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# AN INTELLIGENT WEB-BASED STUDENT MENTAL HEALTH PREDICTION SYSTEM USING SUPPORT VECTOR MACHINE ALGORITHM

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**ABSTRACT:**
Recognizing the onset of mental health issues in students early is vital to supporting students' psychological health and success. In this project, a machine learning based framework for automatic prediction of the Mental health status of students from a structured questionnaire is proposed. The system gathers answers concerning a number of mental and behavioural factors, that include sleep top quality, stress, solitude, college pressures, sadness, concentration, workout routines, smoking, liquor usage, and more. These become pre-processed by Categorical Encoding and feature scaling before being analysed by a Support Vector Machine (SVM) Classifier. The trained model classifies students into three mental health classes: Healthy, Moderate and High Risk and also provides chrome personalized recommendations for positive mental health practices. The experimental results show that the proposed SVM model with a high prediction accuracy of 98.32% is effective in identifying students who may need psychological assistance. Interfacing of developed system with web application using flask gives them a secure users authentication, history of assessments, monitoring of administrators, generating reports etc. making them capable of use in real world scenarios in the field of education. Overall, the proposed method is shown to be viable in the implementation of an intelligent, scalable and user friendly mental health screening system that could aid in implementing early intervention, informed decision making and proactive management of student mental health.

**Keywords**:
Student Mental Health, Machine Learning, Support Vector Machine (SVM), Questionnaire Based Assessment, Flask, Mental Health Prediction.

## INTRODUCTION

Mental health has become a worldwide issue that impacts both individuals and society. Over 970 million individuals suffer from various types of mental illness; one in five persons report having symptoms of mental illness on a daily basis. Around 50 percent of mental health disorders begin by the age of 14 years, 75 per cent prior to 24. Following the COVID-19 pandemic, the number of mental health cases—including anxiety disorders and depression increased by 28%, from over 193 million to 246 million. According to a survey conducted in India around 37.2% of medical students experienced suicidal ideation. These figures highlight the urgent need for awareness, early intervention, and mental health support [1]. A data-driven mental health analysis framework is proposed by Virani et al which uses machine learning and Power BI to identify the factors that are affecting mental health. A study on responses of more than 250 Google form which contains questions related to age, gender, profession, stress, anxiety, insomnia, aggression, addictions, and relationship status. Those results are analyzed using machine learning models which finds the major factors that are affecting the mental health and Power BI techniques to create personalized dashboards and interactive reports of the patterns of this mental health. Many studies concluded that most of the affecting factors are from our life style and most of the analytical tools and machine learning approaches can effectively support mental health assessment, identify high-risk and us a heads up before getting it more, and also understands the behavioral patterns that are associated with different forms of mental health issues like depression, insomnia, panic attacks, and stress [2]. There are many distinct kinds of mental health problems, each with unique symptoms and degrees of severity. These five conditions—anxiety disorder, depression, bipolar disorder, eating disorders, and sleep disorders—are significant problems that are seen in many young people and students.The anxiety disorders exhibit characteristics and causes such as increased

 

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stress, nervousness, sweating, sleep issues, quickened heart rate, and tiredness. However, Bipolar disorder is characterized by mood swings, heightened energy levels, nervousness, indecision and heightened suicidal mentality. Depression can Often lead to sadness, hopelessness, decreased interest in everyday activities, insomnia, slowed body movements and suicidal thoughts. Eating disorders involve having desires for unhealthy consuming foods, maybe even symptoms such as avoiding meals, considering too much about weight. Sleep disorders is the most affecting part of students and causing daytime sleepiness, insomnia, reduced concentration, poor academic performance, and lower quality of life [3].

## RELATED WORK

Lin presented a framework which relies on machine learning technology to detect early signs of mental health problems among college students. The study integrated behaviours, academic and psychological data to create a deeper understanding of the factors associated with the mental health of students. The researchers combined the FP-Growth algorithm with the XGBoost model to enhance the effectiveness of the predictions. Mental health scores from the SCL-90 were included with the study to investigate depression, anxiety, interpersonal sensitivity, paranoia, and obsessive-compulsive symptoms. The proposed FP-Growth-XGBoost has a precision of 83.7%, recall of 78.9%, and an F1-score of 80.4%, out-performing the traditional approaches like Logistic Regression and Decision Trees [4].

