

Development of Smart Mouse Trap Model

Nor Hamizah Syazwani Mohd Salleh^{1*}, Nurhanim Saadah
Abdullah¹

¹Faculty of Technical and Vocational Education,
Universiti Tun Hussein Onn Malaysia, 86400 Parit Raja, Batu Pahat, Johor,
MALAYSIA

*Corresponding Author Designation

DOI: <https://doi.org/10.30880/ritvet.2022.02.02.012>

Received 9 August 2022; Accepted 9 September 2022; Available online 30 September 2022

Abstract: Pests such as mice give so much trouble to human beings. This is because the mouse is known as the disease agent. Moreover, they can spread diseases such as Leptospirosis, Lymphocytic Choriomeningitis Virus (LCMV), and Hantavirus through their saliva and urine. It is most risky when the mouse also shares the same habitat with human beings such as homes, offices, and warehouses. Hence, the Development of the Smart Mouse Trap Model functions to solve human being's problems with the mouse at their homes, offices, and warehouses. The main objective of this study is to design the Smart Mouse Trap Model. This model equipped with motion-sensing for interacting with emitting infrared light, to develop the Smart Mouse Trap Model with the motion-sensing features, and to test the functionality. This study was developed by using the Waterfall Model which involves seven phases consists Requirement Phase, Analyze Phase, Design Phase, Coding Phase, Testing Phase, Operation Phase, and Maintenance Phase. The Smart Mouse Trap Model successfully detects the motion by using the Passive Infrared (PIR) Sensor and sends the data to the Blynk to notify the user about the amount of the mouse in the trap. This study involves the use of technology electronic components such as WiFi Module NodeMCU ESP32, Passive Infrared (PIR) Sensor, and Liquid Crystal Display (LCD). The development of the Smart Mouse Trap Model might help to reduce the rate of patients who are suffering from zoonotic diseases such as Leptospirosis, and Hantavirus

Keywords: Lymphocytic Choriomeningitis Virus (LCMV), Waterfall Model, WiFi Module NodeMCU ESP32, Passive Infrared (PIR) Sensor

1. Introduction

Pest is can be harmful to our life. Mouse is the biggest populations of pests in this world. The causes so many troubles to the human being. Furthermore, the mouse is known as the host reservoirs for at least 60 zoonotic diseases such as plague, typhus, leptospirosis, and hemorrhagic fever (Katica et al., 2019) This is because mouse able to spread their virus by having contact with their urine or any fluid like saliva with infected animals. (Izyan Diyana Ibrahim, 2017).

Normally the pest control service in Malaysia are very costly. The breeding mouse are at large number at one time (Maddigan et al., 2019). Subsequently, the users tend to hire the pest controller service to reduce the breeding rate of rats in their households, offices, and warehouse. However, the service offered by the pest controller quite expensive because they need to apply their products and their skill. Plus, the size of the property also affects the price.

Moreover, by using the pesticides give side effects to a consumers. This can be proven when Malaysia marks 73.4% of suicides, 13.8% of the accidental case, and 1.07% of occupational incidence because of the uses of pesticides among consumers. Additionally, most farmers in Indonesia (69.9%), Malaysia (67.8%), and Sri Lanka (83.5%) strive for treatment from the hospital because they keep exposes to pesticides (Ramzan et al., 2019). This problem occurs because pesticides are exposed to humans through dermal, ingestion, and inhalation. (Zaidon et al., 2018)

2. Methodology

The methodology section describes all the necessary information that is required to obtain the results of the study. Waterfall Model had been chosen in this study. Using the Waterfall Model as guideline to this study because this model are more detailed and it is always been used as guidelineto software development. However, it is been modified and applied for this development of the Smart Mouse Trap Model. It has seven phases which are Requirements Phase, Analyze Phase, Design Phase, Coding Phase, Testing Phase, Operation Phase, and Maintenance Phase. Besides, this section also consists of the Block Diagram of Smart Mouse Trap Model, Flowchart of Smart Mouse Trap Model, and a Research Instrument.

2.1 Waterfall Model

The flowchart of the whole phase in the Waterfall Model needs to be formed to more understand the necessary work that needs to be done as shown in Figure 1.

