AI Shield: Integrated Distress Monitoring and Alert System

Problem Statement & Research

Challenge Description

Safety is a fundamental concern, particularly for women who often face vulnerable situations. The goal of this project is to address this issue by developing an AI-powered system that detects distress signals, such as screams, and automatically alerts trusted contacts with the user's GPS coordinates. This system leverages machine learning to provide a proactive safety mechanism.

Target Audience

The primary users of AI Shield include:

- **Women seeking personal safety solutions.**
- **Parents and guardians looking for tools to ensure the safety of their family members.**
- **Organizations aiming to enhance workplace safety for women.**

Background Research

Extensive research was conducted to understand the nature of distress sounds, physiological signals, and their correlation with emergencies. Studies reveal that audio cues like screams are often accompanied by abnormal pulse and heart rates, which can be detected using wearable sensors or mobile devices.

Similar Existing Solutions

- **bSafe: A personal safety app with an SOS feature but limited audio detection.**
- **Guardly: Offers location sharing and emergency contact alerts but lacks real-time distress sound analysis.**
- **Smart Jewelry: Wearable devices for safety but do not integrate AI for sound detection.**

AI Shield aims to bridge these gaps by combining real-time audio processing, physiological signal monitoring, and GPS tracking.

Development Process

Technical Implementation Details

- **Audio Processing: Using Librosa for feature extraction from audio signals.**
- **AI Model: A CNN-LSTM hybrid model trained on a dataset of distress sounds.**
- **GPS Integration: Google Maps API for location tracking.**

- **Notifications: Twilio API for SMS alerts and email notifications.**

Architecture Decisions

The system architecture includes:

1. **Mobile Device: Captures audio and physiological signals.**
2. **Cloud Server: Processes data using the AI model.**
3. **Notification Module: Sends alerts to trusted contacts.**

AI Model Selection Rationale

A CNN-LSTM hybrid model was chosen for its ability to process both spatial (audio features) and temporal (sound sequences) data effectively. This ensures high accuracy in distress signal detection.

Testing Methodology

- **Dataset: A curated dataset of scream and non-scream audio.**
- **Testing: Accuracy, precision, and recall metrics to evaluate model performance.**
- **Field Testing: Simulated distress scenarios to validate end-to-end functionality.**

Impact & Future Work

Current Limitations

- **Dependence on internet connectivity for real-time processing.**
- **Potential false positives due to similar non-distress sounds.**

Ethical Considerations

- **User data, including location and audio recordings, is encrypted to ensure privacy.**
- **The system is designed to minimize misuse, such as triggering false alarms.**

Deployment Strategy

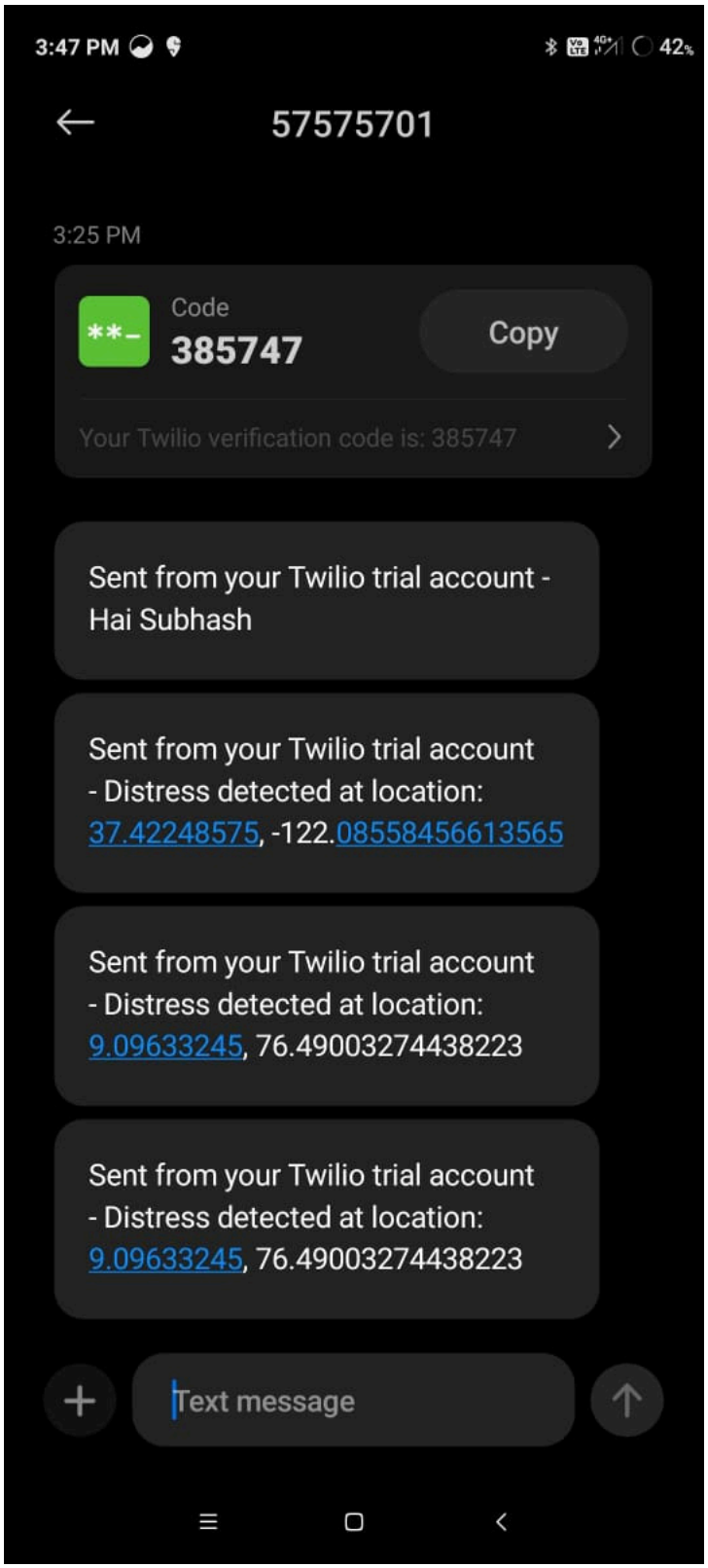
- **Phase 1: Launch as a mobile application for Android and iOS.**
- **Phase 2: Integrate with wearable devices for enhanced functionality.**
- **Phase 3: Collaborate with NGOs and safety organizations for widespread adoption.**

