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Smart Pepper Spray With Gps And Camera Integration

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Abstract: The proposed Smart Pepper Spray is an advanced self-defense device that provides personal security through the integration of modern technology in contrast to traditional pepper spray the device includes GPS tracking and a high-resolution camera which monitors location surveillance in real time and provides visual evidence of emergency visual evidence the device is equipped with a sensor that provides GPS - as sow which GPS-as sow uses the amount spent record and store integrated cameras and film material from incidents that may serve as important evidence for film enforcement agencies compact and user-friendly design ensures portability and user-friendly while operating the system for long-term reliability with a rechargeable battery.

Index Terms – Smart Pepper Spray, Microcontroller ESP8266, Push Button, Servomotor, Bluetooth Module HC-05, Web Camera, Charge Controller Module.

I. INTRODUCTION

In today's world, personal safety has become a top priority, particularly for individuals living in densely populated urban areas or remote, isolated regions. While traditional self-defense tools like pepper spray are effective for immediate protection, they fall short in providing extended support such as real-time alerts, evidence collection, or instant assistance.

The increasing rate of crimes and the demand for faster emergency responses have highlighted the need for smart, technology-driven safety solutions. To address this, a revolutionary smart pepper spray system has been developed, combining the physical deterrent of conventional pepper spray with modern advancements in IoT, GPS, GSM, Bluetooth, and camera technologies.

This intelligent device not only offers physical defense but also acts as a comprehensive safety tool. Upon activation via a push-button trigger, the device instantly releases the pepper spray through a servomotor mechanism and simultaneously initiates a safety protocol. This includes sending emergency SMS alerts with real-time GPS location to pre-registered contacts or authorities, capturing a 10-second video of the incident, and sharing it via platforms like Telegram for real-time evidence. designed for use in hospitals, offices, schools, and public spaces, this robot minimizes human exposure to contaminated areas while improving sanitization efficiency. By combining AI-driven automation and robotics, this project provides an innovative solution to maintaining hygiene, reducing the spread of infections, and promoting a safer environment in high-risk areas.

II. Literature Survey

"Intelligent wearable for personal security" by Smith J and Brown L. It will focus on identifying the wearable features crucial for emergency situations, especially for vulnerable groups, as highlighted in the paper's abstract and introduction. The plan includes analyzing the role of GPS and GSM integration and its relevance to the communication aspects of the Smart Pepper Spray project.[1].

Smart wearables for personal security offer innovative solutions for individual safety, particularly benefiting vulnerable groups. These devices utilize sensors, GPS, and communication technologies to improve detection and response in emergencies. Research in this area emphasizes data protection and technical requirements for effective emergency campaign systems. [2].

These papers' real-time location tracking and cloud integration Zhang w and Chen h was made public in IOT transactions this article explains the use of GPS and GSM modules in real-time tracking applications, especially on devices used for individuals and properties the author examines the reliability and drawbacks of GSM-based communications in various geographical regions and evaluates the cloud memory of video.[3].

Personal Security and portable technology this paper by Williams and Taylor offers an overview of wearable security devices, including those with audiovisual capabilities, GPS, and GSM modules. The research classifies these devices by features like warning systems and camera evidence collection, which is highly relevant to the development of smart pepper spray [4].

"Personal Safety and Wearable Technologies" by Williams and Taylor (2021) reviews wearable safety devices using audio-visual data, GPS, and GSM for emergencies. The paper categorizes devices by alert mechanisms and camera evidence collection, which is relevant to smart pepper spray. User feedback on usability and effectiveness is included, offering design insights. Innovations like smart bracelets aim to automate personal safety through discreet alerts [5].

IoT cloud-based data management for security applications by Nguyen and Patel (Cloud 2020) is crucial for smart pepper spray cameras and data storage. Cloud platforms offer extensive memory and computing resources for large IoT data.[6].

Technically-compatible solutions for women's safety are reviewed by Li and Singh, highlighting the efficiency, limitations, and user adoption of current technologies. Their overview covers GPS, GSM, and camera technologies in personal security devices, identifying areas of success and needed improvement.[7].

In IOT based safety devices for women this works by dr d Revathi Sanjeevi k s Sanjeev a Manoj Kumar m Kalais elvan j these devices can alert nearby people and law enforcement authorities when users are at risk portable devices such as bracelets have been developed to monitor physiological parameters and environmental conditions [8].

This paper analyzes various navigation algorithms, including A*, Dijkstra, and dynamic path planning methods. It finds that real-time path correction using sensor feedback enhances robot efficiency. The research concludes that combining sensor-based navigation with AI decision-making ensures smooth movement in complex environments.[9].

