



Women Safety Analytics- Protecting Women from Safety Threats

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ABSTRACT

In today's world, incidents of harassment and threats against women are increasingly frequent across various settings. Social media platforms, in particular, play a significant role in facilitating these global issues. This paper aims to develop a novel methodology that provides a robust safety mechanism for women, helping them avoid dangerous situations and individuals. The proposed solution, referred to as the Machine Learning-based Social Threat Filter (MLSTF), introduces an innovative approach to threat detection. By focusing on threats originating from social media platforms primarily Facebook, Twitter, and similar sites—this paper demonstrates how to identify and process social media posts, analysing tweets and other posts to detect harmful content. This is achieved by calculating word intensities to assess the nature of the content. Additionally, this paper describes a method that captures real-time data about women's safety through a wearable device (SWD) designed to monitor individual users continuously. This SWD incorporates intelligent sensors, including a body position identifier, GPS, an accident detection sensor, a small microphone to capture distress signals like a black box, and a pen hole camera for location-based imaging. Together, these sensors gather real-time data on a user's safety, transmitting it to a server for processing and analysis, ensuring responsive action where needed.

Keywords: Women Safety, SWD, MLSTF.

1. Introduction

Women's safety is a top priority in today's world, as harassment rates continue to rise globally, especially in numerous countries where incidents occur frequently. This paper presents a "Smart Wearable Device" (SWD) designed to enhance women's safety using advanced technologies such as the Internet of Things (IoT) and Machine Learning. A key benefit of this device is its ability to adapt to real-time datasets from various sources, including social media and live data collected through the wearable device, which can be used as a valuable dataset for further analysis. The SWD provides women with a sense of security, acting as an additional companion that helps them feel confident and safe, even when alone. Equipped with intelligent sensors—including a body position sensor, location tracker, accident detection sensor, a small microphone to record distress signals like a black box, and a pen hole camera to capture location images for detailed analysis—the device operates efficiently through internet services and wireless connectivity. In emergencies, the SWD allows women to quickly send an alert to designated contacts. In critical situations, it automatically sends an emergency alert containing the user's location, voice recordings, and images to specified contacts. This paper proposes a



"Machine Learning-based Social Threat Filter" (MLSTF), which processes data while filtering out irrelevant content to provide accurately trained data enriched with sentiment analysis. This leads to effective dataset processing, allowing for precise results during testing, with enhanced accuracy in detecting threats and distress signals.

2. Recent Works

Recent advancements in women's safety analytics have integrated IoT and AI for proactive threat detection and prevention. For instance, Vigil Net is a sophisticated system that uses wearable IoT devices, such as accelerometers and GPS, to collect real-time data, detecting anomalies that signal potential threats. By employing machine learning algorithms, it can predict and respond to safety risks instantly, alerting both the user and emergency contacts. Privacy remains a challenge, prompting calls for secure data protocols to protect user information while improving response accuracy through user feedback mechanisms. Emerging research also points to the potential of 5G in enabling faster, more reliable connectivity for safety devices, which could enhance real-time data processing and alert systems. This intersection of AI, IoT, and emerging technologies forms the foundation for many recent safety solutions, aiming for better precision and scalability in real-world applications.

3. Proposed work explanation

The proposed approach is built on two key components: a machine learning-based data summarization model for enhancing women's safety and the Smart Wearable Device (SWD). "Combined, these components form a novel methodology known as the Machine Learning-based Social Threat Filter (MLSTF)". MLSTF utilizes machine learning to extract dataset features based on sentiment analysis and flags potentially harmful content, promptly notifying relevant contacts for swift action if threats are detected. The system is powered by an Internet of Things (IoT)-enabled microcontroller based on ESP specifications. The master block diagram outlines the transmitter section of this approach, using a customized microcontroller with IoT web interfacing. This interface leverages cost-effective internet services, working in tandem with a mobile application and interconnected GPS and GSM facilities. Through these connections, the IoT module efficiently identifies the user's location and sends alerts to designated contacts via GSM messaging. The SWD design incorporates an OLED display for compact and efficient visual output instead of larger LCD screens. A block diagram, shown in the following figure, illustrates the receiver unit, where the remote server processes data using machine learning algorithms. This data is securely stored on the server, allowing results to be displayed with relevant metrics. Users can monitor real-time summaries via smartphones, tablets, PCs, and other smart devices.

