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# Development on Smart Killer Bacteria

Z. Mohamad[1], W. R. W. Omar[1], M. A. Rudi[1], N. Shafekah[1], E. Daud[1], N. Kamaruddin[1], M. Rosdi[1], R. Zakaria[1]

[1]Department of Electrical Engineering, Politeknik Sultan Salahuddin Abdul Aziz Shah, 40150 Shah Alam, Selangor, Malaysia.
Corresponding Author's Email: [1]zunuwanas@yahoo.co.uk

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**ABSTRACT** – Nowadays, in globalization era there is always the foundation of the new technologies features every year. Smart Bacteria Killer (SBK) become the most popular features which rapidly gaining its popularity due to its importance to certain applications. The lack of system of cleanliness among doctors, nurses and visitors which expose the patients to illness have been an idea to create the device. The device is designed to create a more attractive and appealing design with low cost and affordable.. The SBK development is to kill bacteria on hands of users. This tool is designed to help doctors, nurses, patients and visitors to feel comfortable and clean while visit patient, friends or relatives. The lack of system of cleanliness among doctors, nurses and visitors which expose the patients to illness have been an idea to create the device. The device is designed to create a more attractive and appealing design with low cost and affordable. The SBK required a safety ultraviolet lamp with a wavelength of 246nm to kill bacteria. The SBK can be used to all the users such as doctors, nurses, patients and visitors at the hospital for hygiene and cleanness and also free from bacteria.

*KEYWORDS :* Electromagnetic, radiation, wavelength, ultraviolet, bacteria.

## 1.0 INTRODUCTION

Ultraviolet (UV) light is an electromagnetic radiation in 400 nm to 100 nm wavelength. It is state between visible light and X-rays [1]. The source of UV radiation was present in sunlight with 290 to 400 nm wavelength range that reaches on the surface of the earth. Electric arcs like tanning lamps, mercury-vapor lamps and black light also produced UV light [2].

Long-wavelength UV radiation can cause chemical reactions, and causes many substances to glow or fluoresce that effect on human health and environment [3]. Consequently, biological effects of UV are greater than simple heating effects, and many practical applications of UV radiation derive from its interactions with organic molecules. Though usually invisible, under some conditions children and young adults can see ultraviolet down to wavelengths of about 310 nm [4], and people with aphakia (missing lens) can also see some UV wavelength while near-UV is visible to a number of insects and birds.

UV radiation can classify into three (3) types. There were Ultraviolet long wave (UV-A), Ultraviolet medium wave (UV-B), Ultraviolet short wave (UV-C). 99% of the UV radiation was reached to the earth was UV-A. UV-A and UV-B contribute to the health hazard that because of over exposure to the sun and the most harmful was UV-C. Filtered ozone layer was UV-B. Germicidal UV-C lamps kill up of most viruses, airborne bacteria and mold spores and also mold and help prevent future mold growth [5]. Time and intensity were contributed to the exposure of germicidal UV. Fundamentally equal in lethal action on bacteria, low intensities was for a long period while high intensities for a short period [6]. Killing power decreases as the distance from the lamps increases was apply to germicidal UV regarding on the inverse square law.

i) UV-C

UV-C was suggested in this research. The beneficial of using the UV-C were efficient and safe, filters and coils, Germicidal Lamp Technology and high output Lamps. Appropriate exposure time with direct exposure to 254nm was for UV-C sterilization. As a result the RNA and DNA of microorganisms like viruses bacteria, protozoa, yeast and mold spores were in inactivate [7]. By rendering them sterile or dead the microorganism are unable to reproduce. The intensity of UV-C radiation knows as dosage with microwatts per square centimetre unit is and fluency by exposure time to that radiation [8]. It is a tool measure to determine the acceptance kill rate by measuring the total amount of UV-C energy that indicate by spectrum colour and the percentage of microorganism see. Were easier to kill compare to the Mold spores hardly to kill compare to

Viruses and microorganisms, as a result much higher dosage of UV light were required. The reading of the result was in the percentage kill of microwatts per square centimetre. Table 1 shows the dosage mold spores with percentage of microorganism sees with the different spectrum colour [9].