Self-defense system for women security with places this paper is p Gourishankar t Logeswaran v Surendar s published by Vasanth journal of personal security and wear able technology 2017 the development of self-defense systems for women's safety that contain location tracing has been a major focus in these systems hope to support recent research provide immediate through innovative technology and improve personal security [10].

women's safety devices and application femme this paper was published by Pavithra Gunasekaran journal of personal security and wearable technology 2017 in worldwide there are many crimes against women.[11].

a smart ring for women's safety based on the raspberry pi this paper was published by Navya r sigil Priya Chatterjee u Nethra v Suma published in 2013 this paper aims to design more accessible and portable devices to help victims contact family and friends in emergencies.[12].

Problem Identification

Many individuals, especially women and vulnerable groups, face the risk of harassment, assault, or physical attacks in public spaces. In emergencies, victims may not have the opportunity to call for help or communicate their location to authorities or trusted contacts.

III. Objectives

Implement a button-based trigger mechanism to activate the servo motor, ensuring reliable and controlled pepper spray release. Provide quick protection against potential threats with minimal user effort. Integrate a HC O5 Bluetooth module to send real-time emergency messages to pre-configured contacts. Enable users to store multiple emergency contacts for better reach and response.

IV. Methodology

The smart pepper spray system operates using an integrated ESP8266 microcontroller, a servomotor for spray activation, and communication modules for GPS tracking, video recording, and live streaming. The methodology of the system is explained as follows:

The system is powered by a regulated power distribution circuit, ensuring stable voltage supply to all components, including the ESP8266 microcontroller, servomotor, Bluetooth module, GPS module, and camera.

The system is triggered manually by pressing a push button, which sends a signal to the ESP8266 microcontroller, initiating the emergency response.

The ESP8266 receives the activation signal from the push button and processes the necessary commands. It controls the servomotor, which physically activates the pepper spray mechanism. The ESP8266 communicates with the HC05 Bluetooth module and GPS module to retrieve the location details.

The microcontroller sends a signal to the servomotor, which mechanically operates the pepper spray nozzle, releasing the spray toward the attacker.

The HC05 Bluetooth module connects with a mobile device for sending emergency messages. The GPS module retrieves the real-time geolocation coordinates of the user.

The system supports live streaming of the situation via a connected dashboard, allowing law enforcement or emergency respond in real-time.