Archanaa C. K. and R. Gnanajeyaraman (2025) proposed an accessible and transparent multimodal approach for early detection of student mental health deterioration using TabNet, a deep learning model. The subjects of their study were 2,050 university students with academic and psychological MSJ assessment scores and learning management system (LMS) behavioral data. TabNet offers explanations to its predictions, unlike many deep learning models, which are considered as a black box. The model correctly identified 81% of the cases with an accuracy rate, had 84% precision, 80% recall, an F1-score of 82%, and an AUC of 85% which is better than Logistic Regression, Random Forest, and Deep Neural Network models [5] achieved.

Karunakaran and others (2022) did concentrate on the identification of mental health conditions by questionnaire-based screening. Their system included two modules: Mental Health Screening (MHS) and Multiple Mental Disorder Screening (MMDS). Responses of 1253 students were analyzed, and commonly used psychological assessments, such as MDQ, GAD-7, PHQ-9, EDE-A, and SDC were employed in the study. Multiple machine learning algorithms were run and the accuracy of Logistic Regression was observed to be maximum that is 93.0% for general mental health screening. Linear SVM showed the strongest performance in terms of accuracy of 78.13% for the identification of the particular mental disorders [6].

Hitherto, Sen et al., (2024) studied the level of stress of students in the COVID-19 pandemic. Their study was conducted using survey data from 1,195 students and measured variables related to study habits, engagement with online learning, use of social media, physical activity, sleep habits, and mental health as well. The various methods of machine learning were analyzed, SVM, Logistic Regression, Random Forest, ANN and Naive Bayes were among them. Of these models, SVM model delivered the best result with accuracy score of 90% with F1 score nearing 0.90 as shown in the confusion matrix. Academic load, online learning experiences, and lifestyle behaviors were shown to be important factors that influence student stress levels

Likewise, Sharma et al. (2024) have created a prediction model for detecting stress, depression, and anxiety among students. The study adopted a large dataset with almost 20,000 students' records with various items such as family support, academic pressure, age, gender, academic and demographic variables, as well as family income. The performance of six machine learning algorithms (Logistic Regression, SVM, RF, KNN, DT, and GB) were compared. The results showed that Random Forest and Gradient Boosting performed best and had 99% of accuracy for both stress prediction and depression prediction tasks, respectively. The findings suggest that ensemble learning methods could be applied in schools for supporting early EMA in educational institutions [8].

## METHODOLOGY

The proposed Mental Health Detection System is attached to an online system where the students can evaluate their mental health condition by answering some structured questions. The system combines machine learning into the web application (written using Flask) to forecast the mental well-being of a student and make tailored suggestions. Overall methodology includes 5 major steps including data collection, data preprocessing, development of machine learning models, mental health prediction and report generation.

 

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**Data Collection**

The information about students' mental health in this study comes from answers to questionnaires. Reponses to twelve questions about psychological well-being and lifestyle factors such as sleeping quality, experiences of anxiety, feelings of loneliness, experiences of academic pressure, experience of fatigue, depression, interactions with others, concentration, stress, physical activity, smoking habits and alcohol consumption are included and occur for each record.

Target attribute defines overall health of an individual and there are three distinct types of target attribute:

- Healthy
- Moderate
- High Risk

The dataset was stored in CSV format and used for training the machine learning model.

**Data Preprocessing**

To help with better data quality, some pre-processing was undertaken prior to training the classification model.

- **Missing Value Handling**
  Data consistency: if there were missing values, they were replaced with the most frequent value (mode) of each feature.
- **Label Encoding**
  The target variable used categorical label values, therefore Label Encoding was performed to encode the class labels into numerical values appropriate for the machine learning algorithms.
- **Feature Selection**
  The set of input features are the 12 responses to the questionnaire and the target feature is the mental health status.
- **Feature Scaling**
  All input features had been normalized to a zero mean and unit variance with the help of StandardScaler as SVM is sensitive to the magnitude of its input features

**Machine Learning Model Development**

The Support Vector Machine (SVM) algorithm in the Scikit Learn library was used to create this classification model. There has been a stratified split of the data set into train-test data, such that 75% of the data set has been used for training and 25% has been used to test. SVM classification was done using Radial Basis Function (RBF) kernel as it is able to model the complex non-linear decision boundaries. The model used had the following hyper parameters:

| Parameter | Value |
|---|---|
| Kernel | RBF |
| C | 6 |
| Gamma | 0.15 |
| Probability | True |

The trained model and feature scaler have been saved using Pickle library for deployment in the web service.

**Web-Based Mental Health Assessment System**

An interactive platform for Mental Health assessment has been created through the web application. The web application has been developed using the Flask framework to create an interactive platform for Mental Health assessment.

