IOT Model - UV based system for Sanitization of package surfaces

Anil Kumar Yadav¹, Dharmveer Singh Rajpoot², Shiv Shankar Prasad Shukla³

¹IES University, Bhopal, ²JIIT Noida, ³ICFAI University, Jharkhand
aky125@gmail.com, drdharmveer16382@gmail.com, ssp.shukla@iujhakhand.edu.in

Abstract. Global issue corona pandemic and lock down has stopped the human life or disturbed. But this situation will not continue for longer period. Normality will take place and life smoothen, but people will fear at workplace due to unknown factors of the corona pandemic, they will be in a dwell mind situation whether to touch the things or not. In this research to mitigate or avoid such situation to think develop IOT devices along with a programmable-Ultra-Violet (UV) based system for sanitization of package surfaces. In this paper, we proposed an emphasized artificial intelligence based IOT - UV system for Sanitization of package surfaces, also developed novel algorithm for the IOT-UW based devices to enhance the efficiency of the disinfection devices in the context of low energy consumption. In order to evaluate performance of IOT-UW will be more efficient than Programmable-UV light in the context of low energy consumption.

Keywords: UV light Controller, Device Driver, conveyor, enclosure

1 Introduction

Artificial intelligence based Internet of thing play vital role in covid-19 pandemic situations as an IOT-Ultra Violet (UV) for the sanitization of object surface like products delivery and other materialistic things. IOT-UV along with artificial intelligence provides solutions for delivery products to the various companies like Amazon, reliance mart and many more from various disinfections [1]. In this concept integrated model IOT and UV along with artificial intelligence for delivery package and products and also automated with micro controlling devices. Earlier many projects based on disinfection devices have been done had using cabinet disinfection mechanism to sanitized objects. It also used for mobile or host system online shopping and mall delivery using this technology and API combination [2, 3, 4]. Ultra violet (UV) used for disinfect for sanitization of the object surfaces.
The delivery of disinfected products like eatable food, vegetables etc. are more secure using internet of thing (IOT) along with automated ultraviolet. This process has been done by delivery man to the given home address through mobile application [5-6]. During operation of such technology real time operation Bluetooth connection should be proper way and it also monitor UV connection. Hardware used in IOT devices governed by 5V/2A power storage that is efficient for backup to fully charged 1000mAh may perform sequentially.

This UV machine automatically stopped after single given by sensor and it will be stopped for few second and it disinfect material like bag etc. surface from covid-19 viruses. IOT given the security to the user to make sure without affected viruses delivery safely moved out [7].

Combined this technology for post covid-19 product delivery from virus free along with ecosystem, with disinfection evidence to the user home delivery the checked and received .It is given trust and believe to the user that no virus affected in to the object [8].

Global issue corona pandemic and lock down has slowed down the human life. The fear of infection through not only direct contact but also through surfaces likely to have been touched by infected persons has led to the cleaning of packets, containers and even vegetables with soaps and detergents. It is notable that ingestion of detergent and similar molecules itself can pose problems to human body. Thus, there is a need for developing programmable disinfection units, which automatically move the packets to be sanitized on a conveyor belt from the entry end, hold them for specified period of time under UV irradiation and then move out to the delivery end. This system will stop the possibility of detergent/soap and such molecules entering the human body [9]. The development of above described unit will require developing codes (programs) for movement, holding and then again movement of conveyor belt to carry the packages from entry to delivery end of the proposed disinfectant system. The sensors at entry end, holding place (inside the enclosure) and delivery end will control the conveyor belt movement. Such systems will be needed in large numbers in different types of manufacturing units/factories, shops, stores for a non-touch disinfection of goods enclosed in packets. To this end, suitable codes/programs will be developed to integrate conveyor belt movement, functioning of UV light sources, and programmable holding time of packets/goods through appropriate sensors [10]. The mechanical system will be fabricated using conveyor belt, motors, and controllers etc., contained in an enclosure. This enclosure will be fitted with UV light sources from different angles to enable disinfection of all surfaces of packets/goods. The corona epidemic may be overpowered soon but the need to disinfect surfaces likely to have been exposed to viruses will continue in future. Hence there is a need to develop the proposed disinfection units for different types of packages.

Normalcy will take place and life smoothen, but people will fear at workplace due to unknown fear of the corona pandemic, they will be in a dwell mind situation whether to touch the things or not. In this research to mitigate or avoid such situation to think develop IOT devices along with a programmable-Ultra-Violet (UV) based system for sanitization of package surfaces. It is emphasized artificial intelligence based IOT - UV system for Sanitization of package surfaces.

The development of above described model has been required to developing instruction or programs for movement, holding and then again movement of conveyor belt to carry the packages from entry to
delivery end of the proposed disinfectant system. The sensors at entry end, holding place (inside the enclosure) and delivery end will control the conveyor belt movement.

2 Proposed Model and Methodology

Artificial intelligence-based Internet of thing play vital role in covid-19 pandemic situations as an IOT-Ultra Violet (UV) for the sanitization of object surface like products delivery and other materialistic things. IOT-UV along with artificial intelligence provides solutions for delivery products to the various companies like Amazon, reliance mart and many more etc. from various disinfections [1]. This involved three Stages: Disinfection devices (hardware assembling), and Programming of control unit and the mobile application. First of all, goods or materials placed into the disinfection device in proper way then control unit signal and auto switch on to start the UV light within device after few second hold sanitized goods released and all system govern through device program with mobile application or desktop.

