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Research Article

i-MOS: Smart Mosquito Repellent System

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Abstract

Dengue is a global issue that continues to be the highest global mortality contributor. A vast effort by medical or research institutions are still ongoing in investigating for scientific cure and treatment, especially in formulating new vaccine or new formulation for vector control to reduce the number of death cases that caused by dengue disease. In response to present scenario, this paper introduces a system tool called as i-MOS, an intelligent Mosquito Spray Dispenser system. The i-MOS is blended with Innovative Revolution 4.0 (IR4.0) through the automation of data controlling and monitoring from cloud computing infrastructure. The i-MOS acts both as the system device and system tools to monitor on the mosquito spray, named as X'MOS. Thus, the i-MOS system displays the data of spray interval of X'MOS, the volume of X'MOS remains after each spray and the total of battery capacity status (in volts). The data is controlled and monitored remotely through the optimizations of direct Wi-Fi module ESP8266 technology. While the i-MOS device is installed with X'MOS spray, the mini aerosol repellent, the battery and the sensor attached to the i-MOS circuit board for an effective environmental-friendly Aedes mosquito spray control. This embedded system encapsulates a free zone of mosquito for your home outlets. The experimentation results show both the device and system run smoothly to update the data of X'MOS spray level and battery consumption status.

Keywords: Dengue; Mosquito; Dispenser; i-MOS Device; X'MOS Spray

Introduction

A mosquito species called Aedes with two (2) variants named as Aedes aegypti (aegypti) and Aedes albopictus (albopictus) release the virus to be the main contributor to dengue [1-4]. The virus is spreading to humans through bites where the quite symptoms only can be recognized within fourteen days of infection [5,6]. These viruses may propagate from human to another with different severity status depending upon individual's body immunisations with minor cases of death. The World Health Organization (WHO) attends to this dengue disease precautious due to reducing the death cases and it is labelled as endemic [7-9]. Several efforts have been put in trial test and many approaches have been conducted as the preventing and combating mechanism [10-12]. In response to present scenario, this paper introduces the automatic spraying

of Aedes mosquito repellent device and system via Industry Revolution 4.0 (IR4.0) technology. This is a collaborative project between higher academic institutions with industry partnership with the aim to fight against vector-borne disease.

The main research objective is to provide a solution for an automatic spray of Aedes repellent in eliminating dengue disease. The automatic solution is mainly applied and adopted in various emerging fields such as engineering, automotive, agriculture, marine biodiversity as well as in computing and robotics to take over labour operation by improving cost efficient solutions. The rest of the sections in this paper includes Section 2 for the research methodology for i-MOS, Section 3 explains the i-MOS background, Section 4 discusses the experimentation being done, Section 5 portrays on the result and discussion and Section 6 summarizes on conclusion and future works.

Materials and Methods

The i-MOS project follows the five (5) phases of activities such as Phase 1 is the review of the literature on the smart IOT system, the appropriate design and implementation for a smart dispensing system. Then Phase 2 is the construction design of i-MOS in controlling and monitoring on the spray volume level during each spray. Phase 3 focuses on the real implementation of assembling the required components for i-MOS circuit board (i-MOS device and i-MOS system development). Phase 4 conducts the i-MOS testing and evaluation and finally Phase 5 on executing documentation. The research activities is illustrated in figure 1.

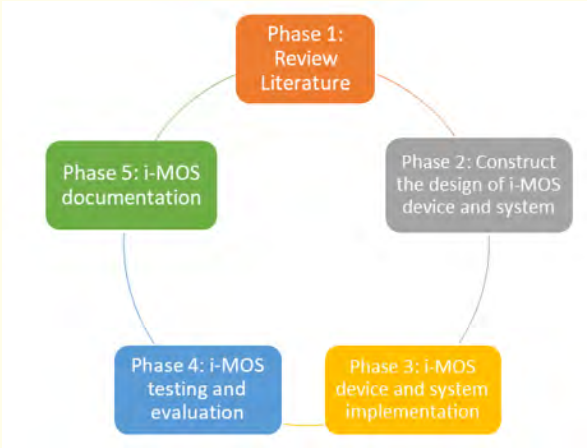


Figure 1: The i-MOS Research Methodology.

This section illustrates the i-MOS project as the milestone achieved upon the collaboration between academia and industry. The member of academia consists of Universiti Malaysia Terengganu (UMT), Universiti Sultan Zainal Abidin (UniSZA) and Universitas Mercu Buana that accountable for idea creation, design and implementation while industry representative is One Team Network (OTN) Sdn. Bhd. and DrMOS Healthcare Sdn. Bhd. for the component of Aedes mosquito repellent called X'MOS spray and i-MOS dispenser.

