Student Stress Monitor: AI-Powered Mental Health Assessment System

Project Proposal

AI Systems Development Course

September 2025

Project Title

Student Stress Monitor: Intelligent Mental Health Assessment and Recommendation System

Intended Use of the System

Target Users

The primary target users are **college and university students aged 18-25** who are experiencing academic pressure, social challenges, and life transitions. Secondary users include **academic counselors, mental health professionals, and student support services** who can utilize the system's insights to better understand student wellness trends.

Real-World Context

Students will interact with the system in various contexts:

- **Personal Assessment**: During periods of high stress (exam weeks, major assignments, life changes)
- **Routine Monitoring**: As part of regular mental health check-ins and self-awareness practices
- **Crisis Prevention**: Early detection of escalating stress levels before they become overwhelming
- **Academic Support**: Integration with campus wellness programs and counseling services

The system operates as a web-based application accessible from any device, allowing students to perform assessments privately in dormitories, libraries, or counseling centers.

Intelligent Capabilities Supporting User Tasks

The AI system enhances traditional stress assessment methods by:

- **Automated Pattern Recognition**: Identifying subtle correlations between lifestyle factors and stress levels
- **Personalized Risk Assessment**: Providing individualized stress predictions based on multi-dimensional analysis

- **Adaptive Recommendations**: Generating contextual advice tailored to specific stress patterns and user profiles
- **Predictive Analytics**: Early warning systems for potential mental health crises
- **Continuous Learning**: Improving accuracy through user feedback and outcome tracking

Overall Functionality

Problem Statement

Traditional mental health assessments rely heavily on subjective self-reporting and clinical expertise, often resulting in delayed intervention and generic treatment approaches. Students frequently struggle to recognize stress patterns or access timely mental health support, leading to academic performance decline, social isolation, and potential long-term psychological impacts.

Core Functions and AI Techniques

1. Multi-Dimensional Stress Classification (Machine Learning)

- **Technique**: Supervised learning using Random Forest classification
- **Function**: Analyzes 20 lifestyle and psychological factors to predict stress levels (Low/Moderate/High Risk)
- **AI Advantage**: Processes complex, non-linear relationships between variables that human assessment might miss

2. Feature Importance Analysis (Knowledge Discovery)

- **Technique**: Tree-based feature importance ranking and correlation analysis
- **Function**: Identifies primary stress contributors for individual users
- **AI Advantage**: Reveals hidden patterns and prioritizes intervention areas

3. Adaptive Recommendation Engine (Rule-Based Reasoning)

- **Technique**: Expert system with conditional logic and user profiling
- **Function**: Generates personalized coping strategies and resource recommendations
- **AI Advantage**: Scales expert knowledge and provides 24/7 accessible guidance

4. Uncertainty Quantification (Probabilistic Reasoning)

- **Technique**: Confidence scoring and prediction uncertainty estimation
- **Function**: Provides reliability metrics for stress level predictions
- **AI Advantage**: Enables informed decision-making and appropriate escalation protocols

Main Components of the System

1. Perception/Input Module

- **Functionality**: Multi-modal data collection through structured questionnaires
- **AI Integration**: Natural language processing for open-text responses (future enhancement)
- **Contribution**: Standardizes diverse psychological and lifestyle indicators into quantifiable features

2. Knowledge Base

- **Functionality**: Stores validated psychological assessment frameworks, clinical guidelines, and intervention strategies
- **AI Integration**: Ontology-based representation of stress factors and their relationships
- **Contribution**: Provides evidence-based foundation for decision-making and ensures clinical validity

3. Machine Learning Engine

- **Functionality**: Core predictive modeling using ensemble methods (Random Forest)
- **AI Integration**: Supervised learning with continuous model improvement capabilities
- **Contribution**: Transforms raw assessment data into actionable stress level classifications

4. Inference Engine

- **Functionality**: Processes ML predictions and applies business rules for recommendation generation
- **AI Integration**: Hybrid reasoning combining statistical inference and expert knowledge
- **Contribution**: Bridges raw predictions with practical, personalized guidance

5. Personalization Module

- **Functionality**: User profiling and adaptation algorithms
- **AI Integration**: Clustering and collaborative filtering for recommendation refinement
- **Contribution**: Ensures interventions are culturally sensitive and individually relevant

6. User Interface and Visualization

- **Functionality**: Responsive web interface with intuitive data presentation
- **AI Integration**: Adaptive UI that adjusts based on user stress levels and preferences
- **Contribution**: Maximizes user engagement and comprehension of complex psychological data

System Architecture Rationale

This modular architecture separates concerns while enabling seamless AI integration. The **perception layer** ensures high-quality data input, the **knowledge base** provides clinical grounding, the **ML engine** delivers objective predictions, the **inference engine** adds contextual reasoning, the **personalization module** ensures relevance, and the **UI layer** maximizes accessibility. This division supports incremental improvement, regulatory compliance, and scalable deployment across diverse educational institutions.

System Impact: By combining machine learning accuracy (90.45% in initial testing) with clinical expertise and personalized delivery, this AI system transforms reactive mental health support into proactive, accessible, and effective student wellness infrastructure.