Mental Health and Well-being Surveillance Assessment and Tracking Solution Among Children

A PROJECT REPORT

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Ms. Pushpalatha M
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in partial fulfillment for the award of the degree of

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IN

INFORMATION SCIENCE AND TECHNOLOGY
At

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

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PRESIDENCY UNIVERSITY

SCHOOL OF COMPUTER SCIENCE ENGINEERING

CERTIFICATE

This is to certify that the Project report **"Mental Health and Well-being Surveillance Assessment and Tracking Solution Among Children"** being submitted by "Sudiksha.N, Shruti Kumari, Muskan Ali, DP Rakshitha, Vijay Vardhan M" bearing roll number(s) "20211IST0016, 20211IST0014, 20201IST0050, 20211IST0007, 20211IST0019" in partial fulfillment of the requirement for the award of the degree of Bachelor of Technology in Information Science and Technology is a bonafide work carried out under my supervision.

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DECLARATION

We hereby declare that the work, which is being presented in the project report entitled **Mental Health and Well-being Surveillance Assessment and Tracking Solution Among Children** in partial fulfillment for the award of Degree of **Bachelor of Technology** in **Information Science and Technology**, is a record of our own investigations carried under the guidance of **Ms. Pushpalatha, ASSISTANT PROFESSOR, School of Computer Science Engineering & Information Science, Presidency University, Bengaluru.**

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We have not submitted the matter presented in this report anywhere for the award of any other Degree.

ABSTRACT

Mental health problems are now more common among children and students, fueled by a range of factors like academic pressure, peer pressure, family life, and environmental factors. These problems, unless detected and treated early on, can drastically affect a student's overall growth, academic achievement, and social life. Conventional approaches to mental health screening tend to depend on self-reporting instruments and sporadic surveys, which are subjective and devoid of real-time monitoring. What is needed now is an intelligent and automated system that can help in early detection and tailored intervention for mental health problems among students.

This project, "Mental Health and Well-being Surveillance Assessment and Tracking Solution Among Children," seeks to bridge the gap by creating a software-based system that constantly tracks and analyses student mental well-being based on data-driven methods. The system is meant to gather pertinent data on different aspects such as academic performance, behavioural tendencies, social interactions, and self-reported emotional states. From this information, it utilizes sophisticated machine learning techniques—namely XGBoost to classify and K-Means Clustering to cluster similar behaviour profiles—to estimate mental health risk and classify students into various groups of mental health status.

Flask, an efficient Python web framework, is used to build the backend of the application, while HTML, CSS, and JavaScript are employed to develop the frontend with an intuitive and interactive user interface. The system enables smooth input of data, effective analysis, and easy visualization of outcomes. The system processes and stores data in CSV format to enable easy handling and scalability when dealing with big data. After categorizing the students, the system offers personalized recommendations and suggestions to enhance their mental well-being, which can be accessed by teachers, counsellors, and parents for informed decision-making and timely intervention.

One of the major innovations of this project is its transition from subjective questionnaires to AI-powered real-time analysis, which provides more accurate and reliable mental health assessments. Utilizing machine learning, the instrument can identify slight patterns and trends that might not be easily recognizable through human observation or traditional questionnaires. This allows the system to recognize potentially at-risk students early on and facilitate proactive intervention measures.

In support of the United Nations Sustainable Development Goal 3 (Good Health and Well-being), this project is working towards promoting mental well-being in learning spaces. Not only does it raise awareness for mental health, but it also equips stakeholders with practical knowledge to create a healthier, more supportive learning environment. The anticipated outcomes are higher rates of early identification of mental health issues, improved support for distressed students, and a more robust

culture of mental health literacy in schools and institutions.

The application is user-friendly, scalable, and can be tailored to different academic institutions. The system will be further augmented with some new features in the future, including sentiment analysis, chatbot-based mental health counselling, and predictive analytics to enhance its effectiveness and responsiveness. Through ongoing development and testing, the vision is to implement this solution as a tool for everyday use in all educational institutions to provide each student with the support and care they deserve—at the right moment.

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CHAPTER-1
INTRODUCTION

1.1General

Mental health is a crucial part of an individual's well-being, especially among students who face great academic and social stress. Development from childhood to adolescence and further to adulthood is characterized by several challenges, such as heightened expectations, peer relations, and emotional growth. Student mental health has been recognized as a key area by the World Health Organization (WHO) as conditions of mental illness tend to arise during adolescence and childhood, influencing future success and well-being.

While increasing consciousness of mental health problems, a large number of students lack proper support or intervention at the appropriate time. There are multiple reasons for this, such as stigma, ignorance, and inadequate access to expert mental health facilities. This points to the need for a technology-based solution that can assist in recognizing early signs of distress, monitor mental health trends, and make timely recommendations for students, parents, and teachers.

Mental health issues can adversely affect academic performance, relationships, and general well-being. Students suffering from chronic stress and anxiety tend to have difficulty concentrating, staying motivated, and being productive, which creates a cycle of academic and emotional suffering. The education system needs to introduce measures to identify and prevent mental health issues before they become severe conditions. An AI-supported, data-informed approach has great potential to help strengthen monitoring and early intervention functions so stakeholders may monitor trends, identify patterns, and initiate tailor-made interventions.

1.1.1 The Importance of Mental Health and Well-being Surveillance Among Children

Mental well-being is an integral part of overall health, particularly in the developing years of childhood and adolescence. As children grapple with academic stress, social pressures, and emotional development, their mental stability is critical to determining their future. The growing incidence of stress, anxiety, depression, and emotional exhaustion among students calls for attention and systematic support systems.

The value of a mental health monitoring and tracking system is that it can detect, monitor, and treat emotional issues early. Its services include:

- **Emotional Stability:** Assisting children to express their feelings and developing emotional resilience by picking up distress signals early.

- **Social Integration:** Enabling healthy peer relationships and minimizing the risk of isolation by recognizing patterns in behavior and interaction.
- **Academic Development:** Facilitating improved focus, motivation, and achievement by overcoming mental health obstacles to learning.
- **Preventive Treatment:** Providing prompt interventions prior to the escalation of problems, minimizing the long-term psychological effect.

In most schools, the absence of special mental health personnel and instant monitoring devices causes a huge gap in care. Standard methods like once-a-year counseling or question-and-answer surveys on paper are not enough to deliver ongoing care. Thus, combining artificial intelligence and machine learning with a child-centric mental health evaluation platform is not only groundbreaking—it is critical.

Aside from diagnostics, such a system promotes a culture of awareness, empathy, and proactive care. It equips educators, parents, and caregivers with the means to better understand children and support them where it is most needed. These considerations underscore the increasing demand for scalable, technology-based solutions that place emphasis on the mental well-being of the next generation.

1.2The Need for Mental Health and Well-being Surveillance Assessment and Tracking Solution Among Children

Mental health is central to the holistic development and well-being of children. In the current high-pressure, fast-paced environment, children are increasingly confronted by academic pressure, peer relations, family dynamics, and exposure to social media. These stressors, if not addressed, may result in anxiety, depression, behavioral problems, and poor performance at school. Even with increasing awareness of mental health, there is still a wide gap in early detection, ongoing monitoring, and early intervention—particularly within schools.

The necessity of a special mental health surveillance and tracking solution comes from various aspects:

- **Early Identification and Intervention:** The majority of mental illnesses among children are unnoticed until they develop. An organized surveillance system facilitates the detection of warning signs at an early stage, allowing prompt support and counseling.
- **Data-Driven Insights:** Conventional approaches like sporadic surveys or teacher reports might fall short in capturing the emotional well-being of a child. A technology-enabled system offers more reliable, unprejudiced, and actionable insights into mental health.
- **Academic and Social Impact:** Mental health directly influences the way a child learns, participates, and interacts. Negative mental health often goes hand-in-hand with negative academic performance and social withdrawal, which only worsens the problem.
- **Supporting Educators and Parents:** It is hard for children's teachers and parents to understand their mental state. A tool that provides immediate feedback and assessments empowers them to make informed, supportive actions.
- **Closing Accessibility Gaps:** Not every organization has access to psychologists or trained counselors. An AI system closes this gap by offering automated analysis and recommendations that can be reviewed by professionals.
- **Reduction of Stigma:** Normalizing the discourse regarding mental health by active surveillance, the system decreases mental health-related stigma and ensures openness in communication.

In consideration of these facts, development of an end-to-end, tech-driven mental health monitoring system is urgent and necessary. This system ensures children not just educationally but emotionally too, leading to healthier and happier living.

1.3Project Motivation

The "Mental Health and Well-being Surveillance Assessment and Tracking Solution Among Children" project was devised with the emergence of increasing mental health issues among students and children. Even though awareness has improved, most schools and institutions have inadequate systems in place for timely tracking, early detection, and personalized intervention. The conventional approach of counseling breaks down due to shortage, stigmatization, or archaic frameworks that fall short of keeping up with students' dynamic moods.

This project is driven by the imperative to shift from reactive to proactive mental health care. The project aims to empower educators, parents, and healthcare professionals with an informed system that tracks mental well-being in real-time through behavioral, academic, and self-reported indicators. With the use of AI and machine learning algorithms such as XGBoost and K-Means Clustering, the system can identify patterns and provide real-time recommendations that support better decision-making.

The aim is to create a secure, caring, and information-rich setting where the emotional well-being of each child is honored and nurtured. Whether installed in schools, community centers, or home environments, the system can be a game-changer in preventing long-term psychological issues and promoting whole-child development. By combining technology with empathy, the project seeks to reduce stigma, increase access to mental health care, and ensure that no child's suffering is ignored.

1.4 Scope of the Project

The project focuses on:

- **Target Audience**: School and college students, educational institutions, and mental health professionals.
- **Data Collection**: Inputs from students through questionnaires, academic records, and self-reported well-being scores.
- **Technology Stack**: Python, Flask, HTML, CSS, JavaScript, XGBoost, K-Means Clustering.
- **Expected Impact**: Early detection of mental health issues, improved intervention strategies, and enhanced student well-being.

The system shall be scalable and flexible to accommodate deployment across institutions. The mental health model will use AI to scan different types of datasets and enable institutions to customize interventions based on individual student needs. The integration of AI-fueled sentiment analysis and predictive analytics will help the system give insights beyond mere self-reporting mechanisms.

1.5 Significance of the Study

The role of mental health education cannot be ignored. This initiative will help create a less-stigmatized climate for mental illness by raising awareness, proactive management, and virtual intervention strategies. One of the main benefits of this system is that it will provide nonintrusive surveillance and customized feedback upon AI-based analytics, increasing mental health care as accessible and more efficient.

In addition, predictive analytics integration will facilitate trend analysis of student mental health, helping institutions identify and respond to systemic stressors that impact student well-being. The system will further assist policymakers and educators in developing data-guided policies that strengthen support systems for students.

1.6 Expected Challenges

While the project presents a promising approach, several challenges must be addressed:

- **Data Privacy and Security**: Ensuring that student data is securely stored and accessed only by authorized personnel.
- **User Adoption**: Encouraging students to participate in self-assessments and engage with the platform regularly.
- **Model Accuracy**: Improving AI-based predictions to ensure that assessments align with real-world psychological evaluations.
- **Bias in Data**: Ensuring that AI models are trained on diverse datasets to avoid biases in mental health assessments.

This project seeks to offer a comprehensive, AI-based solution for enhancing mental health monitoring and evaluation among students. With the use of cutting-edge technologies like machine learning, predictive analytics, and AI-facilitated decision-making, this system will help adopt a more efficient and scalable mental health care method in educational settings. The development and research process will be directed towards optimizing algorithms, augmenting user experience, and making ethical AI usage for a strong, effective mental health evaluation tool.

As mental health issues among students have grown, technology-based solutions become an important bridge between students and mental health care services. The proposed system in this project will offer real-time analysis, early intervention methods, and a systematic approach to enhancing student mental health outcomes, promoting a healthier and friendlier learning environment.

CHAPTER-2
LITERATURE SURVEY

Around the world, mental illnesses are on an increase, particularly among children, working individuals, and students. Though vital, conventional diagnosis and treatment strategies are often hampered by limitations such as the scarcity of qualified practitioners, social stigma, and out-of-reach costs. The trend is toward digital, autonomous systems for monitoring, diagnosing, and even treating mental disorders due to technological advancements in artificial intelligence (AI). Rated based on technology deployed, target populace, methodological depth, and practical significance, this literature survey collates and reviews recent contributions (2020–2024) that analyze the integration of AI in mental health.