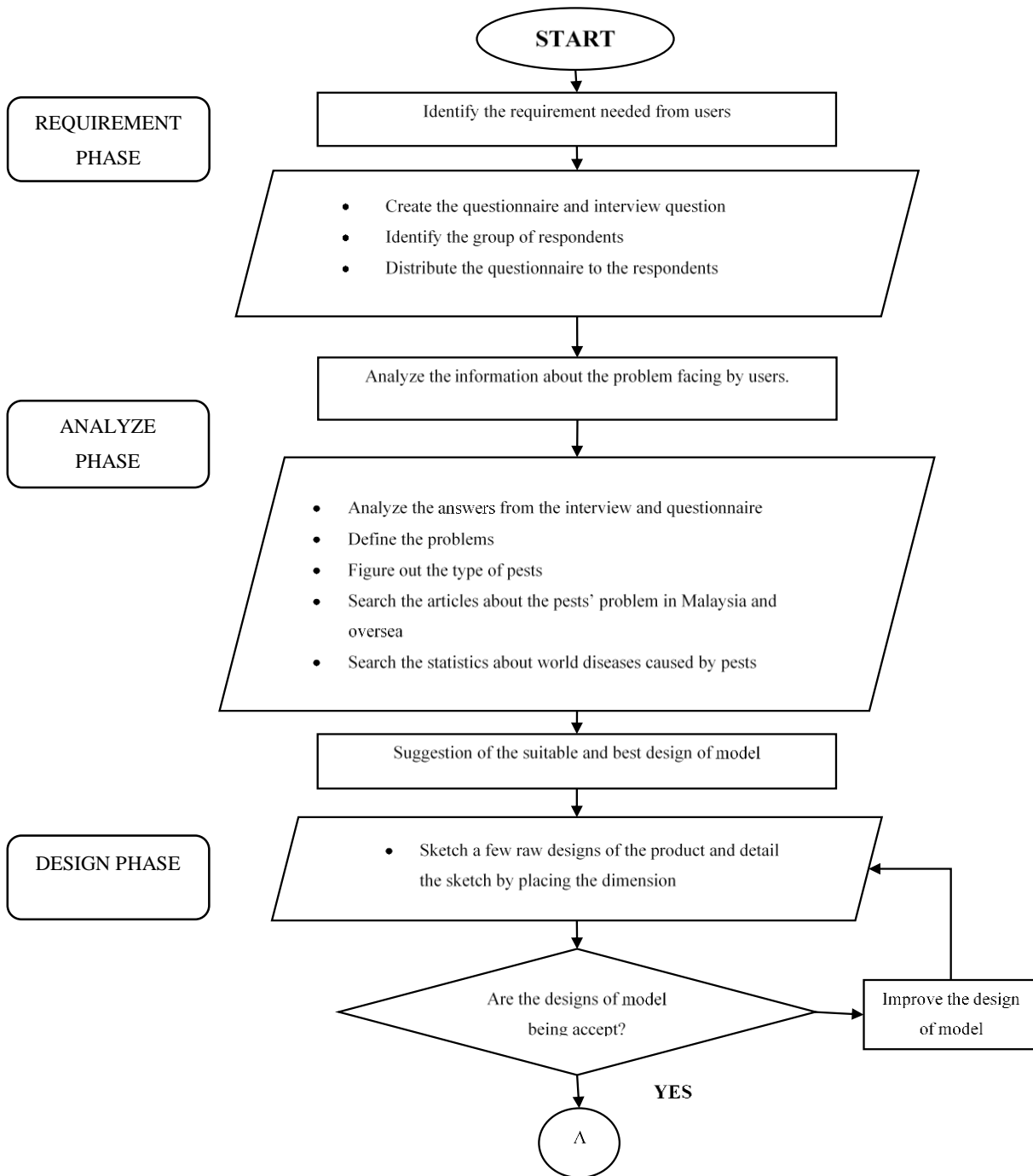


Figure 1: Flowchart of Waterfall Model

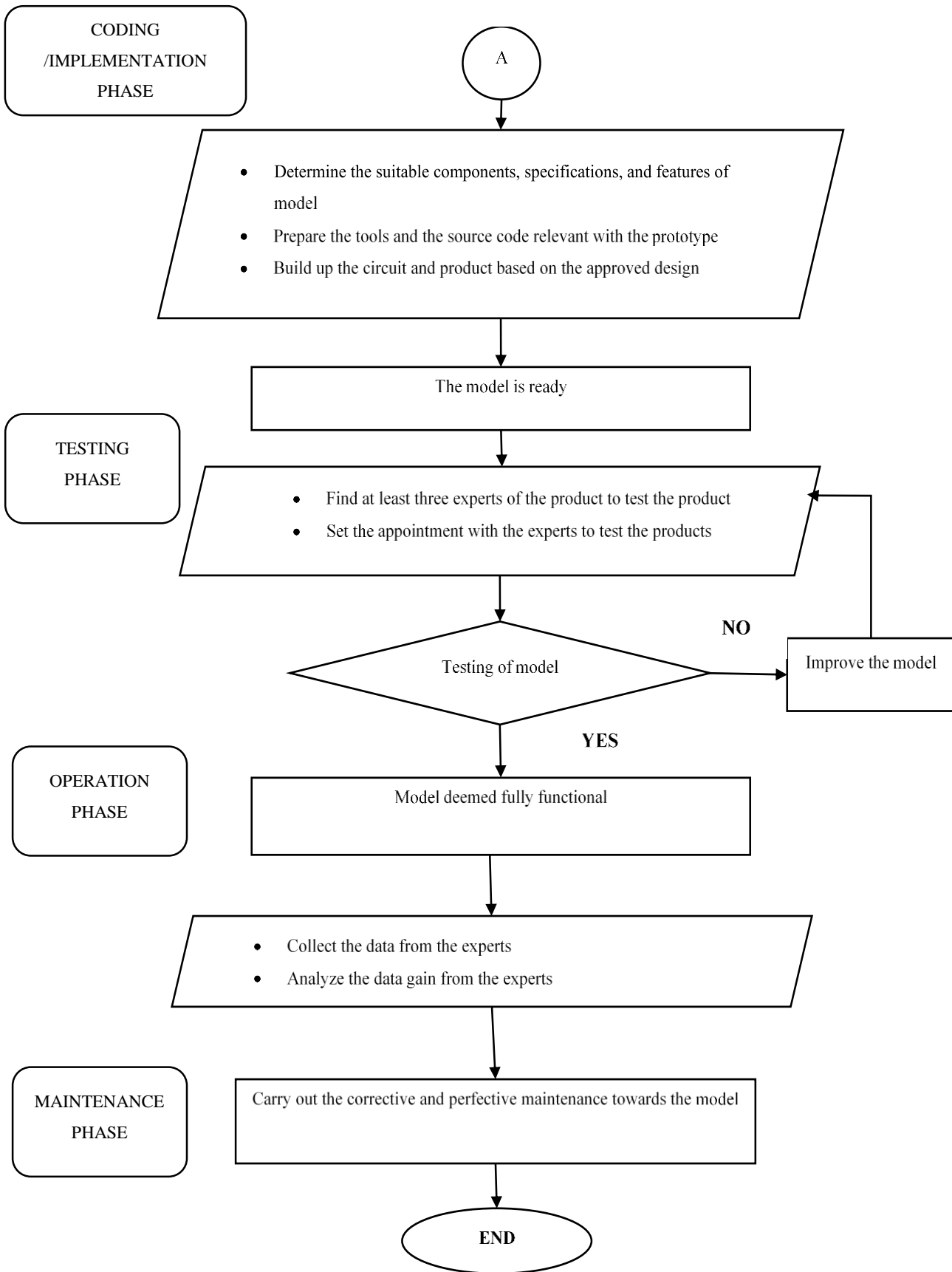


Figure 1(i) : Flowchart of Waterfall Model

2.2 Block Diagram

A Block diagram of the model is important to understand clearly the real function of the Smart Mouse Trap Model. Furthermore, it also will lead to understanding the real operation of each of the components in the Smart Mouse Trap Model as shown in Figure 2.

