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Sky Guardian: Anti-Harassment Drone Patrol

SNEHA[1], VARSHIINI S[2], VEDASHREE M[3], NIKHIL M S[4], Mr. S.CHRISTO JAIN[5]

Students, Department of Electronics and Communication Engineering, K.S.Institute of Technology, Bengaluru, Karnataka, India.[1-4]

Assistant professor, Department of Electronics and Communication Engineering, K.S.Institute of Technology, Bengaluru, Karnataka, India.[5]

Abstract: The Sky Guardian: Anti-Harassment Drone Patrol project aims to develop an autonomous drone system for enhancing women' s safety in emergency situations. When a woman presses an SOS button, her location is instantly sent to the drone via GPS. The drone autonomously files to the victim's location using real-time navigation. Upon arrival, it uses sensors and computer vision to detect the number of people present. Based on the situation, it either deploys a stun gun for a single attacker or releases non-lethal toxic gas like pepper spray for multiple threats. The drone also activates sirens and lights to attract public attention. Live video streaming to authorities ensures quick emergency response. The system combines GPS tracking, threat detection, and automated defense mechanism. It offers rapid intervention and deterrence against potential assaults. The project presents a smart and tech-driven approach to women's safety.

Keywords: Women Safety, Autonomous Drone, SOS Alert System, Real-time GPS Tracking, Threat Detection, Stun Gun Deployment, Non-lethal Toxic Gas, Emergency Response, Live Video Streaming and Self-defense Technology.

I. INTRODUCTION

Women's safety remains a pressing concern in many parts of the world, with incidents of harassment, assaults and violence contributing to rise. Despite various awareness campaigns and safety measures, there is still a significant need for rapid-response technologies that can provide immediate assistance in times of danger. In this context, the integration of autonomous drone technology offers a promising solution. This project proposes a smart drone-based safety system designed specially to respond to emergency situation faced by women. The core idea revolves around empowering women with the ability to call for help by simply pressing an SOS button on a wearable device or mobile application. This action triggers the transmission of the victim's GPS location to a re-deployed drone stationed nearby. The drone, coordinates without requiring manual control. Once the drone reaches the victim's location, it utilizes onboard sensors and computer vision algorithms to analyze the number of individuals present. Based on this assessment, the drone activates the appropriate self-defense mechanism. For a single attacker, a stun gun can be deployed to incapacitate the threat temporarily. In scenarios involving multiple potential attackers, the drone releases a nom-lethal toxic gas, such as pepper spray, to disperse the crowd and provide the victim with a chance to escape. To further enhance its effectiveness, the drone is also equipped with loud sirens, flashing lights, and live video streaming capabilities. These features not only help draw public attention but also allow real-time monitoring by law enforcement or emergency responders. The integration of threat detection, GPS for accurate navigation, and non-lethal counter measures ensures that the drone acts quickly and responsibly without causing excessive harm. This project aims to deliver a practical, scalable, and technologically advanced solution to enhance women's safety in urban and remote areas. By combining modern drone technology with real-time communication and intelligent defense systems, it aspires to serve as both a deterrent to attackers and a life-saving tool for potential victims.

II. LITERATURE SURVEY

"Drone AID: A Smart Human Detection Drone for Rescue" presents the design and implementation of an autonomous drone system aimed at improving disaster response efforts by locating survivors trapped under rubble. Traditional ground-based rescue robots often struggle in unstable or cluttered environments, but Drone AID overcomes these limitations with aerial mobility, broader coverage, and faster deployment. The system incorporates several key components: a Passive Infrared (PIR) sensor for detecting human body heat, an ATmega2560 microcontroller for system control, an OV7670 camera for real-time image and video capture, a Wi-Fi module for communication, and onboard storage for data retention. This combination enables the drone to identify humans by sensing infrared radiation, stream live footage, and relay precise location information to rescue teams. Capable of operating in both daylight and darkness, the drone performs effectively even in areas too dangerous or inaccessible for people or ground- based robots.