Future Improvements

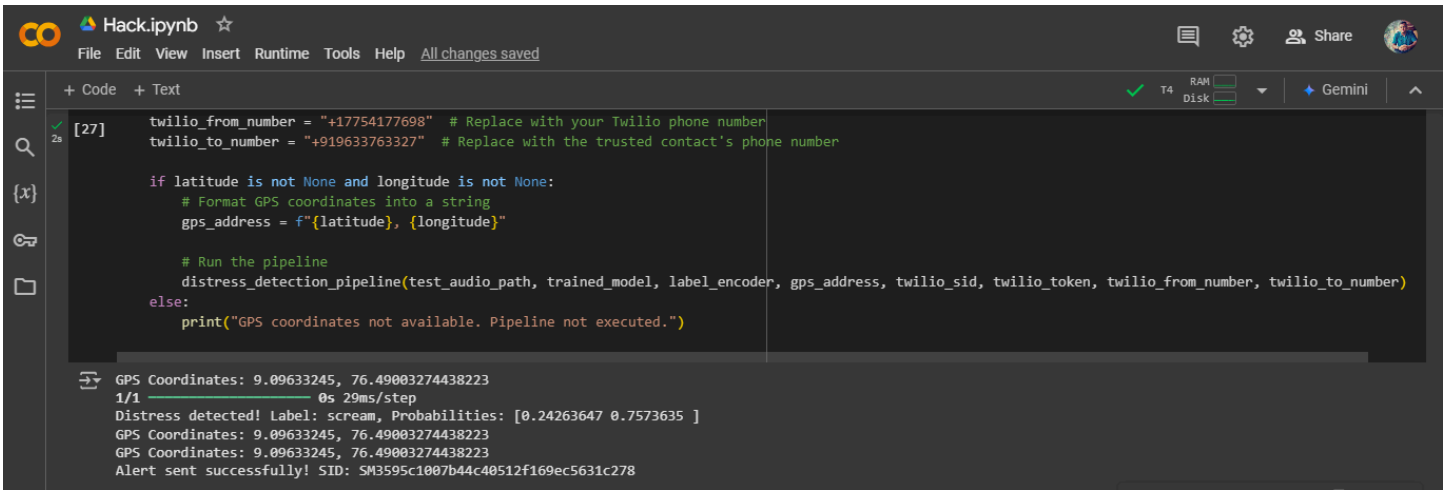
- **Integration with wearable accessories, such as censored rings, bangles, and GPS-enabled clothing.**
- **Localization for multiple languages and region-specific alerts.**
- **Multimodal distress detection combining audio, video, and biometric data.**
- **Advanced real-time processing for offline use cases.**

Screen Shorts of the Result

- **SMS alert**



- **Alert Conformation from the code**


Hack.ipynb
File Edit View Insert Runtime Tools Help All changes saved
Share
+ Code + Text
T4
RAM
Disk
Gemini
[27]
2s
twilio_from_number = "+17754177698" # Replace with your Twilio phone number
twilio_to_number = "+919633763327" # Replace with the trusted contact's phone number
if latitude is not None and longitude is not None:
# Format GPS coordinates into a string
gps_address = f"{latitude}, {longitude}"
# Run the pipeline
distress_detection_pipeline(test_audio_path, trained_model, label_encoder, gps_address, twilio_sid, twilio_token, twilio_from_number, twilio_to_number)
else:
print("GPS coordinates not available. Pipeline not executed.")
GPS Coordinates: 9.09633245, 76.49003274438223
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 29ms/step
Distress detected! Label: scream, Probabilities: [0.24263647 0.7573635]
GPS Coordinates: 9.09633245, 76.49003274438223
GPS Coordinates: 9.09633245, 76.49003274438223
Alert sent successfully! SID: SM3595c1007b44c40512f169ec5631c278