**Table 1.** Mold Spore

| MOLD SPORES | Color | Microorganisms see (90%) | Microorganism see 90% |
|---|---|---|---|
| **Aspergillius glaucus** | Bluish green | 44,000 | 88,000 |
| **Aspergillius niger** | Black | 132,000 | 330,000 |
| **Aspergillius flavis** | Yellowish green | 60,000 | 99.000 |
| **Mucor racemosus A** | White gray | 17,000 | 352,0000 |
| **Mucor racemosus B** | White gray | 17,000 | 352,000 |
| **Oospora Lactis** | White | 5,000 | 11,000 |
| **Penicillium expansum** | Olive | 3,000 | 22,000 |
| **Penicillium roqueforti** | Green | 13,000 | 26,400 |
| **Penicillium digitatum** | Olive | 44,000 | 88,000 |
| **Rhisopus nigricans** | Black | 111,000 | 220,000 |

ii) Types Of Lamp

Germicidal UV-C lamps were divided to three common types [10]. Table 2 describe the characteristic of the types of the Germicidal UV-C lamp.

**Table 2.** Germicidal UV-C characteristic

| TYPE | CHARACTERISTIC |
|---|---|
| **Slim line lamps** | a. Instant-start<br>b. Low, high- and very high-ozone types.<br>c. Life time base on the electrode life and number of starts.<br>d. air cooling and heating systems, conveyor lines, water sterilization<br>e. not need to be turned off |
| **Cold Cathode** | a. instant-start<br>b. large cylindrical cathode coil filament,<br>c. long life unaffected by frequency of starting |
| **Hot Cathode** | a. Preheat / hot cathode<br>b. lamps generally use standard, off-the-shelf fluorescent ballasts<br>c. Economy and space<br>d. Four electrical connections per lamp.<br>e. Life time base on the frequent starts/stops. |

The implementation of this project requires two phase, which is hardware and software development. Hardware development includes Smart Bacteria Killer design and how to measure the bacteria that been killed and LCD display. In software development involves the application of Proteus, PIC controller and MPLAB software in this project. There are use of hardware motion sensor. The motion sensor on the circuit will detect the present of hands in specific distance. When the sensor detect motion above of 30cm the UV lamp will light up and start killing the bacteria. Ultraviolet (UV) light is all around us even though our eyes can't detect it. Our bodies use it to make vitamin D, but too much exposure can cause painful burns and even cancer. Although UV light can be dangerous, it is also very valuable and is used in many ways. UV light is used to identify biological materials, like blood, at crime scenes and in places where sanitation is important. Because it can kill viruses and bacteria, it is also used to sterilize medical and biological research facilities and to sanitize much of our food and water.

Ultraviolet light is one type of electromagnetic wave. Electromagnetic waves are different than waves on a string or waves that you see in water because they don't need anything to travel through. They are waves of pure energy and because of this, they can travel through empty space. They also move really quickly, traveling through space at the speed of light. All visible colors of light, as well as microwaves, X-rays, and radio waves, are also electromagnetic waves. The only difference between these types of electromagnetic waves is their frequency and wavelength. Ultraviolet waves, with wavelengths from 40-400 nanometers (nm), are those that fall between visible light and X rays on the electromagnetic spectrum. Because ultraviolet light has a frequency higher than that of visible light, it carries more energy and has the ability to penetrate our skin. Prolonged exposure to ultraviolet light can cause sunburns and DNA damage, which can contribute to the development of skin cancer.

Sunlight is the greatest source of UV radiation. Man-made ultraviolet sources include several types of UV lamps, arc welding, and mercury vapor lamps. UV radiation is widely used in industrial processes and in medical and dental practices for a variety of purposes, such as killing bacteria, creating fluorescent effects, curing inks and resins, phototherapy and suntanning. Different UV wavelengths and intensities are used for different purposes.

