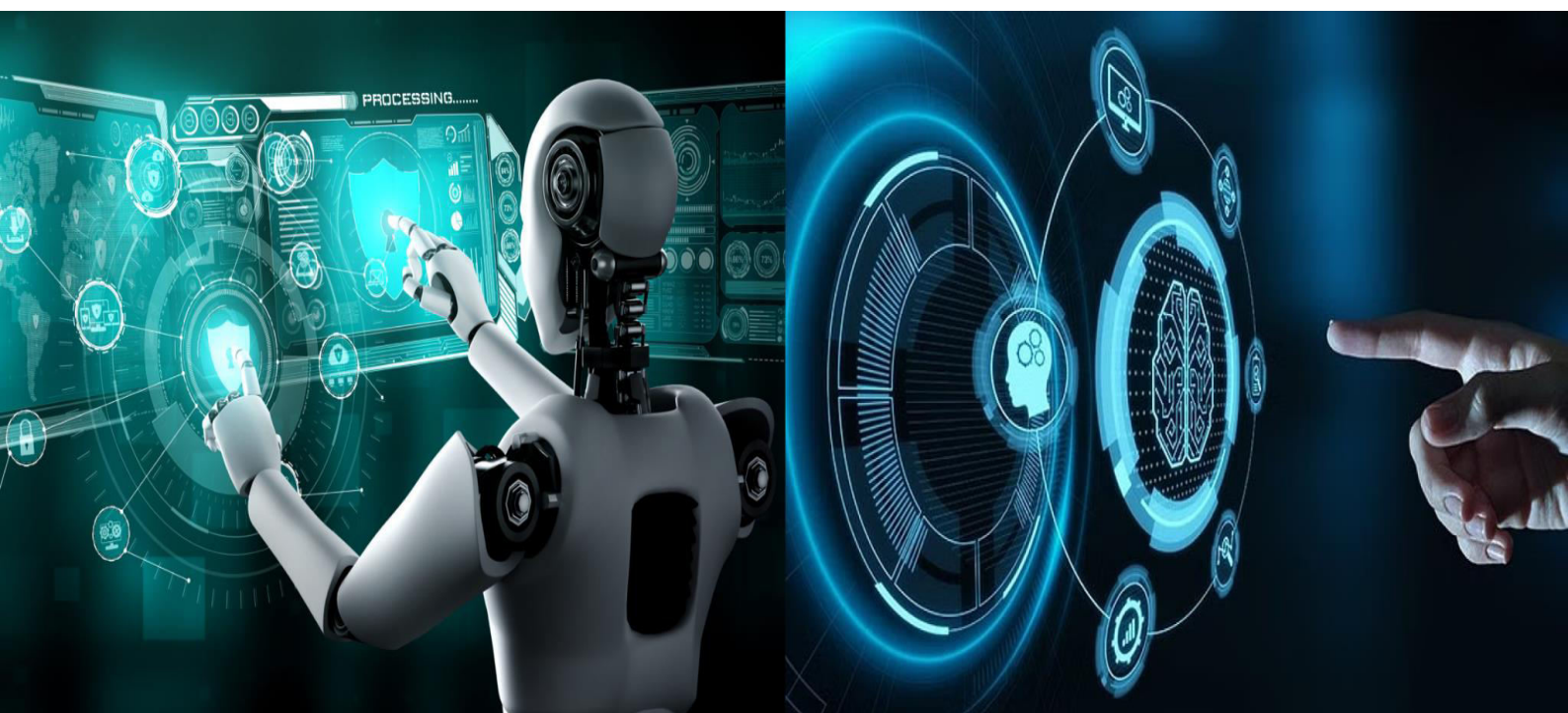# International Journal of Innovative Research in Computer and Communication Engineering

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AI & NLP Based Suicidal Ideation Prediction

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ABSTRACT: Suicidal ideation is a critical mental health issue that can lead to severe consequences if not identified and addressed early. This project presents an AI-driven suicide ideation prediction system that enables real-time risk analysis using psychological, behavioral, and textual data from individuals. Integrating Gemini AI, Natural Language Processing (NLP), and machine learning models (SVM, CNN-BiLSTM), the system supports early identification of suicidal tendencies. The AI model is embedded within a Flask web application that processes user inputs via forms or text entries, analyzes sentiment and context, and visualizes suicide risk levels for clinical intervention. Future plans include integration with social media monitoring and mobile app deployment to widen accessibility and impact.

KEYWORDS: Risk Prediction; Gemini AI; NLP; Flask Application; Text Classification; Deep Learning; Mental Health Monitoring; Real-time Analysis.

