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Smart Mosquitoes Trap Utilizing Thing Speak Monitoring System

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ABSTRACT

Mosquitoes are one of the main sources which reason horrifying illness. Diminishing the mosquito masses is gradually essential especially in populated countries. Mosquitoes caused illnesses like intestinal sickness, dengue, malaria, and other infectious diseases. Numerous methods have been developed to overcome the mosquito's related diseases by reducing the number of mosquitoes. However, there is no sophisticated, safe and continuous monitoring method to eliminate the mosquitoes. This paper presents a smart mosquito's trap system using the Internet of Things (IoT) cloud platform. The developed system attracts the mosquitoes, traps it and stores the number of trapped mosquitoes in Thing Speak cloud in real-time. This prototype system consists of two parts which are the software and hardware. The hardware part consists of ESP8266 Node MCU, dc fan, UV light, electric fence, and CO_2. The software part consists of Blynk application and Thing Speak cloud platform. Users can monitor and control the UV light and DC fan via Blynk. The prototype system has been tested on the university campus during the morning, afternoon and evening hours. The results show the real-time number of mosquitoes trapped in the prototype system.

Key words: mosquito trap; Thing Speak; Blynk; IoT

INTRODUCTION

For the old years, the world has witnessed a widespread of many species of insects especially mosquitoes. Mosquitoes have caused a severe worldwide health hazard, therefore is in charge of transmission of diseases and viruses from the infected body to the healthy body, including the most serious diseases such as dengue and malaria. According to World Health Organization; 91 countries reported a total of 216 million cases ofdengue andmalariain 2016, it increased cases over the previous year as 5 million, 445,000 resulting in global deaths [1]. Female mosquitoes prefer certain places to lay their eggs such as stagnant water, ponds, streams, and remain trees to provide the necessary humidity and temperature for eggs to hatch [2]. The major epidemics were in some countries such as Taiwan, Brazil, Indonesia, Thailand, Australia, India, Malaysia, USA, Mexico, Cuba, and others. This is a base for disease danger caused by the presence of mosquitoes and formulating efficient controlstrategies versus mosquito-borne diseases such as Zika, dengue, and malaria [3].

MOSQUITOES RELATED ISSUES IN MALAYSIA

Malaysia is a tropical country and its environment contains a lot of marshes and lakes. This environment is very suitable for the growth and breeding of insects [4]. The most important and dangerous insects in this environment are mosquitoes because they are transferring of bacteria and microbes through the blood from an infected body to a healthy body. Mosquitoes may cause many deaths with nearly 20 million dengue cases each year.According to The World Health Organization considers dengue fever to be the generality common viral illness transmitted by mosquitoes. The vaccine is not actually obtainable, and mosquito monitoring is a critical component of dengue fever preventing. The traditional land and air use of pesticides do not provide sufficient control over mosquitoes that carry dengue outbreak. Dengue fever is transmitted firstly by mosquito especially Aedes type [5]. The mosquitoes are a container raiser. Thus, the female mosquito Aedes will place her eggs only in a container carrying Swamps. Therefore, the use of insecticides in the areas in which they are present is not considered a sufficient solution to keep human life from the danger of mosquitoes. In public and protect the human from the risk of diseases. Based on this problem, the observation was done

to improve the smart trap system prototype, to make sure this system is able to eliminate the risk of mosquitos. Therefore, applying a smart trap system connects with IoT, in order to achieve a monitoring system that would be able to account for a number of mosquitos enter to this place.

DESIGN, MATERIAL, PROCEDURE, TECHNIQUE OR METHODS

This prototype operates with the help of carbon dioxide attractant and UV light to catch as well as attract mosquitoes enter into the traps. After that, a trigger process will be turned on to find out the percentage of mosquitoes entering the traps. At the same time, it also sends data to the user viaNodeMCU 8266 by the Wi-Fi module to the Thing Speak cloud. With such information or data, users can identify which areas are more focused on the presence of mosquitoes. The fan has been built inside the trap so as to pull in all the mosquitoes without allowing any path outside hence the fan will attract the mosquitoes. Figure 1 shows the proposed idea for the system to use the Internet of things (IOT) is it is reasonable with the final project requirement for each institution of study. Additional to that, software and hardware programs were demandedso as to make reassure that the system was operating successfully.

