Evolution in Electrical and Electronic Engineering Vol. 4 No. 1 (2023) 211-219

EEEE

Homepage: http://publisher.uthm.edu.my/periodicals/index.php/eeee
e-ISSN : 2756-8458

The Automatic Pest Trap (Rat)

Shahrul Nizam Mohamad[1], Chew Chang Choon[1]*

[1]Faculty of Electrical and Electronic Engineering,
Universiti Tun Hussien Onn Malaysia, Parit Raja, Batu Pahat, 86400, MALAYSIA.

*Corresponding Author Designation

DOI: https://doi.org/10.30880/eeee.2023.04.01.025
Received 16 January 2023; Accepted 12 April 2023; Available online 30 April 2023

Abstract: Plants, food, and health are important in human life. One of the direct effects caused by insects is the transmission of various illnesses to healthy plants, known as the pest-disease link. When the population of these pests grows and is not prevented, it will affect crop yields, health, and food supply. One of the main objectives of this project is to design an automatic pest trap so that it can be easily used to catch small pests, especially mice. This project is equipped with several electronic components such as infrared sensors to allow the door to be closed and opened. The use of this smart sensor is to detect pests and trap them effectively. This project can also use a power bank as a backup supply to allow all the components in the trap to work properly. The optimized design has been evaluated by varying two Infrared sensors as the main component in controlling the servo motor as a door to open and close when detecting pest movement. Apart from that, this project has also been equipped with Blynk IoT as an application to send notifications to users when there are pests that have been caught. Initially, the automatic pest trap design procedure including part drawing, material and condition settings, and property settings are all explained. then it is tested and recorded when the trap can detect movement to close and open the door effectively. It is concluded that the trained model can perform relatively well in classifying automatic pest traps. In the future, more data can be used in the training to increase and improve the accuracy and capability of this model. So, the project was created as an attempt to overthrow the population of pests such as mice or any small pest so that the problems of crops, health, and food supply can be overcome. This trap also is simple to use, economical, safer for people, and easy to use to catch pests. In the future, the recommendation for this study is to improve the design such as the prototype design. Improving prototype design gives the project a better product in terms of durability, quality, and sustainability.

Keywords: Blynk IoT, IR sensor, APT

1. Introduction

Today, smart electronics are unavoidable, and their presence has grown increasingly significant and necessary in our daily lives, making many operations more manageable. This technological development

Corresponding author: chewcc@uthm.edu.my

has created a project to solve people's problems, especially farmers and retailers. Many people, especially farmers and retailers, are experiencing problems due to vermin such as mice. The emergence of these animals can be involved with farming, food, and people's health. When the population of these pests grows and is not prevented, it will affect crop yields, health, and food supply. After this, it leads to disease. The average residential vegetable grower plants over a dozen distinct types of vegetables, each susceptible toattack by various insects [1]. The pests destroy agricultural products used for human consumption and animal feed. The disease can then be transmitted or triggered by pests such as rodents via their bacteria. Several zoonotic illnesses, such as plague, leptospirosis, and Leishmaniasis, are spread by rodents [2]. After this, it leads to disease.

Pests generate indirect losses to plant systems, fruits, and seeds in addition to direct losses because the pests leave essential contaminants such as body parts or urine, and off-odors on the product. Animals, in particular, meaning are mice. Mice are one of the most dangerous animals. The mice'surine can cause dangerous diseases such as Hantavirus, transmitted to humans by wildrodents (mice). Because of these close interactions with the food, the pests have become severe pests in all aspects of the food chain and human health.

The result of this development was the idea that its users could have a prototype that was capable of catching pests. An effort had been carried out to ensure that the prototype was able to work in the process of catching pests with a combination of electronic components on the trap. With equipment such as Infrared sensors on traps, the project could detect and capture pest populations more effectively. Designs with the Blynk IoT facility as a message sender were also included in this trap.

2. Materials and Methods

The development process for the automatic pest trap was described in this section. The system's block diagram is shown in the first subsection, followed by a flowchart of the process, and then the specifics of each mechanism and component.

2.1 Block diagram

Automatic pest trap includes advanced trap features such as Arduino UNO microcontroller, Node-MCU ESP32, servo motor, I2C 16x2 Arduino LCD Display Module (LCD), and Infrared sensor. A microcontroller was the main component to enable the Infrared sensor, LCD, and servo motor to work in one condition. A servo motor was used as a component to control the door when the IR sensor detected the movement of pests in and out of the trap. The door would be closed and open by itself when the IR sensor was triggered. The use of this component is low-cost and easy installation. Then, Blynk IoT has been equipped together with an automatic trap to enable notification to be sent to the user when a pest is successfully caught. The block diagram of this project is illustrated in the Figure 1.