The system has two roles of user :

- Student Module
  Student registration like other operations can be carried out with the input of personal and academic data secured in the system. They are then logged on and can answer the 12 question mental health assessment questionnaire which asks about eating behaviors, sleep disorders, stress level, alcohol and tobacco usage, social interaction, concentration level, anxiety, depression, exercise, etc. Depending on their responses, it lets the system figure out what their mental health is, and shows its findings, as well as specific mental health recommendations. Each student is also able to access their personal learning reports, and their individual learning assessment history to refer to in the future.
- Admin Module
  Students' mental health assessments are effectively managed and monitored by administrator login into this system. They can see the entire results of all student assessments, search by student name or

 

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registration number and filter for assessments based on mental health status. The system also enables the admin to sort the students based on the evaluation scores, get details about the students, check assessment history, and even get suggestions personalized for each student. Also, administrators can create graph-based analytics, download both the individual and consolidated assessment reports and delete any old assessment records that are left to keep the record of assessments up to date and organized.

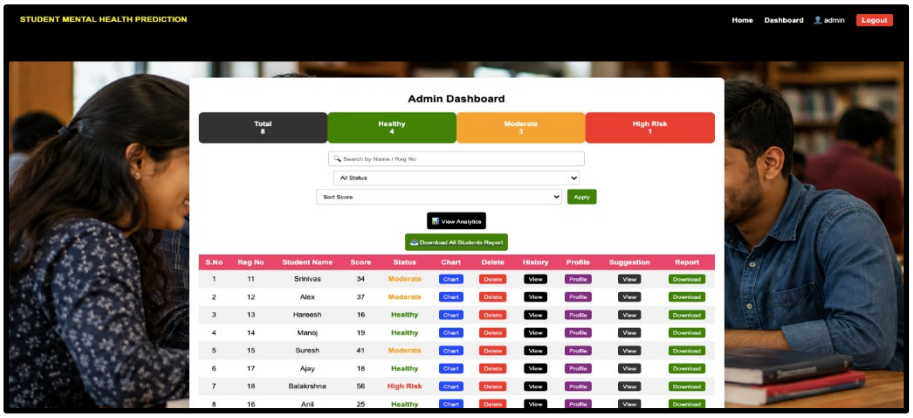


*Figure 3: Home Page of the Proposed Mental Health Assessment System*

**Mental Health Prediction**

Once the questionnaire is submitted, feature vectors, in the form of numbers, represent the responses. The questioner vector will be first scaled with the previously obtained StandardScaler then fed into the trained SVM classifier for prediction. The system further calculates a 'questionnaire score' which is arrived at by adding up all the twelve answers, apart from the machine learning prediction. The following classification of the total score is implemented based on the rule:

| Score Range | Mental Health Status |
|---|---|
| 12-28 | Healthy |
| 29-44 | Moderate |
| 45-60 | High Risk |

The final prediction is made with a combination of the SVM prediction and the categorization by the questionnaire score that provides an accurate prediction

**Personalized Recommendation Generation**

The system recommends individualized suggestions based on the students' responses. Poor sleeping posture and sleeping habits are generated as issues and if not found, it prompts the student to continue practicing healthy lifestyle habits, including length of time spent smoking/alcoholic beverages.

## RESULTS AND DISCUSSION

**Confusion Matrix of the Model**

The confusion matrix of the model is provided. The confusion matrix of the model is presented. The results obtained from the proposed Support Vector Machine (SVM) classifier are shown in the confusion matrix where highly accurate results obtained are given in each of the class in mental health category. Out of the Healthy class, 1125 records were correctly classified with only a few misclassifications. Also, for Moderate learners, most of them were correctly classified and only some appeared to be classified as Clash pupil. At the level of the High Risk category 1307 records were correctly identified, revealing a very high sensitivity to identify psychologically vulnerable students. Overall the confusion matrix shows that the model is able to correctly classify the three categories of mental health condition and the prediction error for it is very low.