Project description

The i-MOS project is a blended digitalization of device and online system that comprises of a few components. The components are the dispenser called as i-MOS, a mosquito spray repellent called as X'MOS that both manufactured by DrMOS Healthcare Sdn. Bhd. And several IoT components including sensors and Wifi module microcontroller. The i-MOS dispenser is a device compartment to be attached together with the repellent spray called X'MOS. The X'MOS repellent is for Aedes mosquito spray repellent and the IoT components used are the Node MCU ESP8266 Wi-Fi Module, DC geared motor, resistor and battery [11-14]. These components are depicted in figure 2.

Figure 2: i-MOS hardware components.

An Arduino microcontroller named as MCU ESP8266 node is the main component in gathering sensor data. It is a connectivity hub to transmitting data from the gateway. The micro-USB allows for reprogramming via Arduino IDE and is operable ranging from 3.3V to 5V power regulator to stabilize output voltage beside flexibility of the sensor to be used. It provides for direct data transmission in cloud environment. Then DC Geared Motor is a combination

between motor and gearbox to reduce the speed while increasing the torque output. The third is resistor to stabilize the amount of power resources by reducing the flow of current. The last component is the battery 3V to provide the energy resources to i-MOS circuit. The complete circuit board is shown in figure 3.

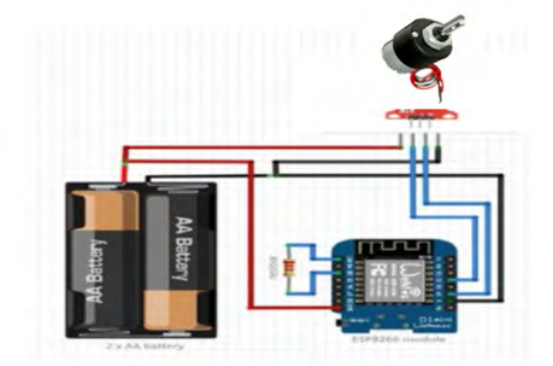


Figure 3: i-MOS circuit board.

Setting area

The focus of i-MOS project is on combating dengue disease by eliminating Aedes mosquito away from our save surroundings. But, after a period of use, many other vector, and insects such as cockroaches and ants might move and stay away from the area that affected with X'MOS repellent. A bottle of X'MOS contains 250 ml in volume for a 300 feet (ft) coverage depending upon the spraying frequency of the setting area at different location (room, living room or office area). The different setting time is set for different area location. For manual spray practice, 1 min is set for 1 spray of X'MOS repellent. For a living room and kitchen, the start and end time for example, from 6:00 am to 6:12 am for 12 sprays to have 33 days.

Through a normal X'MOS operation, a specific Standard Operating Procedures (SOPs) is to be enforced to ensure the optimum effects. There are certain precautions to be applied for each i-MOS utilization. First, we need to record the date of installation, and pre-set the X'MOS exchange date notification in dealer's gadget calendar. Second, we must check the battery condition after 10 months usage. Third, we must perform an estimation to the area of targeted premises where 1 unit of i-MOS for every 300 square feet. Fourth, a reminder needs to be blast to the customer to not switching on the exhaust fan right after the i-MOS device spraying to avoid the drying. And lastly, the i-MOS device should be located at the main entrance or beside the window at about 6 inches (6") from the ceiling to ensure the total spraying coverage. The suggested setting is shown in figure 4 for a home location and figure 5 for a particular bedroom.

Figure 4: The illustration of i-MOS installation for household.

Figure 5: The illustration of i-MOS installation for bedroom.