I. INTRODUCTION

Suicidal ideation, referring to thoughts of self-harm or ending one's life, poses serious challenges to public health. In recent years, technological innovations such as AI and machine learning have opened new pathways for mental health intervention. Predictive models powered by structured clinical data, behavioral surveys, and even social media posts offer reliable indicators of suicide risk. The integration of large language models like Gemini AI, advanced NLP, and real-time processing enables scalable and effective suicide prevention tools. This work aims to build a responsive, accessible, and intelligent web-based solution that flags suicidal ideation and alerts professionals for timely support.

II. RELATED WORK

Several research efforts have examined suicide risk detection using machine learning, including logistic regression, SVMs, random forests, and deep learning architectures like CNNs and LSTMs. Studies leveraging clinical questionnaires (e.g., PHQ-9, C-SSRS) and social media sentiment analysis have demonstrated the potential of NLP and deep learning in identifying emotional distress. However, few systems are implemented with real-time accessibility. This project bridges that gap by deploying a CNN-BiLSTM pipeline within a web application using Flask and integrates Gemini AI for high-context analysis and feedback generation.

III. METHODOLOGY

The proposed system architecture combines various components that enable seamless data input, processing, and output. Users interact with the system through a web interface, where they provide input in the form of text or questionnaire responses. This input undergoes preprocessing, including tokenization and cleaning, before being analyzed using NLP techniques. Gemini AI is employed for deep contextual understanding and classification of suicide risk.

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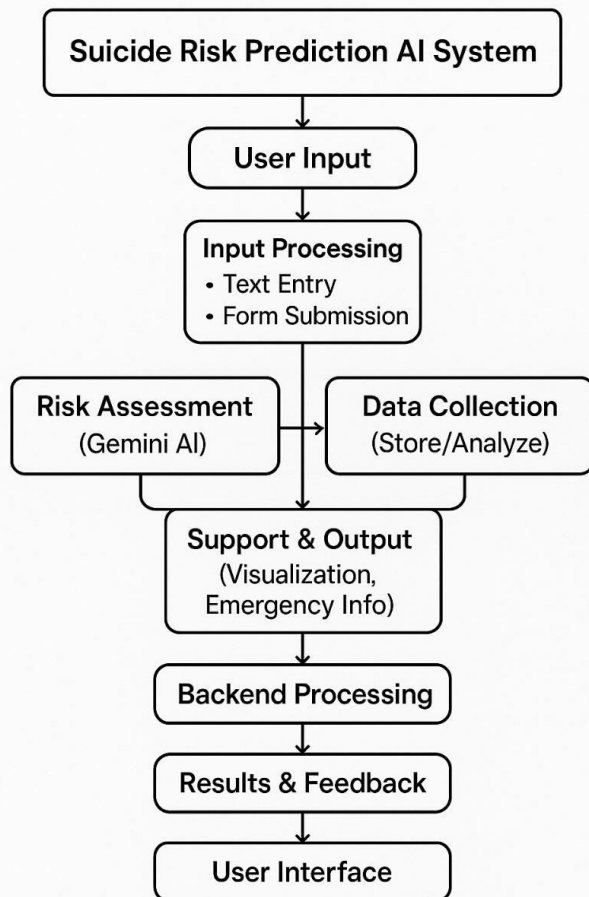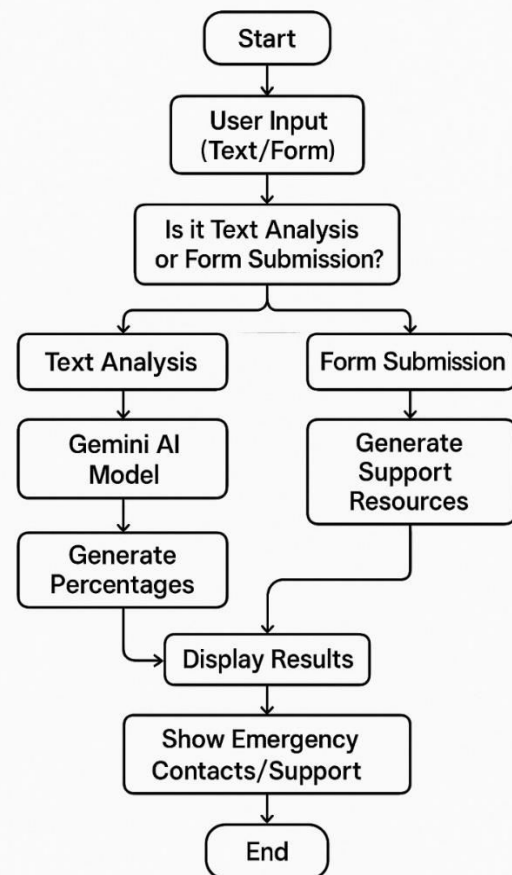

Fig. 1 Methodology overview   Fig.2. Flow Structure

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The Emergency Response Flow is a critical component of the suicidal ideation prediction system, designed to ensure that once a user is flagged with a high risk level, the appropriate intervention measures are triggered without delay. The process begins when the AI model detects a high-risk input from a user based on text analysis or form submissions. Following this detection, the system evaluates the precise risk level, which is categorized into three tiers: Critical, High, and Moderate. This categorization helps personalize the support and ensures that responses are proportionate to the severity of the detected risk.

