

## MosIn Trap the Intelligent Mosquito Trap

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### ABSTRACT

*Currently, dengue and malaria have been epidemic diseases over 129 countries which is 70% of the actual burden is in Asia. There are many electronic mosquito traps on shelf market. However, the trap only apply fan and UV light as components to attract and kill the mosquito. This project, a non-toxic mosquito killer is invented in order to kill the mosquitoes in practical way without chemicals, extremely quiet and safe with high capture rate of mosquitoes. MosIn Trap consists of a fan which speed can automatically change once the mosquito presence in the covered area. Any detection from the zapper will cause the fan's speed increase within 5 minutes and slowly down once the mosquito is not detected. MosIn Trap is installed by current sensor in the zapper to detect the presence of mosquito. Then, the data of detection information will be sent to the mobile application in order to monitor the time presence and number of captured mosquitoes. Thus, the mobile application will allow the user to remotely activate and deactivate MosIn Trap easily. An experiment was conducted in four different places which is bathroom, living room, garden and playground within 16 days. Based on the experimental results, Mosin Trap get highest capture rate which is 82.6 % compare to the others product X (10.7%) and Y (6.6%) respectively. Therefore, the new mosquito trap namely as MosIn Trap has a high efficiency and best solution in order to trap the mosquito that can reduce the epidemic disease over the world.*

**Keywords:** Mosquito trap, Internet of Things, Current Sensor, UV light, Non-Toxic.

### 1. INTRODUCTION

Dengue and Malaria have been epidemic diseases in 129 countries. One modelling estimate indicates 390 million dengue virus infections per year (95% credible interval 284–528 million), of which 96 million (67–136 million) manifest clinically (with any severity of disease). Another study on the prevalence of dengue estimates that 3.9 billion people are at risk of infection with dengue viruses. Despite a risk of infection existing in 129 countries, 70% of the actual burden is in Asia (World Health Organization, 2020) [1]. The number of dengue cases reported to the World Health Organization (WHO) increased over 8-fold over the last two decades, from 505,430 cases in 2000, to over 2.4 million in 2010, and 4.2 million in 2019. Reported deaths between the year 2000 and 2015 increased from 960 to 4032. (World Health Organization, 2020) [1].

The new product namely as MosIn Trap is an electric mosquito trap that kills mosquitoes by attracting them with UV lights [2] and uses dark colours [3]. It is safe, efficient, and most importantly, intelligent. The newest intelligent technology installed in MosIn Trap allows the machine to schedule the mosquitoes start to show up at the scene. Once the mosquitoes are detected, fan inside the MosIn Trap will ramp up its speed on thus starting the process of luring

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the mosquitoes to be trapped inside and killing it instantly without using any sort of chemical but rather by an electric shock. An application was also created to monitor the numbers of mosquitoes and remotely activate and deactivate the product.

This product will be in the form of a trap rather than a spray, it is because many studies and researches have shown the harmful effects of chemical use in sprays [4]. This way, the product can be eco-friendlier while still maintaining a good capture rate. This product will be in the form of a baited type trap, this way capturing mosquitoes will be far more efficient [5] and containing no side effects unlike using aerosol which can thin out the ozone layer [6]. This trap consists a fan which speed can be automatically changed. The fan's speed is based on mosquitoes' presence. More mosquito detection results in faster spinning fans. The mosquitoes' presence can be detected by the current sensor installed in the trap. Any detection from the zapper will cause the fan's speed to ramp up and the information about the detection will be sent to the application. The application will then monitor the number of captured mosquitoes. More than that, this product allows the user to set the activation and deactivation time by choice.

## **2. DESIGN PARAMETERS**

Several parameters are required in order to develop the intelligent mosquito trap such as UV light, colour and aggregation of mosquitoes and bait trap type.

### **2.1 UV Light**

A study has shown that UV light attracts the most percentages of mosquitoes other than any colour. UV light is used due to able visible even from afar distance. The research found that UV light attracted 42.10% more mosquitoes than any other colours. (Masami and Ken-Ichiro,2013)

### **2.2 Colour and Aggregation of Mosquitoes**

Even in daily lives, it is noticed how black colour always attracts mosquitoes significantly better than any other colour. Because of said statement, we decided to utilize dark colour in the making of our product to increase the capture rate of mosquitoes. However, an authorized is needed and official study on this matter to justify our use of dark colour. Because of that, we did some research and found an article talking exactly about that. A part of the article was copied and pasted below as evidence. "To study, whether there is any relation between the colour and aggregation of mosquitoes, an experiment was designed. Black, blue, green, red, white, orange, yellow, violet, and pink colour's chambers were used.