A. Block Diagram

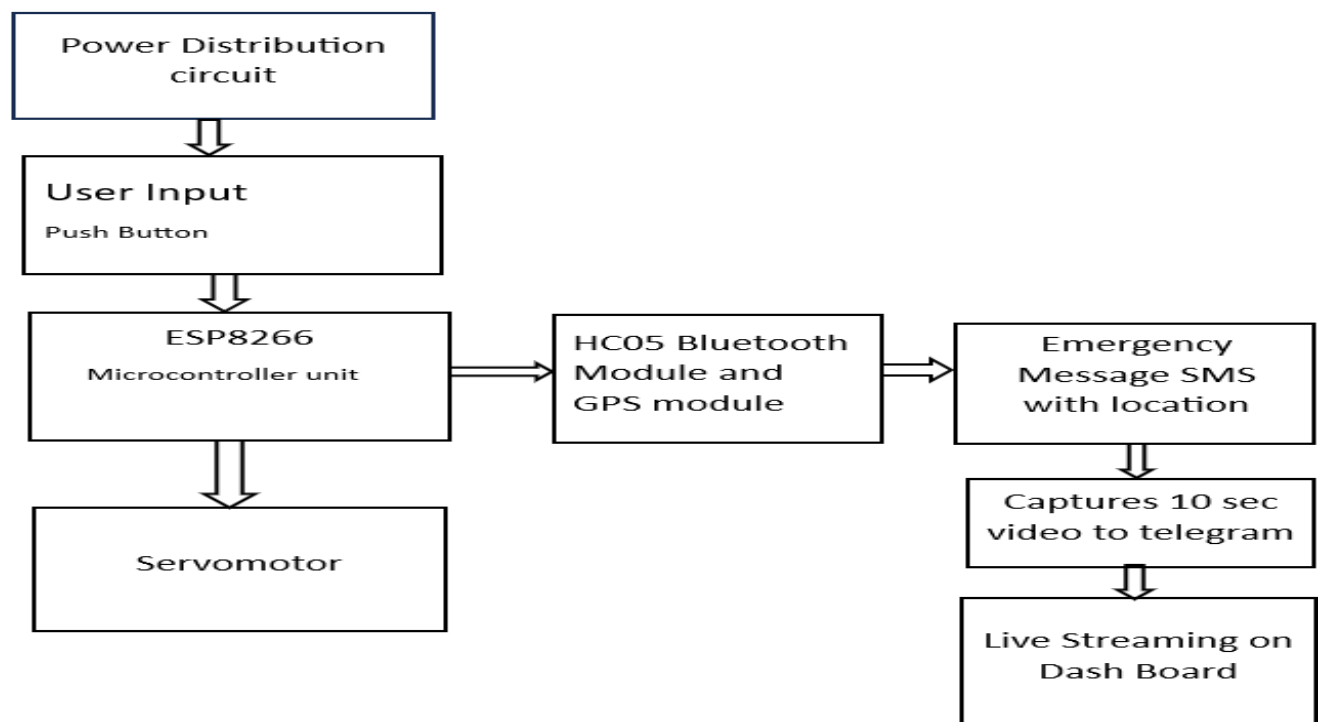


Figure 1: Block diagram of Smart Pepper Spray with GPS and Camera Integration

B. Flowchart

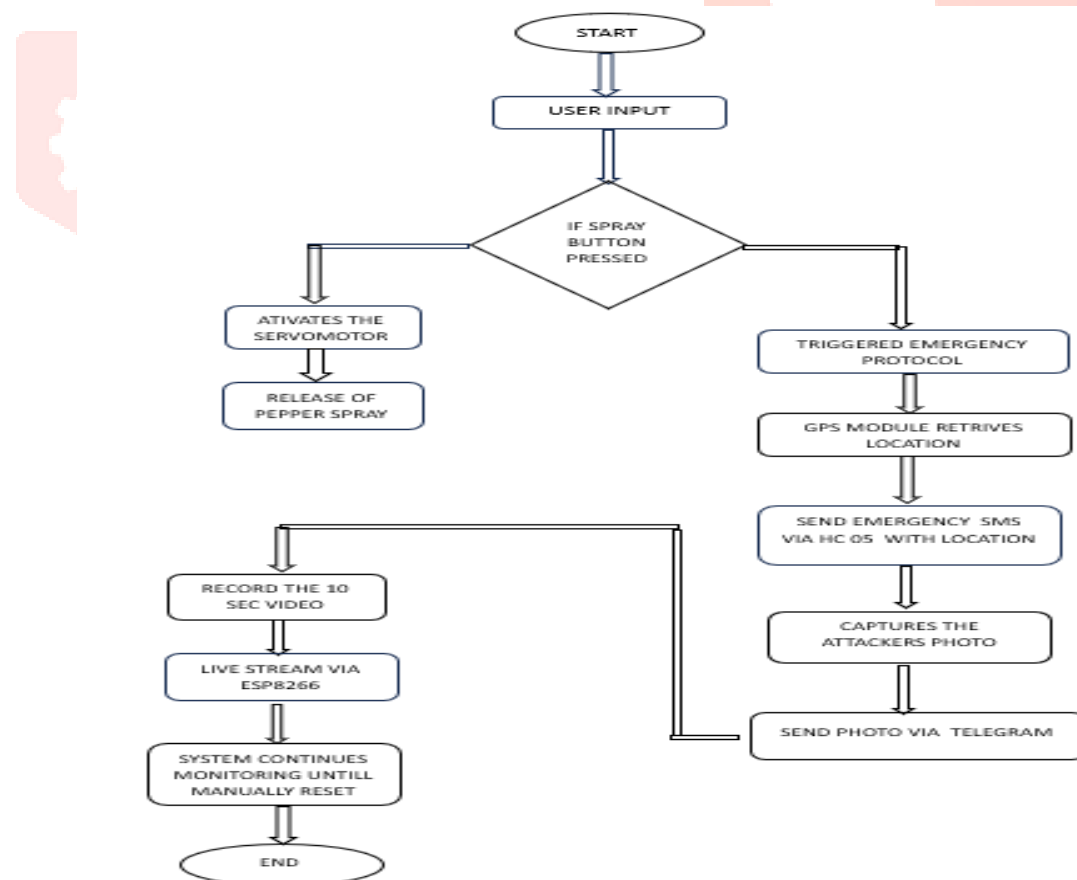


Figure 2: Flowchart of Smart Pepper Spray with GPS and Camera Integration

V. Results



Figure 3: attackers Photo.