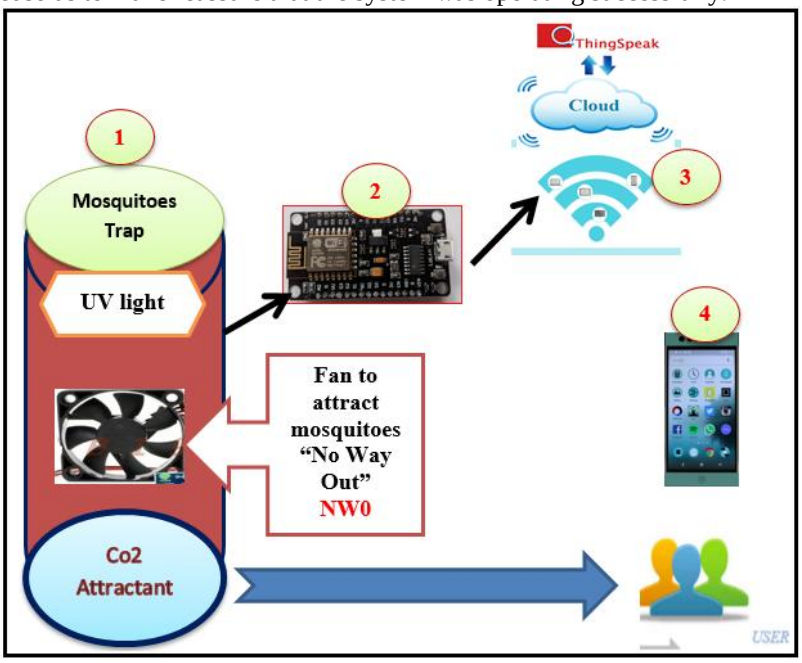

Fig. 1 System Architecture

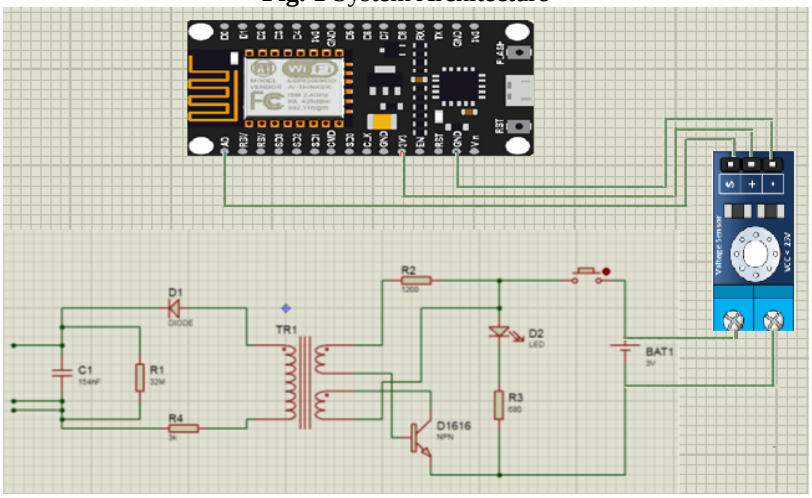

Fig. 2 GPS circuit Design

Circuit Design of Trigger Process for Mosquitoes Counter

The actuator system input signal to the Trigger process is required to obtain random data value by calculating the amount of high or low voltage indicating that the process trigger occurs. Where high voltage indicates no process trigger and when the voltage drops it indicates the process trigger. The input voltage range 3.5V in a stable state and during the shocking process the voltages have been drop to 3.2V, we can depend on this amount of drop voltage to create a condition so you can count on how often trapped mosquitoes.

When the trigger process is turned on, the microcontroller Node MCU8266 starts reading the input voltage from the voltage sensor at the input analogy pin. Node MCU8266 contains memory and 30 pins input/output peripherals for both digital and analogy. Node MCU8266 analogy set has a 10-bit resolution which outcomes in 1024 quantized stages. In this project, the trap prototype development uses two types of nodeMCU8266, The first one was used to control two digital output are in charged for triggering the DC fan and UV light. Thesecond microcontroller is in charge of sending and processing the data to the cloud via the Wi-Fi.

First model of validating tests was conducted by utilizing the multisim program, specific emulation software for Printed Circuit Board (PCB) layout styling evolution. Therefore, the project adopted a Node MCU board, therefore use C++ language to programming this prototype. The trap features can control UV light and fan by using a Blynk application that makes the user it easy to reach the trap.