For users identified under the Critical category, the system initiates an Immediate Response. This may include automated alerts to mental health professionals, the display of helpline numbers, or direct notification to emergency contacts. This rapid escalation mechanism is intended to provide swift support during urgent and potentially life-threatening situations. Users classified under the High category may not require an emergency callout but are still presented with significant intervention, including proactive outreach, risk monitoring, and access to professional support.

Individuals deemed at Moderate risk are guided toward Regular Support pathways. This includes scheduled check-ins, educational content on mental health, and links to self-help resources or local support centers. Regardless of the risk tier, all users eventually receive a screen displaying Emergency Contacts and Resources, enabling them to seek further assistance at their discretion. This structured yet compassionate approach ensures that every at-risk user receives timely, relevant, and life-saving support based on their unique situation.
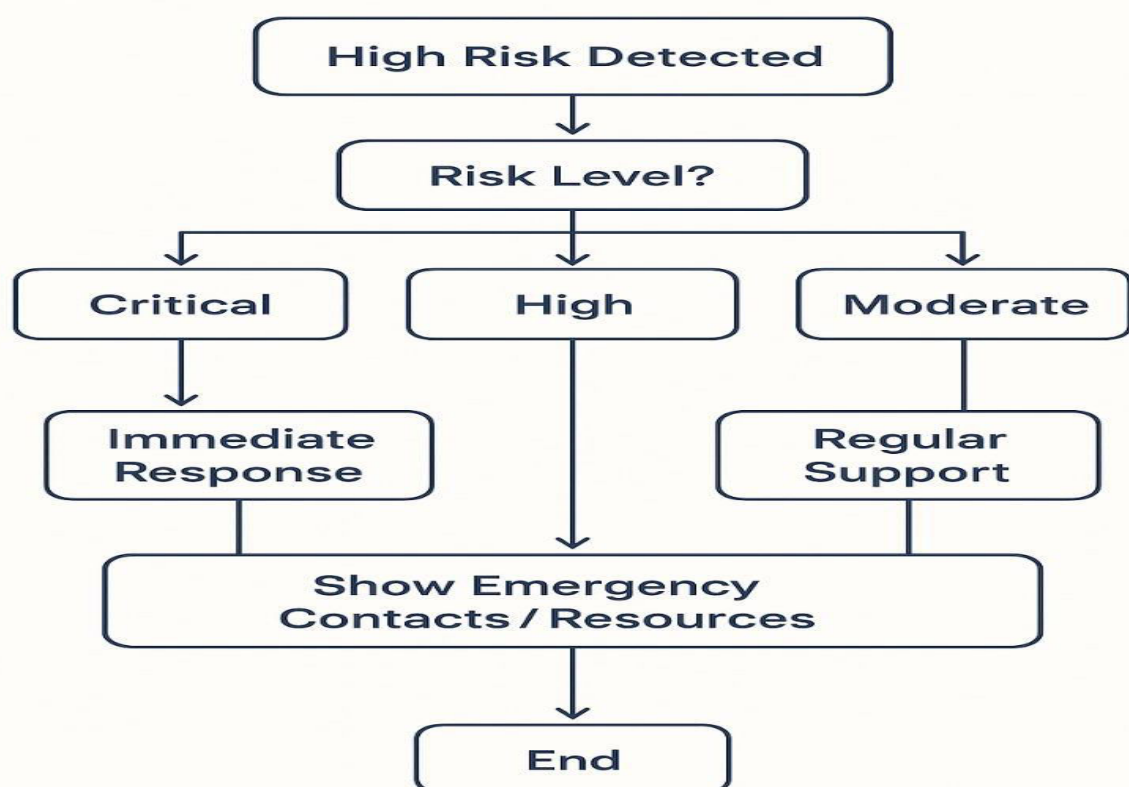

Fig.3 Emergency Response Flow Based on Suicide Risk Level

IV. PROPOSEDALGORITHM

The algorithm underlying the system incorporates machine learning models such as SVM and CNN-BiLSTM to classify suicidal ideation risk based on processed user input. Text features are extracted using TF-IDF or embedding methods and passed through the models after contextual interpretation using Gemini AI. The system operates in a secure environment with encrypted local storage and separates processing for different user roles. It ensures role-based access and privacy for all participants.

