

Automatic Sterilization Disinfection Fogging Using IoT Application System

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Abstract: Nowadays, humanizing a space or area is an important thing in life now. This Covid-19 contagion is of great concern to citizens, and sanitary ware has become an important part of their lives. Therefore, this project can solve the problem by presenting a control system and monitoring a small space or area such as a house using only a smartphone. The development of this project is to centralize control units and switches to sanitize the space or area to be disinfected. The ESP2866 is used to interact with the hardware system. The Blynk app controls the system ON/OFF and pre-sets control times. So, users only need to open the system on their smartphone to set the time and status of the sanitation device. The project mainly focuses on a sanitation control system connected to the ESP2866 via a wireless router. In this project, a smartphone will act as a controller, a wireless router will serve as a medium between the connection, and the ESP2866 will act as a signal receiver. The overall results reveal that researchers can identify the functionality of each component utilised to construct a prototype of a disinfection spraying machine utilizing IoT applications, including the functionality of assessing the time it takes to execute sanitation in different room space regions. Furthermore, the second test is the distance that is used to test the network connection between the mobile phone used as a transmitter and the system used as a receiver.

Keywords: Sanitation, Wireless, IoT

1. Introduction

Coronaviruses are a diverse group of viruses infecting many different animals, and they can cause mild to severe respiratory infections in humans (Ben et al., 2020). According to Azizuddin & Abdul Hamid (2020), from Covid-19 Medical Information Resources and the Covid-19 Risk and Media Communication Resource Center in Collaboration with KPJ Healthcare, Coronaviruses are a large

group of viruses that include other viruses that will cause disease transmission to humans, including SARS CoV (severe acute respiratory syndrome), MERS-CoV (Middle East Respiratory Syndrome) and other viruses. Therefore, the Ministry of Health Malaysia (MOH) has stated that the consequences of the Coronavirus infection will cause patients to have fever, cough, and experience fatigue. Other symptoms include joint pain, difficulty breathing, dizziness, sore throat, chest pain, stuffy nose, flu, and loss of appetite (Malaysian Ministry of Health, 2021). For severe infection levels, patients will get a lung infection and have difficulty breathing. They need a breathing aid stated in the Official Portal of the Ministry of Health Malaysia. Starting in December 2019, the words Coronavirus and COVID-19 are now the focus of attention and talk in society, both old and young. COVID-19 is no longer foreign to communities across the country (Abd Hamid, 2020).

It is of paramount importance that are actively involved in infection control and provided adequate personal protective equipment to safeguard not only themselves but those surrounding them as well (George et al, 2020). The Ministry of Health Malaysia (2021), has issued a statement, not only complying with the standard operating procedures (SOP) set such as wearing a face mask, maintaining physical distancing, and washing hands, people are seen to be proactive in health care to protect themselves and their families.

According to a statement issued by Holley Secon, on 7 March 2020, one of the most effective ways to fight the spread of the new coronavirus is to disinfect surfaces that are touched a lot. Public health experts argue that mass disinfection efforts will have mixed effectiveness in outbreak zones. Disinfecting commonly touched surfaces can help kill germs. Therefore, they always need to ensure that the environment at home is clean. So, with this fogging machine, they can save limited time while at home because this product can be controlled automatically by using a mobile phone and they can complete other work while waiting for the fogging machine to operate. Next, by controlling the use of IoT it can save the user's time and energy.

1.1 Objective of Study

Several research objectives to achieve the purpose of developing this product, including:

- i. Develop a prototype of a mobile phone-controlled home sanitation system that can facilitate users.
- ii. Test the functionality of a prototype of an automated home sanitation system that can facilitate users.

1.2 Limitation of Study

A study conducted should be of interest to consumers with full focus. The positive impact is also likely to affect consumers who use this product. This system will ensure that everyone will comply with the Standard Operating Procedures (TPP) in the home area. It will ensure that parents will ensure cleanliness from Coronavirus infection. Besides that, this system can reduce the spread of the virus inside the house. In addition, it can reduce the rate of infection among children or the elderly from spreading to the surrounding community in Malaysia. It also helps Malaysia fight the Coronavirus disease plaguing and reduce existing cases. Lastly, this system helps clean every space or area in the house and reduce Coronavirus infection carriers from outside entering the safe zone after sanitation.