So as to attach the ESP8266 module with the Blynk application by adopting the ESP8266 board as well as ESP8266 library. If that framework did not utilize, the Arduino compiler may not define and read all the programming code by the user. Moreover, to relate the ESP8266 module directly to the internet, it requires to be a have a certain program with the Wi-Fi SSID and also the internet password. It cannot transmit any signal when the ESP8266 cannot connect to the internet that means the set may not operate as supposed to be.

Figure 3 shows the utilizing two-buttonto control the fan and the ultraviolet light,the first button functions as to set off as well as on the UV light. Second button is used to turn on and off the fan. The two on/of buttons function as a digital connection. The pins used D0 and D2 connection light and fan to ESP8266 controlled by Blynk application.

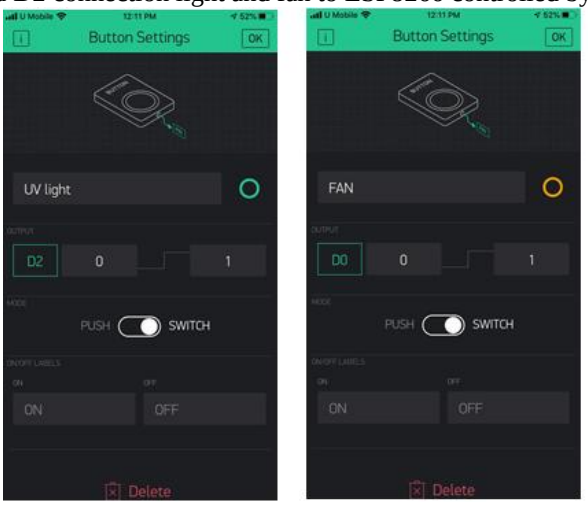

Fig. 3 Pin connection led to ESP8266 controlled usingBlynk

The Internet of Things (IoT) is a framework of interconnected computing resources systems, machines, digital mechanical, objects or people that contain network system which may send, act, and collect data from surrounding which supplied with single identifiers as well have the capability to transmit information via a web without demanding man-to-man or man-to-computer assistance [6].

Thingspeak an open-source network to API and application to store and recover information from things using the MQTT and HTTP protocol over the Local Area Network or throw the internet [7]. ThingSpeakhas integrated backup from the numeral compute software MATLAB from MathWorks, allowing ThingSpeak users todisplay and analyseuploaded informationutilize Matlab without askingto buy of a Matlab license from MathWorks.

Fig. 4 Login system to ThingSpeak platform [7]

Chemical cues such as carbon dioxide (CO_2) are important for the host-finding behaviour of mosquitoes. Control program that used mosquito trapping often contain chemical lure, for example, CO_2, lactic acid oroctanol to raise the catch average. To produce carbon dioxide is made up of several steps. The production of carbon dioxide by yeast in Figure 5 was analysed. Yeast is chemoorganotrophic bacteria thatderive their chemical energy from the collapse of an organic complex like carbon substrates. Brown sugar was utilized to grow the yeast on, for suitable causes; most yeasts utilized sugars as their preferred energy source and carbon. It is simple to utilize and the diffused availability of sugar.

Fig. 5 Yeast [8] and brown sugar [9]

Deeply, based on this paper the hardware structure is designed and developed to suit the electronic components used in it, The exterior structure is made of aluminum or MDF with certain dimensions as shown in figure 6, so that it consists of two layers, first one to produce carbon dioxide and the second layer of electronic components.