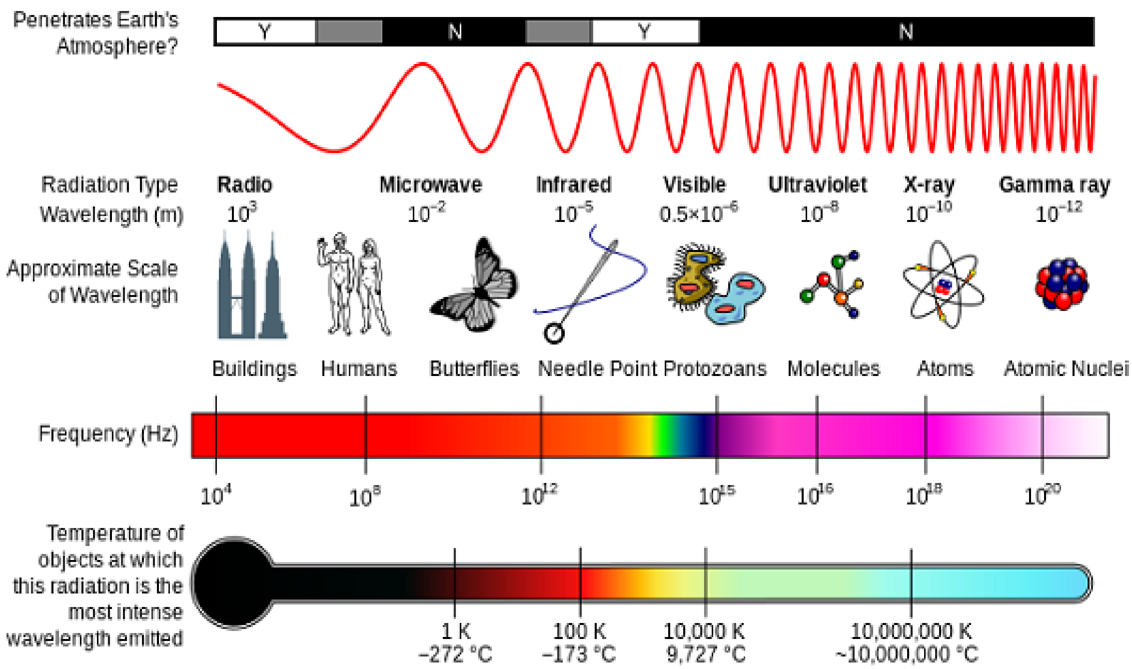


**Figure 1.** UV wavelengths and intensities

### Effect of the UV light exposure

Some UV exposure is essential for good health. It stimulates vitamin D production in the body. In medical practice, UV lamps are used for treating psoriasis (a condition causing itchy, scaly red patches on the skin) and for treating jaundice in new born babies. Excessive exposure to ultraviolet radiation is associated with different types of skin cancer, sunburn, accelerated skin aging, as well as cataracts and other eye diseases. The severity of the effect depends on the wavelength (see Figure 1), intensity, and duration of exposure.

### Effect on the skin

The shortwave UV radiation (UV-C) poses the maximum risk. The sun emits UV-C but it is absorbed in the ozone layer of the atmosphere before reaching the earth. Therefore, UV-C from the sun does not affect people. Some man-made UV sources also emit UV-C. However, the regulations concerning such sources restrict the UV-C intensity to a minimal level and may have requirements to install special guards or shields and interlocks to prevent exposure to the UV. The medium wave UV (UV-B) causes skin burns, erythema (reddening of the skin) and darkening of the skin. Prolonged exposures increase the risk of skin cancer.

## 2.0 METHODOLOGY

This chapter will discuss in detail on the process of the Smart Bacteria Killer development and Sensor detector Standard of Operation (SOP). The implementation of this project requires two phase, which is hardware and software development. Hardware development includes Smart Bacteria Killer design circuit and how to measure the bacteria that been killed and LCD display. The software development involves are of Proteus, PIC controller and MPLAB software in this project.

Figure 2 illustrates the flowchart of SOP procedure for detecting the percentage of bacteria. First is screening the sample under the UV lamp, if the percentage of bacteria detected. Figure 3 illustrated the block diagram of SBK. The processes were started with the motion sensor which is in direct contact to relay. When the current percentage of the bacteria above limit of 80%, the relay will turn from normally close to normally open and will send signal to A/D converter in PIC16F876A. The output will turn on the LCD 16X2 to show the current percentage of the bacteria and will turn on the UV lamp at the same time. When the percentage of bacteria is below 80%, the sensor will automatically turn the relay from N/O to N/C and the UV lamp and the LCD 16X2 will also turned off automatically.