- i. Cost: The design is cheaper than using today's house-to-house sanitation services.
- ii. Time: Users do not need to wait for the sanitation process to be finished because the design only needs to be placed in the space to be sanitized
- iii. Energy: Users do not have to waste their energy because this design is designed with an automatic and controlled by a set time

2. Methodology

The researcher then chose the EDP model, or Engineering Design Process Model, to build this product. This model was chosen because it is a development model that is well-suited to be utilized by researchers in identifying problems during product development and proposing solutions to overcome issues and impediments (Ang, 2016). As a result, this EDP model represents a systematic and structured engineering design process.

2.1 Research Design

Research question or test a hypothesis. It is the blueprint that guides the research process and helps to ensure that the data collected is valid, reliable, and relevant to the research question. Here is the research design that is used in this study: Determining Problems and Project Background, creating a Solution, Prototyping, Testing and Evaluating the Solution, Providing the Solution, and Redesigning.

2.2 Research Procedure

The procedure for operating this Automatic Sterilization Disinfection Fogging Using IoT Application System is shown in the flowchart in Figure 2.

- Determining Problems and Project Background

This analysis is a step to analyze the problem. This phase is to find out the issues that arise and set the direction for the development of the product. So, for this stage, the study is done based on the problem factors. The development process carried out continues according to the objectives and purpose of the study and can be used as a guide throughout the project's development period.

- Making Solution Possible

In phase two of the development of this project, the researcher carried out a detailed study to enable the researcher to suggest solutions to the problems that have been encountered. Therefore, problem-solving in the study is one of the activities carried out by the researcher to provide suggestions for solutions and appropriate methods to be applied throughout the project development process by developing or proposing solutions that can overcome the problems that arise.

- Prototype Development

The development of this prototype involves two main circuit parts, namely the hardware circuit and the software required in developing the Automatic Sterilization System for fogging disinfection using IoT application system. So, task research is very important to develop the project to ensure that researchers use appropriate equipment on this project because to see the suitability of the final function to be produced, the main goal of product development implemented must achieve the objectives of the study. Therefore, the main hardware to build the Automatic Fogging Disinfection Sterilization System using the IoT application system consists of ESP2866, and the prototype software requires Arduino Uno software. Therefore, research and selection of materials to develop this project are very important for researchers to ensure that the materials used are suitable for the final function to be produced and reasonable product development costs. In this step, the prototype is developed. The development of the prototype involves two main parts, namely hardware and software. Hardware and software equipment is essential to ensure that the product produced works well and meets the required features. Figure 1 shows the schematic circuit for Automatic Sterilization Disinfection Fogging using an IoT Application System consisting of an ESP8266 microcontroller, servo motor, Arduino Uno, relay, fogging, and ac plug to the power supply. Table 1 shows a list of the components that are used in this project.

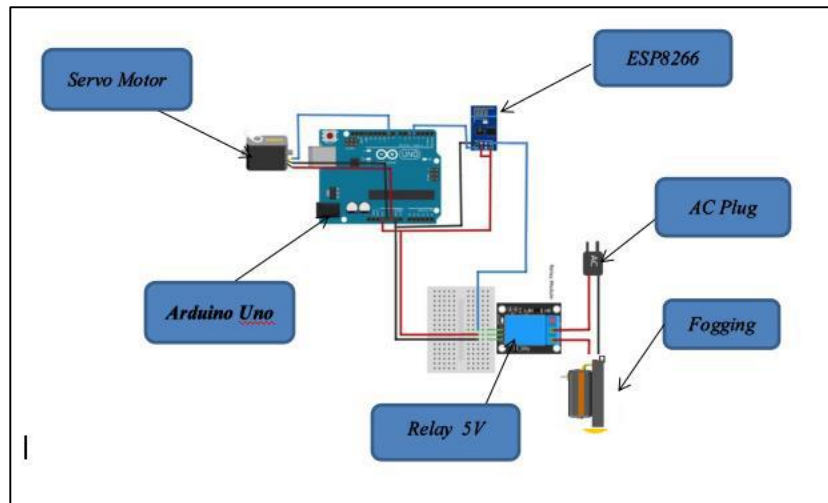


Figure 1: Schematic circuit of Automatic Sterilization Disinfection Fogging Using IoT Application System

