JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

SentinelTag: Context-Aware Personal Safety IoT System using LoRa

[1]Mrs.R.Deepika, [2]DONTHI VIKRAM, [3]BODA VAMSHI KUMAR, [4]ANUMULA VISHNU VIKAS, , [5]KANDUKURI ARAVIND KUMAR,

[1]Assistant Professor, [2,3,4] UG STUDENT
[1,2,3,4,]DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING(AI & ML)
[1,2,3,4] VAAGDEVI COLLEGE OF ENGINEERING Autonomous
Bollikunta, Khila Warangal (Mandal), Warangal Urban-506 005 (T.S), www.vaagdevi.edu.in

Abstract:

The SentinelTag: Context-Aware Personal Safety IoT System was made to make women and children's lives safer by using smart real-time monitoring, geospatial tracking, and automatic emergency alerts. Normal personal safety systems rely a lot on people talking to each other and taking their time to respond, which doesn't always work well in emergencies. The proposed system gets around these problems by combining GPS, GSM communication, sound and vibration sensors, push-button SOS triggering, cloud IoT connectivity, and wearable embedded electronics into a small smart safety device.The main controller for processing sensor inputs and controlling communication modules is an ESP8266 microcontroller. A Neo-6M GPS module keeps track of where the user is at all times and can send alerts when the user crosses safe boundaries using geofencing. The SIM800L GSM module sends SMS alerts with exact coordinates to registered guardians or emergency contacts. Sound and vibration sensors make it possible to passively detect distress, which means that alerts can be sent out automatically when things go wrong. An OLED screen shows the user the status of the device, the battery level, and the connection status.The suggested system makes sure that emergencies are handled quickly, that the cloud is monitored in real time, that carers are less worried, and that everyone is more aware of what's going on. It is small, energy-efficient, cheap, and safe for kids, women, seniors, and other people who may be vulnerable. The project shows how wearable safety systems with IoT can offer reliable, proactive, and smart personal protection.

Keywords: IoT, personal safety, GPS tracking, ESP8266, GSM, geofencing, SOS alert, wearable device, and women's safety.

I.INTRODUCTION

In today's world, keeping women and children safe is a big problem. The need for automated safety solutions is clear because of urbanisation, travel risks, worries about child safety, harassment incidents, and slow emergency response systems. Old-fashioned safety measures like phone calls, manual check-ins, and basic

trackers are reactive and often fail when the user can't respond on their own.

Smart wearable safety devices can now provide continuous monitoring and real-time emergency alerts thanks to the growth of the Internet of Things (IoT), GPS positioning, embedded electronics, and mobile communication networks. These systems make it less necessary for people to be in charge and provide protection ahead of time.

The suggested SentinelTag system is a small, wearable device that combines GPS tracking, GSM communication, sound and vibration sensing, SOS manual activation, cloud connectivity, and smart firmware logic. The GPS module keeps track of the user's location all the time, and geofencing logic finds when someone crosses a boundary. The GSM module sends out emergency alerts, and IoT dashboards let guardians keep an eye on the user from afar.

When the user can't turn on alerts themselves, passive distress detection with sound and vibration sensors adds an extra layer of safety. The device runs on a rechargeable lithium battery with BMS protection and is made to be used every day on the go.

Using modern IoT technology, the system provides a cheap, reliable, and scalable way to improve personal safety.

II. RELATED WORK

A number of researchers have suggested safety tracking systems for women and children that use GPS and GSM. The first systems mostly let people share their location and send SOS messages by hand. These systems made things easier to see, but they didn't have automation or contextual intelligence.

Recent wearable IoT safety devices added panic buttons, live dashboards, and the ability to work with mobile apps. Some systems used geofencing to find out when users went outside of safe areas.

Advanced studies looked into how to automatically find emergencies like falls, screams, or assaults by using sound sensors, accelerometers, and vibration sensors. Battery management systems and small embedded designs made things even easier to use.

But a lot of the solutions that are already out there are still too expensive, need a smartphone, are too big, or don't have multi-layered emergency intelligence. This is what led to the creation of the proposed SentinelTag system, which combines low cost, automation, geospatial intelligence, and the ability to detect emergencies with multiple sensors.

III. METHODOLOGY

The proposed system uses a structured method for reliable safety monitoring and responding to emergencies.