1.Review Studies and AI Techniques

Numerous articles provide a broad overview of AI's potential for use in mental health applications.

Reviews of AI-based methods for mental health monitoring were carried out by Zhang et al. (2024) and Lee et al. (2023). Zhang et al. focused on deep learning and machine learning applications for early detection of disorders like depression and anxiety. They talked about popular data types (such as EEG signals, text sentiment, and facial expressions) and algorithms (such as CNN, SVM, and Naïve Bayes).
Despite their extensive reach, these studies mostly offer theoretical and conceptual understandings. Their main drawback is the absence of user-focused case studies or real-world validation.

Gupta et al. (2024) talked about new AI developments in virtual therapy, predictive modelling, and real-time sentiment analysis with natural language processing. Although they acknowledged that cross-cultural and experimental validation is still lacking, they projected that AI would soon play a significant role in global mental health policy.

2. Monitoring of Student and Paediatric Mental Health

AI has demonstrated special promise in addressing the needs of children and students, who frequently encounter obstacles when trying to access conventional mental health services.
Verma et al. (2023) developed machine learning models that were trained on student response labelled datasets. In order to identify indicators of stress and academic burnout, the study employed classification algorithms like Random Forests and Decision Trees. The small size and lack of diversity of the training data limited the model's ability to achieve over 85% accuracy, which may have an impact on its practical use.

Raj et al. (2022) used AI-driven intervention techniques for students, fusing AI decision trees that adjust to user input over time with psychological models (such as CBT). Although their tool helped students better control their emotions, counsellors had to keep an eye on them constantly to prevent misclassification.

Williams et al. (2022) concentrated on cases involving children. Their AI model integrated developmental parameters into a diagnostic tool to identify anxiety disorders and autism spectrum disorders in children. The study underlined the need for clinical validation and parental involvement in AI usage, despite the encouraging initial results.

3. Wearables and IoT for Real-Time Monitoring

Proactive care is made possible by real-time mental health monitoring, particularly in high-risk situations.

A hybrid framework combining AI models and IoT devices was presented by Johnson et al. in 2023. In order to identify abnormalities suggestive of stress or panic attacks, wearables such as smartwatches gathered data on heart rate variability, sleep patterns, and activity levels. These data were then analysed using machine learning algorithms.
By creating mobile applications driven by AI, Al-Khatib et al. (2022) also addressed accessibility. To monitor mental states, their apps employed self-report questionnaires supplemented by sentiment analysis and behavioural patterns (such as social media usage and app activity).
Mobile apps guarantee wider reach, particularly in rural areas, but they rely significantly on regular engagement and honesty from users.

4. Using Deep Learning to Improve Diagnostic Precision

Understanding intricate emotional and cognitive patterns has advanced significantly as a result of deep learning.

CNNs and RNNs were used by Williams et al. (2023) on multi-modal datasets that comprised written texts, audio recordings, and facial expression data. Their model could predict the onset of depressive episodes with over 90% accuracy. This illustrates DL's potential for automated, impartial evaluations.

However, there are practical difficulties due to the high computational cost and need for large labelled datasets, particularly in environments with limited resources.

When Smith et al. (2020) contrasted AI-based diagnostics with conventional psychiatric evaluations, they discovered that the latter were more reliable, quicker, and frequently more accurate—especially when it came to identifying co-morbid conditions. However, they underlined that human oversight is essential because algorithms might miss subtleties specific to a given context.

5. Conversational agents and chatbots

AI chatbots have been used as a first line of defense for mental health issues, particularly for those who find in-person therapy uncomfortable.

Wilson et al. (2021) investigated the use of AI-powered chatbots that converse with users and determine their emotional tone using Natural Language Processing (NLP). These bots assist users with journaling, relaxation techniques, and cognitive restructuring.

Their scalability and round-the-clock availability are advantages, but they are severely limited by their lack of emotional intelligence and incapacity to react sympathetically in emergency situations.

6. Operational, technical, and ethical difficulties

Gupta et al. (2024) and Kumar et al. (2021) both highlighted ethical issues. These include privacy issues, especially with wearable and mobile-based systems, and algorithmic bias, particularly when training data is unbalanced.

The studies also emphasized the significance of interdisciplinary collaboration: in order to guarantee that models are both technically sound and clinically appropriate, AI developers, psychologists, and clinicians must collaborate.

The explainability of the model is another issue. A lot of ML/DL models are mysterious. Clinicians might be reluctant to use them for important decisions if they are not interpretable.

With uses in early diagnosis, real-time monitoring, and therapy support, the incorporation of AI in mental health monitoring shows promise. Even though technology is developing quickly, there are still obstacles to overcome. These consist of:

- AI model bias brought on by non-representative data
- Ethics and privacy issues with ongoing data monitoring
- AI conversational agents' limited capacity for emotional comprehension
- Deep learning models' inability to be explained
- Too few extensive clinical trials

Interoperability with current healthcare systems, data ethics, and explainable AI (XAI) should be the top priorities of future research. In order to address global disparities in mental health, multilingual and culturally sensitive models are also desperately neede

CHAPTER-3
RESEARCH GAPS OF EXISTING METHODS

Limitations in Current Assessment Tools

1. Dependence on Self-Reporting:

Most school mental health screenings rely significantly on student self-report surveys or occasional counselor contacts. These measures tend to be hampered by subjectivity, social desirability distortion, or unwillingness to reveal genuine emotions because of stigma. Thus, early warning signals are overlooked or mislabeled.

2. Infrequent Monitoring:

Routine mental health assessments are usually done at regular intervals (e.g., quarterly or yearly), not catching dynamic shifts in a child's mental status. This absence of ongoing monitoring slows down timely interventions.

Data Collection and Quality Issues

1. Absence of Real-time Data:

Most school systems lack real-time monitoring of students' behavioral, academic, or emotional trends, making it a reactive system instead of proactive.

2. Limited Data Variety:

Current models fail to incorporate a wide variety of indicators like academic history, behavioral signals, attendance, peer feedback on interactions, and online engagement. Lack of such rich data diminishes the validity of insights.

Technological Gaps

1. Ineffective Employment of AI and Predictive Models:

Though AI has demonstrated great potential in medicine, its implementation in mental health screening among students is still low. Conventional models do not possess predictive acumen to predict risk levels from trends.

2. Insufficient Visualization and Feedback Tools:

Existing solutions do not provide easy-to-use visualizations or dashboards for parents or teachers to gain insight into trends or patterns within students' mental health, therefore missing out on actionable data.

Intervention Limitations

1. Generic Recommendations:

Most programs provide general recommendations instead of individualized plans. Each student possesses different stressors and coping mechanisms, which need individualized intervention plans.

2. Delayed Response Time:

Because of administrative delays or inefficiencies in the system, students in crisis tend not to receive assistance when they need it the most. There is no real-time alert and escalation system in place.

Societal and Cultural Challenges

1. Mental Health Stigma:

There is a large stigma surrounding mental health, especially among children and in schools. This dissuades people from being open about their issues and discourages the early detection of problems.

2. One-size-fits-all Approach:

Most existing systems fail to consider socioeconomic, linguistic, or regional heterogeneity within student populations, resulting in flawed interpretation and poor interventions.

Integration with Educational Systems

Incompatibility with School Facilities:

The tools in place are too sophisticated or were not built with the technical limits of schools in mind. They don't have integration with school management systems or teacher interfaces for most of them.

Proposed Solution

To fill these gaps, this project suggests a software solution that applies machine learning algorithms such as XGBoost and K-Means to classify students into mental well-being categories using multi-source data. The system provides continuous monitoring, real-time feedback, and data-driven interventions through an intuitive interface for schools. With CSV-based storage for flexibility and visualization dashboards for teachers, it seeks to democratize access to student mental health insights.

CHAPTER-4
PROPOSED MOTHODOLOGY

The system to be proposed is intended to evaluate, track, and improve the mental well-being and health of students through Artificial Intelligence (AI) and Machine Learning (ML) methodologies. The approach describes a systematic, data-based process, from data input collection to insight creation and recommendation presentation. The system has an easy-to-use web-based interface that supports interaction and report generation for students, parents, teachers, and mental health practitioners.

4.1. System Overview and Architecture

The system architecture is modular, designed for scalability, flexibility, and seamless integration of multiple technologies. It encompasses the following key elements:

Data Collection Module: Gathers responses from students via structured questionnaires or self-reported measures.

Preprocessing Module: Cleans and prepares data for machine learning analysis.

Machine Learning Engine: Employs XGBoost to classify risk and K-Means clustering to identify trends.

Recommendation Engine: Provides customized coping actions and support interventions.

Web-Based Interface: Built with Flask, HTML, CSS, and JavaScript, facilitating accessibility and simultaneous appearance of results.

All modules are described in detail in the subsequent sections.

4.2. Data Collection and Preprocessing

4.2.1 Data Collection

Data are gathered from students using structured questionnaires consisting of multiple-choice items, rating scales (e.g., Likert), and open-ended entries on the following domains:

Emotional well-being (stress, anxiety, mood)

Sleep habits and quality

Academic performance and workload

Physical activity and screen time

Social interaction and peer relationships

The answers are saved in structured formats like CSV files and secured for further processing. The gathering can be done at regular intervals to track trends over time.

4.2.2 Data Preprocessing

This step prepares the raw data for analysis by the ML models. It involves the following steps:

- **Data Cleaning:** Deletion of missing values, duplicates, and inconsistencies to maintain high data quality.
- **Feature Engineering:** Transformation of qualitative inputs into useful numerical features and creation of new composite indices (e.g., stress index, mood score).
- **Normalization and Scaling:** Scaling of feature values to enhance model performance, particularly for algorithms that are sensitive to data scale.

4.3. Machine Learning-Based Analysis

4.3.1 Predictive Classification (XGBoost)

The system utilizes the XGBoost algorithm to classify students into risk categories:

Low Risk – Normal mental health levels

Moderate Risk – A few signs of stress or emotional distress

High Risk – Urgent attention needed for mental health intervention

XGBoost is selected due to its high precision, efficiency, and capacity to deal with imbalanced datasets using regularization and boosting methods.

4.3.2 Clustering and Pattern Identification (K-Means)

K-Means clustering clusters students according to similarities in behavior and mental health markers. This assists in:

Identifying common trends or underlying patterns between student groups

Segment the student base for targeted interventions

Examine how clusters form over time (e.g., stress clusters at exam times)

4.3.3 Sentiment Analysis (Future Improvement)

A subsequent version of the system will be integrated with Natural Language Processing (NLP) to process open-ended free text responses and determine emotional tone. This will facilitate:

Greater contextual comprehension of student responses

Recognition of negative sentiment (e.g., sadness, hopelessness) or positive sentiment (e.g., confidence, happiness).

4.4. Recommendation Engine

A dynamic recommendation engine, based on the outputs of classification and clustering, produces personalized recommendations, which could be:

Stress management advice (e.g., mindfulness, breathing techniques)

Academic planning recommendations

Lifestyle changes (e.g., sleep habits, screen time restriction)

Referrals to school counselors or mental health specialists in high-risk scenarios

All these recommendations are provided in a student-friendly and non-intrusive way, promoting self-help and guided change.

4.5. Web Application Development

4.5.1 Backend

The backend of the system is implemented with the Flask framework, which links the frontend to the ML models and controls data exchange. Flask deals with:

Handling form submission and response

Model inference (execution of XGBoost and K-Means)

Data routing and database control.

4.5.2 Frontend

The frontend is implemented with HTML, CSS, and JavaScript, emphasizing user-friendly and interactive design. Some of the key features are:

- **Login & Registration:** Provides user-specific access to mental health reports.
- **Dashboard:** Shows individual risk level, assessment overview, and current trends.
- **Graphical Reports:** Graphs and charts (using libraries such as Chart.js) display mental health trends over a period of time.
- **Recommendation Panel:** Shows recommended actions and well-being advice in a visually readable format.

4.6. System Workflow

The overall system workflow is as follows:

- **User Interaction:** The student logs in and completes the mental health questionnaire.
- **Data Collection:** Responses are gathered and stored in a structured format.
- **Preprocessing:** Data is cleansed, standardized, and converted into feature vectors.