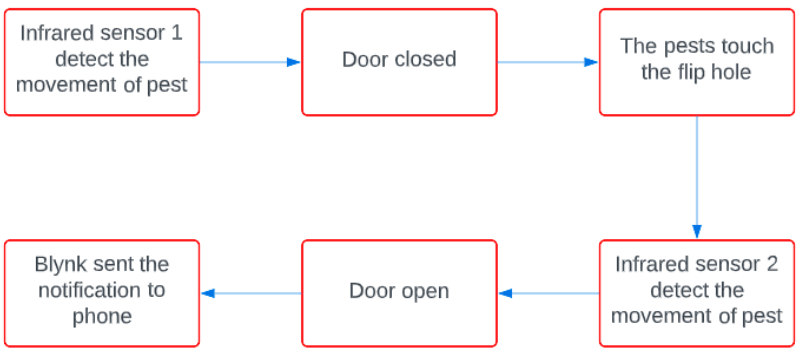


Figure 1: Block diagram of automatic pest trap

2.2 Flow chart

The flow of the project is shown in the Figure 2. In the initial state, the door would always been opened until the Infrared sensor 1 (IR sensor) detects the movement of pests in the trap. When IR sensor 1 detects movement, the door controlled by the servo motor would close. A flip hole had been designed in the trap, once the pest entered the flip hole, IR sensor 2 will detect the movement of the pest that had entered the storage tank. When IR sensor 2 was triggered, the door would opened again. The PIR sensor placed in the tank as a Blynk component would send a notification to the user. It showed how the process takes place from beginning to end.

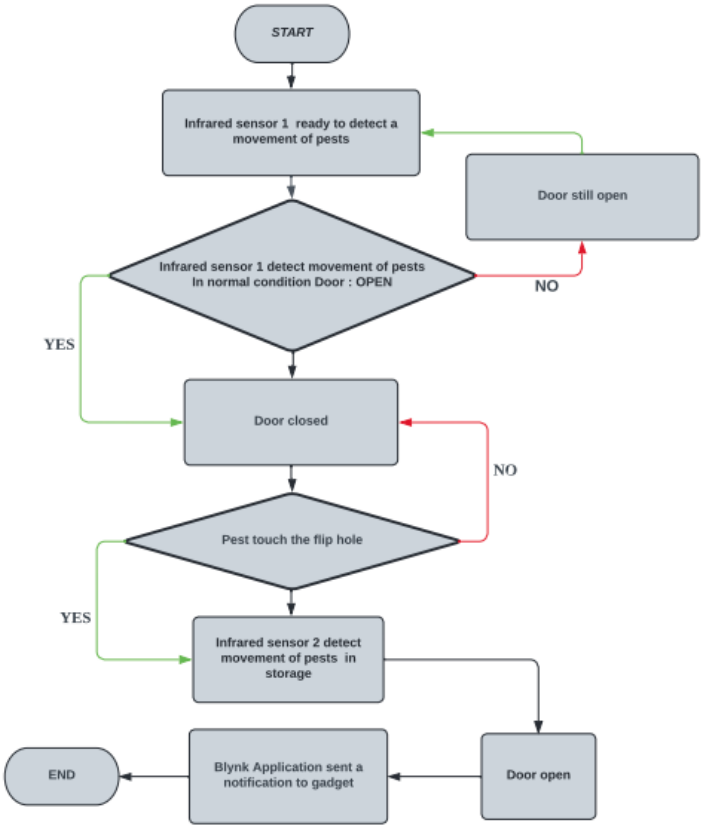


Figure 2: Flow chart of the automatic pest trap

2.3 The material used for development and schematic diagram of the project

Table 1 listed all the materials used for the development of automatic pest trap. Whilst Figure 3 shows the complete schematic diagram. This diagram showed how the position of all the components that had been installed on the trap. This allows all components to work simultaneously. Figure 3 also shows the electronic setup of this project. This combination is carried out carefully so that the wire and components are not exposed to pests to avoid being bitten or damaged.