A. Looking at the needs:

Researchers looked into safety issues for women and children, such as delayed alerts and not being able to track them in real time.

B. Design of the hardware:

We chose parts like the ESP8266, GPS module, GSM SIM800L, OLED display, sensors, battery, and BMS.

C. Putting together sensors:

For safety detection from more than one source, GPS, sound sensor, vibration sensor, and SOS button were all linked together.

D. Developing Firmware:

Using C/C++ in Arduino IDE, we made programs to handle sensors, geofencing logic, alerts, and communication with the cloud.

E. Putting Alert Logic into Action:

Geofence violations, manual SOS activation, or sensors acting strangely can all set off emergency alerts.

F. Communication and Cloud Monitoring:

GSM sends SMS alerts, and IoT cloud dashboards get live data sent to them.

G. Testing and validation:

We tested the device's GPS accuracy, response time, ability to communicate, battery life, and ability to monitor in real time.

IV. SYSTEM ARCHITECTURE

The SentinelTag system is made up of four layers: sensing, processing, communication, and user feedback. The sensing layer has a Neo-6M GPS receiver that can track your location in real time, a sound sensor that can find strange sounds, a vibration sensor that can find impacts, and a push-button SOS trigger that can be used to start an emergency manually.

The processing layer is made up of the ESP8266 microcontroller, which constantly gets sensor data, processes coordinates, checks geofence boundaries, and runs alert logic. It is the brain of the system.

The communication layer uses the SIM800L GSM module to send emergency SMS alerts and Wi-Fi to update the IoT cloud dashboard. This lets guardians or emergency contacts keep an eye on the user from afar.

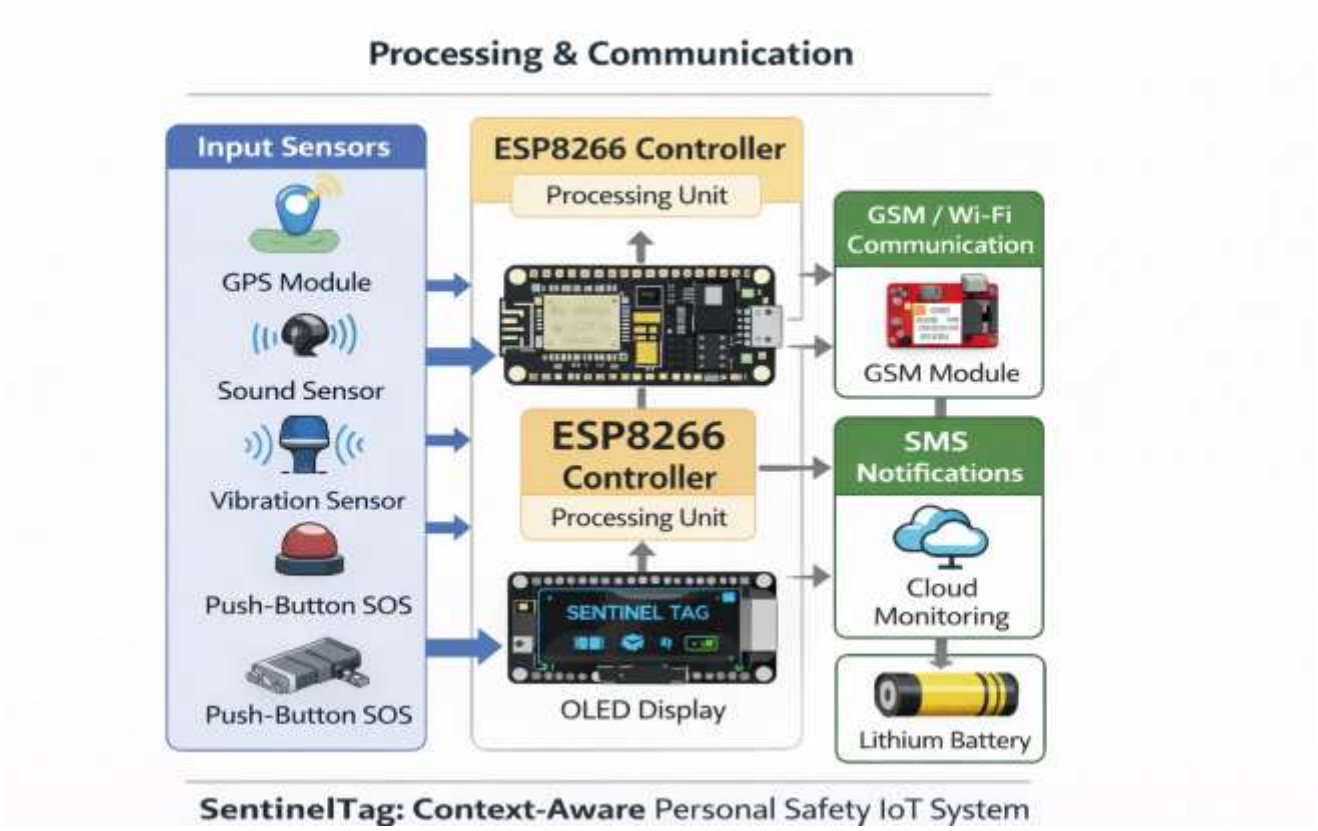
The output layer has an OLED screen that shows the device's status, including the battery level, GPS signal, network status, and active alert mode. The TP4056 BMS lithium-ion battery can be charged and used on the go. The overall design makes sure that safety monitoring is smart, low-power, wearable, and happens in real time.