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During testing, Drone AID demonstrated reliable human detection at distances of up to 8 meters, significantly enhancing the speed and efficiency of rescue operations. The system is compared favorably with existing detection technologies, offering advantages such as real-time video transmission, automated navigation, and improved responsiveness. The paper also outlines the system architecture and workflow, emphasizing its technical viability and practical utility. In conclusion, Drone AID proves to be a cost-effective, dependable, and powerful tool for urban search and rescue missions, showcasing the potential of drone technology in disaster management.[1]

"Civilian Stun Guns: Neural or Aural Stimulation" explores the real physical effects of popular civilian-use stun guns, which are often marketed as devices capable of incapacitating attackers by disrupting muscle and nerve function. Researchers tested ten of the best-selling models, analyzing their electrical output and comparing the results to established standards used in medicine and law enforcement. The findings revealed that these stun guns deliver significantly less electrical charge per pulse than what's required to effectively stimulate nerves or muscles. Although the devices produce loud noises—averaging over 100 decibels—their electrical capabilities fall short of causing actual neuromuscular incapacitation. Instead, the loud crackling sound seems to be the main factor behind their deterrent effect, causing psychological intimidation rather than physical impairment. The study concludes that these stun guns rely more on fear through noise than on any real physical incapacitation, pointing out a clear mismatch between how they are advertised and how they actually function. [2]

"IoT-Based GPS Tracking System with SOS Capabilities" outlines the development of a compact, battery-operated tracking device that combines GPS technology with Internet of Things (IoT) functionality and emergency alert features. The device is built around a microcontroller interfaced with both GPS and GSM modules. When activated, it transmits real- time location information via SMS and to a central web server. This server—developed using Node.js and MongoDB—stores historical location data and allows authorized users to view tracking information through a clod-hosted web interface on AWS, with interactive maps displayed using the Open Layers API. The device operates through a simple one-button mechanism: pressing it once initiates continuous tracking, while a double press triggers an SOS alert. In emergency mode, the system identifies users located within a one-mile radius by comparing live GPS data with previously stored locations, then sends them alerts. These SMS messages include Google Maps links to help recipients quickly locate the sender. The system is designed to support a range of use cases, from individual safety to monitoring valuable assets. The authors emphasize the innovative integration of real-time emergency alerts into standard tracking technology, aiming to create a safer, more responsive user network. They also suggest future improvements, such as reducing the device's size and enhancing its user interface.[3]

"Women Drone Security System" is an integrated hardware-software solution that combines a mobile application with an automated drone response system to enhance women's safety. The mobile app is designed to detect distress through voice recognition—specifically, a scream—and immediately sends an emergency alert. If a drone is within a 1-kilometer radius, it receives the distress signal and navigates to the woman's location using GPS tracking. At the same time, the app notifies local authorities, family members, and nearby registered users with an SOS alert. Upon arrival, the drone activates an alarm to draw public attention and deter the attacker. It is equipped with facial recognition technology, capable of identifying individuals even if they are wearing masks, and stores this data for future investigation. The concept proposes optional defense mechanisms such as non-lethal gas dispersal (e.g., chloroform or laughing gas) or laser targeting to disable potential threats, though these features would require strict ethical and legal oversight. This system emphasizes the urgent need for improved women's safety solutions, particularly in countries like India, where incidents of gender-based violence remain alarmingly high. According to data from the National Crime Records Bureau (NCRB), in 2019, an average of 88 rape cases were reported each day, and the vulnerability of women has significantly increased over the past decade. The proposed system aims to provide immediate support, enhance rapid response, and contribute to a broader goal of gender equality by ensuring a safer environment for women.[4]

"Women Safety Patrolling Drone Using Machine Learning, IoT, and Cloud Computing" India is often seen as a challenging destination for solo female travelers due to concerns around safety. In addition to adapting to the large population, intense weather, dust, and noise, women also face the added worry of personal security. While the Government of India has made significant efforts—such as enacting the Criminal Law (Amendment) Act, 2018, which increases penalties for crimes against women—these measures typically come into play after an incident has already occurred. With the rapid advancement of technologies like machine learning, IoT, and cloud computing, there is a growing opportunity to use these tools for preventive safety measures. One innovative approach is the use of patrolling drones specifically designed to enhance women's safety. These drones can continuously monitor public areas and respond quickly when a woman in distress signals for help via her smartphone. Upon receiving the alert, the nearest drone can navigate to the scene promptly to provide support and act as a deterrent to potential threats. This proactive use of technology offers a promising way to prevent crimes against women before they happen.[5]

