Alert Aura - Women Safety Application

Abstract: Our proposal is to create an AI-driven mobile application designed to autonomously respond to emergencies, specifically aimed at enhancing women's safety. This application integrates advanced machine learning models to process real-time data from diverse sources, including sensors, video feeds, speech samples, and location-specific crime history. By analyzing these inputs, the app identifies potential threats and initiates automated actions, such as sending SOS alerts to emergency contacts, notifying local authorities, and capturing evidence.Our proposed AI-powered mobile application aims to revolutionize personal safety, particularly for women. By leveraging cutting-edge machine learning techniques, the app proactively detects and responds to potential threats, empowering users to feel secure in their daily lives. This innovative solution is designed to bridge the gap between traditional emergency response systems and real-time, personalized protection.

The system relies on the following components working in unison:

1. **Speech Emotion Analysis**: Detects distress or panic through real-time voice analysis.
2. **Video Surveillance**: Employs computer vision to identify suspicious activities or potential threats in the user's surroundings.
3. **Sensor-Based Monitoring**: Analyzes data from accelerometers, GPS, and gyroscopes to recognize sudden movements or unsafe environments.
4. **Crime Risk Assessment**: Utilizes crime statistics of the user’s location to gauge risk and enhance situational awareness.

This application delivers a comprehensive and proactive emergency response system, combining real-time monitoring with historical data insights. Its context-aware functionality ensures users in high-risk scenarios receive immediate assistance and peace of mind, offering an innovative solution to safety challenges in vulnerable situations.

Objectives :

1. **Enhance Personal Safety:** Develop an AI-powered mobile app that autonomously identifies and reacts to emergency situations to protect women in real-time.

2. **Integrated Data Analysis:** Leverage sensor inputs, video feeds, speech samples, and crime history to provide comprehensive threat detection and response.
3. **Automated Emergency Actions:** Enable immediate actions such as sending alerts, notifying authorities, and capturing evidence for legal or investigative use.
4. **Location-Based Risk Assessment:** Use crime history and contextual data to predict and mitigate risks in specific areas.
5. **User-Friendly and Secure:** Ensure the application is accessible, easy to use, and maintains user data privacy and security.
6. **Proactive Assistance:** Provide context-aware support to preemptively address potential threats and ensure timely intervention.

Existing System :

1. **Panic Button Applications:** These rely on manual activation to send SOS alerts but are ineffective when the user cannot respond quickly.
2. **Location-Based Alert Systems:** Utilize GPS to track and alert emergency contacts about deviations from safe zones but lack real-time threat detection.
3. **Video Surveillance Tools:** Designed for static monitoring, these systems do not integrate multi-modal data for dynamic emergency response.
4. **Safety Wearables:** Devices offering manual SOS features and location tracking lack advanced AI-driven threat analysis.
5. **Standalone Models for Crime Prediction:** Focus on predicting crime hotspots using historical data but fail to incorporate real-time inputs for immediate assistance.

Existing systems lack real-time, rely heavily on user intervention, and do not provide holistic, automated emergency responses.

Proposed system: The proposed system is an AI-powered mobile application designed to autonomously enhance women's safety by analyzing real-time multimodal data streams. Unlike existing systems, it integrates various machine learning models to process inputs such as speech, video, sensor data, and crime history, offering a holistic and automated emergency response.

[**Multimodality** is the application of multiple literacies within one medium. Multiple literacies or "modes" contribute to an audience's understanding of a composition.]

Key Features :

1. **Speech Analysis:** Detects distress through voice patterns using advanced emotion recognition.
2. **Video Processing:** Monitors surroundings for threats using computer vision and video analytics.
3. **Sensor Data Integration:** Analyzes accelerometer and GPS data to identify abnormal movements or risky locations.
4. **Crime History Insights:** Predicts risks based on historical crime data for the user's location.
5. **Automated Response:** Sends SOS alerts, notifies authorities, and records evidence autonomously.

This comprehensive, real-time, and context-aware solution addresses the limitations of existing systems, providing a proactive approach to personal safety.

Modules :

1. **Speech Emotion Detection:**Analyzes voice inputs to detect stress, panic, or distress emotions in the user's tone, providing early warning signals.
2. **Video Analytics:**Processes live video feeds using computer vision to identify suspicious activities, attackers, or other threats.
3. **Sensor Data Processing:**Integrates accelerometer, gyroscope, and GPS data to monitor sudden movements, falls, or risky location patterns.
4. **Crime Data Prediction:**Analyzes historical crime records for the current location to evaluate real-time risk factors and guide responses.
5. **Emergency Response Automation:**Automatically triggers SOS alerts, informs emergency contacts or authorities, and captures evidence during critical situations.

Software Requirements :

1. **Programming Languages and Frameworks**
    - **Frontend**
        1. Flutter or React Native for cross-platform development
    - **Backend**
        1. Python (for AI and ML models).
        2. Node.js or Django for server-side development.