Table 1: List of components are using in Automatic Sterilization Disinfection Using IoT Application System (Louis, 2016 & Badamasi, 2014)

Component	Function
ESP8266	Works as a microcontroller like Arduino to be able to connect directly with Wi-Fi and make a TCP/IP connection.
Relay Module 5V	A device that operates on the electromagnetic principle to move the contactor from the ON position to the OFF position or vice versa by using electrical power.
Serve Motor	Rotary actuators or linear actuators allow precise control of angular or linear position, velocity, and acceleration.
Arduino Uno	Works to create programs to control various electronic components and functions Arduino Uno is made to make it easier for users to do prototyping and programming microcontrollers.
Fog Machine Heater	The fog machine has a heating chamber developed to generate significant fog immediately upon turning on the heating element combined with the heating chamber to receive the amount of liquid.
Pump Fog Machine	Is a high-quality oil pump for garage and fog machine pumps. Also, this mini laser fog machine pump is designed to be used at parties, and other events. This is because this pump is a compact fog machine with high efficiency and strong power.

▪ **Testing and Evaluating the Solution**

The process of product testing is a very important element and should be done by the researcher by making a test with those who are more experts in the field involved and need to ensure that each component used in the development of the product is tested with proper procedures. Therefore, this testing should also involve consumers to ensure that the product built is appropriate and ensure that the product can meet the needs and desires of consumers. This testing very much consists in testing the electronic circuit to be used in the proper design in the place recommended. Therefore, electronic testing will involve testing the suitability of the components to be used and testing the functionality and the durability of the product. In more detail, this testing will involve the researchers themselves, experts in the fields involved, lecturers and even users. The researcher needs to record the results of the evaluation made and

needs to be analyzed to find out whether it is necessary to improve the project developed or not. The test proposal is based on the study's main objectives.

- **Delivering the Solution**

In this phase, the product is intended to solve a problem that occurs to increase one's productivity. The prototype created should be developed with existing skills and the need to apply existing technology, and it is also to ensure that the product produced is valuable and safe to use and should be consulted with experts in related fields and get feedback from them. This is because feedback from them is very important for the reviewer so that the products can meet the demands and needs of the users. Thus, this feedback can help researchers improve their products in terms of capabilities and functions that are unique if required by consumers. So, the course of this process can ensure that the product produced has its own purpose and objectives.

- **Redesign**

Redesigning is a process of improving and increasing the functionality of a product on the good to be better. The face-to-face design will take place when the researcher obtains feedback from various parties, especially references from the experts involved. Therefore, every feedback received needs to be improved. It is necessary to make improvements to the product. The researcher also needs to improve the functionality of the product developed.