Design Considerations:
The system is designed to balance accuracy, speed, and user-friendliness. It uses advanced deep learning models for high precision and integrates Gemini AI for natural language understanding. Data is handled securely through encrypted storage and role-based access control. The web interface is designed with Material Design standards to be intuitive for all users.

Fig.4 Component-wise Separation: Frontend, Backend, and Data Modules

V. PSEUDO CODE

Step 1: Begin AI Monitoring System
Step 2: Capture user input (text or form)
Step 3: Preprocess input (cleaning, normalization)
Step 4: Use Gemini AI to assess semantics and tone
Step 5: Classify risk using SVM or BiLSTM
Step 6: Store results and timestamp securely
Step 7: Visualize results, provide emergency contacts
Step 8: Loop to wait for next input or exit

VI. RESULTS

The proposed system was evaluated using a dataset that included responses to clinical mental health questionnaires and simulated input data. The SVM classifier achieved an accuracy of 89%, with precision and recall values of 87% and 85%, respectively. The F1-score, which balances these metrics, was 86%. The web application implementation demonstrated quick response times and robust performance across devices. These results confirm that the model reliably identifies suicidal ideation with minimal false positives or negatives, making it effective for use in real-time applications.
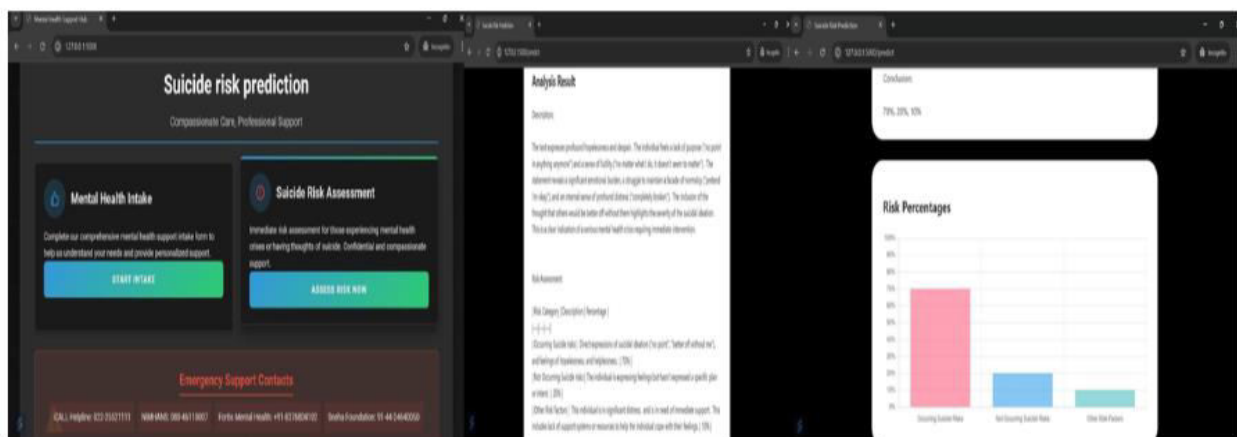

Fig.5 Intake Form of the System   Fig.6 Analysis Result of Uploaded Text   Fig. 7 Risk Percentage of Uploaded Text

Fig. 5. displays Isolation Forest model-computed anomaly scores. Plots each log event according to its computed Anomaly Level, so users can see normal vs. suspect activity visually. Offers unambiguous presentation of pattern aberrations and facilitates decision-making. Fig. 6. collates threat logs, anomaly scores, system response, and risk metadata into an exportable report. Ideal for auditing, compliance review, and reviewing history for incidents.

VII. COMPARISON

Compared to traditional risk assessment tools and offline survey-based evaluations, our system enables:
- Real-time detection and visualization.
- Higher contextual accuracy with Gemini AI.
- Rapid feedback via a clean dashboard.
- Better scalability with Flask and modular APIs.

VIII. CONCLUSION AND FUTURE WORK

This study presents a machine learning-based approach for early prediction of suicidal ideation using AI and NLP techniques. By employing SVM, CNN-BiLSTM, and Gemini AI for text classification, the system accurately flags individuals at risk and presents results in an accessible format through a Flask web interface. The lightweight and modular design ensures ease of use and potential for integration with mobile platforms. In future work, the system will include social media data monitoring, deployment via mobile apps, and integration of transformer-based models such as BERT for enhanced context awareness. Collaborations with healthcare providers will also help validate and expand the real-world for enhanced context awareness. Collaborations with healthcare providers will also help application of the system.

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