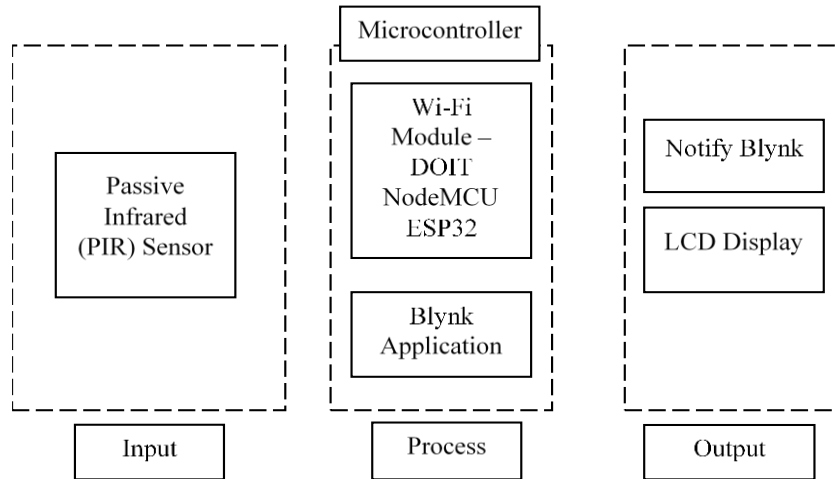


Figure 2: Block Diagram of Smart Mouse Trap Model



Figure 3: The Smart Mouse Trap Model

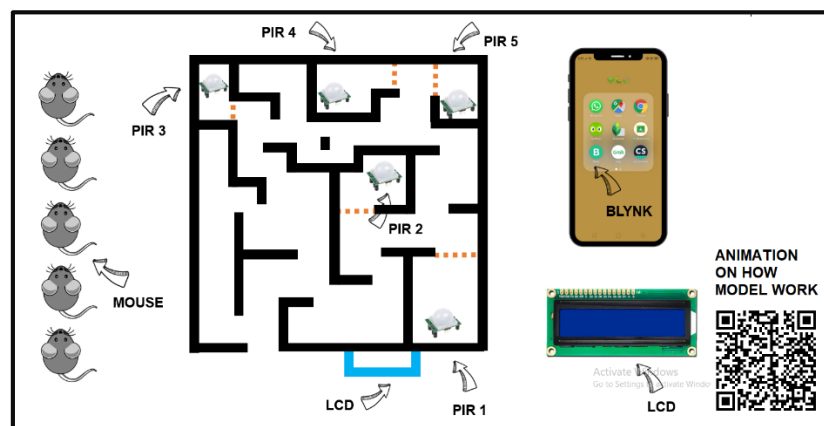


Figure 4: Simulation on How Smart Mouse Trap Model Work

Based on the block diagram as shown in Figure 2, the microcontroller Wi-Fi Module NodeMCU ESP32 controls the whole operation of the model. Meanwhile, the Passive Infrared (PIR) sensor going to implement at a certain place in the mousetrap. The motion of the mouse is known as the input for this system. When the Passive Infrared (PIR) sensor detected the motion of the mouse, ESP32 Wi-Fi Module and Blynk Application going to process the input.

Then, the Blynk Application and ESP 32 Wi-Fi Module going to send the data to the Blynk Notify to notify the users of the number of a mouse trapped in the mousetrap. Meanwhile, the Liquid Crystal Display at the mousetrap will display the number of the mouse had been trapped. When the number of mice is five, Blynk will notify the user to collect the trap. The actual model of Smart Mouse Trap can be shown as Figure 3. Meanwhile, the simulation of Smart Mouse Trap Model can be viewed through the QR code as shown in Figure 4.

2.3 Flowchart of Smart Mouse Trap Model

The Smart Mouse Trap Model functions to show the appearance of the actual Smart Mouse Trap. However, this model also can show the functionality of the actual Smart Mouse Trap which is to trap the mouse using the motion-sensing that uses the interaction of emitting infrared light as shown in Figure 5.