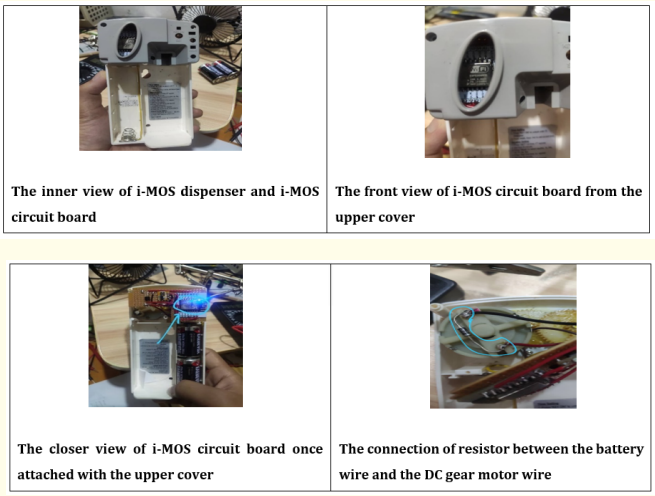
Discussion

Experimentation

Experimentation is done in 11th Gen Intel(R) Core(TM) i5-1135G7 @ 2.40GHz 2.42 GHz with 12GB RAM. The i-MOS system is based upon open-source programming language, Pre-hypertext (PhP) and MySQL Database Management System with XAMPP control engine. The website address to access the system is https://mospryiot.musproject.com.

Device setup

The images in Figure 6 show the internal part of i-MOS dispenser and the complete circuit board attached to the i-MOS dispenser, and the connection between a resistor to battery and to DC gear motor for power stabilization.



The inner view of i-MOS dispenser and i-MOS circuit board

The front view of i-MOS circuit board from the upper cover

The closer view of i-MOS circuit board once attached with the upper cover

The connection of resistor between the battery wire and the DC gear motor wire

Figure 6: The setting of i-MOS device.

Results

The data of X'MOS spray is recorded ranging from device identification (DISP-ID), the specific location, the date, the spray level (SP-Level) and a bettery level (Bat-Level). Data is recorded starting from 01/01/2021 to 10/2/2021. Table 1 shows recorded data from DISP001.

DISP-ID	Date	SP-Level	Bat-Level
DISP001	1/1/2021	800	3.000
DISP001	2/1/2021	780	2.996
DISP001	3/1/2021	760	2.992
DISP001	4/1/2021	740	2.988
DISP001	5/1/2021	720	2.984
DISP001	6/1/2021	700	2.980
DISP001	7/1/2021	680	2.976
DISP001	8/1/2021	660	2.972
DISP001	9/1/2021	640	2.968
DISP001	10/1/2021	620	2.964
DISP001	11/1/2021	600	2.960
DISP001	12/1/2021	580	2.956
DISP001	13/1/2021	560	2.952
DISP001	14/1/2021	540	2.948
DISP001	15/1/2021	520	2.944
DISP001	16/1/2021	500	2.940
DISP001	17/1/2021	480	2.936
DISP001	18/1/2021	460	2.932
DISP001	19/1/2021	440	2.928
DISP001	20/1/2021	420	2.924
DISP001	21/1/2021	400	2.920
DISP001	22/1/2021	380	2.916
DISP001	23/1/2021	360	2.912
DISP001	24/1/2021	340	2.908
DISP001	25/1/2021	320	2.904
DISP001	26/1/2021	300	2.900
DISP001	27/1/2021	280	2.896
DISP001	28/1/2021	260	2.892
DISP001	29/1/2021	240	2.888
DISP001	30/1/2021	220	2.884
DISP001	31/1/2021	200	2.880
DISP001	1/2/2021	180	2.876
DISP001	2/2/2021	160	2.872
DISP001	3/2/2021	140	2.868
DISP001	4/2/2021	120	2.864
DISP001	5/2/2021	100	2.860
DISP001	6/2/2021	80	2.856
DISP001	7/2/2021	60	2.852
DISP001	8/2/2021	40	2.848
DISP001	9/2/2021	20	2.844
DISP001	10/2/2021	0	2.840

Table 1: Recorded data of i-MOS for DISP001 spray interval at the bedroom.

The graphs on figure 7 to figure 8 are plotted from spray level and battery level status reading. From Table 1, it depicts that the spray level is reduced by 20 while the battery power (in volts) is reduced by 0.004 on two (2) different dates. The status of X'MOS spray indicates it is emptied by a month and 10 days on 10/02/2021, but the battery volts remain at the voltage of 2.840.

