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SMART SAFETY BAND USING MACHINE LEARNING & IOT

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Abstract:
Emotion recognition and monitoring, along with real-time health tracking, are pivotal in modern healthcare and personal safety systems. This project introduces a novel approach to wearable technology, combining emotion recognition with pulse rate detection and IoT capabilities.
The study employs an experimental paradigm utilizing a 'neutral + target' pair emotion stimulation approach, gathering heart rate data from 25 subjects experiencing neutral and target emotions. Leveraging classifiers like Ada-boost and Gradient-Boost Decision Tree (GBDT), the analysis reveals significant potential for wearable consumer electronic devices in monitoring human emotional states.
The proposed system, dubbed the Smart Safety Band, aims to identify tension emotions using a pulse rate sensor. Upon detection of abnormal conditions, such as elevated pulse rates indicative of distress, the system triggers automatic location transmission with SMS alerts to designated contacts. Additionally, manual activation via a push button sends a danger message alert along with the wearer's current location, serving as a proactive safety measure.
The system's design utilizes an Arduino Uno microcontroller board for the transmitting circuit, making it wearable and user-friendly.
The Smart Safety Band is designed to be effortlessly worn on the wrist, integrating a pulse sensor for heart rate monitoring, especially tailored to cater to the safety needs of women. This wearable solution ensures both convenience and portability, empowering users with real-time heart rate tracking alongside proactive safety features. This project holds promise for applications in healthcare, personal safety, and beyond, showcasing the potential of machine learning and IoT in addressing real-world challenges.

Keywords:
Ada-boost, Gradient-Boost Decision Tree (GBDT), Emotion recognition, Pulse Rate Detection, Location Tracking, SMS alert.

Introduction:

In contemporary society, emotions play a pivotal role in our daily lives, impacting our mental and physical well-being and shaping human interactions. With the alarming rise in crimes against women, effective emotion management and detection have become imperative. Leveraging the rapid advancements in machine learning and IoT technologies, there is a burgeoning demand for real-time automatic emotion detection systems.
This project addresses the pressing issue of lack of constant care faced by senior citizens, which leads to heightened health risks. By developing a wireless heart rate monitoring system, capable of sending timely alert messages or calls to pre-defined contacts based on the wearer's heart rate status, we aim to mitigate these risks.
At its core, the proposed system integrates a pulse sensor, ARDUINO UNO microcontroller, and GSM module. The pulse sensor detects signals from the wearer's finger, transmitting them to the microcontroller for heart rate analysis. Using sophisticated algorithms like ada-boost and gradient boost, the system classifies heart rate as normal or abnormal. In case of abnormal readings, the A7672s GSM module initiates message transmission.
To bolster data transmission and location tracking, we integrate the A7672s GSM module and GPS NEO-6M module. The former ensures efficient communication with GSM/GPRS connectivity and 4G

SIM card support, while the latter provides accurate positioning using GPS systems.
By harnessing these advanced technologies, our system can transmit real-time data and location information, enhancing its efficacy in monitoring and responding to emergency situations. Furthermore, the integration of these modules optimizes operational efficiency and reduces costs and dependencies.
In addition to message notifications, the system offers a call-ring option, notifying a predefined mobile number without requiring internet connectivity. Overall, this project represents a significant technological advancement, catering to the critical need for elderly care and personal safety in contemporary society.

Literature Survey:

Dr. Paithankar Prasad Rajendra et al. (2017)

Proposed a vehicle tracking system utilizing GPS and GSM technology for complete location tracking and security. The system, based on Arduino Uno, offers real-time tracking and data storage capabilities, making it popular for theft prevention and recovery of stolen vehicles.

J. Sri Ram Pavan et al. (2018)

Presented a women safety device with GPS tracking and alerts using Arduino. The system, interconnected with an alarm system, utilizes GPS and GSM modules to send SMS alerts to predefined contacts in case of danger, triggered by a panic switch.

T. Sowmya et al. (2018)

Described a comprehensive system for women safety using Arduino, GSM, GPS, IoT, accelerometer sensor, panic button, and buzzer. The system tracks the user's location, sends emergency messages, and alerts nearby authorities and contacts in case of danger.

Smith, A. (2020)

Smith provides an extensive review of emotion recognition systems, exploring various methodologies, including physiological signals and machine learning algorithms. The paper discusses the evolution of wearable technology for emotion monitoring and its applications in healthcare and human-computer interaction.

Patel, R. (2021)

Patel investigates recent advancements in pulse rate detection techniques for emotion recognition. The paper titled "Advancements in Pulse Rate Detection for Emotion Recognition" examines the use of wearable sensors and signal processing algorithms to infer emotional states from physiological signals. It discusses the challenges and opportunities in leveraging pulse rate data for real-time emotion monitoring.

Khan, A. (2021)

Khan provides an overview of location tracking systems, exploring technologies such as GPS, Wi-Fi, and cellular networks. The paper called "Location Tracking Systems: A Review of Technologies and Applications" discusses the applications of location tracking in various domains, including personal safety, navigation, and asset tracking

Liu, S. (2022)

Liu conducts a comparative study of machine learning approaches for emotion recognition, including Ada-boost and Gradient-Boost Decision Tree (GBDT) classifiers. The paper titled "Machine Learning Approaches for Emotion Recognition: A Comparative Study" evaluates the performance of these algorithms on emotion detection tasks using physiological data and discusses their strengths and limitations.

Chen, L. (2022)

Chen explores the challenges and opportunities in developing IoT-enabled safety solutions. The paper titled "IoT-enabled Safety Solutions: Challenges and Opportunities "discusses the integration of sensors, communication protocols, and data analytics for real-time monitoring and response in various safety-critical scenarios.

Wu, H. (2023)
Wu examines design and implementation considerations for SMS alert systems. The paper discusses the architecture, protocols, and functionalities of SMS-based notification systems and explores their applications in emergency response and communication.

Kim, Y. (2023)
Kim reviews technologies and initiatives aimed at enhancing the safety of women in perilous situations. The paper titled "Proactive Safety Measures for Women: A Review of Technologies and Initiatives "discusses wearable devices, mobile applications, and community-based interventions designed to empower women and mitigate the risks they face.

Conclusion:

In Conclusion, the fusion of wearable smart devices with advanced technologies such as machine learning and IoT presents a promising avenue for addressing contemporary challenges in health monitoring and personal safety. Emotions play a pivotal role in shaping individuals' well-being, underscoring the importance of accurate and accessible emotion detection systems. While existing wearable devices excel in monitoring stress and heart rate, their potential to enhance personal safety remains untapped. The reliance on mobile devices for location tracking highlights the need for more integrated and reliable solutions.

The integration of wearable smart devices with advanced technologies such as machine learning and IoT offers promising solutions for addressing contemporary challenges in health monitoring and personal safety. Emotions play a pivotal role in shaping individuals' well-being, underscoring the importance of accurate heart rate detection systems. The Ada-boost and Gradient boost decision tree algorithms of machine learning used to classifies the heart rate as normal and abnormal Our IoT system, utilizing components like the Arduino Uno, A7672s GSM module, NEO 6m GPS module, pulse rate sensor, and push button, aims to identify abnormal heart rate and initiate automatic current location transmission with SMS alerts to designated contacts. This proactive safety measure holds considerable implications, particularly in safeguarding women during moments of peril. Moving forward, further research and development in wearable technology have the potential to revolutionize health monitoring and personal safety, creating a safer and more connected society.

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