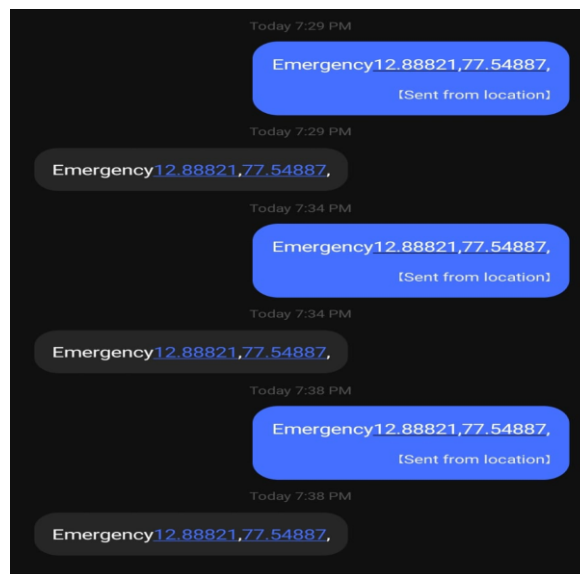


Figure 4: SMS with location to Registered Number

Activates the pepper spray mechanism using a servo motor. Sends an emergency SMS with the user's location to pre-configured contacts via the HC O5 Bluetooth module. Captures and sends images to a Telegram bot for remote monitoring. Streams live video to a web dashboard for real-time tracking. The system runs on a 12V battery with a charge controller, ensuring portability and reliability. It utilizes Python, OpenCV, and Telegram API for image processing and messaging, while the ESP8266-based web server enables live video streaming. This project provides an effective, real time self-defense mechanism for individuals in distress, ensuring quick response and safety assistance through an automated and connected security solution. The Smart Pepper Spray with GPS and Camera Integration is an advanced self-defense device designed to enhance personal safety by incorporating modern technology. This system integrates a traditional pepper spray canister with a GPS module, camera, and wireless communication to provide real-time tracking and evidence collection. When activated, the device captures images or videos of the attacker while simultaneously logging the user's location via GPS. This data is then transmitted to emergency contacts or authorities through GSM, Wi-Fi, or Bluetooth, ensuring immediate response. The system is controlled by a microcontroller such as an ESP32 or Arduino, enabling smooth communication between components. Additionally, a mobile application can be used to receive SOS alerts, monitor location history, and provide emergency assistance.

VI. Applications

1. Women's Safety APPLICATIONS

- Helps women protect themselves from harassment, assault, and potential attacks.
- Automatically sends live location and attacker's image to family, friends, or authorities.
- Provides a quick and reliable self-defense tool for late-night travelers or individuals in unsafe areas.

2. Law Enforcement & Public Safety

- Assists police officers and security personnel in non-lethal crowd control situations.
- Enables officers to capture live footage of incidents for legal documentation.
- Can be remotely activated in distress situations to alert backup teams.

3. Student and Campus Safety

- Provides college students and school children with a portable security device.
- Alerts campus security in case of emergencies, helping create safer educational environments.
- Reduces the risk of kidnapping, bullying, or violence on campuses.

VII. Conclusions

The Smart Pepper Spray with Camera Integration is a significant advancement in personal safety technology. By combining traditional self-defense mechanisms with real-time video recording and smart connectivity, this device enhances security and provides crucial evidence in emergency situations. With features like automatic video capture, GPS tracking, and instant alerts, it ensures that incidents are documented and help can be summoned quickly. This innovation is particularly useful for individuals in vulnerable situations, offering both protection and peace of mind. It is a technologically advanced self-defense tool that enhances personal safety by combining physical protection with real-time tracking and evidence collection. Unlike conventional pepper sprays, this device ensures that when a user is in danger, not only is the attacker incapacitated, but their identity and location are immediately recorded and transmitted to emergency responders and trusted contacts. The combination of GPS tracking, a camera, and a GSM module ensures that when the pepper spray is deployed, the location of the user is instantly shared with emergency contacts and authorities, facilitating a quick response. This is especially useful for women, students, night workers, and elderly individuals who may face potential threats. In today's world, where personal safety remains a growing concern, the Smart Pepper Spray with GPS and Camera Integration presents a technologically advanced and practical self-defense solution. This device bridges the gap between traditional self-defense mechanisms and modern IoT-based security solutions by incorporating real-time monitoring, automated alerts, and evidence recording, ensuring enhanced protection and accountability.

VIII. Future Scope

1. AI-Powered Threat Detection & Automated Activation

Facial Recognition & Behavior Analysis – AI can detect suspicious behavior, aggression, or known criminals.
 Sound-Based Activation – Recognizes distress signals (e.g., shouting "Help!") and automatically triggers recording or alerts.
 Motion-Based Triggering – AI can detect sudden movements (like an attack) and automatically activate the spray.

2. Next-Gen GPS & Connectivity

Real-Time GPS Tracking – Sends exact location updates to emergency contacts and law enforcement.
 Geo-Fencing Alerts – Notifies users when entering high-crime areas and suggests alternative routes.
 IoT Integration – Seamless connectivity with smartwatches, smartphones, and smart home security systems.

IX. References

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