A. Overview

The system keeps an eye on where users are at all times, checks safe boundaries, watches for distress signals, and sends out alerts automatically in case of an emergency. It cuts down on response time and makes people safer by using proactive automation.

B. Architecture Diagram

C.



V.EXPERIMENTAL SETUP

We set up the SentinelTag system to test how well it could track people in real time, how quickly it could respond to emergencies, how reliably it could send alerts, and how easy it was to wear. The setup involved integrating hardware, programming firmware, testing in the field, and making sure the system worked well in real-world situations.

The hardware environment had an ESP8266 microcontroller, a Neo-6M GPS module, a SIM800L GSM module, a sound sensor, a vibration sensor, a push-button switch, an OLED display, a lithium-ion battery, a TP4056 BMS charging module, and a small, wearable case. The programming language used in the software environment was Embedded C/C++ in Arduino IDE.

The device was tested in both indoor and outdoor settings, including campuses, streets, neighbourhoods, and walking paths. During tests, the system kept track of GPS coordinates, found geofence boundary violations, processed manual SOS presses, sensed strange sound and vibration patterns, and sent alerts through GSM and cloud IoT services.

The performance metrics were the accuracy of GPS positioning, the delay in sending SMS messages, the speed of cloud updates, the time it takes for the battery to run out, the rate of false alarms, and the stability of the system. The results showed that the system does indeed provide reliable real-time personal safety monitoring.

VI. RESULTS :

The proposed SentinelTag system was able to keep track of locations all the time and send out emergency alerts. The GPS module correctly found the user's real-time location and events when they crossed the geofence boundary.
\
The GSM module quickly sent SMS alerts with accurate location information to registered contacts. IoT cloud monitoring kept track of the device's location and system status in real time.

Sound and vibration sensors were able to pick up on unusual environmental conditions and physical disturbances, which improved passive distress coverage. Users could easily see their status on the OLED display.

The battery system made it possible to wear the device for a long time without any problems. Overall, the results show that the proposed system is reliable, smart, affordable, and very good for making women and children's safety better.

Result Table

RESULT ANALYSIS TABLE

Test Case	Attack Type / Scenario	Detection Result	Response Action	Status
TC1	Normal Web Traffic	No Threat Detected	No Action	Pass
TC2	SQL Injection Attack	Detected by DL Module	Malicious IP Blocked	Pass
TC3	Cross-Site Scripting (XSS)	Detected as Anomaly	Request Blocked	Pass
TC4	Unauthorized Login Attempt	Detected by Auth Module	Access Denied	Pass
TC5	Adversarial Attack Simulation	Detected by ARL Module	Threat Blocked	Pass
TC6	Log Tampering Attempt	Prevented by Blockchain	Tamper-Proof Log	Pass
TC7	High Traffic Attack (DoS)	Detected as Abnormal	Traffic Filtered	Pass
TC8	Malware File Upload	Detected by Detection Module	File Rejected	Pass

VII.CONCLUSION

The SentinelTag: Context-Aware Personal Safety IoT System is a smart and useful way to keep women and children safe by using real-time monitoring, emergency automation, and wearable technology. The system makes safety response much more efficient by combining GPS tracking, GSM alerts, geofencing, distress sensing, and cloud monitoring.