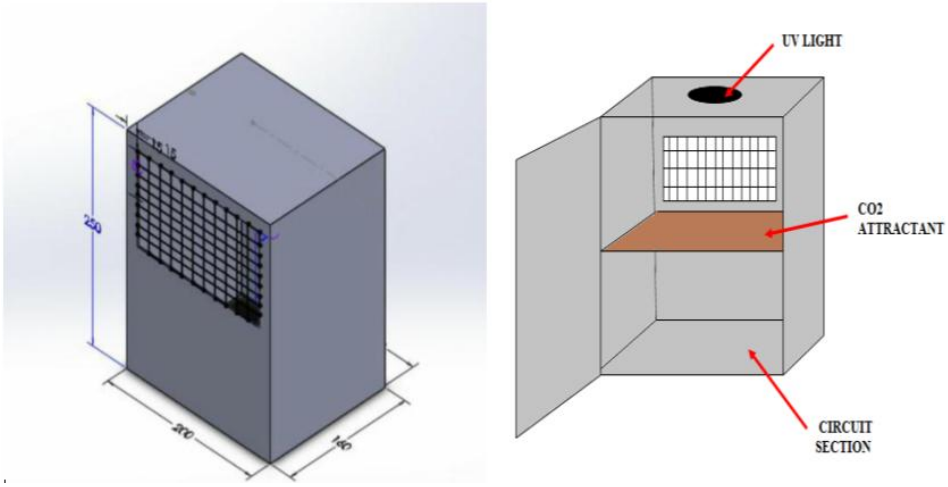

Fig. 6 Planning sample of proposed smart mosquitoes trap

RESULTS AND DISCUSSION

The scope of linking Node MCU 8266 is highly based on the strength of the Wi-Fi router and the network. Fundamentally, the prototype put with suitable distance to the router was situated in an area near to the students and staff of University Tun Hussein Onn Malaysia (UTHM). The main task of this Wi-Fi was to transmit the information to the cloud as well as to control and master the DC fan andultraviolet lightby utilizing the Blynk system. The practical location of actual time enforcement of mosquito trap was showed to obtain the study and the result of the accuracy of that system thathad been built. The test was implemented in three phases; inthe evening, afternoon and morning. The analysis of the variability in the number of mosquitoes detected through experiments conducted at three different periodical timesfor the same place, the number of mosquitoes trapped at night wasthe largest amount compared to the morning and afternoon due to the low temperatures as well as the impact of ultraviolet light. The framework for the test was the Old Complex FKEE; within the main university, since there are a lot of trees in that area, which is likely to be a mosquito breeding state as shown in Figure 7. When the group was operated, the mosquitoes were flying near the experiment site.

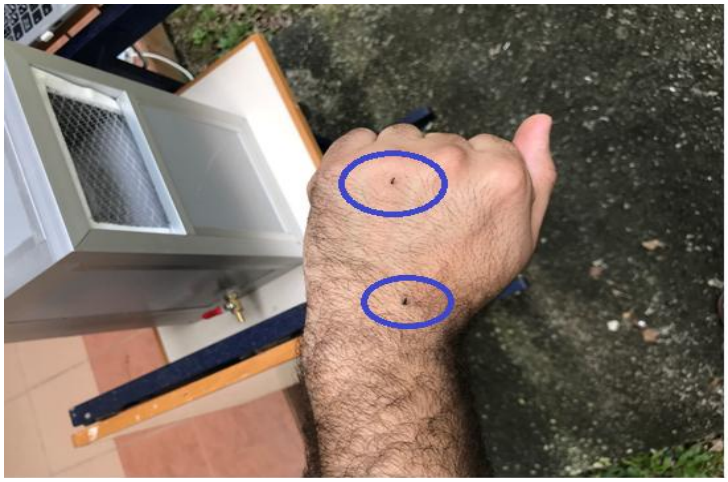

Fig. 7 Mosquitoes were available in the testing area

A. Experiment result measurement for the trigger system with ThingSpeak platform in UTHM

The test was implemented to find data on the number of mosquitoes in the chosen spot. The test was achieved on 22/10/2019 and consisting of three situations that are the morning, afternoon and evening. At the first should be sure the trap was connected to Wi-Fi the select the network name and password the result shows that the data displayed in the ThingSpeak platform is the name of the device used by the user.

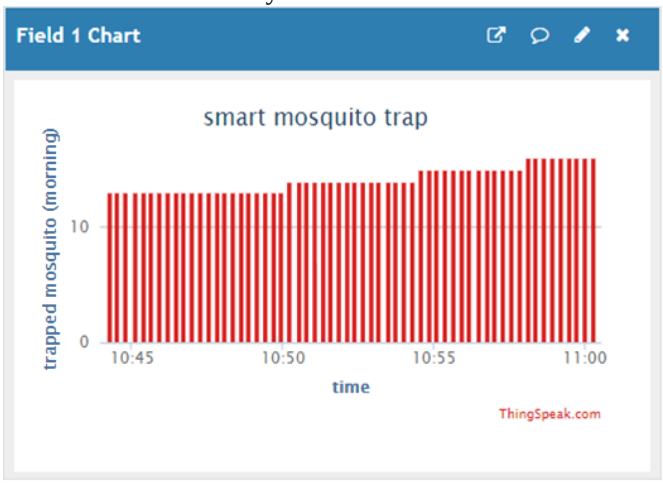

Fig. 8 DataStream saved in ThingSpeak platform in the morning

Figure 8shows that from 8 am to 11 am, the number of mosquitoes trapped in the trap increases rapidly and continuously over time depending on the information coming to the cloud and the process.The number of trapped mosquitoes reached 16 at the end of the morning experience.