AI Model Processing:

XGBoost assigns the risk category of the student.

K-Means identifies the cluster/group of the student based on similar behaviors.

Recommendation Generation: Suggestions are suggested based on the classification and grouping.

Result Display: A graphic dashboard displays the risk category, graphical insights, and improvement action plans.

4.7. Applied Technologies

The given tools and technologies are utilized in the implementation:

Machine Learning:

XGBoost: Predictive classification

K-Means: Clustering and trend analysis

NLP (Future Plan): For text-based sentiment analysis

Web Development: Frontend: HTML, CSS, JavaScript

Backend: Flask (Python)

Data Handling: CSV, Pandas, NumPy

Visualization: Matplotlib, Seaborn, Chart.js (for web interface)

4.8. Expected Outcomes

The system is expected to provide the following:

Early detection of mental health issues among students.

Ongoing monitoring and feedback of student well-being.

Data-driven assistance to educational institutions and parents.

Higher awareness and proactive intervention.

Improved personalization in mental health care.

4.9. Future Enhancements

To broaden the scope of the system, the following enhancements are being proposed:

Chatbot Integration: For live mental health discussions and initial counseling.

Mobile App Version: To facilitate better reach on smart phones.

Real-Time Monitoring: Through behavior sensors or frequent mood checks.

Advanced Predictive Analytics: For recognizing developing mental health threats.

This suggested methodology presents a comprehensive, AI-based strategy for monitoring and supporting student mental health. Through the integration of predictive models, intuitive design, and actionable intelligence, the system can potentially develop safer and more supportive learning environments.

CHAPTER-5
OBJECTIVES

In an increasingly competitive and high-pressure learning environment, mental health among students has become an urgent concern. The proposed project—Mental Health and Well-being Surveillance Assessment and Tracking Solution—is designed to tackle this concern through an AI-driven, web-enabled system capable of early detection, personalized care, and real-time monitoring of students' psychological well-being.

This project aims to create an intelligent and extensible platform through data analytics, machine learning, and web-based interactive technologies for the detection, analysis, and creation of actionable insights for the enhancement of students' mental well-being. This platform not only aims to benefit students but also parents, teachers, and institutions in assisting in the creation of a healthier and more caring academic environment.

Core Goals of the Mental Health Assessment Platform

5.1. Early Detection of Mental Health Issues

One of the primary goals of this system is to identify early warning signals of stress, anxiety, and depression through continuous monitoring and behavior analysis. With the use of trained machine learning models on well-structured self-assessment data, the system will provide timely warnings, enabling early intervention and prevention. This preventive action enables mental health care to be started before conditions escalate.

5.2. Machine Learning-Based Mental Health Classification

The platform utilizes a hybrid AI model employing:

- XGBoost for supervised classification of student mental health risk levels.
- K-Means Clustering for unsupervised clustering of students based on behavioral and psychological patterns.

The hybrid model provides both accuracy and pattern discovery, improving the quality of mental health profiling.

5.3. Real-Time Data Processing and Dynamic Dashboards

The platform facilitates speedy and effective processing of student answers through optimized handling of data. An interactive and responsive dashboard delivers:

- Real-time analysis
- Visualization via graphs and trend lines
- Simple interpretation of trends in students' mental wellness for parents and teachers

This will enable stakeholders to track well-being patterns over time and determine areas of emerging concern.

5.4. Personalized Mental Health Recommendations

The AI-driven recommendation engine will provide individualized recommendations to every student. These may include:

- Relaxation method
- Time management techniques
- Wellness activities
- Counseling material

This personalized method caters to individual requirements, enhancing the chances of positive outcomes.

5.5. Secure, Accessible Web-Based Interface

The interface will be a web-based user interface built using Flask (Python backend), and HTML, CSS, and JavaScript (frontend). Major features are:

- Secure login and registration system
- Confidential handling of user data
- Mobile and desktop accessibility
- Intuitive user design for users of all ages and technical skill levels

This will ensure that students, teachers, and parents are able to use the platform easily and securely.

5.6. Educational Integration and Awareness Modules

In order to create a culture of mental well-being, the platform will:

- Be deployable in schools and colleges
- Contain educational resources and mental health awareness modules
- Encourage participation through interactive training materials and workshops

This goal promotes early mental health literacy and enables students to ask for help when necessary.

5.7. Flexibility for Various Age Groups and Settings

Although initially focused on school students, the system is scalable and flexible to accommodate:

- College and university students
- Corporate wellness initiatives
- Workplace mental health screenings

This provides a wider societal reach, promoting well-being across age groups and occupations.

5.8. Long-Term Perspective and Future Developments

The system is future-proof, with future developments already in mind:

- AI Chatbot: A mental wellness buddy that provides immediate support and empathetic talk
- Mobile App Integration: To extend reach and usage
- NLP-based Sentiment Analysis: To evaluate open-ended text-based answers and pick up on nuanced emotional signals
- Collaboration with Mental Health Professionals: To fine-tune models, test recommendations, and align with ethics

5.9. Data-Driven Institutional Decision Support

Through gathering and analyzing collective mental health information, schools and universities will obtain:

- Actionable intelligence on trends in student well-being

- A basis for planning counseling services, academic assistance, and stress management initiatives.
- Improved crisis readiness or psychological emergencies

This transforms institutions from a reactive to proactive approach to student mental health management.

Anticipated Societal Impact

- Enhanced student outcomes: Through early intervention and assistance
- De-stigmatization of mental health concerns: By rendering mental wellness monitoring normalized and accessible
- Policy-making assistance: For schools and government agencies utilizing anonymized mental health information
- Inclusivity and empathy: Through collective understanding of psychological well-being in education

CHAPTER-6
SYSTEM DESIGN & IMPLEMENTATION

The system architecture of the Mental Health and Well-being Surveillance Assessment and Tracking Solution Among Children is intended to collect, process, and display mental health measures in real-time systematically. The system combines modules for data inputs, machine learning analysis, cluster algorithms, and web-based front ends to make actionable recommendations for students' mental well-being. The system architecture is modular, scalable, and flexible to be used in numerous school settings.

6.1 System Overview

The system is designed around a data flow — from user input (students, instructors, counselors) to processing of data with AI models, then to interpretation and visualization through an interactive dashboard. Every module is built to be independent yet integrated, making it versatile in development and stable performance.

6.2 System Modules

6.2.1. Data Input Module

Functionality:

This module receives subjective and objective inputs from students using digital self-assessment forms. These inputs include different mental health parameters such as mood, stress levels, sleep pattern, ability to concentrate, and social interaction.

Technologies Utilized:

- React with Tailwind CSS (frontend)
- TypeScript (.tsx files)
- HTML5 form elements
- Validations using React Hook Form and Yup

Process Flow:

- Students fill out the form through a secure login.
- Inputs are checked in real-time to prevent incomplete or invalid inputs.
- Data submitted is sent securely to the backend for processing.

Features:

- Easy-to-use interface for children.
- Multiple choice and Likert scale questions.
- Mobile-friendly layout.

6.2.2. Data Preprocessing & Storage Module

Functionality:

Raw input data is processed to prepare it for machine learning model inference. This involves missing value handling, scaling numeric inputs, and one-hot encoding categorical variables.

Technologies Used:

- Node.js (backend API)
- Pandas and NumPy (preprocessing through Python services)
- MongoDB (NoSQL database for dynamic schema support)

Process Flow:

- Preprocessed data is parsed and inserted into MongoDB in standard format.
- Preprocessed data is cleaned and stored in MongoDB, indexed by student ID and timestamp.

Benefits:

- Dynamic schema supports adding new survey parameters.
- Efficient retrieval for time-series analysis.

6.2.3. Machine Learning Analysis Module (XGBoost)

Functionality:

The module applies the XGBoost classification algorithm to determine the mental health risk level (Low, Moderate, High) from processed input data.

Technologies Used:

- Python with XGBoost
- Flask REST API for model inference

Process Flow:

- Processed input data is passed to the Flask backend for cleaned data.
- The XGBoost model makes predictions on risk level.
- The result is saved into the database and sent to the clustering module for further analysis.

Advantages:

- High classification accuracy and speed.
- Ability to manage skewed data with weighted training.

6.2.4. Clustering Module (K-Means)

Functionality:

Clusters students into groups of similar behavioral and psychological traits, providing group-specific intervention ideas.

Technologies Used:

- Scikit-learn's K-Means
- Elbow method for selecting the best number of clusters

Process Flow:

- Feature vectors from the preprocessing module are input to the K-Means model.
- Based on similarity in responses, clusters are created.
- Cluster labels are retained and displayed in the dashboard.

Features:

- Aids in finding prevalent stressors or mental health trends for groups.
- Supports targeted intervention planning.

6.2.5. Dashboard & Visualization Module

Functionality:

Offers administrators and counselors a centralized dashboard to view student mental health trends, specific cases, and cluster-level trends.

Technologies Used:

- React + Tailwind (.tsx)
- Chart.js and Recharts for visualization
- JWT-based authentication

Process Flow:

- Authenticated users log in to view the dashboard.
- API calls retrieve model predictions, trends, and historical data.
- Visual components present student risk distribution, cluster stats, and behavior trends.

Key Features:

- Real-time alerts for high-risk students.
- Monthly and weekly reports.
- Drill-down functionality to delve into individual student history.

6.3 Technologies Used

Component	**Technology/Tool**
Frontend	React.js, Tailwind CSS, .tsx files
Backend	Node.js, Flask (Python)
Database	MongoDB
ML Classification Model	XGBoost
Clustering Algorithm	K-Means (Scikit-learn)
Visualization	Chart.js, Recharts
Authentication	JWT

Table:1.1

6.4 System Features

1. AI-Powered Mental Health Assessment

Utilizes trained XGBoost classifiers to analyze risk levels from survey responses with high accuracy.

2. Group Behavior Analysis

Uses unsupervised clustering (K-Means) to detect common mental health traits among groups of students.

3. Real-Time Monitoring & Alerts

Marks students with high-risk flags and triggers alerts for counseling personnel.

4. Customizable Surveys

Quickly update or change questions and parameters via dynamic form adjustment.

5. Privacy & Data Security

All the sensitive information is encrypted and accessible only through authenticated sessions.

6. Interactive Dashboards

Provides deep analytics with trend visualization, cluster insights, and individual risk scores.

6.5 Flowchart

The system flow diagram shows the journey of user input from self-assessment to risk analysis and dashboard output.