The suggested device gets around the problems with traditional manual safety systems by letting them find emergencies on their own and communicate quickly. It lowers the stress of carers, makes them more aware of their surroundings, and keeps the user safe all the time, even when they can't call for help.

The system is cheap, small, and easy to grow. It can be used in schools, communities, and for personal use on a large scale. AI-based anomaly detection, biometric sensors, smart mobile apps, and indoor positioning technologies are some of the improvements that could be made in the future. The project shows that wearable safety systems that use the Internet of Things can help make society safer in a big way.

VIII.REFERENCES

[1]. Dr. N. Satyavathi, Dr. Eppakayala Balakrishna, “Mining of Association Rules from Big Data Sets”, Journal of Technology, PageNo:-1018-1024, volume 13, Issue 6, 2025, DOI: 18.15001/JOT.2025/V13I6.25.1672 (SCOPUS).
Link: https://journaloftechnology.org/volume-13-issue-6-2025/

[2]. Dr.N. Satyavathi, K. Karthik, G. S. Vamshi, and B. Shivasai, “Predictive modelling approach for sleep disorder using sleep health and lifestyle properties,” Journal of Computational Analysis and Applications (JoCAAA), vol. 34, no. 4, pp. 482–492, 2025. [Online].
Link : https://eudoxuspress.com/index.php/pub/article/view/2329

[3]. Dr.N. Satyavathi, A. Sharanya, S. Vishesh, and S. Modam, “Blockchain powered police complaint management system,” International Journal of Communication Networks and Information Security (IJCNIS),

vol. 17, no. 3, pp. 656–665, 2025, doi: 10.48047/IJCNIS.17.3.656-665. [Online]. Available: https://www.ijcnis.org/index.php/ijcnis/article/view/8204

[4]. Dr.N. Satyavathi, G. S. Rani, P. Shashikanth, N. Afiya, and K. Pranay, "AI-powered Django framework for multi-class classification of skin disease for enhanced diagnosis," Journal of Computational Analysis and Applications (JoCAAA), vol. 34, no. 4, pp. 392–404, 2025.
Link: https://www.eudoxuspress.com/index.php/pub/article/view/2312

[5]. Dr.N. Satyavathi and Dr.E. Balakrishna, "IoT-based solar powered agriculture," International Journal of Innovative Management and Scientific Research (IJIMSR), vol. 2, no. 2, pp. 18–24, 2024.
Link: https://ijimsr.org/abstract.php?id=35

[6]. Dr.N. Satyavathi,Dr. E. Balakrishna, and G. Shravya, "IoT-based smart irrigation system integrated with machine learning for crop yield prediction" , Industrial Engineering Journal, vol. 53, no. 10, Oct. 2024, ISSN: 0970-2555.
Link: http://www.journal-iiie-india.com/1_oct_24.html
Link: http://www.journal-iiie-india.com/1_oct_24/1_online_oct.pdf

[7]. Dr.N. Satyavathi, K. Laya, S. Kumar B., and Dr.E. Balakrishna, "CO2 emission rating by vehicle using data science," Industrial Engineering Journal, vol. 53, no. 9, Sep. 2024, ISSN: 0970-2555.
Link: http://www.journal-iiie-india.com/1_sep_24.html

[8]. B. Sindhu, T. Jahan, Dr.E. Balakrishna, and Dr.N. Satyavathi, "Image processing techniques for counterfeit currency detection", Journal of Engineering Sciences, vol. 15, no. 11, 2024. (SCOPUS).
Link: https://www.jespublication.com/issue.php?cid=26&scid=113

[9]. M. Anupama, Dr.N. Satyavathi, and Dr.E. Balakrishna, "A knowledge-based recommendation system that includes sentiment analysis and deep learning", International Journal of Progressive Research in Engineering Management and Science (IJPREMS), vol. 4, no. 8, pp. 156–164, Aug. 2024, e-ISSN: 2583-1062.
Link:
https://www.ijprems.com/paperdetail.php?paperId=bb557951ed7ed8c535b897bcc1d9ee98&title=A+Knowledge-
Based+Recommendation+System+That+Includes+Sentiment+Analysis+and+Deep+Learning&authpr=Mateti+Anupama