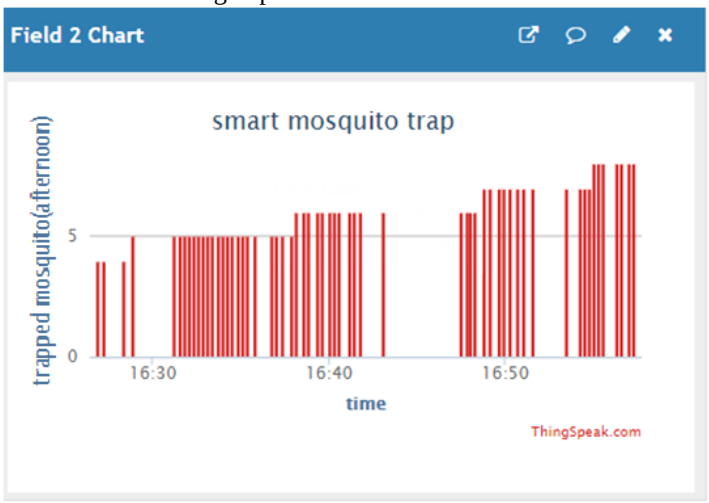

Fig. 9 DataStream saved in ThingSpeak platform in the afternoon

In figure 9presents that from 2 pm to 5 pm, the experiment showed that the number of mosquitoes killed in the trap was very small, with the result in the first hour was zero, even starting to increase but slowly depending on the information coming to the cloud as well as the trigger process until it reaches At the end of the experiment the total of killed mosquitoes was eight due to the decrease in the number of mosquitoes to rise in high temperature.

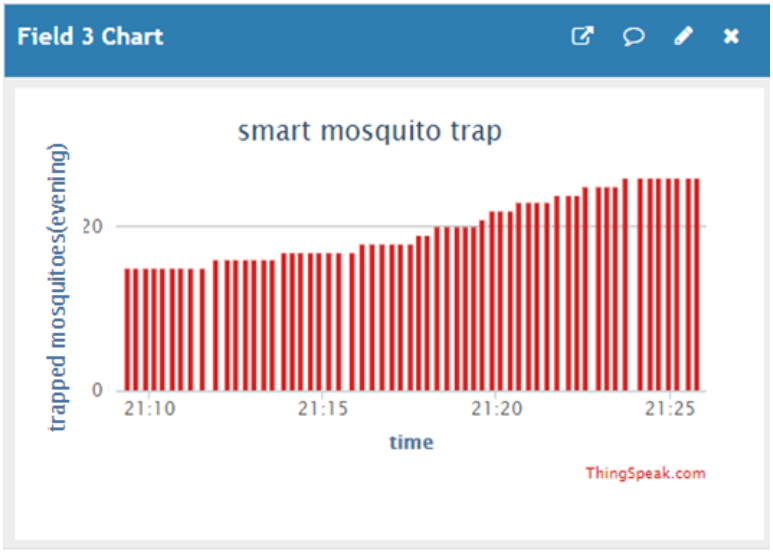

Fig. 10 DataStream saved in ThingSpeak platform in the evening

In Figure 10 presents that from 7 pm to 10 pm, the experiment showed that the number of imprisoned mosquitoes in the trap began to increase again, and the result was at the first o'clock was eight, until the process began to increase continuously as the highest catch of mosquitoes was recorded Especially in the last hour, where we got to the solution of eleven killings based on the information received to the cloud as well as the trigger process until it reaches the end of the experiment, The total number of trapped mosquito are 26 where the high number of mosquitoes is due to low temperature and UV light effect..

B. Experiment result measurement for the trigger system with the excel sheet

One of the advantages of the ThingSpeak cloud is the ability to collect data, save and analyze data directly through the program Matlab, as well as the ability to export data to Microsoft Excel in the form of a table where the table contains several fields, including date, day, year and the number of times trapped mosquitoes can be analyzed that data Finer shaped curves using solving linear equations as shown in figure 11.

