**P.L.A.N.E.T.: Portable Luminol Analysis for Navigating Evidence Trails**

Mac Hideyoshi P. Asoi ¹, Ceejay C. Imperial ², Jamier Ivan Madrid ³, Paul Gerald T. Sebastian ⁴

¹Information Technology

²College of Computer Studies

³Research Development and Innovation Center

⁴Our Lady of Fatima University

⁵Research Adviser

September 2024

1. Introduction

The investigation of crime scenes is a critical aspect of law enforcement, where the effective detection of biological evidence can significantly impact case outcomes. Among the various methods employed, luminol is a well-established reagent used to reveal traces of blood and other bodily fluids, even when they are not visible to the naked eye. However, the conventional application of luminol often presents challenges, including the need for specialized equipment and expertise. This project proposes the development of P.L.A.N.E.T. (Portable Luminol Analysis for Navigating Evidence Trails), a compact and user-friendly tool that enables law enforcement officers to quickly and effectively apply luminol in the field, enhancing the overall efficiency of crime scene investigations.

2.0 Background of the Study

Forensic science has evolved significantly over the past few decades, yet the detection of biological evidence remains a persistent challenge in many investigations. Traditional luminol testing involves complex procedures and can be time-consuming, often requiring laboratory analysis after the initial fieldwork. Moreover, access to advanced forensic tools is limited in rural or underserved areas, where timely evidence collection is crucial. By leveraging Raspberry Pi technology, P.L.A.N.E.T. aims to bridge this gap by providing a portable solution that empowers officers to perform on-site luminol tests. This innovation not only streamlines the evidence-gathering process but also contributes to a more proactive approach in solving crimes, ultimately enhancing the effectiveness of the criminal justice system. Through this project, we seek to improve the accessibility and efficiency of forensic tools available to law enforcement, ensuring that critical evidence is not overlooked.

3.0 Statement of the problem

The effectiveness of crime scene investigations heavily relies on the timely and accurate detection of biological evidence, such as blood and bodily fluids. Traditional luminol testing methods are often cumbersome and require specialized training and equipment, which can delay the investigative process. This limitation is particularly pronounced in remote or underserved areas where law enforcement may lack access to advanced forensic technology. Consequently, critical evidence may be overlooked, impacting the resolution of cases and the overall effectiveness of the criminal justice system.

3.1 Main Problem

The primary issue is the lack of accessible, efficient, and user-friendly tools for conducting luminol tests in the field, which hampers the timely detection of biological evidence during crime scene investigations.

3.2 Specific Problem

Complexity of Current Methods: Traditional luminol application requires extensive training and knowledge, making it challenging for first responders and officers without forensic backgrounds to effectively utilize it.

Lack of Portability: Existing luminol testing equipment is often bulky and not easily transportable, limiting its use in varied environments and urgent situations.

Delayed Results: The need for laboratory analysis of luminol tests can result in significant delays in obtaining evidence, slowing down investigations and potentially jeopardizing cases.

Inconsistent Application: Variability in how luminol is applied and assessed by different users can lead to inconsistent results, reducing the reliability of the evidence gathered.

Limited Availability of Forensic Resources: Many law enforcement agencies, particularly in rural or underserved areas, lack access to advanced forensic tools and technologies, hindering their investigative capabilities.

4.0 Objective of the Study

The primary objective of this study is to develop P.L.A.N.E.T. (Portable Luminol Analysis for Navigating Evidence Trails), a user-friendly and portable luminol testing tool that enhances the efficiency and accessibility of biological evidence detection during crime scene investigations.

4.1 General Objective

The general objective of this study is to create an innovative portable luminol analysis system that empowers law enforcement officers to effectively and quickly detect biological evidence in the field, thereby improving the overall efficiency of crime scene investigations.

4.2 Specific Objective

Design and Development: To design a compact and portable device that integrates a luminol application mechanism with user-friendly controls and real-time data analysis capabilities.

User Training and Accessibility: To provide comprehensive training materials and support to ensure that law enforcement personnel can effectively utilize the device without requiring extensive forensic training.

Field Testing and Validation: To conduct field tests to evaluate the effectiveness and reliability of the portable luminol tool in various crime scene conditions and scenarios.

Data Collection and Analysis: To implement a data collection system that logs luminol test results, environmental conditions, and user feedback for further analysis and improvement of the tool.

Collaboration with Law Enforcement: To engage with law enforcement agencies to gather insights and feedback throughout the development process, ensuring the tool meets their practical needs and enhances their investigative capabilities.

5.0 Scope and Limitation

Scope: The P.L.A.N.E.T. project focuses on developing a portable luminol analysis tool specifically designed for use in crime scene investigations. The scope includes:

Target Users: Primarily law enforcement officers and first responders who require efficient methods for detecting biological evidence in various field conditions.

Functionality: The tool will provide capabilities for applying luminol, capturing results, and logging data for subsequent analysis.

Field Testing: The project will involve testing the tool in diverse environments, including urban, rural, and remote locations, to assess its effectiveness in real-world scenarios.

Limitations:

Chemical Limitations: The effectiveness of luminol can be influenced by environmental conditions, such as the presence of light, surface materials, and the age of the biological evidence, which may limit detection in certain situations.

Training Requirements: While the tool aims to simplify the process, users may still require basic training to ensure proper application and interpretation of results.

Resource Availability: The project may face constraints in terms of funding, materials, and access to testing environments, which could affect the development timeline and thoroughness of field tests.

Technology Limitations: The reliance on Raspberry Pi and integrated sensors may introduce challenges in terms of durability and performance in varying field conditions.

6.0 Significance of the study

The P.L.A.N.E.T. project is significant as it addresses a critical need for efficient and accessible forensic tools in crime scene investigations. By developing a portable luminol analysis tool, the study enhances the ability of law enforcement officers to detect biological evidence quickly and accurately, thereby improving the overall effectiveness of investigations. This accessibility is particularly beneficial for agencies in rural and underserved areas, where resources may be limited. Additionally, the project provides training materials, empowering personnel to utilize advanced forensic methods with confidence. Ultimately, the timely detection of biological evidence can lead to more successful case resolutions, contributing to a more effective criminal justice system. Furthermore, the data gathered will serve as a foundation for future research and innovation in forensic technology, fostering ongoing advancements in the field.