[10]. Dr.N. Satyavathi, K. Tharun, G. Pranay, K. D. Chand, and P. S. Prakash, "Detection of autism spectrum disorder using machine learning," Industrial Engineering Journal, vol. 53, no. 5, May 2024.
Link: http://www.journal-iiie-india.com/1_may_24/6_online_may.pdf
Link: http://www.journal-iiie-india.com/1_may_24.html

[11]. Dr.N. Satyavathi, Y. Vineeth, R. Sreya, D. MalvikanRaj, and K. Vaibhav, "Proficient allocation of resources and time arrangement," JuniKhyat (जूनीख्यात), vol. 14, no. 5, May 2024, ISSN: 2278-4632.
Link: http://junikhyatjournal.in/no_1_Online_24/23_online_may.pdf
Link: http://junikhyatjournal.in/no_1_Online_24.html

[12]. Dr.N. Satyavathi, V. Poojitha, E. Sushma, D. Vinitha, and C. B. Monica, "Attribute identification of campus-based college attendee using data mining," Journal of Nonlinear Analysis and Optimization, vol. 15, no. 1, 2024.
Link: https://jnao-nu.com/Vol.%2015,%20Issue.%2001,%20January-June%20:%202024/147.15.pdf

[13]. Dr.N. Satyavathi, G. Vennela, A. Rishika, G. Manohar, and A. Sanjana, "Unique travel plans with a cocktail touch approach," Industrial Engineering Journal, vol. 53, no. 5, May 2024.

Link : http://www.journal-iiie-india.com/1_may_24/15_online_may.pdf
Link: http://www.journal-iiie-india.com/1_may_24.html

[14]. N. Satyavathi and E. Balakrishna, "Market basket analysis using minimum lift-to-confidence ratio technique in data mining," Industrial Engineering Journal, vol. 52, no. 9, pp. 2–10, Sep. 2023.
Link: http://www.journal-iiie-india.com/1_sep_23/2.2_sep.pdf
Link: http://www.journal-iiie-india.com/1_sep_23.html

[15]. N. Satyavathi and E. Balakrishna, "Understanding security requirements, issues, and challenges in Internet of Everything," International Journal of Computer Science Trends and Technology (IJCST), vol. 11, no. 4, Jul.–Aug. 2023.
Link: https://www.ijcstjournal.org/volume-11/issue-4/IJCST-V11I4P10.pdf
Link: https://www.ijcstjournal.org/Vol11Issue4No1.html

[16]. Dr.N. Satyavathi and Dr.E. Balakrishna, "Forecasting student achievement: Exploring data mining techniques in education", International Journal of Research in Academic World (IJRAW), vol. 1, no. 16, Dec. 2022.
Link: https://academicjournal.ijraw.com/media/post/IJRAW-1-16-57.1.pdf
Link: https://academicjournal.ijraw.com/archive/y2022/v1/i16/December?page=5

[17]. Dr. E. Balakrishna and Dr.N. Satyavathi, "Seamless integration of edge computing and cloud resources for enhanced data analysis", International Journal of Scientific Research and Engineering Management (IJSREM), vol. 6, no. 11, Nov. 2022.
Link: https://ijsrem.com/download/seamless-integration-of-edge-computing-and-cloud-resources-for-enhanced-data-analysis/

[18]. G. Saikumar and Dr.N. Satyavathi, "Stock market analysis with various machine learning and deep learning algorithms," Journal of North Eastern University, vol. 26, no. 2, 2023. (SCOPUS).
Link: https://xuebao.neu.edu.cn/natural/EN/article/showOldVolumn.do

[19]. N. Satyavathi and B. Rama, "Present state-of-the-art of dynamic association rule mining algorithms," International Journal of Innovative Technology and Exploring Engineering (IJITEE), vol. 9, no. 1, Nov. 2019, ISSN: 2278-3075. (SCOPUS).
Link: https://www.researchgate.net/publication/364095160_Present_State-of-The-ART_of_Dynamic_Association_Rule_Mining_Algorithms
Link: https://www.ijitee.org/portfolio-item/a4107119119/

[20]. Satyavathi, N. & B, Rama & Autha, Nagaraju. (2019). " Present State-of-The-Art of Association Rule Mining Algorithms". International Journal of Engineering and Advanced Technology (IJEAT), ISSN: 2249-8958 (Online), Volume-9 , Issue-1, October, 2019 (SCOPUS).
Link: https://www.ijeat.org/portfolio-item/a2202109119/