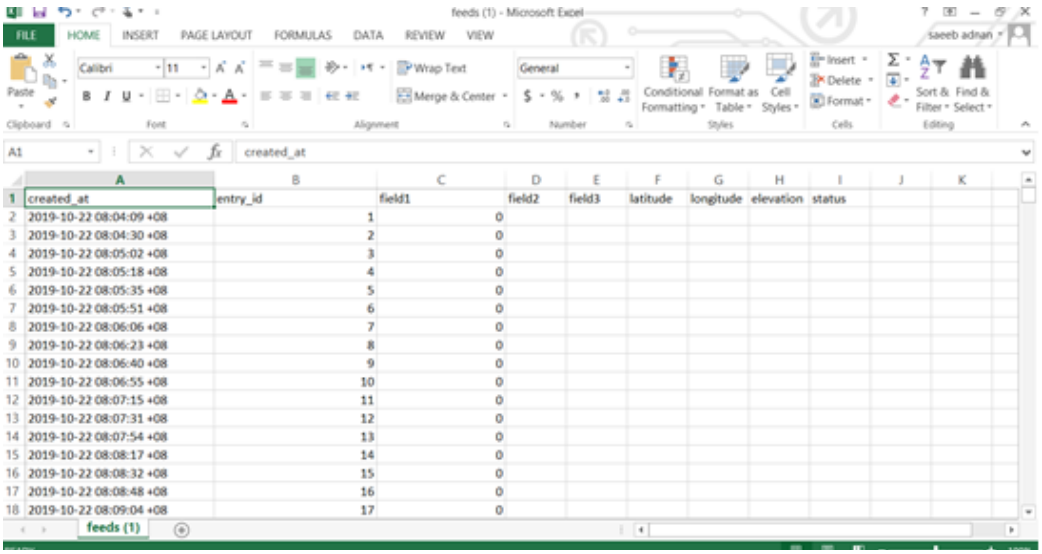

Fig. 11 DataStream saved in excel sheet

As in Figure 12 and Figure 13 and Figure 14 we note a graph showing the amount of increase trapped mosquitoes in proportion to time, where these drawings can be implemented through Microsoft Excel solution for linear and non-linear equations.