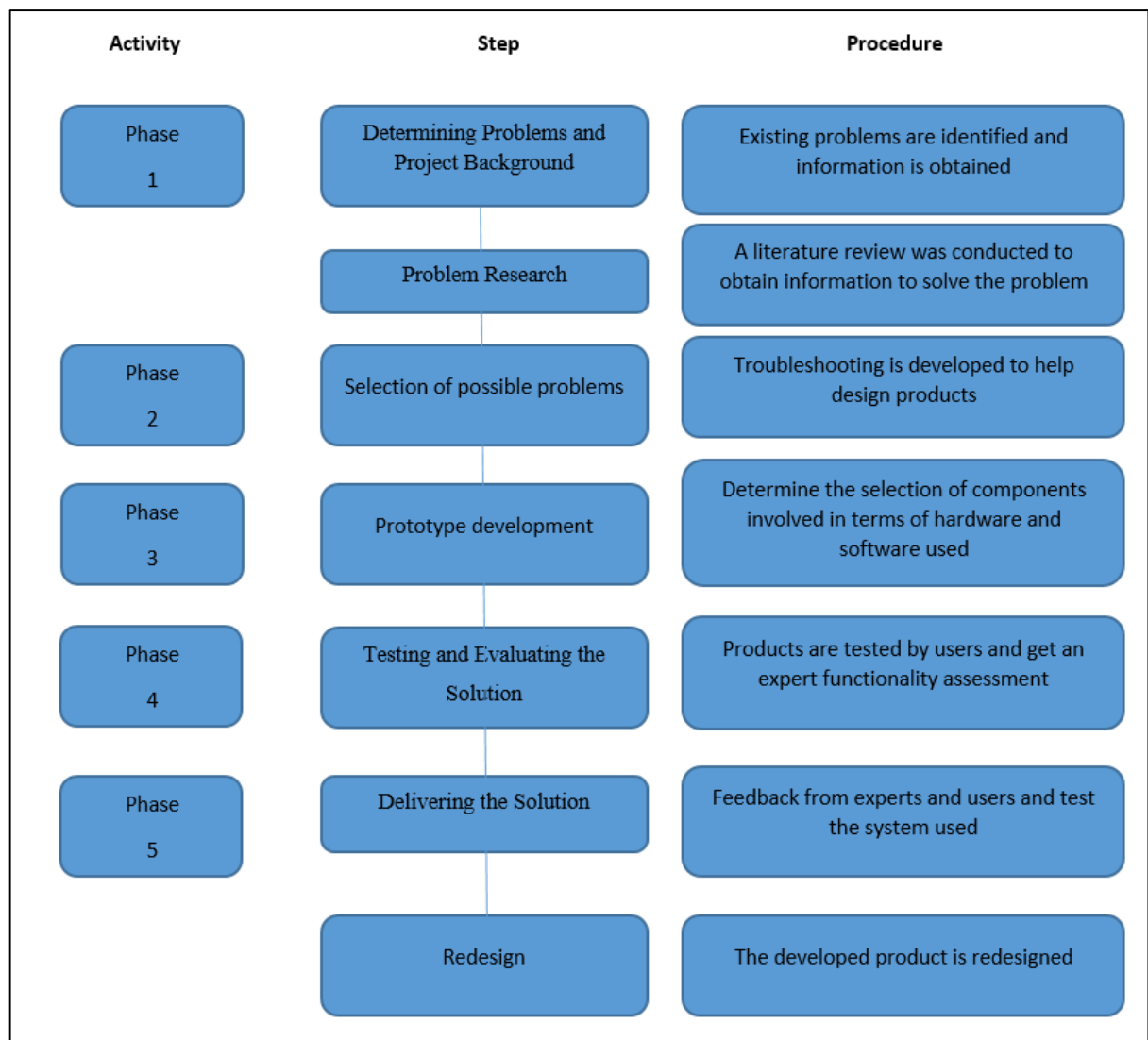


Figure 2: Project Development Flow Chart

2.3 Research Instrument

The research equipment used to collect, measure, and analyze data relevant to the subject is described in this section. Tests, surveys, scales, questionnaires, and checklists are examples of research instruments. To show the device's capability, it is testing an Automatic Sterilization Disinfection Using IoT Application System. Testing is carried out on Blynk apps in accordance with a timetable to guarantee that the Automatic Sterilization Disinfection Using IoT Application System functions effectively. Table 2 displays the results of the tests on Automatic Sterilization Disinfection Using IoT Application System and how they were performed.

Table 2: Results of the tests on Automatic Sterilization Disinfection Using IoT Application System and how they were performed

Functionality experiments	Test performed
Arduino and ESP8266 Microcontrollers	The Arduino and ESP8266 Microcontrollers are used in measurement scale products, and Timer fixation on disinfection fogging is intended to give instructions to the functionality of other components. Next, the programming software included in the microcontroller enables each component involved in the development of this product to perform a variety of directed functions.
Blynk	The Blynk app is the process of creating a link between the smartphone and the ESP8266. Therefore, the steps for this process are started by uploading the Blynk app through the Apps Store app for iPhone users or Google Play for Android users. This application will set the time taken to perform sanitation.

3. Results and Discussion

The results and discussion section presents data and analysis of the study, from the experiment that has been conducted to the Automatic Sterilization Disinfection Using IoT Application System.

a) Timer

This test was done with two differences in room space in the Officer Residential College. There are two types of rooms, and they have different room spaces. So, this test is done to test the time it takes to do sanitation in different room spaces. Table 3 and Table 4 show the timer results.