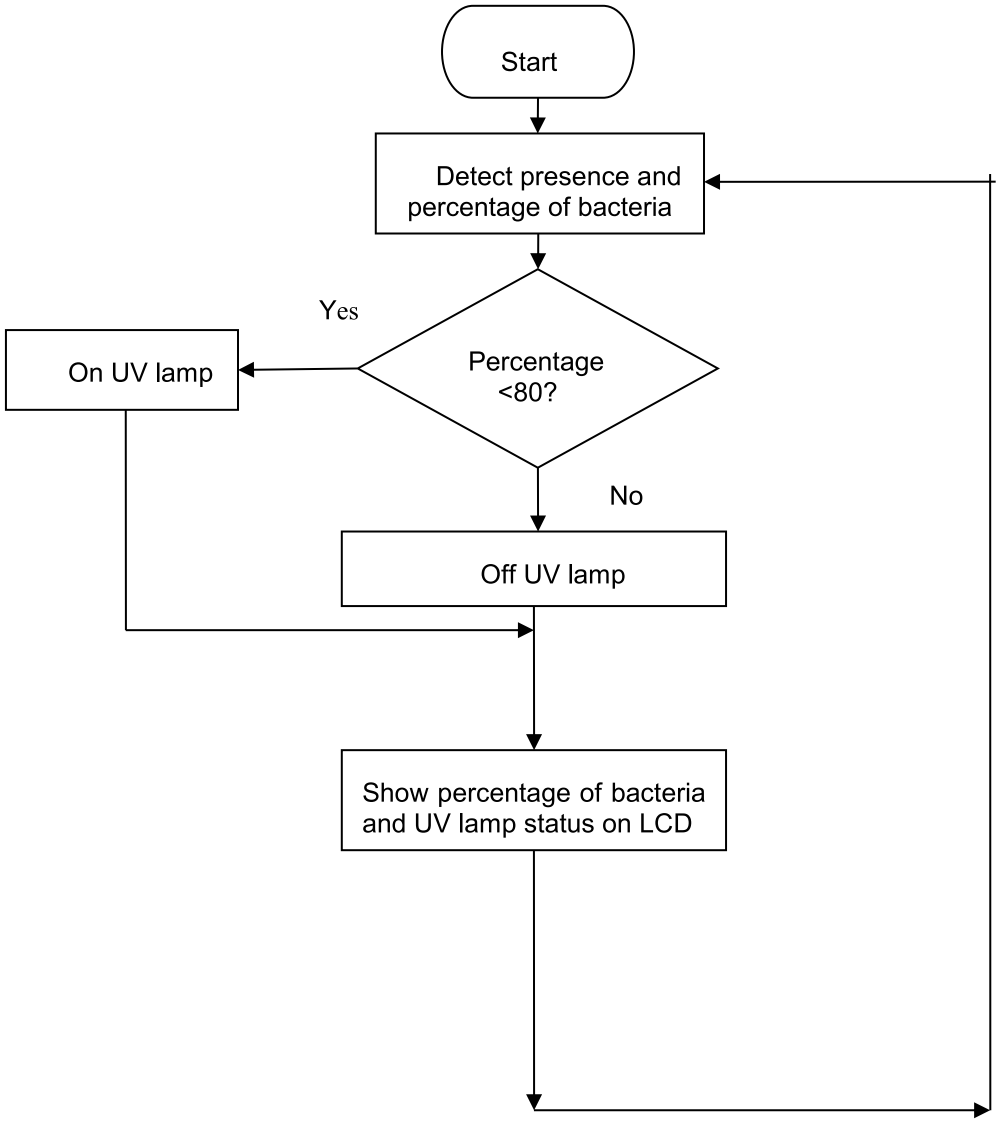


**Figure 2**. Flowchart of sensor detector Standard of Operation

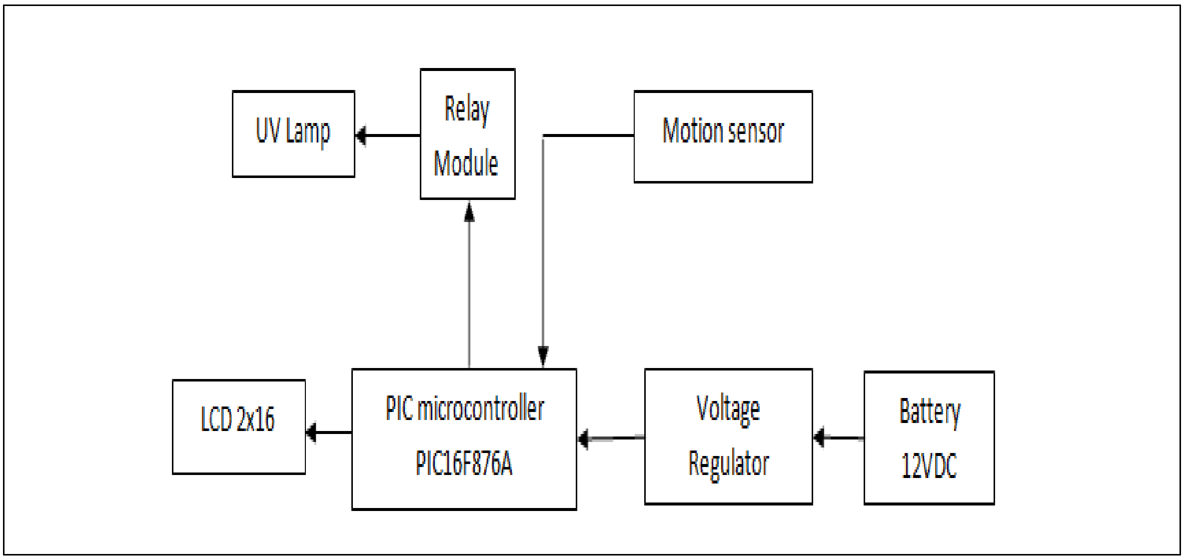


**Figure 3.** Block diagram of SBK

## 3.0 RESULT

This SBK may help people to feel comfortable and clean when entered hospitals. Besides, it can help hospital authorities to increase level of cleanliness among staffs and visitors. In addition, this project can also help to protect patients from infected by a serious disease as shown in figure 4 & 5.

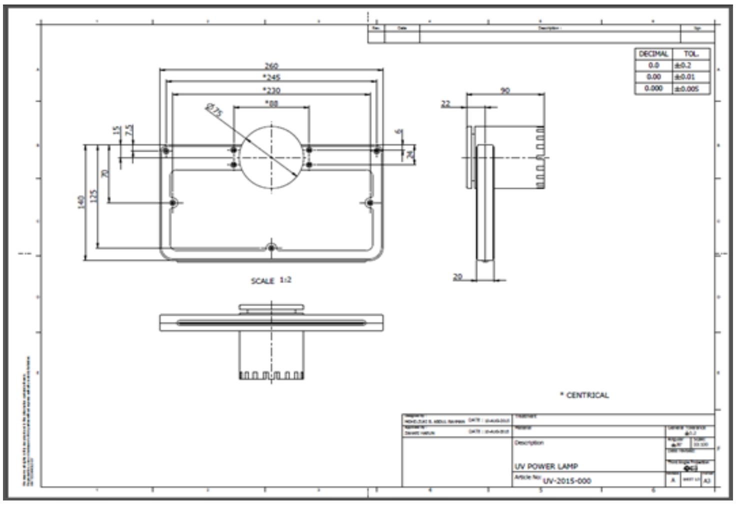


**Figure 4**. Design SBK

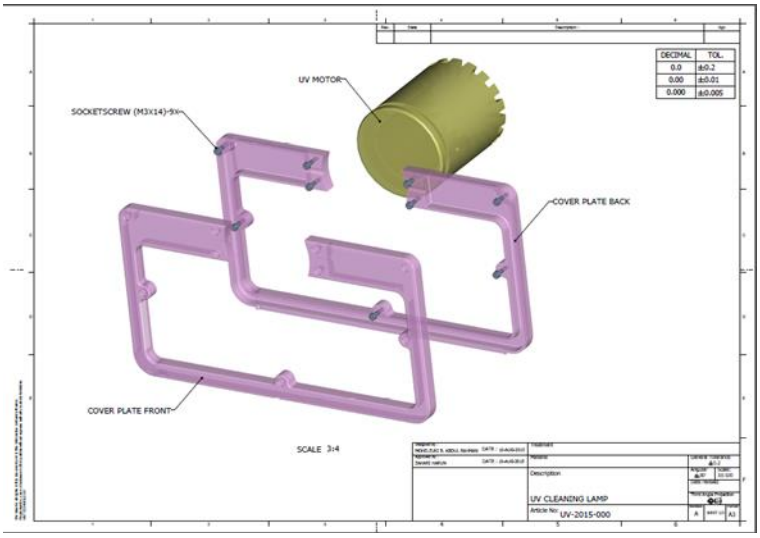


**Figure 5.** Development SBK

## 4.0 CONCLUSION

Smart Bacteria Killer (SBK) is design to detect and than kill the bacteria when the percentage of bacteria is below 80%, screening microorganisms and viruses exposure through ultraviolet that will fluencies of time and intensity. It is recommended especially in the intensive care unit (ICU) need to practices in order to make safer and maintaining health and preventing disease, especially through cleanliness means free from bacteria and so that he disease does not spread. Finally, this project gives benefit for hospital and industries because it was an innovation of something that expensive and able to reduce the cost.

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