![Diagram of Programmable and UV based automated disinfection system](image_url)

Fig1. Shows model of Programmable and UV based automated disinfection system

In figure 2, device consists of compact enclosure in which UV (ultra violet) light is fitted and a conveyor is passing through it. Conveyor is loaded with desired objects at one end of the enclosure and moved towards the other end of the enclosure, passing under intelligent sensor to recognize and identify the position of object and conveyor movement stops at the other end of the enclosure by the action of another sensor. The loaded conveyor will stop inside the enclosure for few seconds (55seconds) of time interval, this is the soaking period of UV light by the surface of the objects, then the conveyor will again move out of enclosure and objects are ready for picking up. At the same time other end is ready for objects loading and same cycle will be repeated again and again.
Fig. 2 Schematic representation of disinfection devices

3 Working Procedure and Novel Algorithms

The working procedure of the above model is described as IoT & AI Cloud Suite; IOT-UV along with artificial intelligence provides solutions for delivery products to the various companies like Amazon, reliance mart products, and packages. Thus, the algorithm for the following disinfection device is as follows:

Step: 1 Start PC or mob app and install disinfection device driver.
Step: 2 after installation execute the app
Step: 3 auto test the device connection: If disinfection device connected by Bluetooth to the system, then the blue LED is turn on.
Step: 4 Set the socking time
Step: 5 Click on the “activate” button. System shows the state of disinfection device as activated. The red LED will turn on start blinking, these light shows loading goods on conveyors.
Step: 6 Input goods
Step: 7 Disinfection process will start
Step: 8 conveyors will start and move towards end of enclosure intelligent sensor
identify goods inside enclosure if yes the red LED will switch from blinking to continuous and UV lamps will turn on.

Step: 9 sound of buzzer emitting short beep

Step: 10 Socking of goods enabled i.e. the loaded conveyor will stop inside the enclosure for desired period of time interval; this is the soaking period of UV light by the surface of the goods.

Step: 11 collect sanitized goods, at the same time other end is ready for objects loading and same cycle will be repeated again and again.

Step: 12 Exit.

4 Applications and advantages

From the write up presented under various headings in this proposal, it is clearly established that the developed system will be useful in a large number of sectors for practical applications. These include:

• Airports and Railway stations where luggage surface disinfection before entering the facility crowded by a large number of people
• In Banking sector where currency notes will be required to be disinfected.
• Malls & Marts and shops for disinfecting packaged merchandise.
• Sports material disinfecting before use by players.

Following are the advantages of the machine

• The machine is versatile in use in the field.
• Machine can disinfect any object irrespective of size and shape (under machine capacity).
• Easy to handle
• Unskilled worker can operate
• System can be installed at shops, industries, mall & Marts, railway station, Banking and airport and pantry etc.
• Unskilled worker can operate
• System can be installed at shops, industries, mall & Marts, railway station,
  Banking and airport and pantry etc.

5 Conclusion and Future Work

We conclude that programmable IOT-UV based Disinfection system is the more effective and better efficiency in the context of low energy consumption. Inelegance IOT with UV light reduced the energy consumption. The artificial intelligence algorithm may be utilized as optimization. The developed System can be installed at shops, industries, mall & Marts, railway station, Banking and airport and pantry etc.

5
References

[1] John Boyce, Nancy L. Havill and Brent A. Moore. Terminal Decontamination of Patient Rooms Using an Automated Mobile UV Light (2011) journal of infection control and hospital epidemiology vol. 32, pp.1-7
[2] Maureen Spencer, Michelle Vignari, Elizabeth Bryce Helen Boehm Johnson, Loretta Fauerbach, Denise Graham. A model for choosing an automated ultraviolet-C disinfection system and building a case for the C-suite: Two case reports (2017). American Journal of Infection Control 45 (2017) pp. 288-92.
[3] Sara E. Beck. UV LED Disinfection (2018). Swiss federal institute of aquatic science and technology Vol. 20 pp 1-7.
[4] Beatrice Casini, Benedetta Tuvo, Maria Luisa Cristina, Anna Maria Spagnolo, Michele Totaro, Angelo Baggiani and Gaetano Pierpaoilo Privitera . Evaluation of an Ultraviolet C (UVC) Light-Emitting Device for Disinfection of High Touch Surfaces in Hospital Critical Areas (2019). International Journal of Environmental Research and Public Health, Vol.16,pp.1-10.
[5] Marcel Bentancor, Sabina Vidal. Programmable and low-cost ultra violet room disinfection device (2018) journal of elsevier vol. 46, pp.1-13,
[6] Weber DJ, Rutala WA, Miller MB, Huslage K, Sickbert-BennettE. Role of hospital surfaces in the transmission of emerging health care-associated pathogens: norovirus, Clostridium difficile, and Acinetobacter species. Am J Infect Control 2010, pp.25–33.
[7] Sehulster L, Chinn RY, Centers for Disease Control and Prevention, Healthcare Infection Control Practices Advisory Committee. Guidelines for environmental infection control in healthcare facilities: recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC). MMWR Recomm Rep 2003, pp. 1–42.
[8] Rutala WA, Weber DJ, Healthcare Infection Control Practices Advisory Committee. Guideline for disinfection and sterilization in healthcare facilities, 2011pp.378-385.
[9] Carling PC, Parry MF, Von Beheren SM; for the Healthcare Environmental Hygiene Study Group. Identifying opportunities to enhance environmental cleaning in 23 acute care hospitals. Infect Control Hosp Epidemiology 2008, pp.1–7.
[10] Griffith CJ, Obee P, Cooper RA, Burton NF, Lewis M. The effectiveness of existing and modified cleaning regimens in a Welsh hospital. J Hosp Infect 2007, pp.352–359.
[11] Dancer SJ, White L, Robertson C. Monitoring environmental cleanliness on two surgical wards. Int J Environ Health Res 2008, pp.357–364.