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"UAV-Based Security System for Preventing Harassment Against Women" study presents an innovative use of Unmanned Aerial Vehicles (UAVs) to help prevent physical harassment in public spaces. While current surveillance systems are effective in crowded areas, they often fall short in monitoring isolated or less populated locations— places where such incidents are more likely to occur due to limited visibility and response time. The proposed system addresses this gap by using UAVs that are activated through a wearable device, especially designed for individuals—primarily women—who may be in danger. The system is particularly focused on nighttime operations, as that is when many assaults tend to happen. When a potential threat is detected, the user can trigger the alert using a primary wearable device. This device transmits the user's GPS coordinates to a central control unit, which then dispatches a drone to the specified location. Once there, the UAV uses input from a secondary wearable to identify and follow the individual in need of help. Importantly, the solution emphasizes affordability and low computational requirements, making it a practical and efficient option for real-time motion tracking and rapid response.[6]

"Women Safety Device with Stun Gun". Women's safety remains a significant issue in today's society, often restricting their freedom due to the constant threat of harassment and violence. While technological progress has offered some solutions, many challenges still persist in effectively safeguarding women. This paper presents a practical and affordable solution: a compact, Raspberry Pi-based safety device equipped with sensors to monitor body temperature, heart rate, and voice. Leveraging the Internet of Things (IoT), the system sends real-time alerts via SMS that include the user's location and images of the incident, and also initiates emergency calls to pre- selected contacts. The goal is to offer a more reliable and responsive safety mechanism, especially beneficial for women working late hours in corporate environments. Another related innovation involves the development of a smart, power bank-like device that includes fingerprint authentication, health tracking, automated alert messages, and an integrated stun gun for self-defense. These technological interventions are designed to empower women, promote safer movement in public spaces, and contribute toward reducing violence against them.[7]

"The Adoption of Drone Technology" can play a significant role in enhancing the safety of women, particularly during the night when many people, regardless of gender, feel vulnerable. In many places around the world, the fear of being alone in the dark is a common concern. Unfortunately, women often face heightened risks, especially during these hours. With this project, I aim to contribute to the well-being of women who are striving to achieve independence and freedom. These drones can be used as a smart safety mechanism, providing security and assisting in tasks such as patrolling and surveillance, much like the work of law enforcement, to ensure women feel safer and more protected during nighttime.[8]

"Systematic Review on Civilian Drones in Safety and Security Applications" The employment of unmanned aerial vehicles, also known as UAVs, is expanding rapidly across various civil application areas. Some of these domains include real-time tracking, the provision of wireless coverage, sensing, searches and rescue, the delivery of goods, safety and surveillance, security, and safety checks of engineering structures. Smart UAVs represent the next technology revolution in UAV technology. They promise to provide new possibilities in various applications, notably lower risk and costs for civil infrastructure. The military has traditionally used unmanned aerial vehicles (UAVs) in countries such as the United Kingdom or the United States to partake in military and dangerous operations. The application and usage of these UAVs have become more commercial. Civilians can easily buy UAVs, commonly known as drones, from online platforms or shops. The main aim of this study is to review selected publications presenting previous efforts on using Civilian Drones in Safety applications. He study was accomplished using a systematic review research approach reviewing 45 publications. Drones have become more common, and it is crucial to understand how they work, especially since they entered the civilian domain. The research shows how civilian drones have been used in numerous safety applications, such as security cameras videotaping a house to ensure its safety.[9]

"GPS Systems Literature: Inaccuracy Factors and Effective Solutions". Today, Global Positioning System (GPS) is widely used in almost every aspect of our daily life. Commonly, users utilize the technology to track the position of a vehicle or an object of interest. They also use it to safely navigate to the destination of their choice. As a result, there are countless number of GPS based tracking application that has been developed. But, a main recurring issue that exists among these applications are the inaccuracy of the tracking faced by users and this issue has become a rising concern. Most existing research have examined the effects that the inaccuracy of GPS have on users while others identified suitable methods to improve the accuracy of GPS based on one or two factors. The objective of this survey paper is to identify the common factors that affects the accuracy of GPS and identify an effective method which could mitigate or overcome most of those factors. As part of our research, we conducted a thorough examination of the existing factors for GPS inaccuracies. According to an initial survey that we have collected, most of the respondents has faced some form of GPS inaccuracy. Among the common issues faced are inaccurate object tracking and disconnection of GPS signal while using an application. As such, most of the respondents agree that it is necessary to improve the