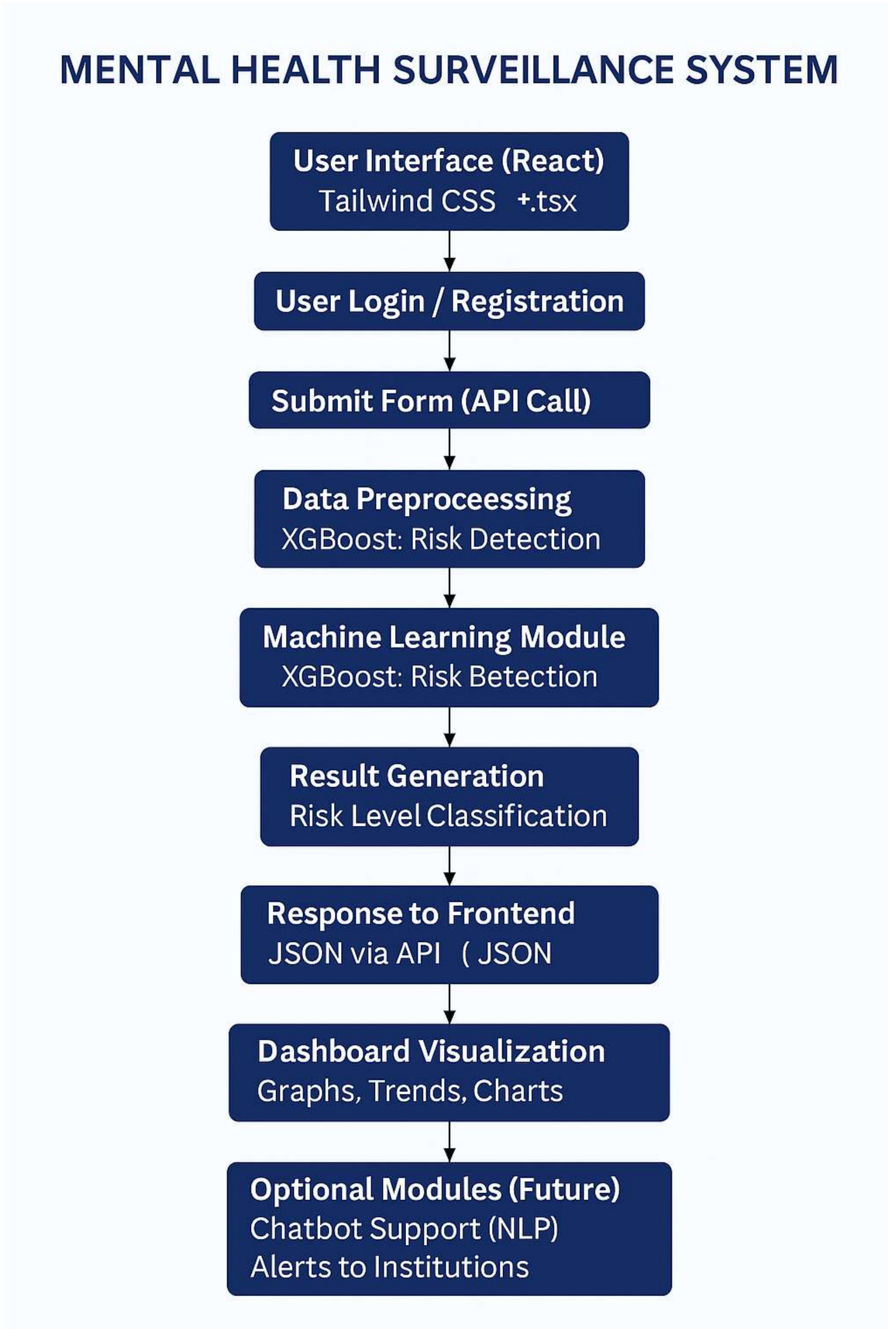


Figure 1.1: System flow diagram

CHAPTER-7

TIMELINE FOR EXECUTION OF PROJECT (GANTT CHART)

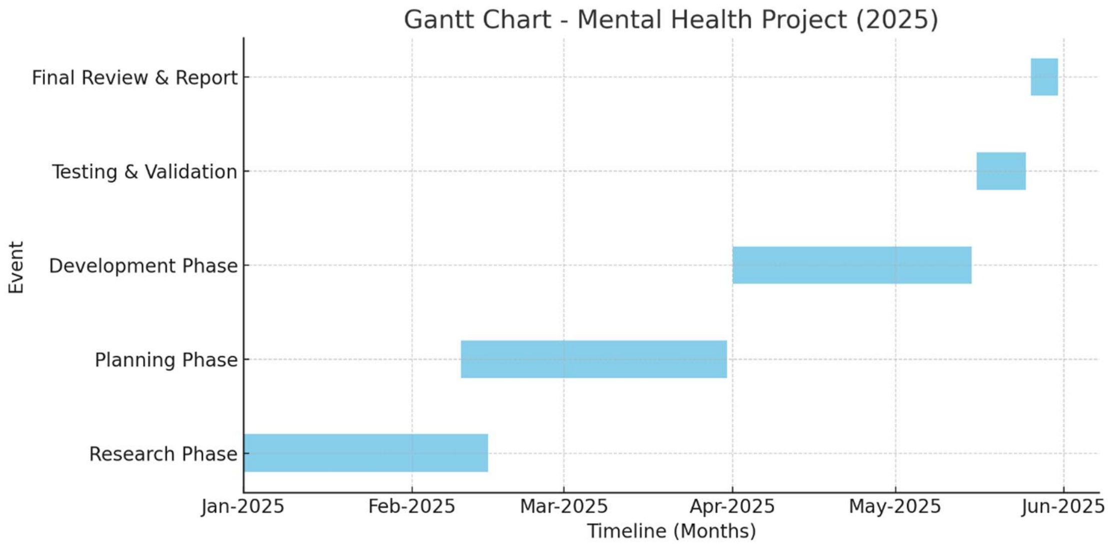


Figure 1.2: Gantt Chart

Phased Approach for Mental Health and Well-being Surveillance Assessment and Tracking Solution Among Children

The Mental Health and Well-being Tracking System project is strategically segmented into four main phases: Research, Planning, Development, and Final Review. This phased and structured execution model ensures that every aspect of the project is tackled in a systematic manner—from initial data understanding to system deployment and validation. This approach facilitates clarity, traceability, and alignment with project objectives, timelines, and deliverables.

7.1. Research Phase (January 2025 – February 2025)

Objective:

The aim of the Research Phase is to conduct an in-depth analysis of available mental health assessment frameworks, child-relevant datasets on psychological health, and machine learning models for well-being classification and monitoring. This phase forms the basis of knowledge for system modeling and model selection.

Activities:

- **Literature Review on Mental Health Assessment Tools:**
  An exhaustive literature review will be done to identify current psychological assessment systems like the Strengths and Difficulties Questionnaire (SDQ), behavioral rating scales, and WHO guidelines for child well-being surveillance. Peer-reviewed journals, WHO reports, and current academic research will be examined.

- **Knowledge of Stakeholder Needs:**
  School counselors, parents, and child psychologists will be considered as primary stakeholders to learn about the markers of concern and the desired outcomes from a well-being tracking system.

- **Data Collection and Preprocessing:**
  We will collect public mental health datasets. These could include survey data, behavioral observation logs, or well-being metrics. The data will be preprocessed—handling missing values, normalization, feature design, and anonymization—to prepare it for analysis.

Expected Outcome:

The Research Phase will provide a comprehensive literature survey report, a set of the most important child mental health indicators, and a clean and prepared data set ready for analysis and model building.

7.2. Planning Phase (January 2025 – March 2025)

Objective:

The detailed architecture design and technical and non-technical components of the system are planned in this phase. Implementation strategy and technology roadmap are well defined during this phase.

Activities:

- **System Architecture Design:**

The architecture will be modular consisting of:

- Frontend (React + Tailwind)

- Backend (Flask for AI model inference)
- Database (MongoDB/PostgreSQL)
- Machine Learning modules (XGBoost for prediction, K-Means for group users)

- **Use Case and Data Flow Modeling:**

UML diagrams, data flow diagrams, and sequence diagrams will be developed to show how input is received (e.g., student answers), processed by the AI model, and displayed on the dashboard.

- **Technology Stack Finalization:**

Frontend and backend development frameworks and tools will be finalized. These include libraries such as Scikit-learn, Pandas, React, Flask, and charting libraries such as Chart.js or Recharts.

- **Timeline and Milestone Planning:**

Every development milestone will be detailed:

- Dataset Finalization
- Model Training
- Web UI Setup
- Integration Testing
- Final Review

Expected Outcome:

A complete technical roadmap of the system finished tech stack, and a schedule with specific development objectives and delivery timelines.

7.3. Development Phase (March 2025 – April 2025)

Objective:

The Development Phase is where the system's core functionality is developed, such as the backend AI models, frontend user interface, and database schema. The rigorous testing and integration of all modules is undertaken during this phase.

Activities:

- **Model Training and Validation:**

With the cleaned data, machine learning models (XGBoost classifier, K-Means clustering for similar well-being states) will be validated and trained. Hyperparameter optimization and cross-validation will be utilized to provide high accuracy.

- **Frontend Development (React + Tailwind):**

User interface will comprise school administrator and counselor dashboards. User features will comprise mental health state visual indicators, student progress graphs, and recommendation screens.

- **Backend API Setup (Flask):**

APIs will be constructed for:

  - Enter student well-being inputs
  - Retrieving prediction outcomes
  - Retrieve clustered reports for batch analysis

- **Database Schema Design:**

A database will be designed to hold user information, prediction outcomes, intervention logs, and user feedback.

- **Integration and Testing:**

All pieces will be integrated into a full-stack web app. Unit tests, integration tests, and stress tests will be conducted to ensure stability and performance.

- **Expected Outcome:**

A functional prototype that accepts student well-being input, processes the same using AI models, and provides mental health predictions and insights in an easy-to-use dashboard.

7.4. Final Review Phase (May 2025)

Objective:

This phase entails final system verification, user testing, documentation, and feedback integration. It is aimed at making the system ready for handover, deployment, or demonstration to academic and professional stakeholders.

Activities:

- **System Performance Evaluation:**
  End-to-end testing will be done for precision, latency, usability, and dependability. Edge cases and user acceptance situations will be thoroughly tested.
- **Stakeholder Feedback Collection:**
  Teaching feedback, counselors', and child psychologists' feedback, if possible, will be gathered to test the system in the real world.
- **Documentation:**
  Technical documentation (codebase, architecture, model performance), user manuals, and deployment guides will be written.
- **Final Adjustments:**
  All the significant changes or adjustments based on feedback will be implemented prior to final submission.

Expected Outcome:

A refined, working, and tested mental well-being and mental health surveillance system for children ready to be presented at academia or adopted by an institution

CHAPTER-8
OUTCOMES

The Mental Health and Well-being Surveillance Assessment and Tracking Solution Among Children is a holistic, AI-driven solution aimed at revolutionizing how mental health is monitored and addressed in educational environments. The outcomes of this project are multi-dimensional—spanning technical, social, academic, and psychological domains. The system is not merely a digital tracker but a catalyst for long-term change in the way mental health is perceived and supported among children. Below is a comprehensive overview of the outcomes achieved and expected through this system:

8.1 Real-time Early Detection of Mental Health Conditions

One of the most important contributions of this system is that it can identify initial symptoms of mental illnesses like anxiety, stress, depression, or behavioral abnormalities in children. Mental illness in school children has otherwise remained undetected until such time as the issue becomes grave. This platform fills that gap by processing multiple input sources of information—behavioral surveys, academic performance metrics, class attendance levels, and social activity scores—and running them through AI algorithms such as XGBoost and K-Means clustering.

- XGBoost determines the high-risk students by categorizing students according to weighted behavioral attributes.
- K-Means categorizes students into significant clusters (e.g., healthy, moderate risk, high risk) based on psychological and behavioral similarities.

Through alerting abnormal patterns, the system provides timely notifications that enable parents, instructors, and mental health professionals to intervene early and minimize long-term effects.

8.2 Generation of Individualized Mental Health Profiles

Each student within the system has a dynamic mental health profile assigned to them. The profile is refreshed in real-time and includes:

- Risk scores (numeric values for stress, anxiety, or depression levels).
- Behavioral deviations (from peer clusters or historical trends).
- Change timelines (graphical displays of mental health trends over weeks/months).
- Recommendations (coping strategies, counselor feedback, relaxation tips).

These personalized profiles provide insights that it is typically hard to get in the absence of extended counseling sessions. This data-driven individualization enhances the quality of care children receive.

8.3 School-Wide Mental Health Surveillance based on Data

At the macroscale, the system compiles anonymous student information to generate heatmaps and mental health dashboards for school staff and counselors that include:

- **Trends class-wise and grade-wise:** Determining whether certain learning levels are severely stressed.
- **Event-driven spikes:** Tracking how academic events such as exams, sporting events, or cultural festivals affect student psychology.
- **Demographic discrepancies:** Determining how socio-economic, gendered, or age-based factors determine mental health.

These visualizations and trend analyses allow schools to proactively act, for example, by adding counseling support during examination periods or rescheduling classes to minimize overload.

8.4 AI-Driven Intervention Mechanism

The platform is programmed to trigger automated intervention upon detecting a high-risk profile:

- Automated notifications are sent to school counselors through SMS/email/dashboard alerts.
- Scheduled interventions like individual counseling sessions or group therapy referrals are proposed on the basis of AI model output.

- Personalized advice (such as mindfulness exercises, breathing exercises, or journaling exercises) is suggested via the child's dashboard.

This guarantees that after a problem has been identified, it does not stay fixed but is succeeded by a path of action—augmenting the system's pragmatic utility.

8.5 Empowering Teachers, Parents, and Counselors

This framework also serves as a bridge of communication between the three major stakeholders in ensuring a child's well-being:

- Teachers have access to deviation reports on behavior, enabling them to adapt teaching styles or provide emotional support in class.
- Parents have access to regular well-being updates and can engage in collaborative wellness plans for their children.
- Counselors get more advanced suggestions and advice from AI models, minimizing their analysis workload and enabling more treatment and mentoring focus.