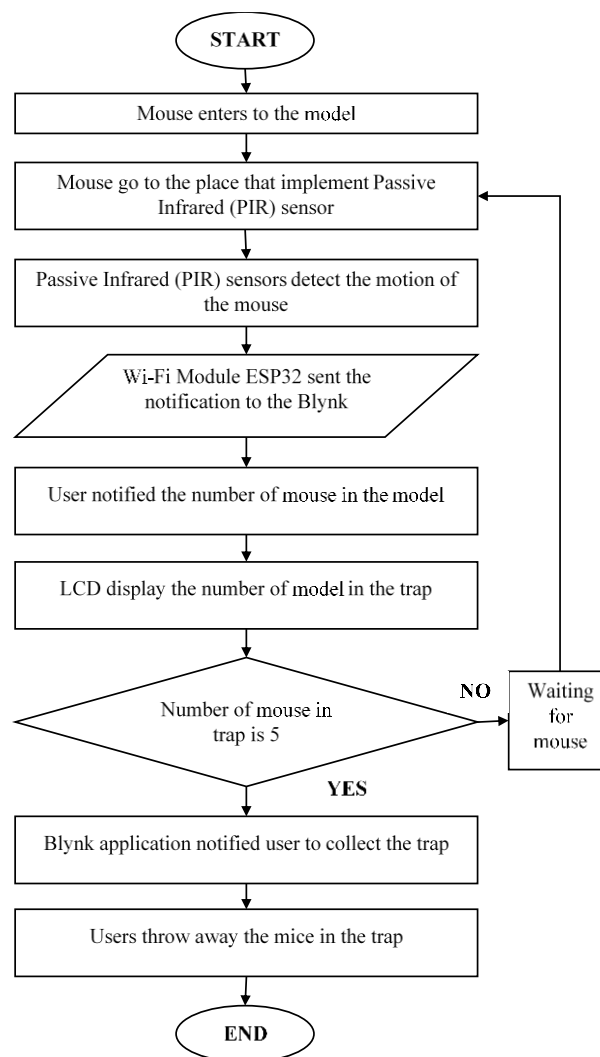


Figure 5: Flowchart of Smart Mouse Trap Model

2.4 Research Instrument

The product evaluation checklist is an instrument developed by the researcher to evaluate the functionality of the Smart Mouse Trap Model. Furthermore, this product evaluation checklist was distributed to those who are experts in the related field. The researcher distributed this product evaluation checklist to five experts. The product evaluation checklist contains questions related to the Smart Mouse Trap Model which is about the design aspect, functionality aspect, maintenance aspect, and suggestion for the Smart Mouse Trap Model. Besides, the researcher used the nominal scale for this evaluation checklist which is Yes and No. Plus, there are also open questions in this evaluation checklist.

3. Results and Discussion

The results and discussion section presents the data and analysis of the product evaluation checklist feedback. Moreover, the results are organized in the table form.

3.1 Design Aspect of Smart Mouse Trap Model

Design aspects of the Smart Mouse Trap Model were one of the aspects that had been evaluated by the experts. There are ten items that had been asked to the experts through the product evaluation checklist

Table 1: Evaluation of the Design Aspect by the Experts

NO	ITEM	YES		NO	
		TOTAL	%	TOTAL	%
1	Does the design of the Smart Mouse Trap Model help users to understand the aspects of the product Smart Mouse Trap?	5	100	0	0
2	Does the Smart Mouse Trap Model have design originality?	5	100	0	0
3	Does the size of the Smart Mouse Trap Model is convenient to apply in the industry?	2	40	3	60
4	Does the color of the Smart Mouse Trap Model is suitable?	5	100	0	0
5	Does the material of the Smart Mouse Trap Model is suitable for this project?	5	100	0	0
6	Does the material to build the Smart Mouse Trap Model is easy to find?	5	100	0	0
7	Does the material build the Smart Mouse Trap Model is durable?	2	40	3	60
8	Does the cost to build the Smart Mouse Trap Model is expensive?	1	20	4	80
9	Does the design of the Smart Mouse Trap Model appeal to you?	5	100	0	0
10	Does the design of the Smart Mouse Trap Model suitable for further development?	4	80	1	20
TOTAL		39	78	11	22

Table 1 shows the evaluation from experts regarding the Design of the Smart Mouse Trap Model. The results from the product evaluation checklist show all of them agreed with item 1, item 2, item 4, item 5, item 6, and item 9. Moreover, all experts agree that this model help user understands the concept of the Smart Mouse Trap Model. They also appeal to the design of the Smart Mouse Trap Model. Furthermore, all of them also agreed that the Smart Mouse Trap Model has design originality.

Experts find that the Smart Mouse Trap Model has suitable color and material for the model is easy to find. The color for the model is black and the material used is the wooden casing. However, three experts find out that the material of this model is not durable. This is because the researcher uses the wooden casing for the model where it can be easily broken.