Table 1: Component used for Automatic pest trap

Component	Description
 Arduino Uno[3]	Arduino is an open-source electronics platform that uses simple hardware and software to make it easy. Arduino boards can read inputs such aslight from a sensor, a finger on a button, or a tweet and convert them to output.
 Servo motor[4]	An actuator that provides for precise control of angular or linear position, velocity, and acceleration is known as a servomotor (or servo motor). An appropriate motor and a position feedback sensor make up this device. A servo motor, a shaft, a potentiometer, a drive gear, an amplifier, and either an encoder or a resolver is some of the components that make up a closed-loop control system.
 A passive infrared sensor (PIR sensor)[5]	PIR sensors mean passive infrared sensors and are used in applications that require the detection of human or particle movements in a particular range. These sensors are small, affordable, low power, easy to operate, and durable.
 Active infrared sensor (IR sensor)[6]	The sensor that measures and detects infrared radiation in its environment is known as an infrared (IR) sensor. What is infrared radiation then? Electromagnetic radiation with wavelengths longer than visible light is referred to as infrared radiation, also known as infrared light
 Blynk application[7]	Blynk is a new platform that allows users to easily create an interface to manage and monitor hardware projects using only iOS or Android mobile. With this application, one template can be created by selecting the project dashboard after downloading the Blynk software and organizing buttons, launchers, graphs, and other widgets on the screen.
 NodeMCU ESP32[8]	ESP32 is a series of low-cost power systems on a chip microcontroller. The ESP32 is a more complex model of the ESP8266 family. Espressif Systems is the company that developed and developed the ESP32 family. Dual-core and an ultra-low power co-processor are features of the ESP32. It was created to address ESP8266's lack of security.
 I2C 16x2 Arduino LCD Display Module[9]	The differences are substantial. Simply said, no signals are correlating (except for VCC, GND, and VDD, VSS - power supply, but it is no signal in fact). Standard LCDs use a serial data bus, whereas I2C uses a parallel data bus. These cannot be directly connected.

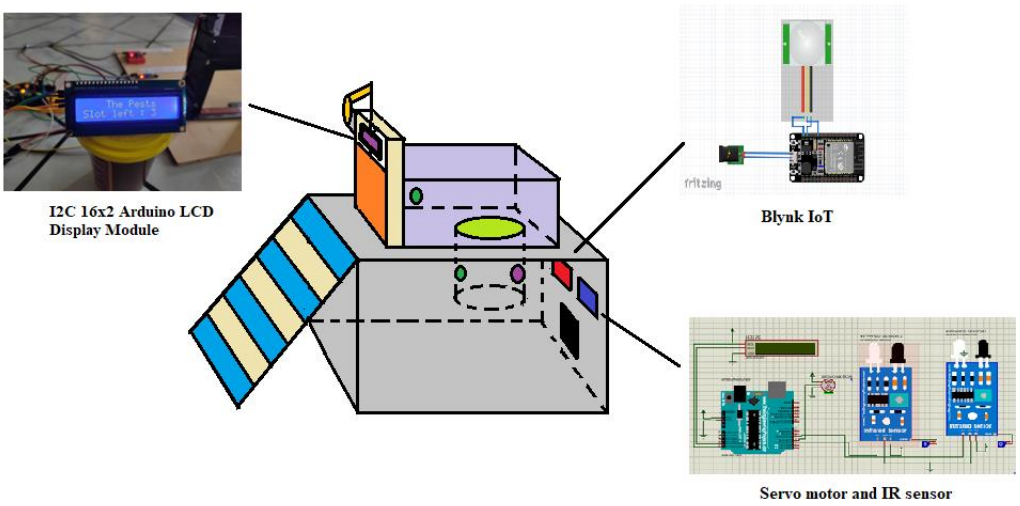


Figure 3: A combination of the design project

3. Results and Discussion

Figure 4 to Figure 10 show the results of the developed system such as LCD and also servo motor. Besides that, it also consisted part where notification to the user had been sent by using a Blynk application.

3.1 Results of I2C 16x2 Arduino LCD Display Module

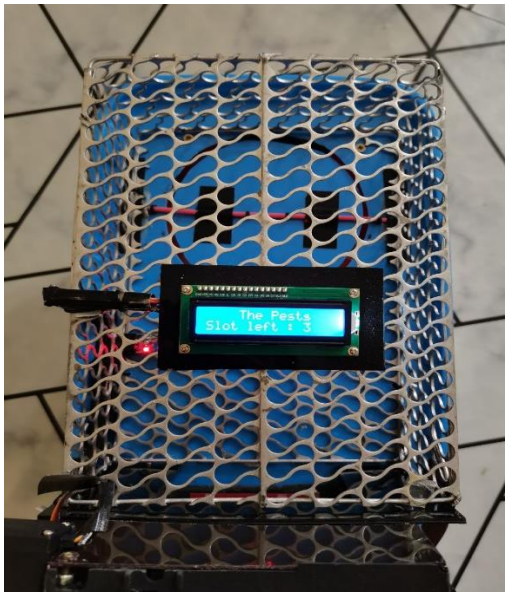


Figure 4: LCD shows the display of the initial condition

LCD showed the number of pests to be captured. Numbers could be set in the Arduino Idea by using Arduino Coding. This figure showed the value before the IR sensor 1 detects a movement, this meant it was in the initial condition.