2. **Libraries and Tools**
    - **Speech Emotion Analysis:**
        1. Google Speech-to-Text API or open-source libraries like Librosa for audio feature extraction.
        2. Pre-trained models like Wav2Vec2 or custom emotion detection models.
    - **Video Analytics**
        1. OpenCV for video processing.
        2. TensorFlow or PyTorch for computer vision models.
    - **Sensor Data Integration**
        1. Android Sensor API and iOS Core Motion framework for accelerometer and gyroscope data.
        2. Google Maps API for GPS and location tracking.
    - **Crime Data Insights**
        1. Google Places API or a custom database for crime history records.
        2. Data visualization tools like D3.js for risk mapping.
    - **Cloud Services**
        1. Firebase or AWS for cloud storage and real-time database management.
        2. Twilio API for sending SMS and making emergency calls.
3. **Database Management**
    - **Relational Database:** PostgreSQL or MySQL for user and historical crime data.
    - **NoSQL Database:** MongoDB for sensor and real-time data storage.
4. **AI/ML Model Deployment**
    - TensorFlow Lite or PyTorch Mobile for on-device inference.
    - AWS SageMaker or Google AI Platform for backend model training and deployment.
5. **Security Features**
    - End-to-end encryption for user data and communication.
    - OAuth 2.0 for secure user authentication.

Hardware Requirements :

1. **Mobile Device**
    - Smartphone with accelerometer, gyroscope, microphone, GPS, and camera sensors.
    - **Minimum specifications :**
        1. **RAM**: 3GB

    2. **Storage**: 32GB
    3. **Processor**: Qualcomm Snapdragon 845 or equivalent.
2. **Backend Server**
    - **Cloud Hosting Provider**: AWS, Google Cloud, or Azure.
    - **Specifications** :
        1. **CPU**: Minimum 4 vCPUs.
        2. **RAM**: Minimum 16GB.
        3. **Storage**: Minimum 100GB SSD.
        4. **Bandwidth**: 100 Mbps or higher for real-time data handling.
3. **Development and Testing Hardware**
    - Laptops or desktops with the following specifications:
        1. **Processor**: Intel Core i7 or AMD Ryzen 7.
        2. **RAM**: 16GB.
        3. **Storage**: 512GB SSD.
        4. **GPU**: NVIDIA GTX 1660 or equivalent for ML model training.
4. **Other Peripherals**
    - External microphones for accurate audio analysis during testing.
    - Cameras for testing video analytics in various lighting and environmental conditions.

References :

1. Latif, S., et al. (2020). "Survey of deep learning-based techniques for speech emotion recognition." _IEEE Access_, 7, 49321-49335.
2. Zhang, Y., et al. (2018). "Speech emotion recognition with transferred learning from speaker verification." _Interspeech_, 2456-2460.
3. Redmon, J., Farhadi, A. (2018). "YOLOv3: An Incremental Improvement." _arXiv preprint_, arXiv:1804.02767.
4. Goodfellow, I., et al. (2016). _Deep Learning_. MIT Press
5. Malekzadeh, M., et al. (2019). "Protecting sensory data against sensitive inferences." _Proceedings of the 18th ACM/IEEE International Conference on Information Processing in Sensor Networks_ (IPSN), 193-204.
6. Shi, F., et al. (2020). "A survey on deep learning for anomaly detection." _ACM Computing Surveys (CSUR)_,53(1), 1-36.
7. Gerber, M. S. (2014). "Predicting crime using Twitter and kernel density estimation." _Decision Support Systems_, 61, 115-125.

8. Wang, Z., et al. (2019). "DeepCrime: Attentive hierarchical recurrent networks for crime prediction." _Pacific-Asia Conference on Knowledge Discovery and Data Mining_, 400-412
9. Atrey, P. K., et al. (2010). "Multimodal fusion for multimedia analysis: A survey." _Multimedia systems_, 16(6), 345-379.
10. Baltrusaitis, T., et al. (2018). "Multimodal machine learning: A survey and taxonomy." _IEEE Transactions on Pattern Analysis and Machine Intelligence_, 41(2), 423-443.
11. Rahimi, A. M., et al. (2018). "Mobile edge computing: A survey and taxonomy." _IEEE Communications Surveys & Tutorials_, 20(1), 359-380
12. Shi, W.,Dustdar, S. (2016). "The promise of edge computing." _Computer_, 49(5), 78-81.
13. Farooq, U., et al. (2015). "A review of emergency alert systems for developing regions." _Journal of Network and Computer Applications_, 47, 151-161.

Project Guide : Dr. J. Srinivas

Team :

N. Sushanth [1608- 21 - 737 - 002]

D. Shanmukhaditya [1608- 21 - 737 - 036]

R. Venkata Anirudh [1608- 21 - 737 - 054]