3.2 Functionality Aspects of Smart Mouse Trap Model

Functionality aspects of the Smart Mouse Trap Model were one of the aspects that had been evaluated by the experts. There are ten items that had been asked to the experts through the product evaluation checklist. Table 2 shows the evaluation from experts regarding the Functionality of the Smart Mouse Trap Model. The results from the product evaluation checklist show most of them agreed with item 1, item 2, item 3, item 4, item 6, item 7, item 8, and item 9.

Table 2: Evaluation of the Functionality Aspect by the Experts

NO	ITEM	YES		NO	
		TOTAL	%	TOTAL	%
1	Does it easy to switch on/off the Smart Mouse Trap Model?	5	100	0	0
2	Does the microcontroller ESP 32 at the Smart Mouse Trap model able to control other hardware like sensors, Liquid Crystal Display (LCD)?	5	100	0	0
3	Does the microcontroller ESP 32 at the Smart Mouse Trap model transmit the right data to the Blynk application?	5	100	0	0
4	Does it easy to synchronize the microcontroller ESP 32 with the BLYNK application?	5	100	0	0
5	Does the Passive Infrared (PIR) sensor at the Smart Mouse Trap model able to detect the motion?	4	80	1	20
6	Does the Passive Infrared (PIR) sensor is suitable for the Smart Mouse Trap Model?	5	100	0	0
7	Does the sensitivity of Passive Infrared (PIR) Sensor at the Smart Mouse Trap model can be modified?	5	100	0	0
8	Does the Liquid Crystal Display (LCD) monitor on the trap shows the right total of the mouse inside the trap?	5	100	0	0
9	Does the BLYNK application display synchronize data the same as the Liquid Crystal Display (LCD)?	5	100	0	0

10	Does the Blynk application display and Liquid Crystal Display (LCD) help users to know the status of the Smart Mouse Trap Model?	4	80	1	20
TOTAL		48	96	2	4

Most of the experts agreed that the microcontroller ESP 32 at the Smart Mouse Trap model able to control other hardware like Passive Infrared (PIR) sensors and Liquid Crystal Display (LCD). Furthermore, they also agreed that the microcontroller ESP 32 at the Smart Mouse Trap model successfully transmits the right data to the Blynk application. Besides, all experts find out that Passive Infrared (PIR) sensor is the suitable electronic component for the Smart Mouse Trap Model. Additionally, all of them also agreed that the Blynk application display and Liquid Crystal Display (LCD) help users to know the status of the Smart Mouse Trap Model

However, there is an expert who finds the Passive Infrared (PIR) sensor at the Smart Mouse Trap model unable to detect the motion by mouse since the researcher just used hand motion. He suggested using the real mouse or hamster to make sure the Passive Infrared (PIR) sensor able to detect accurately. Hence, the researcher comes out that the functionality of the Smart Mouse Trap Model is successfully produced because 96% of the expert evaluation agreed with the functionality aspect of the Smart Mouse Trap Model.

3.3 Maintenance Aspect of Smart Mouse Trap Model

Maintenance aspects of the Smart Mouse Trap Model were one of the aspects that had been evaluated by the experts. There are seven-item had been asked to the experts through the product evaluation checklist. Table 3 shows the evaluation from experts regarding the Maintenance of the Smart Mouse Trap Model. The results from the product evaluation checklist show most of them agreed with item 1, item 3, and item 4. All the experts agreed that the program code of the Smart Mouse Trap model can be easily modified on Arduino IDE. Besides, all the experts find out that the electronic spare part and casing material for the Smart Mouse Trap model is easy to find on the market.

Table 3: Evaluation of the Functionality Aspect by the Experts

NO	ITEM	YES		NO	
		TOTAL	%	TOTAL	%
1	Does the program code of the Smart Mouse Trap model can be modified on Arduino IDE?	5	100	0	0
2	Does the electronic component in the Smart Mouse Trap model easily damage?	2	40	3	60
3	Does the electronic spare part for the Smart Mouse Trap model is easy to find on the market?	5	100	0	0
4	Does the casing material of the Smart Mouse Trap Model is easy to find at the market?	5	100	0	0
5	Does it easy for the user to put food (bait for mouse) in the Smart Mouse Trap model?	4	80	1	20
6	Does it easy for the user to clean up the Smart Mouse Trap Model after use it?	3	60	2	40