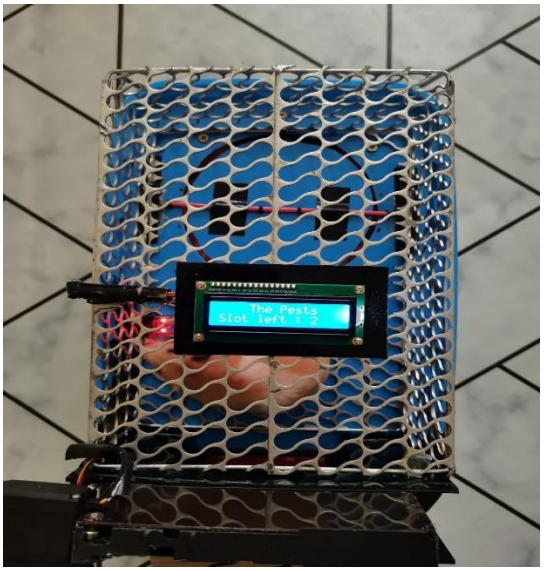


Figure 5: LCD shows the value when the IR sensor detects movement

When there is movement in the trap. the number of left slots will change to a reduced value. This figure shows an example of an LCD.

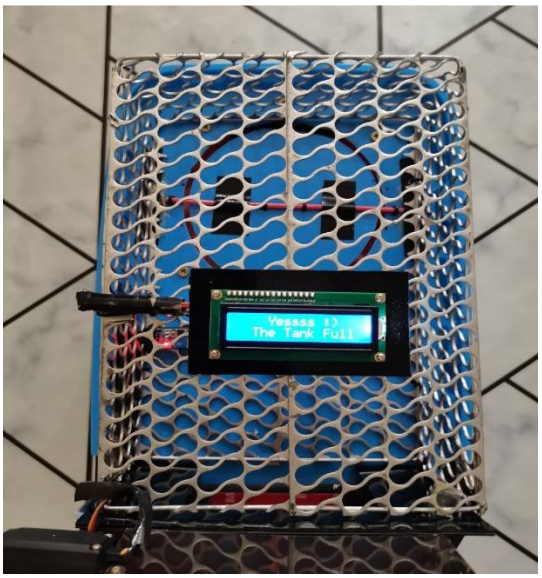


Figure 6: LCD shows the maximum value for the number of pests caught

Figure 6 shows the output produced by LCD. This occured when the number of pests to be caught had been set to Arduino Uno using Arduino coding. In this way, the estimated number of pests that had entered the trap would be known.

3.2 Results of servo motor

Figure 7: The door in the initial condition

Figure 7 shows the initial condition of the door. This situation occured before Infrared sensor 1 detects a movement.

(a) (b)

Figure 8: (a) The door closed when IR sensor 1 detect the pest (b) The trap on the side view

Figure 8 shows the door in a closed state. This situation occurred when infrared sensor 1 detects the movement of pests that had entered the trap. This door would always be closed until infrared sensor 2 detects movement in the storage tank. When the IR sensor detected it, it meant pests have entered the storage.

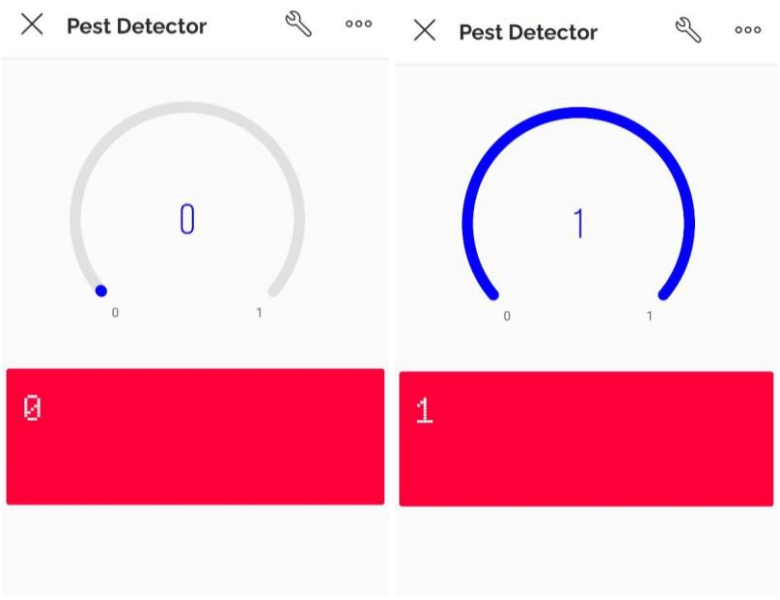
(a) (b)