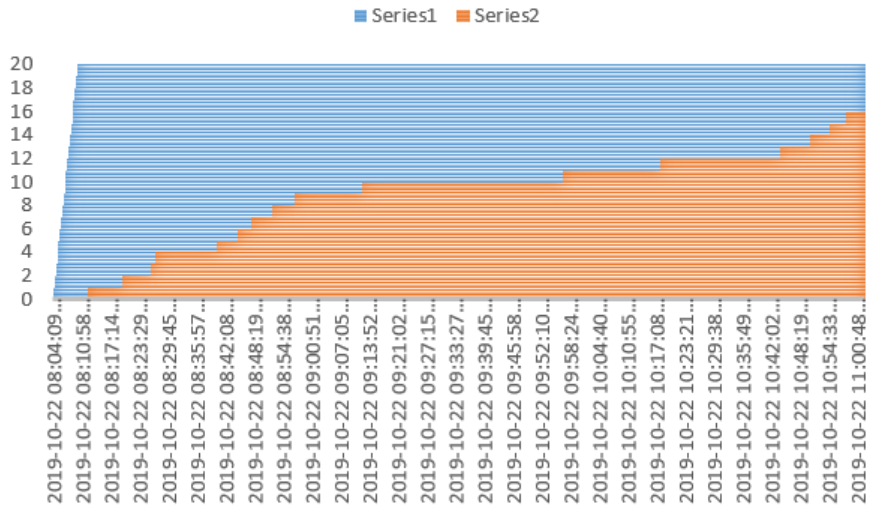

Fig. 12 DataStream saved in excel sheet in the morning test

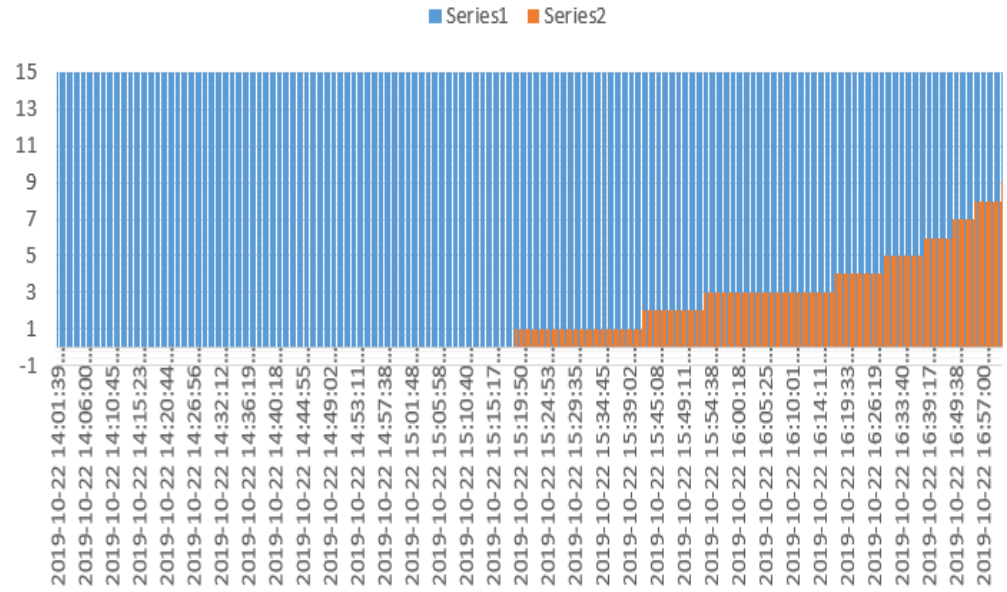

Fig. 13 DataStream saved in excel sheet in the afternoon test

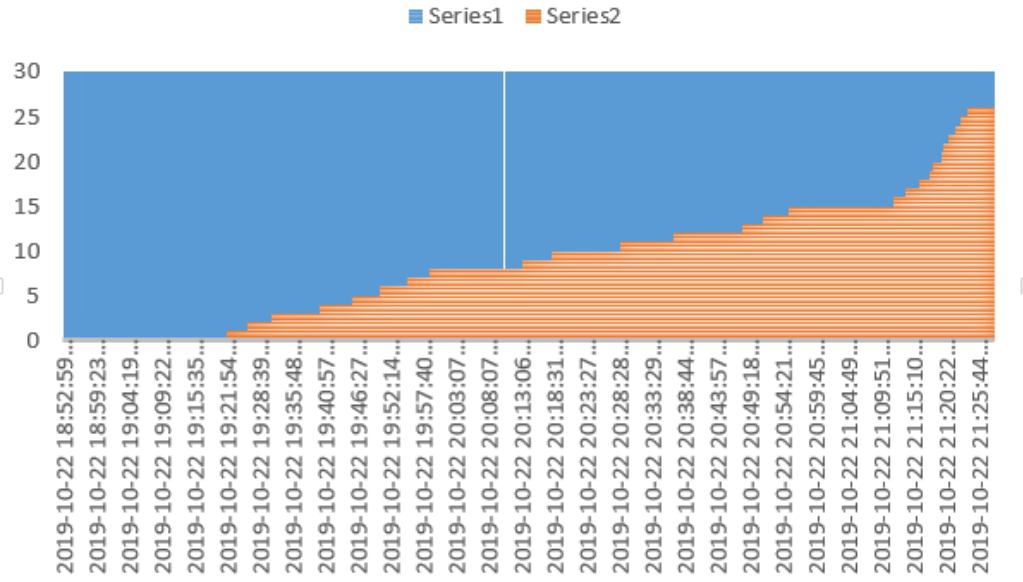

Fig. 14 DataStream saved in excel sheet in the evening test

CONCLUSION

Finally, the mosquito trap was developed for the intended purpose. This network had an ESP8266 Wi-Fi module to notify the customers. This framework was easily set, it requireda Wi-Fi connection, and the customer had the ability to access theinformation which was provided by ESP8266. This model wasalso attracted the mosquitoesto the trap with UV lamps, fans, and attractive carbon dioxide. This modelprotectedpeople fromthe mosquito to save their lives and take action to alleviate mosquito bites.

An external test was performed to determine whether the infiltration structure was useful to determine if the mosquitoes were found in this area or not. The ESP8266 module allowed you to collect and send data to the cloud. In terms of few cost, this is even more economic friendly than using a GSM module.

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