In the first observation, out of the 500+10 mosquitoes, 465+2 were found to be aggregated on black colour, on blue and green 10+1 and 15+2 respectively, while other colours; red, white, orange yellow, violet and pink had no aggregation of mosquitoes. The second observation also showed that out of 600+10 mosquitoes, 565+5 were reported on black colour, while on blue and green colour 20+2, 14+2 respectively, no mosquito was found on the other colours, except the white having a single mosquito only." (Om Datta and SC Dhiman,2020).

### **2.3 Bait Trap Type**

The population of malaria - carrying mosquitoes declined by 42% in homes that had the traps and the prevalence of malaria was 30% lower among people living in houses with a trap than among those in houses without a trap. (HT Staff, 2016).

### 3. METHODOLOGY

Early sketches are made in a drawing application using Autodesk Fusion 360. With said application, various shapes have been selected to see if it would fit the product's intended design. After multiple discussions with some trials and errors, the cuboid was chosen as the final design. After further discussion, the chosen measurement for the product its orientation is 6cm in both length and width and 30cm in height. A drawer-type container has also been chosen to be put into the product's design to fit the product's criteria. The container is designed fit into the product perfectly to save space. Earlier chosen shape has been discussed on it's orientation whether for it to be vertical or horizontal. Vertical orientation has been chosen after through discussion. Justification for chosen shape is the capture rate of mosquito can be maximized.

MosIn Trap was created using a Clarity Ender 3 Pro 3D printer. 3D printing method was chosen as the product's shape which is an oval is easier to be printed. This method also supports the factor of the product's durability and toughness since the material used to make the product is quite solid and rigid.

#### Design:

The design of product more elegant to fit the more modern style decorations and arts. This design is bound to be more attractive because of its simplistic shape and colour which tends to be liked by modern generations. Because of that, putting it in many parts of a household, such as the bedroom, the lounge, the kitchen and many more, can still be suitable. Furthermore, it can also serve as a night light, as it has been mentioned, the product will have a UV light installed, because of how soft-looking and dim UV light is, it can be a night light that comforts people's eyes to sleep.

#### Function:

When a mosquito is detected, the fan will slowly ramp up it's speed to suck the mosquito, after a short period of time, if there is another mosquito detected, the fan will continue to slightly raise it's rotation speed until it reaches a cap. After a while, if there is no longer any detection, the fan will slowly decrease it's speed until it comes to a complete stop. This can help manage the trap to be more effective on when to be more active. The trap will also record the amount of captured mosquito with the help of a current sensor inside the trap.

#### Effectiveness:

Because of the new technology installed, MosIn Trap is able to run automatically without any interference from the user besides from small modifications. But other than that, MosIn Trap will run perfectly and automatically while still keeping its high standards and performances. This new kind of technology also eases its usability for the user, because of people's enormous time usage with their phone, creating an application as an option to remotely control MosIn Trap is a way to simplify an already simple process even more. MosIn Trap will also be a lot safer compared to other products in many kinds of way. Because of how the product is intended, the product will not be using any kind of chemicals such as aerosol, which can thin out the ozone layer. Besides that, any sort of physical injury from the product such as the fan hitting the finger will be very unlikely, because of how the fan will constantly stay on low speed. In addition, any short circuit occurrence will be impossible as MosIn Trap relies on battery for its main energy source.

As the problems have been stated, MosIn Trap is created with the hope of decreasing the cases of dengue and malaria hopefully by a significant percentage. Since dengue and malaria has been one of the most known and deadly diseases, it is important to try to stop or at least decrease its infection. Electric problems such as short circuit and energy waste can also be prevented or decreased by using MosIn Trap as the product relies on battery or a USB plug. The product's usage of only zapper to kill the mosquito can also be a lifesaver as some people tend to be exposed to the mosquito's repellent dusts smokes.

#### 4. RESULTS AND DISCUSSION

After research about UV light and colour usage has been made, a verification on that research has been made by conducting a few experiments. The first testing was conducted to evaluate the UV light and its effectiveness. Then, a normal light is installed into the product and let it run for a fixed time, furthermore, UV light is installed for the other experiment and the result was recorded. UV light managed to capture 17 mosquitoes in a single night while the normal light managed to capture 11 mosquitoes. The second testing was conducted towards the product's base colour usage. The analysis is to see if darker colour could attract more mosquitoes than brighter colour. This product was painted with a bright colour and left it operating through a fixed timespan. Then, did the same again testing with darker colour. The result is recorded. Darker base colour is able to attract 14 mosquitoes while the brighter one is able to capture 8 mosquitoes. Based on this experiment, by using UV light and darker base colour is more effective in attracting mosquitoes. In the span of 4 days, the location has alternated between indoor and outdoor placement of the product to test its effectiveness and performance. For indoor locations, some of the most common spots for mosquito breeding ground to occur was chosen, that includes the bathroom and the living room. For outdoor places, the garden and the playground were chosen as the test locations. The results of rate mosquitoes caught at indoor and outdoor location as summarize in Table 1.