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accuracy of GPS. This leads to another objective of this paper, which is to examine and evaluate existing methods as well as to identify the most effective method that could improve the accuracy of GPS.[10]

III APPLICATIONS

1. Personal Safety and Emergency Response: The system can serve as a rapid-response personal security tool, offering immediate protection for women facing threats in isolated or unsafe environments.

2. Smart City Surveillance: Integrated with smart city infrastructure, these drones can patrol high-risk areas and provide both deterrence and active defense capabilities, enhancing urban safety for women.

3. Law Enforcement Support: Police departments can deploy these drones to assist in rescue operations or to provide protection during high-risk situations involving female victims.

4. Campus and Institutional Security: Educational institutions and workplaces can use the drone system to safeguard women on campuses and in office complexes, especially during late hours.

5 .Public Transport Safety: The drone system can be programmed to monitor vulnerable zones like parking lots, bus stops, or train stations where women often face harassment or assault risks.

6.Disaster and Conflict Zones: In regions affected by conflict or natural disasters, where law enforcement presence is limited, these drones can offer women a means of self-protection and distress signaling.

IV PROBLEM IDENTIFICATION

Despite advancements in technology and growing awareness, women continue to face serious safety challenges in both public and private spaces. Incidents of harassment, assault, and violence often occur in locations where immediate help is unavailable or delayed. Traditional self-defense tools such as pepper sprays or alarms may not always be effective, especially when the victim is caught off guard or unable to react quickly. There is a pressing need for innovative solutions that can provide swift and automated responses in dangerous situations. The lack of accessible, real-time protective systems leaves a critical gap in personal security for women. Additionally, overcrowded public areas and poorly lit or isolated locations further increase vulnerability. Current law enforcement resources are often stretched thin, making it difficult to ensure timely intervention. A drone-based defense system equipped with non-lethal weapons such as a stun device and disabling gas can help bridge this gap. This approach aims to empower women with a reliable, technology- driven safety mechanism that responds instantly to threats. Identifying and addressing these gaps is crucial to developing a more responsive and effective personal safety solution.

V FUTURE SCOPE

The future of women's safety technology holds promising advancements with the integration of drone- based defense systems. As personal security concerns rise, especially in urban and remote areas, such autonomous aerial systems could serve as immediate responders in times of danger. Future developments may enhance their intelligence through AI-powered threat detection, enabling the drone to autonomously assess risky situations and act accordingly. Integration with mobile apps and wearable devices can allow users to trigger the drone remotely in emergencies. With advancements in miniaturization and battery life, these drones may become more portable and accessible. Enhanced GPS and real-time tracking can improve response accuracy, ensuring help reaches victims faster. Furthermore, legal frameworks and safety protocols can evolve to regulate the use of non-lethal weapons like stun guns and disabling gases, ensuring ethical deployment. Over time, such systems could be adopted widely in public spaces, campuses, and transport hubs. The drone's surveillance capabilities can also aid law enforcement in identifying and preventing crimes. As technology matures, these systems could become a vital component of future smart safety infrastructure dedicated to protecting women.

VI CONCULSION

The development of a drone-based safety mechanism for women offers a proactive solution to the growing concern of personal security. By incorporating a stun gun and non-lethal gas, this system provides an effective means of self-defense that can deter potential threats and offer immediate protection. The mobility and quick deployment capabilities of drones make them highly suitable for emergency scenarios, especially in areas with limited access to law

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enforcement. With advancements in automation, GPS tracking, and remote operation, such systems can be seamlessly integrated into existing safety infrastructure. Their application extends beyond individual protection to public safety monitoring and crime prevention. Moreover, as awareness and demand for women's safety technologies increase, these drones could become a common feature in urban security networks. The project highlights the potential of combining technology with personal safety tools to create a smarter and more secure environment for women. Continued innovation and regulatory support will be key to refining and deploying these systems effectively in real-world scenarios.

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