The aim of this project is to eliminate and kill the Aedes mosquito in conjunction to reduce the number of dengue death cases since

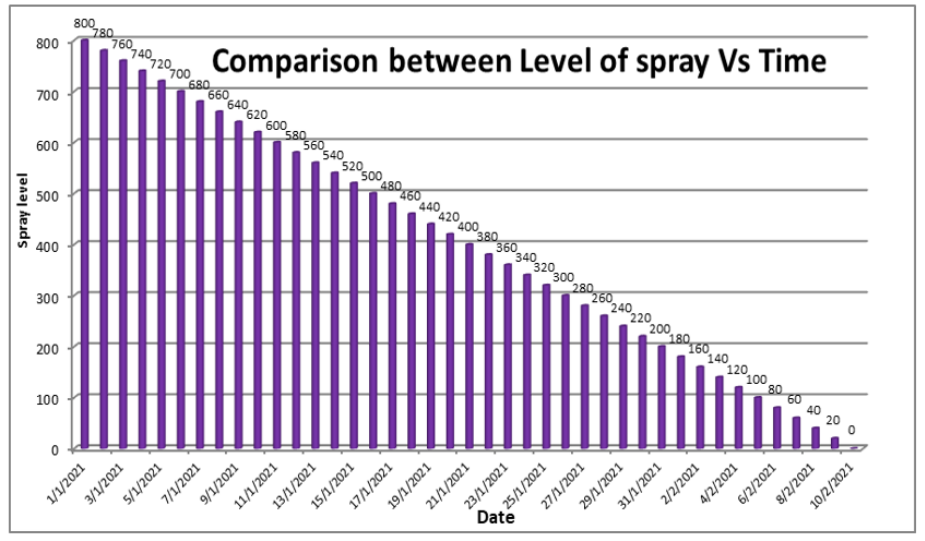


Figure 7: Evaluation on the level of spray in specific date-time.

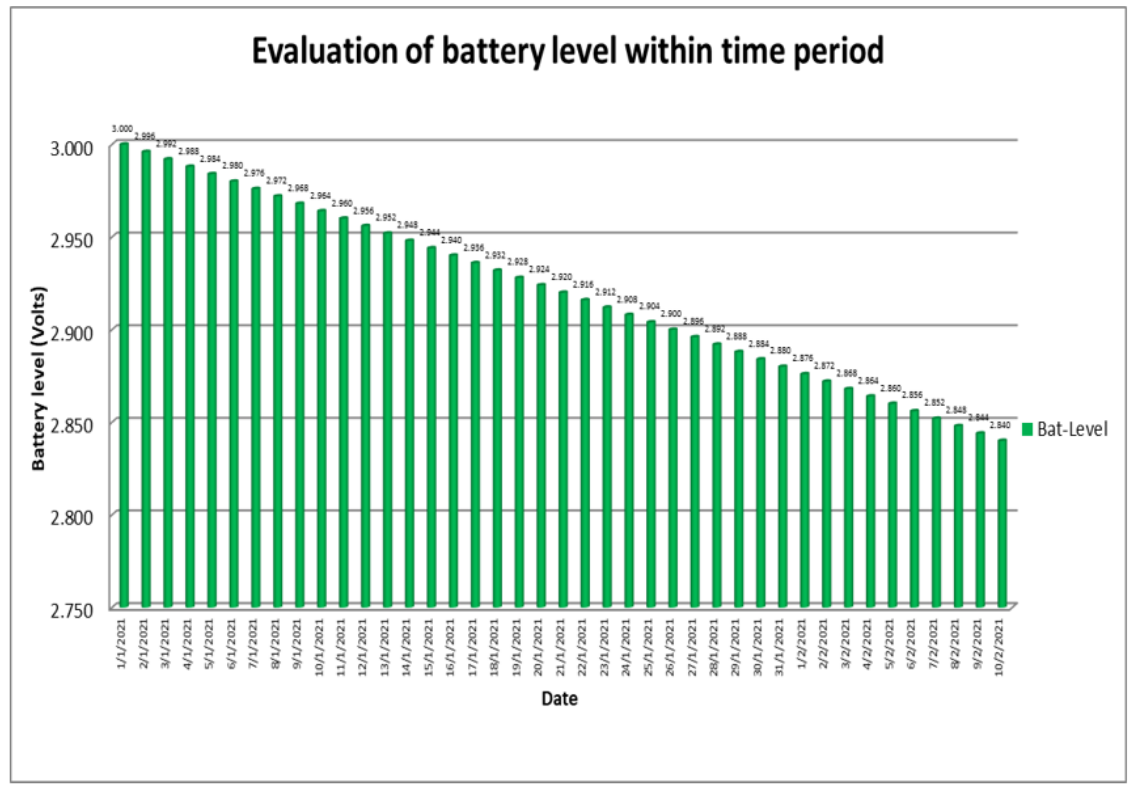


Figure 8: Evaluation on the different level of battery (Volts) in specific date.

no vaccine could be formulated to date. The clinical testing and evaluation is conducted as a result of grants collaboration between higher academic institutions and industry such as UMT, UniSZA, One Team Network Sdn. Bhd., Dr MOS Healthcare Sdn. Bhd., Institute of Medical Research (IMR) and UPM. The i-MOS could act as a complete package where the controlling and monitoring of the spray is done remotely, and data is accumulated and stored in a cloud environment. Any i-MOS devices could be monitored via the status of the spray level together with the status of the battery consumptions to utilize IR4 in new norms especially in Covid-19 endemic era.