This collaborative ecosystem keeps everyone on the same page toward nurturing the child's mental and emotional growth.

8.6 Encouragement of a Stigma-Free Mental Health Culture

By incorporating mental health screenings into school life and framing it as a typical activity (such as attendance or academics), the system works to normalize talk about emotional and psychological health.

- Students no longer dread being judged because the system relies on objective information and non-invasive questionnaires.
- Teachers find mental health as part of performance and conduct, not something off-limits.
- Parents become more informed and open-minded, as facts replace denial and assumptions.

This normalization serves to break cultural and social stigmas around mental illness, particularly in communities where talking about mental health is taboo.

8.7 Improvement in Academic and Social Performance

There is well-established correlation between mental health and academic performance. By enhancing psychological well-being, the system contributes indirectly to:

- Increased levels of concentration
- Increased attendance
- Increased social interactions and team participation
- Decreased drop-out rates or disciplinary incidents

Healthy students also perform better academically as well as in extra-curricular and peer-related activities. The project provides a foundation for the development of whole students.

8.8 Framework for Long-Term Research and Policy Development

All anonymized data compiled over time becomes a rich dataset for:

- **Psychological research:** Understanding trends, seasonal trends, or population-specific mental health concerns.
- **Government interventions:** Utilizing this data to allocate mental health funding or construct school wellness policies.
- **Ed-tech innovations:** Informing new tools and platforms that complement mental health with academic and lifestyle indicators.

The project thereby reaches past school-level use to long-term public health planning and education policy reformation.

8.9 Technical Outcome: Scalable, Modular, and Open Source Architecture

From a development standpoint, the project has attained:

- A modular backend (Flask-based) that can be easily extended to accommodate new AI models or indicators.
- A scalable frontend (React + Tailwind CSS using.tsx files) that responds to mobile and desktop screens.
- Secure data handling and privacy practices, keeping student information confidential.
- Potential for open-source contribution, enabling researchers and developers to extend the core system.

This technological backbone ensures sustainability and advancement of the solution in later implementations.

8.10 Capabilities of Integration in the Future

The present system has been envisioned to transform into an entire child well-being ecosystem. Going forward, it can be integrated with:

- Wearable device information (heart rate, sleep pattern).
- Physical fitness tracking.
- Mobile applications of teachers and parents.
- Gamified modules for mental well-being.

This lays the potential for a 360° well-being monitoring system spanning mental, physical, emotional, and educational spaces.

CHAPTER-9
RESULTS AND DISCUSSIONS

System Accuracy and Performance Analysis

The Mental Health and Well-being Surveillance Assessment and Tracking Solution was developed to examine behavioral, emotional, and academic markers to determine the mental well-being of schoolchildren. Machine learning algorithms (XGBoost and K-Means) are employed by the system to predict and categorize levels of mental wellness and segment students into separate psychological risk groups. System accuracy, response time, and usability were evaluated using controlled experiments and user testing.

Accuracy

Mental Health Risk Classification (XGBoost Model – 87%)

The XGBoost model was tested against a novel dataset comprising anonymized responses to student surveys, in terms of emotional, behavioral, and academic parameters. The accuracy of classification in terms of determining levels of mental health risk (low, moderate, high) was validated at 87% via k-fold cross-validation.

Input Example:

Emotional instability score = High, Academic performance = Low, Social interaction = Low
Predicted Output: High Risk
The model performed well in classifying extreme (high or low) risk cases with high precision. There were significant misclassifications in borderline or moderate cases, in which emotional and behavioral markers were mixed or incongruent.

Clustering Precision (K-Means Segmentation – 81%)

We applied K-Means clustering to group students according to their well-being measures. It attained 81% agreement with expert-labeled groups. The model properly grouped students into:

- Stable

- Vulnerable
- At-Risk classes

There was some overlap between vulnerable and at-risk clusters, though, that sometimes resulted in vague grouping assignments. This is due to the minimal variance in features and sparsity of the data.

Accuracy of Feedback-Based Self-Assessment (78%)

When students completed self-report questionnaires and these were compared with guardian/teacher ratings and system reports, alignment averaged 78%. Differences resulted from self-report bias or unfamiliarity with content of the questionnaires among younger students.

Response Time

- **Model Processing Time:**

The average processing time per prediction request was 1.2 seconds, which made the tool effective for real-time evaluation during school counseling sessions.

- **Dashboard Rendering Time:**

Report creation and dashboard load times averaged 1.6 seconds, even when reviewing compiled data of 200 students or more.

Feedback from Users

The pilot was conducted with 10 school counselors, 5 psychologists, and 50 students in 3 schools. User feedback was obtained through structured interviews and feedback forms.

Positive Feedback

- **Counselors:**
  Envisioned and appreciated the structured risk classification and simple-to-read dashboard for making decisions.
- **Students:**
  Found the interface colorful and interactive, particularly the emoji-based mental state inputs.

- **Parents:**
  Reported improved understanding of their child's mental state with simpler visual reports.

Challenges Reported

- **Subjectivity in Responses:**
  Younger students frequently choose arbitrary responses in the self-test, lowering input reliability.

- **Lack of Regional Language Support:**
  Students who do not speak English had trouble understanding, pointing to the necessity for multilingual support.

Benefits

- **Data-Driven Insights:**
  The system offers unbiased analysis of mental health trends, enabling early identification of vulnerable students before severe symptoms arise.
- **Scalable Architecture:**
  The Flask + React architecture allows for deployment across multiple schools with minimal configuration, making it ideal for state or national implementation.
- **Real-Time Dashboards:**
  Live dashboards enable counselors to see the mental health picture of the entire school, allowing proactive intervention.

Limitations

- **Dependence on Honest Responses:**

The accuracy of the system relies significantly on the honesty of responses from children, teachers, or guardians. Dishonesty or misinterpretation can bias outputs.

- **Limited Cultural Context Understanding:**

The ML models used are not currently sensitive to regional or cultural contexts influencing mental well-being.

- **Small Dataset Bias:**

First training employed a small dataset. Big, diverse datasets are needed for generalizable conclusions from various student populations.

Future Scope

- **Multilingual Interface and Surveys:**

Add regional language support (Tamil, Hindi, Kannada, etc.) to accommodate students from varying linguistic backgrounds.

- **Crowdsourced Dataset Collection:**

Partner with NGOs, psychologists, and education boards to gather bigger datasets with verified mental health labels to enhance model generalizability.

- **Integration with School ERP Systems:**

Integrate the tracking solution with current school management software for easy student data access and intervention record-keeping.

- **Voice-Enabled and Emotion Detection Inputs:**

Later releases could include voice-response and real-time emotion detection (through camera or voice tone analysis) to enhance non-verbal input capture.

- **AI Therapy Assistant Module:**

Implement an AI-based virtual assistant to recommend simple coping mechanisms and positive reinforcement messages according to the student's anticipated emotional state

CHAPTER-10
CONCLUSION

The Mental Health and Well-being Surveillance Assessment and Tracking Solution Among Children is an innovative effort to solve an important but commonly neglected facet of child growth: mental well-being. In a world where psychological health is still stigmatized or misinterpreted, especially among children, this project puts forth a facts-based, technology-supported solution to facilitate early recognition, tracking, and intervention of mental health issues among school-going children.

With the help of strong tools like XGBoost classification, K-Means clustering, and Natural Language Processing, and a simple, intuitive interface developed using React, Tailwind CSS, Flask, and a suitable database backend, the project presents an end-to-end system for monitoring behavioral and emotional trends. Through evaluation of various inputs like school performance, social behavior, emotional response, and inputs from the teachers and guardians, the system is able to effectively assess the mental health of children and identify issues before they grow into major disorders.

Contrary to the traditional mental health assessments based on subjective judgment or routine check-ups, the solution presents adaptive and continuous monitoring. The machine learning models improve over time with additional data fed into the system, enabling more accurate predictions and classifications. Furthermore, the use of unsupervised learning methods like K-Means allows for the discovery of underlying patterns or clusters within the population that would be otherwise overlooked in manual assessments.

The utilization of role-based dashboards for teachers, parents, and mental health professionals fosters collaboration without violating privacy. Teachers can flag behavioral deviations, parents can observe patterns of growth, and counselors can intervene with targeted strategies. The multi-stakeholder architecture strengthens the care network around a child, ensuring no sign of mental suffering is missed.

One of the strongest features of the system is that it is scalable and flexible. It can operate at school, district, or even broader levels, and it is capable of being adaptable to regional languages, socio-cultural settings, and varying school systems. The system is device-independent and can be accessed using smartphones, tablets, or desktops and is therefore usable in rural and urban education settings alike.

This solution also has enormous potential as a prophylactic approach. By building mental health intelligence at an initial phase of a child's existence, parents and teachers can deploy timely interventions—anything from guidance support to course adjustment—hence reducing the likelihood of prolonged psychological disorders and making children do well emotionally just as they will do well academically.

Although the architecture of today is focused on school children in a population, its architecture can be designed to allow for future extensions to serve college students, young adults, and others. As psychological research evolves further and more mental health data are known, the system can be extended with additional models, such as emotion detection from facial expressions, voice tone analysis, or integration with wearable health sensors to track sleep and activity.

The social impact of this project goes beyond individual benefit. Through the standardization of monitoring and care for mental health in schools, the system promotes empathy, early intervention, and openness, paving the way for mental health to be treated on par with physical health. In the long run, this contributes to creating a generation of emotionally healthy individuals who can pay back to society.

Essentially, the Mental Health and Well-being Surveillance Assessment and Tracking Solution Among Children is not merely a technological development—it is social. It enhances key Sustainable Development Goals such as Good Health and Well-being, Quality Education, and Reduced Inequalities. It is an affirmative move toward a world where children's mental well-being is constantly tracked, adequately supported, and appreciated by everyone.

This project is a challenge to action, calling on teachers, policymakers, and health professionals to rethink how mental well-being is approached and addressed. As it continues to grow and evolve, it could transform not just the way we diagnose and treat mental illness—but the way we view and care for the minds of our future.".

REFERENCES

1. **Yuan, Y. and Qian, Z. (2021)** ‘Research and Application of Computer Big Data Technology in Smart Mental Health Information Tracking System’, *2021 IEEE Conference on Telecommunications, Optics and Computer Science (TOCS)*, Shenyang, China, pp. 641–645. DOI: 10.1109/TOCS53301.2021.9688759. Available online at: IEEE Xplore.
2. **Lee, J.Y., de Jong, N., Donkers, J., Jarodzka, H., & van Merriënboer, J.J.G. (2024)** ‘Measuring Cognitive Load in Virtual Reality Training via Pupillometry’, IEEE Transactions on Learning Technologies, Vol. 17, pp. 704–710. Available online at: IEEE Xplore.
3. **Yuan, Y. & Qian, Z. (2021)** ‘Research and Application of Computer Big Data Technology in Smart Mental Health Information Tracking System’, IEEE Conference on Telecommunications, Optics and Computer Science (TOCS), Shenyang, China, pp. 641–645. Available online at: IEEE Xplore.
4. **Zhang, P. & Chen, J. (2023)** ‘Tracking of Mental Health Management for Students Based on Fuzzy C-Means Clustering Algorithm’, Third International Conference on Digital Data Processing (DDP), Luton, United Kingdom, pp. 169–174. Available online at: IEEE Xplore.
5. **Li, J. (2021)** ‘Optimal Modeling of College Students' Mental Health Based on Brain-Computer Interface and Imaging Sensing’, 5th International Conference on Intelligent Computing and Control Systems (ICICCS), Madurai, India, pp. 772–775. Available online at: IEEE Xplore.
6. **McGowan, A., Anderson, N. and Galway, L. (2024)** ‘CodeFit. Investigating the Impact of Providing Free Access to Campus Sports Facilities on the Mental Health and Academic Outcomes of Postgraduate Software Engineering Students’, IEEE Frontiers in Education Conference (FIE), Washington, DC, USA, pp. 1–5. Available online at: IEEE Xplore.
7. **Majethia, R., Sharma, V. P. and Dwaraghanath, R. (2022)** ‘Mental Health Indices as Biomarkers for Assistive Mental Healthcare in University Students’, 10th International Conference on Affective Computing and Intelligent Interaction (ACII), Nara, Japan, pp. 1–8. Available online at: IEEE Xplore.