Figure 9: (a) The door opening again (b) The trap on the side view

Figure 9 shows the door opening again. This situation occurred when infrared sensor 2 detects the movement of pests that had entered the storage space. The door would always open until IR sensor 1 detects movement again.

3.3 Results of the Blynk application

By using NodeMCU ESP32 and PIR sensors, Blynk IoT could function well to send notifications. ESP32 can work well with my Arduino coding. When the PIR motion sensor detected a movement, a notification would be sent to my phone.



(a) (b)

Figure 10: (a) Display that shows before the PIR sensor detects the movement

(b) Display that shows after the PIR sensor detects the movement

Figure 10 shows the widget that had been designed for the Blynk on mobile. LCD and Guage widgets that had been used in Blynk application. When there was movement, the LCD and gauge would show a value of one.

4. Conclusion

A successful Automatic pest trap has been developed. Based on this, all tests had been conducted and the objective was achieved. This success was achieved when successfully using the Blynk IoT, servo motor, Infrared sensor, and LCD I2C 16x2 Arduino LCD Display Module as important components in this project. Based on the results of this automatic pest trap, can catch pests such as rodents as proof of the success of the project. By using two infrared sensors (IR sensor) this project successfully controls the servo motor as the main gate for the automatic trap. The use of an infrared sensor as a sensor module is very accurate when it can detect movement and send signals to the Arduino very quickly. It is because the sensor component can detect heat radiation (infrared radiation) from the subject moving around such pest, which changes over time and space. by using this IR sensor, the capture will be more effective because the probability that the pest will enter will be difficult to get out because the servo motor will continue to be closed until the pest enters the storage tank Next, this project can send notification by using Blynk IoT as a cloud application. This notification is sent directly to the mobile when the PIR motion sensor connected to the ESP32 node-MCU detects movement in the

storage tank. Usage. therefore, this platform will make it easier for users to find out the results of the capture that has been made.

Acknowledgment

The authors would also like to thank the Faculty of Electrical and Electronic Engineering, Universiti Tun Hussein Onn Malaysia for its support.

References

[1] Dr. Blake Layton, Jr (2022,13 June). Insect Pests of the Home VegetableGarden. Mississippi State University. Retrieved from http://extension.msstate.edu/publications/insect-pests-the-home-vegetable- garden.

[2] B Peter J. Krause (2018). Rodent-borne diseases and their public health importance in Iran. National library of medicine. National center for biotechnology information. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5908068/.

[3] Benne(2019, 3 February). How to control a character I2C LCD with Arduino.Makerguides. Retrieved from https://www.makerguides.com/character-i2c-lcd-arduino-tutorial/.

[4] Wally Gastreich(2018, 27 August). what is a servo motor and how it works?Real as. Retrieved from https://realpars.com/servo-motor/.

[5] Lady Ada [20190. PIR Motion Sensor. Pyroelectric ("Passive") InfraRed Sensors. Retrieved from https://learn.adafruit.com/pir-passive-infrared-proximity-motion-sensor.

[6] Danny Jost (2019, July 30). What is an IR sensor? Fierce electronic. Retrieved from https://www.fierceelectronics.com/sensors/what-ir-sensor.

[7] Jordan Bunker (2015, July 6). Control an Arduino with Your Smartphone via Blynk. Retrieved from https://makezine.com/2015/07/06/control-arduino- your-smartphone-via-blynk/.

[8] Sara Santos(2021,6 September).ESP32 vc ESP8266-pros and cons.Maker advisor.Retrieved from https://makeradvisor.com/esp32-vs-esp8266/#:~:text=The%20ESP32%20is%20a%20dual,ADC%2C%20DAC%2C%20and%20PWM.

[9] Benne(2019, 3 February). How to control a character I2C LCD with Arduino.Makerguides. Retrieved from https://www.makerguides.com/character-i2c-lcd-arduino-tutorial/.