Ultraviolet Disinfection Apparatus A Research Journal Presented to the Faculty of the College of Computer Engineering AMA College of Calamba

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ABSTRACT
Pandemics are large-scale outbreaks of infectious diseases that can significantly increase morbidity and mortality over broad geographic areas and cause significant economic, social, and political disruption. This research presents an integrated approach to ultraviolet-C (UV-C) disinfection systems capabilities designed for healthcare, educational, and commercial environments. Data gathered by surveys conclude that disinfection devices are needed in establishment premises and buildings. This thesis project will be placed in different areas and sanitized locations. This kind of sanitizing method had a broad range of effects and had several advantages.

Keywords: UV-C Disinfection, Infection Control, Microbial Validation,

INTRODUCTION

Ultraviolet-C (UV-C) light lamps have gained significant attention as a modern solution for disinfection, particularly in the wake of global health challenges such as the COVID-19 pandemic. UV-C light, which operates within the 200–280 nm wavelength range, is highly effective in inactivating harmful microorganisms by disrupting their DNA or RNA, preventing replication and infection. As a result, UV-C lamps are now widely used in healthcare settings, public spaces, and even homes to reduce the spread of viruses, bacteria, and other pathogens. Despite their effectiveness, many UV-C devices lack user-friendly features that confirm proper usage and ensure safety during operation. This study aims to design and develop a UV-C light lamp that not only delivers effective disinfection but also includes intuitive features for real-time monitoring, safety, and ease of use for both professionals and general users.

FRAMEWORK

THEORITICAL FRAMEWORK

UVC lamps emit ultraviolet light between 200 and 280 nm, which damages the DNA or RNA of microorganisms, preventing them from replicating and effectively inactivating them. These lamps produce UVC light which disrupts harmful pathogens without chemicals. The UVC light is absorbed by the genetic material, causing mutations like thymine dimers in DNA, rendering the pathogen harmless. UVC disinfection is highly efficient, chemical-free, and effective against a wide range of pathogens, including bacteria, viruses, and fungi.

CONCEPTUAL FRAMEWORK

POWER SUPPLY - is a device that provides electrical energy to power electronic circuits or equipment.
ADAPTER - is a device that enables compatibility between different types of connectors or power sources. It typically converts electrical voltage, current, or signal type to match the requirements of a specific device.
MICROCONTROLLER - is a small, integrated computer on a single chip that contains a processor, memory, and input/output peripherals. It is commonly used to control embedded systems and perform specific tasks in devices like appliances, cars, and robots.
UVC LAMP - is a type of ultraviolet light that emits UVC radiation, which is effective in killing or inactivating harmful microorganisms like bacteria and viruses. It is commonly used in disinfection applications, such as water purification, air sanitization, and surface cleaning.

OBJECTIVES OF THE STUDY

The goal of this study is to develop an integrated framework for UV-C disinfection. This framework aims to enhance the effectiveness of UV-C disinfection by ensuring proper application and verification. It seeks to improve usability by making the system accessible to users with varying levels of technical expertise. The study will validate these systems through testing to ensure accurate microbial reduction and disinfection efficacy. Ultimately, the framework aims to make UV-C disinfection more reliable and verifiable across diverse environments.

METHODOLOGY

This study used a mixed-methods approach, combining laboratory testing, engineering development, and field validation to create a monitoring framework for UV-C disinfection systems. The process included four phases: developing reliable methods for measuring UV-C dosage, designing user-friendly visual display systems, validating microbial reduction through lab testing, and deploying the systems in real-world settings. The foundation development involved identifying key UV-C parameters, designing multi-point sensors, creating algorithms for disinfection metrics, and developing intuitive interfaces. The final framework bridges technical data and user-friendly verification, ensuring both scientific accuracy and practical usability.

RESEARCH DESIGN

Designing a UV-C light lamp for effective disinfection requires selecting an appropriate light source, such as mercury vapor, LED, or pulsed-xenon, with wavelengths around 260 nm for optimal germicidal activity. Ensuring uniform irradiance distribution involves designing reflectors and enclosures to minimize shadowed areas and achieve consistent surface disinfection. Incorporating safety features, including automatic shut-off mechanisms during maintenance or when the lamp is not properly enclosed, is crucial to prevent direct UV-C radiation exposure. Finally, conducting rigorous performance validations against relevant pathogens ensures compliance with established standards and guidelines, confirming the lamp's disinfection efficacy

PARTICIPANTS OF THE STUDY

This study employed a purposive sampling technique to select participants with relevant knowledge or experience in disinfection practices, particularly in healthcare, commercial, and residential settings. The sample consisted of 20 respondents from diverse backgrounds including healthcare professionals, facility managers, residential homeowners.

DATA COLLECTION AND INSTRUMENT

Data were collected through an online survey distributed via Google Forms. The survey form was composed of two major parts: Part A focused on the importance and perceived need for UV-C disinfection, while Part B explored the specific reasons participants believed UV-C disinfection was necessary. The questionnaire consisted of structured multiple-choice questions, Likert scale items, and open-ended responses to ensure comprehensive data collection on both qualitative and quantitative levels. The questionnaire consisted of 20 items divided into two major sections:

Part A: Importance and Need for UV-C Disinfection

This section contained 10 questions using a 5-point Likert scale (1-Strongly Disagree to 5-Strongly Agree) to assess participants' perceptions regarding the importance of enhanced disinfection methods. Questions focused on awareness of pathogens, concerns about current disinfection practices, and perceived need for advanced technologies.

Part B: Why We Need UV-C Disinfection

This section comprised 10 questions exploring specific factors driving interest in UV-C technology, including effectiveness against various pathogens, implementation feasibility, cost considerations, and safety concerns. This section used a combination of Likert scale questions, multiple-choice items, and rank-order questions to gather comprehensive data on attitudes toward UV-C disinfection technology.

DATA ANALYSIS

The responses from the Google Forms survey were compiled and analyzed using basic descriptive statistical methods. Charts and graphs were generated to present frequency distributions, percentage responses, and trend patterns based on participant feedback. The data were then interpreted to determine general agreement, identify knowledge gaps, and highlight significant perceptions regarding UV-C disinfection. These findings were instrumental in drawing conclusions about the public's awareness and demand for UV-C disinfection technology.

RESULT AND DISCUSSION

CONCLUSION

Creating a UV sanitation lamp can be successful project with the potential to address hygiene and cleanliness challenge.by addressing safety, design and effectiveness, it can become a valuable tool in the ongoing fight against viruses

RECOMMENDATION

The UV-C device could be developed having more lamps and with higher wattage whenever found essential. Safety features for the device can be included to protect from any external collision.

ETHICAL STATEMENT

This study on UV-C lamps adheres to ethical guidelines by ensuring that all participants are fully informed of the study's purpose and potential risks, with their consent obtained prior to participation. We are committed to maintaining the confidentiality and privacy of all data collected, ensuring the safety and well-being of all involved. Additionally, the study prioritizes non-harmful methods and the responsible use of UV-C technology, following appropriate safety protocols to prevent any adverse effects.

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