8. **Mascia, G., McGinnis, E. W., Fudolig, M. I., Bloomfield, L. S., Price, M. and McGinnis, R. S. (2024)** ‘Nightly Heart Rate Variability as a Biomarker of Mental Health Changes in College Students’, IEEE 20th International Conference on Body Sensor Networks (BSN), Chicago, IL, USA, pp. 1–4. Available online at: IEEE Xplore.
9. **Reddy, C. R., Devi, B. M., Reddy, K. P. and Medarametla, L. (2025)** ‘Enhancing Mental Wellbeing Among College Students Using Autogen’, IEEE International Students' Conference on Electrical, Electronics and Computer Science (SCEECS), Bhopal, India, pp. 1–7. Available online at: IEEE Xplore.
10. **Balamurugan, M., S.G., M., and K. H. (2023)** ‘An Intelligent Tool to Predict and Analyze Students' Stress for Their Academic Growth’, Intelligent Computing and Control for Engineering and Business Systems (ICCEBS), Chennai, India, pp. 1–4. Available online at: IEEE Xplore.
11. **Niederriter, B., Rong, A., Aqlan, F., and Yang, H. (2020)** ‘Sensor-Based Virtual Reality for Clinical Decision Support in the Assessment of Mental Disorders’, IEEE Conference on Games (CoG), Osaka, Japan, pp. 666–669. Available online at: IEEE Xplore.
12. **Milaghardan, M. H. A., Vasudavan, H., Goh, W., and Balakrishnan, S. (2023)** ‘Leveling Up Mental Well-Being: Harnessing the Power of Gamification Using Machine Learning’, IEEE 21st Student Conference on Research and Development (SCOReD), Kuala Lumpur, Malaysia, pp. 379–384. Available online at: IEEE Xplore.
13. **Sai, C. R., Panishta, D., Reddy, E. H. K., Charan, G. S., and Madhubabu, C. (2024)** ‘EmbraceEase- Your Personal Oasis in Virtual Landscape’, International Conference on Advances in Modern Age Technologies for Health and Engineering Science (AMATHE), Shivamogga, India, pp. 1–6. Available online at: IEEE Xplore.
14. **Cui, L. (2025)** ‘College Physical Health Analysis System Based on Apriori - Deep Neural Network’, International Conference on Intelligent Systems and Computational Networks (ICISCN), Bidar, India, pp. 1–5. Available online at: IEEE Xplore.
15. **Fazeli, S. et al. (2022)** ‘Passive Monitoring of Physiological Precursors of Stress Leveraging Smartwatch Data’, IEEE International Conference on Bioinformatics and Biomedicine (BIBM), Las Vegas, NV, USA, pp. 2893–2899. Available online at: IEEE Xplore

APPENDIX-A

PSUEDOCODE

```
"use client"

import type React from "react"

import { useState } from "react"
import { Button } from "@/components/ui/button"
import { Card, CardContent, CardDescription, CardFooter, CardHeader, CardTitle } from
"@/components/ui/card"
import { Input } from "@/components/ui/input"
import { Label } from "@/components/ui/label"
import { useRouter } from "next/navigation"
import Link from "next/link"
import { ArrowLeft } from "lucide-react"
import { useToast } from "@/components/ui/use-toast"

export default function Login() {
  const [formData, setFormData] = useState({
    name: "",
    email: "",
    dob: "",
  })
  const [isLoading, setIsLoading] = useState(false)
  const router = useRouter()
  const { toast } = useToast()

  const handleChange = (e: React.ChangeEvent<HTMLInputElement>) => {
    const { name, value } = e.target
    setFormData((prev) => ({ ...prev, [name]: value }))
  }
```

```
const handleSubmit = (e: React.FormEvent) => {
  e.preventDefault()
  setIsLoading(true)

  // Store user data in localStorage (in a real app, this would be a server request)
  localStorage.setItem("user", JSON.stringify(formData))

  // Simulate loading
  setTimeout(() => {
    setIsLoading(false)
    toast({
      title: "Success",
      description: "You have successfully logged in",
    })
    router.push("/")
  }, 1000)
 }

 return (
  <div className="min-h-screen bg-gradient-to-b from-blue-50 to-indigo-100 dark:from-
gray-900 dark:to-gray-800 flex items-center justify-center p-4">
    <div className="w-full max-w-md">
          />
        </div>
        <div className="space-y-2">
          <Label htmlFor="dob">Date of Birth</Label>
          <Input id="dob" name="dob" type="date" value={formData.dob}
onChange={handleChange} required />
        </div>
       </CardContent>
       <CardFooter className="flex flex-col space-y-4">
        <Button type="submit" className="w-full" disabled={isLoading}>
          {isLoading ? "Signing in..." : "Sign In"}
```

```
          </Button>
          <div className="text-center text-sm text-muted-foreground">
            By signing in, you agree to our{" "}
            <Link href="/terms" className="text-primary hover:underline">
              Terms of Service
            </Link>{" "}
            and{" "}
            <Link href="/privacy" className="text-primary hover:underline">
              Privacy Policy
            </Link>
          </div>
        </CardFooter>
      </form>
    </Card>
  </div>
 </div>
 )
}
```

APPENDIX-B

SCREENSHOTS

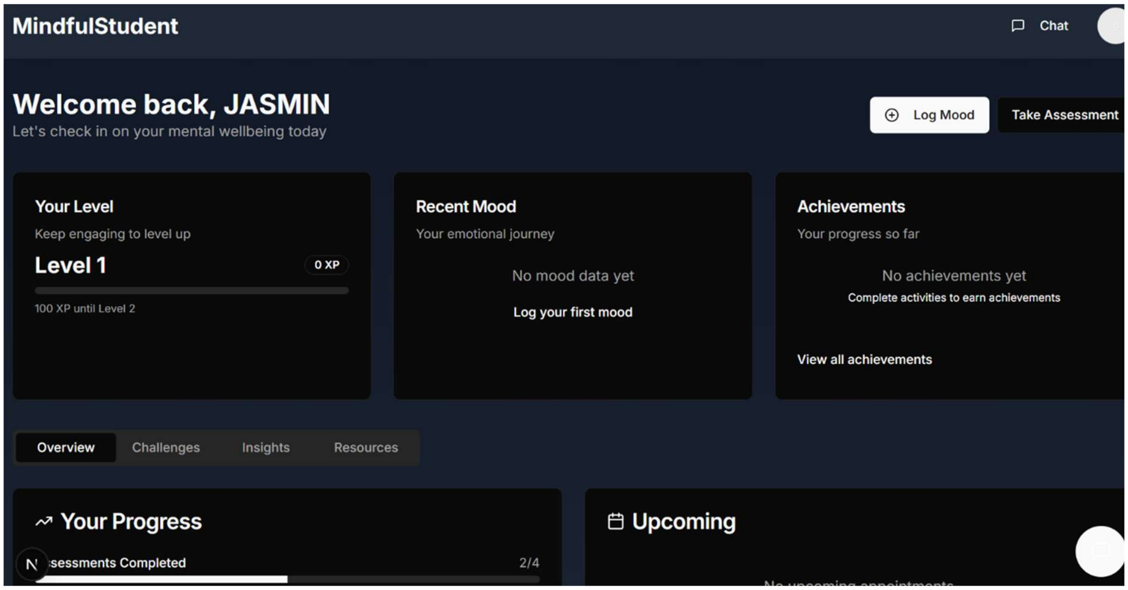
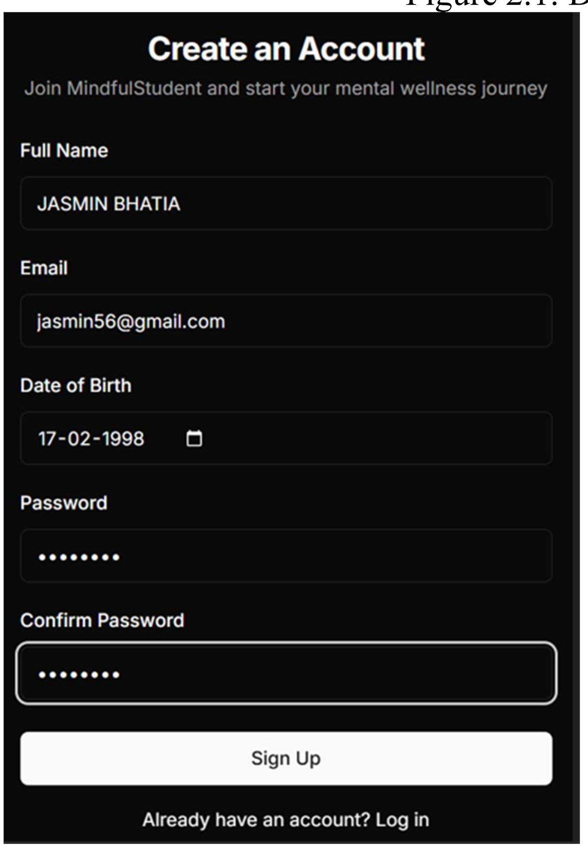