**Table 1** Rate of mosquitoes caught indoor and outdoor

Type	Indoor										Outdoor									
Location	Location 1 (Bathroom)					Location 2 (Living Room)					Location 3 (Garden)					Location 4 (Playground)				
Day	1	2	3	4	Tol	1	2	3	4	Tol	1	2	3	4	Tol	1	2	3	4	Tol
Product X	4	3	3	3	13	2	3	4	4	13	5	7	6	4	22	6	4	4	5	19
MosIn Trap	6	4	5	6	21	5	6	5	4	20	7	5	8	9	29	9	8	6	7	30
Product Y	2	3	2	1	8	2	3	4	2	11	3	6	5	4	18	2	3	4	2	13
Average for MosIn Trap	20.5										29.5									
Average for Product X	13										20.5									
Average for Product Y	9.5										15.5									

Outperforming the other products X and Y, our MosIn trap has proved its capability to keep its standard and performance for both types of location. Both the count of mosquitoes caught and its average count have shown that MosIn Trap is best at every single aspect of its kind. It is effective, affordable for its look and price, and most importantly, having a new feature that no other existing product has ever created. Below shows an analysis to related to MosIn Trap.

Observations that have been made showed that our product's average capture rate is significantly better than the other two products. With all the features that are scientifically tested and proven to be effective, our product was made to maximize its purpose to capture as much mosquito as possible. Based on the summary as shown in Table 2 and Figure 2, this experiment showed the MosIn Trap is the highest capture rate with 46.08% compared to Product X with 30.88 % while Product Y is 23.04 %.

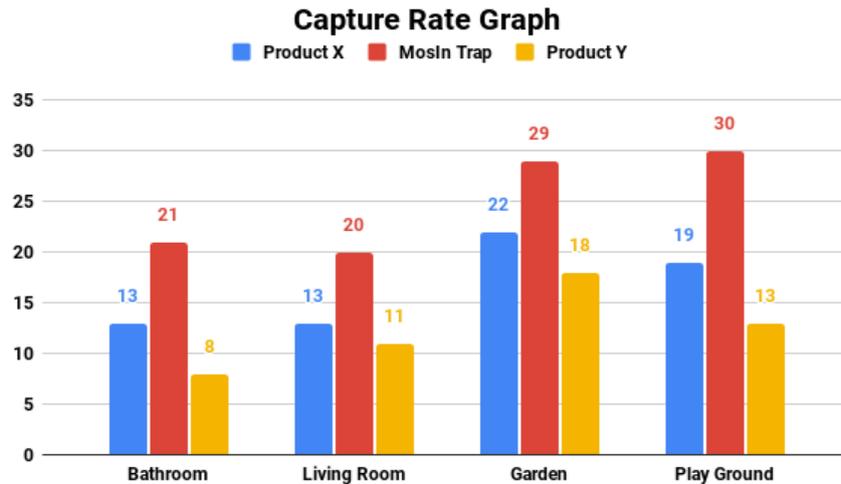


Figure 2. Capture Rate Results.

Table 2 Summary of rate of mosquitoes caught indoor and outdoor

Type	Indoor		Outdoor	
Location	Location 1 (Bathroom)	Location 2 (Living room)	Location 3 (Garden)	Location 4 (Playground)
Product X	13	13	22	19
Mosin Trap	21	20	29	30
Product Y	8	11	18	13

## 5. CONCLUSION

Even with costly materials used, the price of the product was made to be affordable for people all around the world. This will then lead to an increased amount of mosquito trap being utilized, thus decreasing the population of mosquitoes and malaria carrier mosquitoes. There are a lot of characteristics for the product that make up for its good quality. Some of the characteristics are the product use of no harmful chemical such as aerosol that can produce unpleasant smell, utilizing a current sensor to detect any mosquito presence, the fan that will automatically control its speed based on mosquitoes detections, this feature can help the fan to be more efficient on using energy, dark colours are used because of its effectiveness that are scientifically tested and using UV light to maximize the attraction of mosquitoes. Thus, having such excellent characteristics, it is also made as efficient as possible when making the product, that is to use a 3D printer. A mobile application was created to remotely activate or deactivate the product. For the final touch of the product's making, the container was made which can easily be used to discard captured and killed mosquitoes. This product also serves as a nightlight despite being a mosquito trap as the UV light inside it is comfortably dim to human eyes.

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