini 2MP camera is set up on the prototype for monitoring the condition of farm manually. NodEMCU ESP8266 is used to instruct for the camera to capture and record the picture of the thief. Observation can be seen in Table 2 on how the pixels of camera lens influence the manifesting of picture capture and recorded.

Table 2: Observation effect of pixel of camera with picture captured quality.

Sample picture	Observation
	Camera Resolution setting for the condition is 160x240 which indicates the size of picture obtain. The small size of pictures appeared on the monitored screen.
	Camera resolution was then set to the condition is 640x480 pixels as the image become much clear and better. The size appeared on the screen increased from the previous picture.
	The camera is focused more on the items when the pixels is set to 1600x1200. The larger size of the image appeared

For this project, the Arduino Software IDE is used to write the coding because the language was closed to human language (high-level language) and easy for

error detection compare to Micro C which it is heavy towards assembly machine language (low-level language). Figure 5 below shows a coding to make the alarm triggered (ON) when the input, PIR motion sensors trace a motion subject move in front of it

```

Sketch, Arduino IDE | Arduino 1.8.5
File Edit Sketch Tools Help
Upload
Sketch: sketch_arduino_esp8266.ino
#include <SoftwareSerial.h>
SoftwareSerial mySerial(10, 11); // DVT TO 3...5VR TO 10
char msg;
int motion = 7;
int LED_RED = 12;
int LED_GREEN = 13;

void setup() {
  Serial.begin(9600);
  pinMode(13, OUTPUT);
  pinMode(12, OUTPUT);
  pinMode(7, INPUT);
}

void SendMessage() {
  mySerial.println("AS+CMQF=1"); // Sets the GSM Module in Text Mode
  delay(1000); // Delay of 1000 milli seconds = 1 second
  mySerial.println("AS+CMQD=+601169321709,\"A\"); // Register with mobile number
  delay(1000);
  mySerial.println("SEND IS AN INTERUDER AT YOUR FARM");// The SMS text you want to send
  delay(1000);
  mySerial.println(128); // ASCII code of CTRL-Z
  delay(1000);
}

void loop() {
  digitalWrite(LED_RED, HIGH);
  motion = digitalRead(7);
  if (motion == HIGH)
  {
  }
}

```

Figure 5: A part of source programming in Android mobile programming application.

Conclusions

The farm security system as in information was design and built with the intention to help the farmers that have farm protecting their belongings and crops revenue from being a steal and destroyed by wild animals. It can ease the burden of farmers out there in protecting their farm crops and equipment. It is suitable to be controlled and observed from any place whenever it was built attach to GSM and IoT camera which can ease the human energy and efforts requirement in protecting their land and belongings in 24 hours per day.

References

K. Erb, A. Mayer, T. Kastner, K. Sallet, and H. Haberl, "The Impact of Industrial Grain Fed Livestock Production on Food Security: an extended literature review Final report Main Messages," pp. 1–82, 2012

L. Genever, "Electric fencing for livestock Key messages," pp. 1–21, 2015.

R. K. A. Mendoza, B. J. S. Malijan, and R. B. Caldo, "Development of Smart Farm Security System with Alarm Mechanism using Image Processing," vol. 3, no. 3, pp. 73–84, 2016.