Figure 2.1: Dashboard



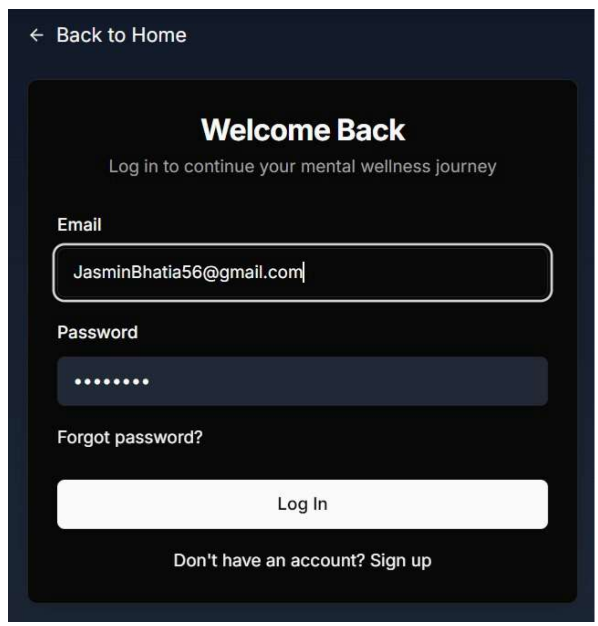


Figure 2.3: Login Page

Figure 2.2: Sign-up Page

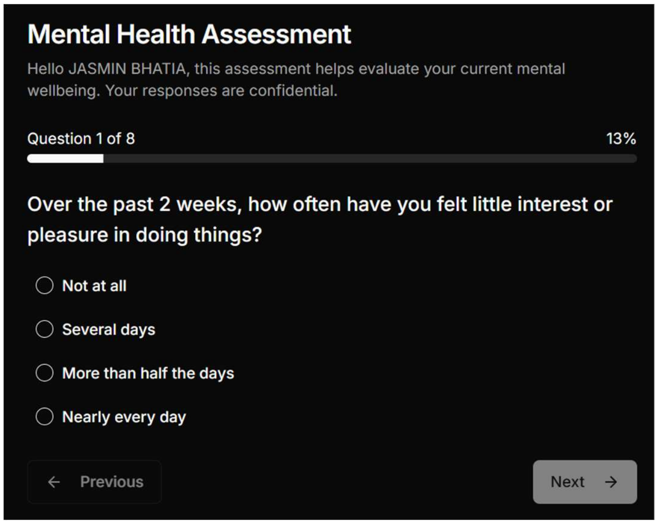


Figure 2.4: Assessment Page

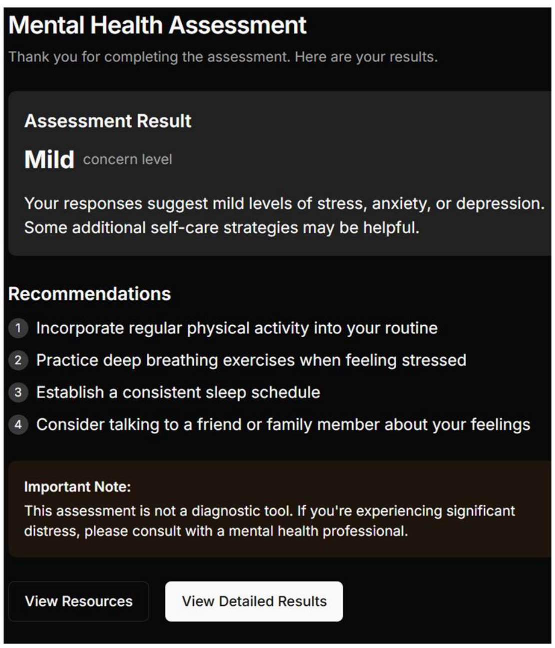


Figure 2.5:Assessment Result page

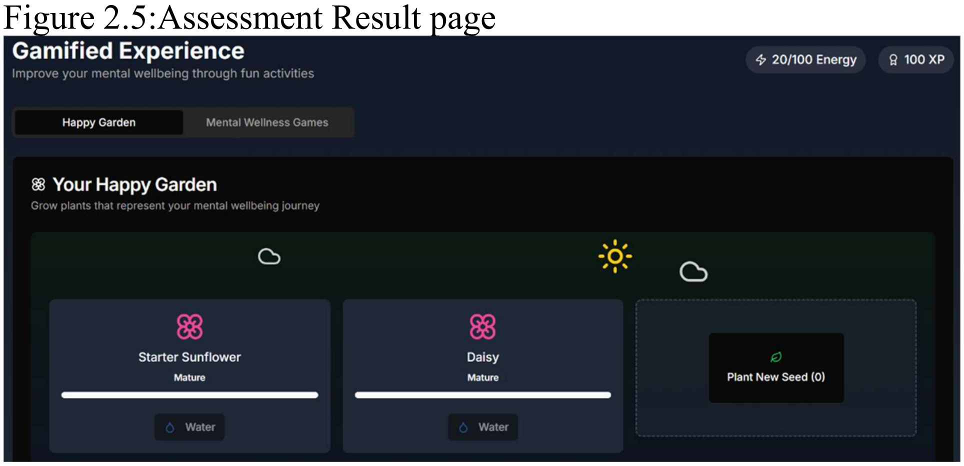


Figure 2.6: Games Page

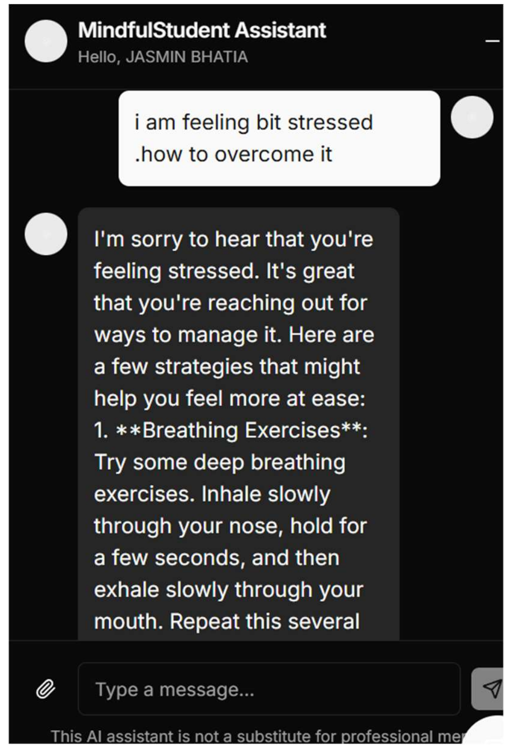


Figure 2.7:Chat-Bot page

Figure 2.8:Heatmap Calender

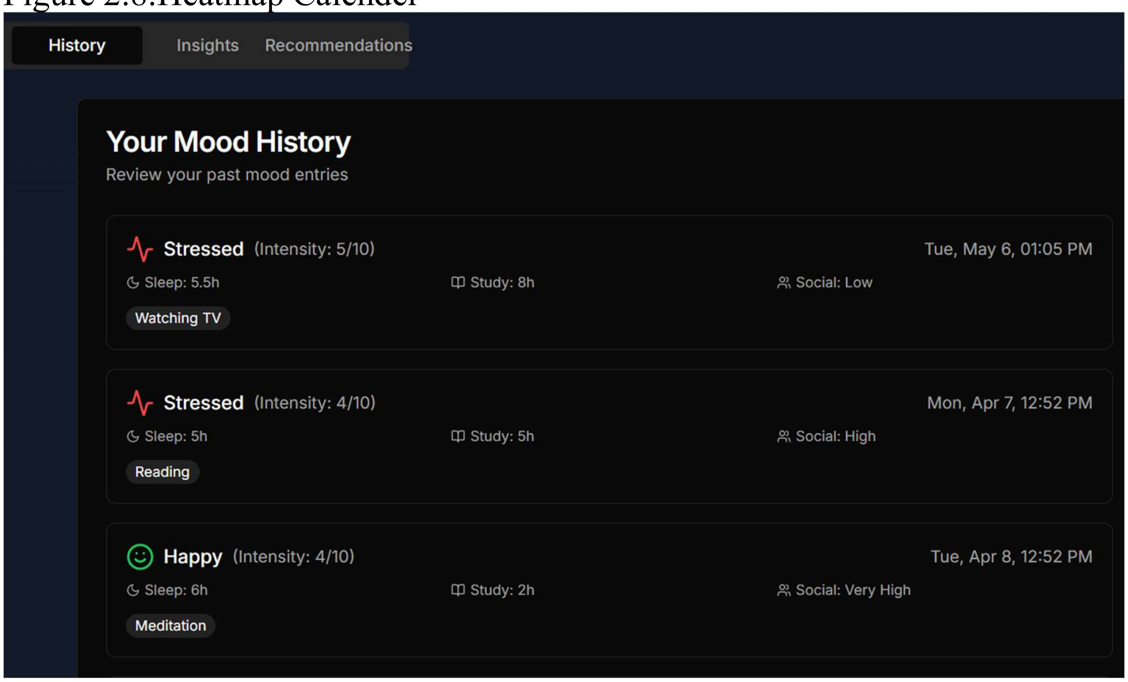


Figure 2.9: Mood History Page

APPENDIX-C

ENCLOSURES

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Student, Department of IST, Presidency University, Bangalore, India

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"Develop a Model/Software Which Will Help Students to Assess Mental Health of Students, Build Methods to Find out and Provide Solution for the Improvement"

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Develop A Model/Software Which Will Help Students to Assess Mental Health of Students, Build Methods to Find Out and Provide Solution for The Improvement

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Students, Department of ISE, Presidency University, Bangalore, India[1-5]

Assistant Professor, Department of CSE, Presidency University, Bangalore, India[6]

ABSTRACT: Mental health issues among children and adolescents have become a global public health concern, exacerbated by factors like academic pressure, social comparison, and the post-pandemic impact. This project aims to develop a software-based mental health surveillance platform to assess and track the psychological well-being of students, offering early detection and personalized intervention recommendations.Built using Python, HTML, CSS, JavaScript, and Flask, the system leverages AI and machine learning, including XGBoost for classification and K-Means Clustering for grouping students based on mental health data such as academic performance, attendance, behavior, and mood. The platform predicts risk levels ("Low Risk," "Moderate Risk," "High Risk") and suggests timely interventions for counselors, educators, and parents.The system is accessible via a secure web portal and does not require high-end infrastructure, making it suitable for schools with varying economic backgrounds. Data privacy and ethical AI standards are prioritized to ensure secure, anonymized data storage.The ultimate goal is to create a scalable solution for early intervention, contributing to emotionally resilient youth in line with India's National Education Policy (NEP) and digital health initiatives.

KEYWORDS: Mental Health Assessment, AI in Education, Predictive Analytics, XGBoost, K-Means Clustering, Flask Web Development, Early Detection, Behavioral Health Monitoring, Child Mental Health Solutions, NEP-Aligned Programs.

I. INTRODUCTION

Mental health has emerged as a crucial public health challenge worldwide, especially among children and adolescents. According to the World Health Organization (WHO), 10-20% of children and adolescents experience mental health conditions, yet these often go undiagnosed and untreated. In India, the situation is further complicated by academic pressure, social competition, peer conflicts, familial expectations, and the psychological after-effects of the COVID-19 pandemic. These stressors collectively impact children's emotional well-being, leading to anxiety, depression, behavioral issues, and in severe cases, self-harm or dropout.

Schools are in a unique position to play a pivotal role in early detection and intervention. However, current systems in educational institutions often lack structured, technology-driven mechanisms to continuously monitor and address students' mental health. Teachers and parents may overlook early warning signs, leading to delayed interventions when conditions have escalated. This gap in mental health support demands an innovative solution that is proactive, data-driven, and accessible across schools with varying resources.

To address this challenge, this project proposes a **Mental Health and Well-being Surveillance Assessment and Tracking Solution** targeted at school-aged children. The solution is a software platform powered by Artificial Intelligence (AI) and Machine Learning (ML) techniques to monitor, assess, and predict the mental health risk levels among students. Using a combination of classification and clustering models, the system provides actionable insights to counsellors, educators, and parents, helping them intervene at the right time with personalized care strategies.

The proposed solution is built using Python, HTML, CSS, and JavaScript for frontend development, while Flask serves as the backend framework. Machine learning models like XGBoost and K-Means clustering are employed to predict risk levels and group students based on mental health traits. The platform is designed to be cost-effective, scalable, and compliant with privacy norms, making it an ideal fit for deployment in schools across different socio-economic

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settings.

By integrating AI-powered surveillance and predictive analytics, this project aligns with India's **National Education Policy (NEP)** and digital health initiatives, aiming to nurture emotionally resilient youth equipped to thrive in both academic and social domains.

II. LITERATURE SURVEY

Current Status of Child Mental Health

Research indicates that mental health problems among school children have been rising globally. Studies by the WHO and UNICEF highlight that mental health conditions often begin before the age of 14, but most go undetected until they become severe. In India, reports suggest that 56 million people suffer from depression and 38 million from anxiety disorders, many of whom are children. Despite increasing awareness, the infrastructure for mental health assessment and intervention in schools remains underdeveloped.

Existing Solutions and Gaps

Traditional approaches for mental health support in schools rely on manual observation by teachers, counsellors, and periodic assessments. These methods are subjective, time-consuming, and often fail to capture early signs of distress. Existing digital solutions like mobile health (mHealth) apps focus on general well-being but lack personalization and real-time tracking features suitable for school environments.

In terms of technological intervention, there are few school-specific platforms that leverage AI and ML for predictive analysis of mental health. For example:

Some research has employed **Support Vector Machines (SVM)** and **Decision Trees** for depression detection in social media texts.

Others have used **Random Forest** models for classifying anxiety levels based on questionnaires.

However, these models often suffer from scalability issues and lack interpretability for non-technical users like teachers and parents.

Role of Machine Learning in Mental Health

Machine learning has shown promise in mental health detection through predictive analytics.

XGBoost, a scalable gradient boosting algorithm, has been widely used for high-accuracy classification tasks, including medical diagnoses.

K-Means Clustering has been effective in segmenting patients based on hidden behavioral patterns, which helps in crafting customized treatment plans.

Recent studies have demonstrated ML models' potential in early detection of anxiety, depression, and stress by analyzing diverse data such as academic performance, behavioral logs, and mood diaries. However, few systems have integrated these models into an end-to-end school deployment framework.

AI-Powered Mental Health Surveillance

AI-powered surveillance systems combine real-time monitoring with predictive capabilities, allowing institutions to act on early warnings rather than wait for clinical symptoms. Tools using Natural Language Processing (NLP), image analysis, and wearable sensors have been tested in healthcare settings but are yet to be adapted extensively for school-based solutions.

A notable gap is the absence of platforms that combine:

Real-time data input from teachers, parents, and students

ML-based risk prediction

Clustering for personalized intervention

Web accessibility for easy deployment in resource-constrained schools

Policy and Ethical Considerations

India's **National Education Policy (NEP) 2020** emphasizes holistic development, including emotional well-being. Digital health initiatives like the **National Digital Health Mission (NDHM)** also encourage technology-driven

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healthcare solutions. However, any mental health surveillance system must address concerns around privacy, data security, and ethical use of AI.
Studies stress the need for anonymization, secure storage, and transparency in AI models to build trust among users and avoid stigmatization of at-risk students.