7	Does it easy for the user to check the functionality of every electronic component for the Smart Mouse Trap Model like Passive Infrared (PIR) sensor, microcontroller ESP32, and Liquid Crystal Display (LCD)?	4	80	1	20
TOTAL		28	80	7	20

Meanwhile, four experts agreed that user can be easy to put the bait in the Smart Mouse Trap Model and check the functionality of every electronic component for the Smart Mouse Trap Model like Passive Infrared (PIR) sensor, microcontroller ESP32, and Liquid Crystal Display (LCD). However, three experts state that the electronic component in the Smart Mouse Trap model easily damages. Hence, the maintenance aspect for the Smart Mouse Trap Model needs to be focused more on by the researcher.

3.4 Suggestion and Improvement

In the suggestion and comments sections, all the experts agreed with the design of the Smart Mouse Trap Model. Furthermore, they also find out that the electronic components in the Smart Mouse Trap Model can be function even just using the dummy data. However, they also give constructive suggestions for the Smart Mouse Trap Model. Most of them suggested to the researcher for using the real mouse or hamster for the Smart Mouse Trap Model. This is because to figure out either the mouse is trapped after passing a one-way door or not. Furthermore, there is also an expert who suggested improving the user manual guide with add the maintenance section about the model. Moreover, there is also an expert who proposed the Smart Mouse Trap Model used the dry battery power supply for users easy to bring the model anywhere.

4. Conclusion

The Smart Mouse Trap Model had been successfully developed according to the set duration and fulfilled the objective of the study stated at the beginning of the study as shown in Figure 5. The development of this Smart Mouse Trap Model might help users to get rid of the mouse at their house, offices, and warehouse at a reasonable cost and make users have less exposure to pesticides. The suggestions suggested by the experts might help the future researcher to produce an efficient and better version of the Smart Mouse Trap. Last but not least, the researcher hopes that with the cooperation of industry, the Smart Mouse Trap can be commercialized to the user and can be used at the place facing the problem with the mouse.



<https://www.youtube.com/watch?v=3q7U0ePV4uY>

Figure 5: QR Code of Smart Mouse Trap Model Work

Acknowledgment

A special thanks to my supervisor, Dr. Nurhanim Saadah Binti Abdullah for her countless hours of supervising, reflecting, reading, encouraging, and most of all patience throughout the entire process of

this study. Besides, I would acknowledge all the panels, experts, and also lecturers at Universiti Tun Hussein Onn Malaysia who were involved in the willingness to provide guidance and ideas throughout this study.

References

- Izyan Diyana Ibrahim, M. T. H. P. (2017). *Updates on Leptospirosis in Malaysia*. <http://www.ppukm.ukm.my/farmasi/>
- Katica, M., Smajović, A., Hassan Ahmed, N., Dukić, B., & Baljić, R. (2019). The bite of a rat infected with *Pseudomonas aeruginosa* in laboratory conditions: An uncommon case *Journal of Istanbul Veterinary Sciences* The bite of a rat infected with *Pseudomonas aeruginosa* in laboratory conditions: An uncommon case16, Abbreviated Title: *J Ist Vet Sci. Journal of Istanbul Veterinary Sciences*, 3(1), 13. <https://doi.org/10.30704/http-www-jivs-net.551979>
- Maddigan, F., Chinn, W. G. H., & Murphy, E. C. (2019). Diet, population structure and breeding of *Rattus rattus* L. in South Island beech forest. *Researchgate.Net*. <https://doi.org/10.20417/nzjcol.43.22>
- Ramzan, M., Naeem-Ullah, U., Bokhari, S. H. M., & Saba, S. (2019). PESTICIDES; ACUTE POISONING, SUICIDES AND DISABILITY IN HUMANS. *World Journal of Biology and Biotechnology*, 4(2), 5. <https://doi.org/10.33865/wjb.004.02.0214>
- Zaidon, S. Z., Ho, Y. Bin, Hashim, Z., Saari, N., & Mangala Praveena, S. (2018). Pesticides Contamination and Analytical Methods of Determination in Environmental Matrices in Malaysia and Their Potential Human Health Effects-A Review. In *Malaysian Journal of Medicine and Health Sciences* (Vol. 14, Issue SP1). https://medic.upm.edu.my/upload/dokumen/2018080309054110_MJMHS_Aug_2018.pdf