Conclusion

The Internet of Things (IoT) concept is successfully applied in this project as the realization of IR4.0 technology into daily life routine. It definitely would reduce manpower energy to manual checking for refill on the Aedes repellent and reduce the labour cost with the initial objective to combat against Aedes mosquito through adaptation of green technology as well as to support environmental-friendly ecosystem. Monitoring the real time data exchange is crucial as a concluding remark for big data analytics initiatives (15-16]. In future, we would like to test our X'MOS-IOT in spraying for hand sanitizer liquid to improve the Standard Operating Procedure (SOP) in combating COVID-19.

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Conflict of Interest

No.

Bibliography

1. Prasad P Rajendra., *et al*. "An Efficient E-Health Monitoring with Smart Dispensing System for Remote Areas". 2018 3rd IEEE International Conference on Recent Trends in Electronics, Information and Communication Technology (RTEICT). IEEE (2018).

2. Kumar K Anil and D. Aju. "An Internet of Thing based Agribot (IOT-Agribot) for precision agriculture and farm monitoring". *International Journal of Education and Management Engineering* 10.4 (2020): 33-39.

3. Krishna K Lokesh., *et al*. "Internet of Things application for implementation of smart agriculture system". 2017 International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud) (I-SMAC). IEEE, (2017).

4. Kumar R and M Pallikonda Rajasekaran. "An IoT based patient monitoring system using raspberry Pi". 2016 International Conference on Computing Technologies and Intelligent Data Engineering (ICCTIDE'16). IEEE, (2016).

5. Gunawan Teddy Surya., *et al*. "Performance evaluation of smart home system using internet of things". *International Journal of Electrical and Computer Engineering* 8.1 (2018): 400.

6. Koo Dan D., *et al*. "An Internet-of-Things (IoT) system development and implementation for bathroom safety enhancement". *Procedia Engineering* 145 (2016): 396-403.

7. Man Mustafa W A W A Bakar and A Razak MAB. "MUS-Tracker: An IoT based system in controlling and monitoring of beehives". *International Journal of Emerging Trends in Engineering Research* 8.6 (2020).

8. Bakar Wan Aezwani Wan Abu., *et al*. "iMHS: An IOT Embedded for Aedes Mosquito Home System". (2020).

9. Man Mustafa., *et al*. "Dengue innovation: a sustainability approach for preventing and controlling of dengue diseases outbreaks via IoT technology". IOP Conference Series: Materials Science and Engineering 769.1 (2020).

10. Man Mustafa W A B W A Bakar and M Noor MIHB. "ITDS: An intelligent tissue dispenser system". *International Journal of Recent Technology and Engineering* 8.3 (2019): 2613-2619.

11. Singh Himanshu., *et al*. "IoT based smart home automation system using sensor node". 2018 4th International Conference on Recent Advances in Information Technology (RAIT). IEEE (2018).

12. Ayadi Noura., *et al*. "Identification and development of a real-time motion control for a mobile robot's DC gear motor". *International Journal of Computer Applications in Technology* 55.1 (2017): 61-69.

13. Wang Zhongqiang., *et al*. "A 2-transistor/1-resistor artificial synapse capable of communication and stochastic learning in neuromorphic systems". *Frontiers in neuroscience* 8 (2015): 438.

14. Liu S., *et al*. "Lithium-ion Battery Cathode Material Li~ 3V~ 2 (PO~ 4)~ 3: Synthesis by Sol-gel Procedure and Performance Studies". *Chinese Journal of Inorganic Chemistry* 22.6 (2006): 1067.

15. Yusof Mohd Kamir and Mustafa Man. "Efficiency of JSON for data retrieval in big data". *Indonesian Journal of Electrical Engineering and Computer Science* 7.1 (2017): 250-262.

16. Man Mustafa., *et al*. "Mining association rules: A case study on benchmark dense data". *Indonesian Journal of Electrical Engineering and Computer Science* 3.3 (2016): 546-553.