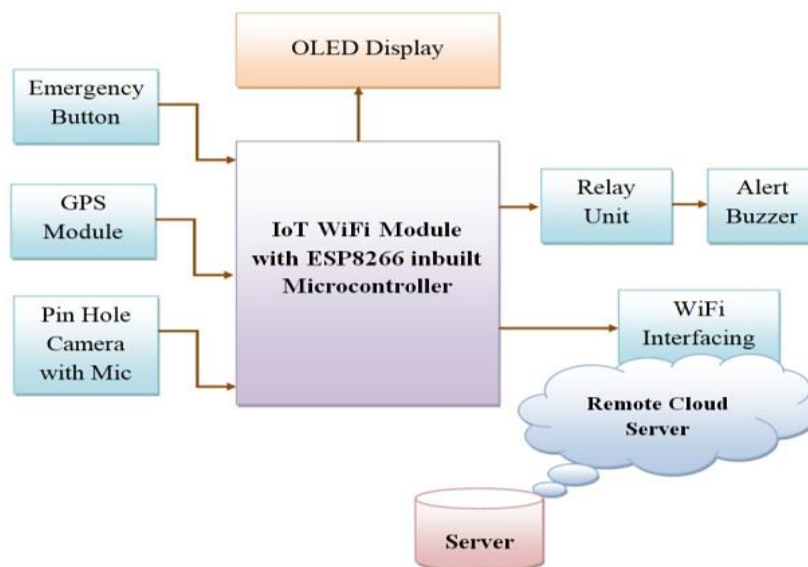


Fig. 3 Transmitter Section Block Diagram

4. Preparation of Figures

The following figure demonstrates the time-efficiency of the proposed approach, where the Smart Wearable Device (SWD) collects data from its sensor units and transmits it to a remote server within fractions of a second. This data transfer occurs continuously at set time intervals. The figure also presents a time analysis, detailing the amount of information gathered from the SWD in milliseconds and the corresponding data accumulation on the server, based on specific time intervals.

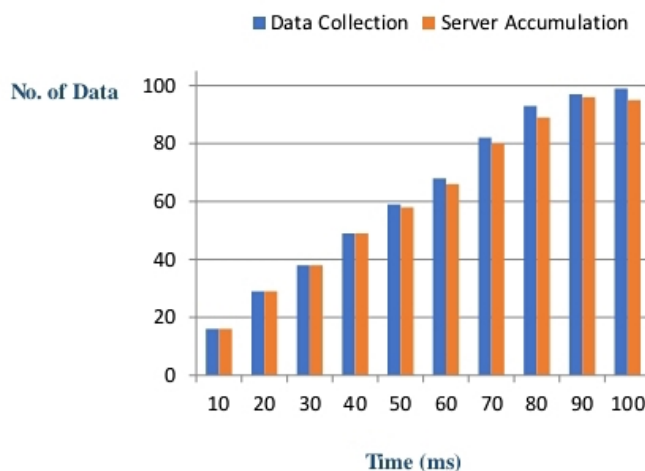
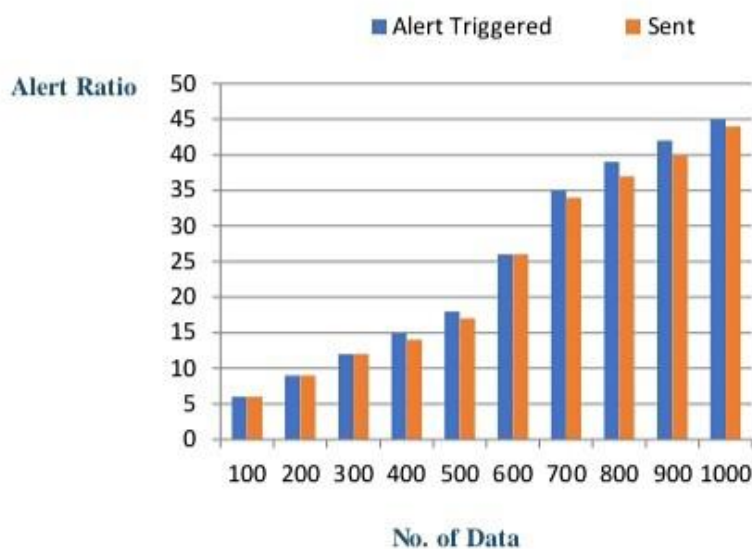


Fig. 4 Data Collection and Server Side Data Accumulation Ratio Estimation Perception based on Time Concern



The following figure illustrates the accuracy of the alert mechanism, showing the number of messages triggered by the Smart Wearable Device (SWD) and the number of messages successfully sent to recipients. In this figure, the x-axis represents the number of data volumes processed by the SWD, and the y-axis indicates the number of alerts generated and messages successfully dispatched to recipients.



No. of Alerts Triggered vs. No. of Alerts Sent

5. Conclusions

This paper introduces a comprehensive solution for women's safety management, incorporating advanced constraints and the latest technologies. It presents a new machine learning strategy known as the Machine Learning-based Social Threat Filter (MLSTF), which builds on traditional machine learning methods with a training and testing model. This approach also features a compact device, the Smart Wearable Device (SWD), which gathers data from integrated sensors and transmits it to a server via an Internet of Things (IoT) module. Data collected on the server is analysed through the MLSTF model, which filters data based on standard and unusual activity patterns. Alerts are triggered under abnormal conditions, with high accuracy levels demonstrated in Fig-6. The accuracy of data processing within the proposed approach is shown in Fig-5. Together, the MLSTF model, IoT connectivity, and SWD integration offer effective support in safeguarding women from harassment and related threats. Future work could enhance this model by incorporating deep learning techniques to improve accuracy and focusing on scalability to extend the model's applicability. These enhancements would further optimize this women's safety system.



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