Table 3: Result between the area of Room B and Room C and the specified time of 2 minutes

Room	Area (m)	Timer	Smoke
B	3.3528×3.3528	2 minutes	Overall
C	4.8768×2.4384	2 minutes	Half

Table 4: Result between the area of Room B and Room C and the specified time of 3 minutes

Room	Area (m)	Timer	Smoke
B	3.3528×3.3528	3 minutes	Overall
C	4.8768×2.4384	3 minutes	Overall

Based on the analysis that has been done for a period, that is to spray on the room space with different areas. So, from this analysis, the researcher managed to set different time periods and different room areas to see the smoke emitted according to a predetermined time by using a mobile phone.

b) Length

The test was performed with two different distance differences, namely 10 meters and 35 meters with or without obstacles. So, this test is to test the connection network between the mobile phone used as the transmitter and the system used as the receiver. Table 5 and Table 6 show the length result.

Table 5: Results between the distance of 10 meters within terms of no detection and detection wireless signal systems

Type of Phone	Length (m)	Type of Space	Condition	Connection
I-phone	10	No Detection	Active	Ok
I-phone	10	Detection	Active	Ok

Table 6: Results between the distance of 35 meters within terms of no detection and detection wireless signal systems


Type of Phone	Length (m)	Types of Spaces	Condition	Connection
I-phone	35	No Detection	Not Active	Not Ok
I-phone	35	Detection	Not Active	Not Ok



Therefore, with reference to these results, it is proven that the type of space does not affect the connection between the mobile phone and the Wi-Fi router, but the distance affects the connection status. This is because the distance is a problem for wireless network connection (Wi-Fi) for 35 meters with or without barriers. So, this may be due to the strength of the Wi-Fi signal and the ability of mobile phones to reach the signal within 35 meters. Thus, this means that the long distance between the mobile phone and the Wi-Fi router causes the signal to weaken, the mobile phone and the Wi-Fi router cannot be connected.

c) Angle

This test was performed with three different angular differences, namely 45 °, 90 ° and 180 °, with the time taken for each rotation of the rotating rotor. So, this test is to test the time taken for each round of different angles. Table 7 shows the angle result. Based on the analysis, the time taken to complete one rotation varies. From this analysis, the researcher completes different rotations according to different rotation time periods. Moreover, each rotating rotation of the fogging smoke was successfully removed according to each rotating rotation to varying degrees.

Table 7: Time Difference for Each Different Rotation Angle

Angle (°)	Time	Diagram
0°- 45°	73 second	

0°- 90°	93 second	
0°-180°	1 minute 51 second	

c) Round Servo and Fogging Pump Machine

This test was performed with a time difference set between the servo rotation results and the resulting smoke results. So, this test is to test the functionality of the servo used with the fogging pump used to see the resulting smoke output. Table 8 shows the servo rotation results.

Table 8: Time was taken with servo rotation and the resulting smoke

Time(minutes)	Servo Rotation	Smoke
1	Rotate	Out
2	Rotate	Out
3	Rotate	Out
4	Rotate	Out
5	Rotate	Out

Based on the analysis that has been done, the researcher managed to see the functionality of the product by looking at the rotating servo rotation cycle with the resulting smoke that can be emitted according to variable timing. It proves that the objective of this project is to test the functionality of the automatic disinfection system controlled by mobile phones to work successfully.

Based on the analysis that has been conducted, shows that researchers can identify the functionality of each component used to develop a prototype of a disinfection spraying machine using IoT applications. Researchers tested the functionality of testing the length of time it takes to perform sanitation in different room space areas. In addition, the second test is the distance. This test is to test the connection network between the mobile phone used as a transmitter and the system used as a receiver. Next, angle testing, i.e., testing the time taken for each round of different angles. Finally, the servo cycle test is to test the functionality of the servo used with the fogging pump used to see the resulting smoke output.

4. Conclusion

A study conducted should be of interest to the consumer with its focus. The positive impact is also likely to affect consumers who use this product. This system will ensure that everyone will comply with the Standard Operating Procedures (TPP) in the home area. It will ensure that parents will ensure cleanliness from Coronavirus infection. In addition, this system can reduce the rate of spread of the virus in the home because a house is a place of rest for everyone. In addition, it can reduce the rate of

infection among children or the elderly from spreading to the community in Malaysia. It also helps Malaysia fight the Coronavirus disease that is plaguing and reducing existing cases. In addition, this system in cleaning each space or area in the house clean and reduces the eradication of Coronavirus infection prevention from outside the designated area make sanitation.

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