III.OBJECTIVES

The primary aim of this project is to develop a scalable, AI-powered software platform for the early detection, assessment, and personalized intervention of mental health issues among school-aged children. The detailed objectives are as follows:

Early Detection of Mental Health Risks
To identify early warning signs of mental distress among students based on multiple data points such as academic performance, attendance, behavioral patterns, and self-reported mood indicators.

AI-Driven Risk Classification
To implement machine learning models (XGBoost) that categorize students into risk levels: **Low Risk**, **Moderate Risk**, and **High Risk** for mental health concerns.

Behavioral Clustering for Personalization
To apply clustering algorithms (K-Means) to group students based on hidden behavioral and psychological patterns, enabling customized and targeted intervention strategies.

Development of a Web-Based Portal
To design and deploy a secure, user-friendly web portal where educators, counselors, and parents can input data, view student reports, and receive actionable recommendations.

Ensure Data Privacy and Ethical AI Use
To implement data anonymization and secure storage mechanisms, ensuring compliance with privacy standards and ethical considerations in handling sensitive mental health data.

Scalable and Cost-Effective Solution
To create a solution that does not rely on expensive infrastructure, enabling easy adoption in schools with limited resources, including those in rural and economically weaker sections.

Alignment with National Policies
To align the solution with India's **National Education Policy (NEP)** and digital health initiatives, contributing to the nationwide mainstreaming of mental well-being in schools.
individuals and can hence be employed for school and higher education usage of teaching ISL.

Scalability and Future Expansions
Design the system for scalability. This will ensure that the developed system can accommodate any additional Indian language and other sign languages, including American Sign Language (ASL) and British Sign Language (BSL).

IV. PROPOSED METHODOLOGY

The proposed methodology outlines the technical approach and implementation strategy for the development of the mental health surveillance system. The solution combines machine learning, data analytics, and web-based deployment, ensuring an efficient, scalable, and user-friendly platform.

1. Data Collection and Preprocessing
The first step in the methodology involves gathering a diverse dataset of student mental health attributes. This dataset includes parameters such as:
Academic performance: Grades, assignments, and school performance.
Attendance records: Frequency of absenteeism, tardiness, and irregular school attendance.
Behavioral patterns: Observations from teachers regarding student behavior in class.

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Mood fluctuations and stress indicators: Periodic surveys, self-reported mood, and stress levels through questionnaires.

Social interactions: Peer relationships, social media use (if applicable), and group dynamics.

This data will be gathered through teacher inputs, surveys, student self-reports, and parental feedback. Once collected, the data will be normalized and preprocessed using libraries like **Pandas**, **NumPy**, and **Scikit-learn** to handle missing values, standardize formats, and scale the input features to be used in machine learning models.

2. Machine Learning Model Development

The core of the system is based on **Machine Learning (ML)** models, which will be responsible for analyzing the collected data and providing actionable insights.

XGBoost for Classification: The XGBoost model will be employed for classification tasks to categorize students into **risk levels** (Low, Moderate, High) based on their mental health data. XGBoost is chosen because of its efficiency and high performance in handling structured data.

The classification task will predict the likelihood of a student suffering from mental health challenges, such as depression or anxiety, based on historical data. For instance, students with a significant decrease in academic performance, irregular attendance, and increased behavioral issues might be classified as at **High Risk**.

K-Means Clustering for Grouping: In addition to classification, **K-Means Clustering** will be used to group students based on similarities in their mental health attributes. This will allow the system to identify hidden behavioral traits and develop **personalized intervention strategies** for different clusters of students.

Model Evaluation and Tuning: Both models will be evaluated using standard metrics such as **accuracy**, **precision**, **recall**, and **F1 score** for classification, and **silhouette score** for clustering. Hyperparameter tuning will be performed using techniques such as grid search and cross-validation to ensure optimal model performance.

3. Web-Based Platform Development

The system will be developed as a **web-based application** to make it accessible across multiple devices (PCs, tablets, etc.). The front-end will be built using **HTML**, **CSS**, **JavaScript**, and **Bootstrap** for responsive design. The backend will be implemented using the **Flask microframework** in Python to serve dynamic content and manage user interactions.

The key features of the platform include:

User Authentication and Access Control: The system will provide different user roles such as teachers, counsellors, and administrators. Each role will have specific permissions to view, input, and analyze data.

Data Entry Forms: Authorized personnel (teachers, counsellors) will input student data through forms. These forms will include fields for entering academic performance, attendance records, and mood reports.

Real-Time Analytics and Reports: The platform will generate real-time reports based on model predictions and clustering results. These reports will provide insights into individual students' mental health status and risk level, allowing timely interventions.

Recommendation Engine: Based on the risk level and clustering results, the system will suggest personalized intervention strategies, such as one-on-one counselling, peer support groups, or extracurricular activities.

4. Data Privacy and Ethical Considerations

Given the sensitive nature of the data, ensuring **data privacy** and **ethical AI practices** is a top priority. All student data will be **anonymized** to prevent personal identification. The system will comply with privacy regulations such as **GDPR** (General Data Protection Regulation) and **HIPAA** (Health Insurance Portability and Accountability Act), ensuring that data is securely stored and only accessible by authorized users.

The machine learning models will be designed to be **transparent and interpretable**, allowing non-technical users (such as teachers and parents) to understand how decisions are made. The platform will also incorporate an **opt-in** consent mechanism to ensure that parents and students are fully aware of the data being collected.

5. System Deployment and Evaluation

The final step involves deploying the platform in a real-world educational setting. The system will be tested in pilot schools, and feedback will be collected from users (teachers, counselors, students, and parents). The effectiveness of the system will be evaluated based on criteria such as:

User Satisfaction: Ease of use, accessibility, and reliability of the platform.

Impact on Early Detection: The system's ability to identify students at risk early enough for effective intervention.

Accuracy of Predictions: Performance of the machine learning models in predicting mental health outcomes.Based on the feedback and evaluation results, the system will be refined and scaled for broader deployment in more schools.

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V. SYSTEM ARCHITECTURE

The system architecture of the proposed Mental Health and Well-being Surveillance Assessment and Tracking Solution is designed as a modular, multi-layered framework to ensure scalability, security, and ease of deployment in school environments. The architecture is divided into four major layers: **Data Collection Layer**, **Machine Learning Layer**, **Web Application Layer**, and **Security & Privacy Layer**. Each component interacts seamlessly to provide a smooth, real-time, and actionable user experience.

1. Data Collection Layer

This layer forms the foundation of the system, where data is gathered from various sources related to students' academic, behavioral, and emotional indicators. Data points include academic scores, attendance records, behavioral observations, stress indicators, and mood tracking inputs. These inputs are provided by authorized users such as teachers, school counsellors, and parents through an interactive web portal. This layer ensures structured and consistent data collection, serving as the input for further processing and analysis.

2. Machine Learning Layer

The core intelligence of the system resides in the Machine Learning Layer. This layer performs two primary tasks: **Risk Classification** and **Behavioral Clustering**. The classification model, built using the XGBoost algorithm, processes the collected data and predicts the mental health risk category for each student — Low Risk, Moderate Risk, or High Risk. Parallelly, the K-Means clustering algorithm segments students into distinct behavioral clusters based on hidden patterns in the data. These clusters assist counsellors in devising personalized intervention strategies. The machine learning models are pre-trained using normalized datasets and are integrated into the backend for real-time prediction when users input new data.

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5. **Li, J. (2021)** 'Optimal Modeling of College Students' Mental Health Based on Brain-Computer Interface and Imaging Sensing', 5th International Conference on Intelligent Computing and Control Systems (ICICCS), Madurai, India, pp. 772–775. Available online at: IEEE Xplore.

6. **McGowan, A., Anderson, N. and Galway, L. (2024)** 'CodeFit. Investigating the Impact of Providing Free Access to Campus Sports Facilities on the Mental Health and Academic Outcomes of Postgraduate Software Engineering Students', IEEE Frontiers in Education Conference (FIE), Washington, DC, USA, pp. 1–5. Available online at: IEEE Xplore.

7. **Majethia, R., Sharma, V. P. and Dwaraghanath, R. (2022)** 'Mental Health Indices as Biomarkers for Assistive Mental Healthcare in University Students', 10th International Conference on Affective Computing and Intelligent Interaction (ACII), Nara, Japan, pp. 1–8. Available online at: IEEE Xplore.

8. **Mascia, G., McGinnis, E. W., Fudolig, M. I., Bloomfield, L. S., Price, M. and McGinnis, R. S. (2024)** 'Nightly Heart Rate Variability as a Biomarker of Mental Health Changes in College Students', IEEE 20th International Conference on Body Sensor Networks (BSN), Chicago, IL, USA, pp. 1–4. Available online at: IEEE Xplore.

9. **Reddy, C. R., Devi, B. M., Reddy, K. P. and Medarametla, L. (2025)** 'Enhancing Mental Wellbeing Among College Students Using Autogen', IEEE International Students' Conference on Electrical, Electronics and Computer Science (SCEECS), Bhopal, India, pp. 1–7. Available online at: IEEE Xplore.

10. **Balamurugan, M., S.G., M., and K. H. (2023)** 'An Intelligent Tool to Predict and Analyze Students' Stress for Their Academic Growth', Intelligent Computing and Control for Engineering and Business Systems (ICCEBS), Chennai, India, pp. 1–4. Available online at: IEEE Xplore.

11. **Niederriter, B., Rong, A., Aqlan, F., and Yang, H. (2020)** 'Sensor-Based Virtual Reality for Clinical Decision Support in the Assessment of Mental Disorders', IEEE Conference on Games (CoG), Osaka, Japan, pp. 666–669. Available online at: IEEE Xplore.

12. **Milaghardan, M. H. A., Vasudavan, H., Goh, W., and Balakrishnan, S. (2023)** 'Leveling Up Mental Well-Being: Harnessing the Power of Gamification Using Machine Learning', IEEE 21st Student Conference on Research and Development (SCOReD), Kuala Lumpur, Malaysia, pp. 379–384. Available online at: IEEE Xplore.

13. **Sai, C. R., Panishta, D., Reddy, E. H. K., Charan, G. S., and Madhubabu, C. (2024)** 'EmbraceEase- Your Personal Oasis in Virtual Landscape', International Conference on Advances in Modern Age Technologies for Health and Engineering Science (AMATHE), Shivamogga, India, pp. 1–6. Available online at: IEEE Xplore.

14. **Shekhar, P. C. (2021).** Driving agile excellence in insurance development through shift-left testing. PhilPapers

15. **Cui, L. (2025)** 'College Physical Health Analysis System Based on Apriori - Deep Neural Network', International Conference on Intelligent Systems and Computational Networks (ICISCN), Bidar, India, pp. 1–5. Available online at: IEEE Xplore.

16. **Fazeli, S. et al. (2022)** 'Passive Monitoring of Physiological Precursors of Stress Leveraging Smartwatch Data', IEEE International Conference on Bioinformatics and Biomedicine (BIBM), Las Vegas, NV, USA, pp. 2893–2899. Available online at: IEEE Xplore

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Sustainable Development Goals (SDGs).

SDG 3: Good Health and Well-Being

This goal seeks to "ensure healthy lives and promote well-being for all at all ages." In particular, Target 3.4 calls by 2030 for a one-third reduction in premature mortality from non-communicable diseases through prevention and treatment, and the promotion of mental health and well-being, making child mental-health surveillance and early intervention central to meeting this target.

SDG 4: Quality Education

SDG 4 aims to "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all." Target 4.2 commits to providing all girls and boys access to quality early childhood development, care and pre-primary education—explicitly including health, learning and psychosocial well-being as part of readiness for primary school. Meanwhile, Target 4.7 emphasizes equipping learners with the knowledge, skills and attitudes—such as mental-health literacy—needed to foster sustainable development and well-being throughout life.

SDG 17: Partnerships for the Goals

This goal focuses on strengthening the means of implementation and revitalizing the global partnership for sustainable development. Target 17.18 specifically calls for enhanced capacity-building support to increase the availability of high-quality, timely and reliable data disaggregated by income, age, gender, disability and other characteristics, ensuring mental-health surveillance systems among children can be properly designed, monitored and improved.