 

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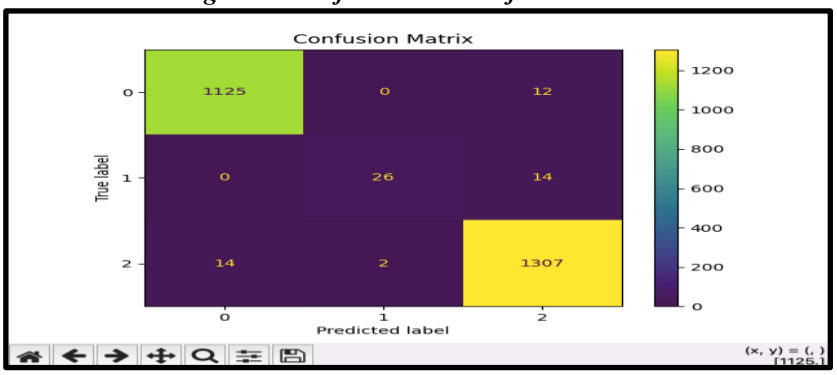
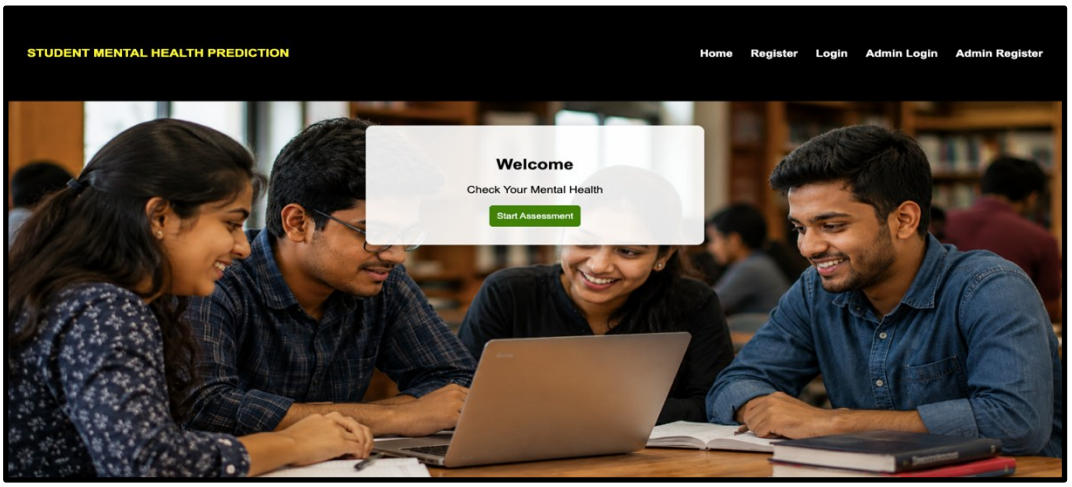
*Figure 2: Confusion Matrix of the Model*



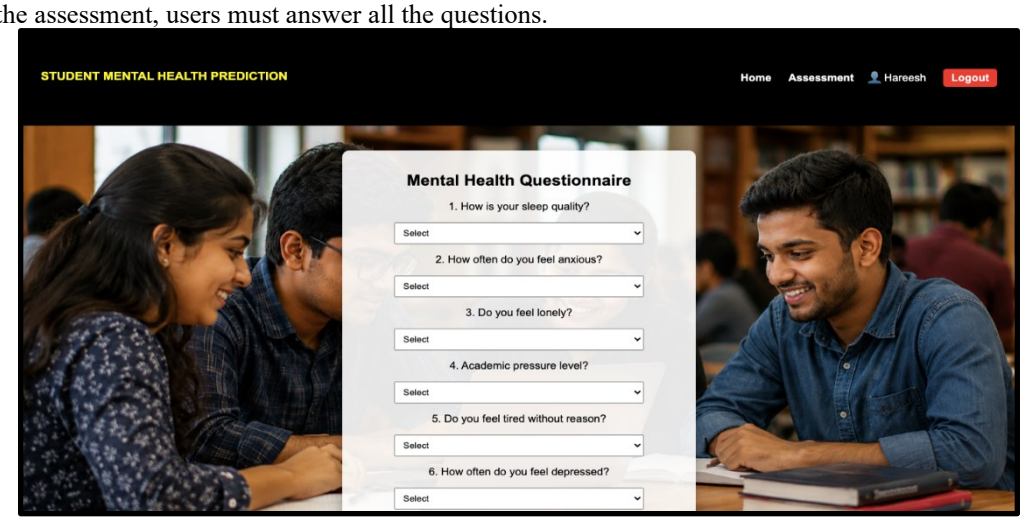

**Home Page of the Proposed System**

The proposed mental health evaluation system to be implemented remotely through the Web interface makes it easily accessible for students to put into use the system. On successful login, users are taken to the home page where they can take mental health assessment. The interface is kept as user-friendly as possible and is highly accessible.




**Mental Health Assessment Interface**

When the user chooses the assessment option, he or she is given a list of 12 questions related to mental health and lifestyle. Measuring mental health, it includes key elements like sleep quality, cognitive focus, physical engagement, social engagement, tobacco use, alcohol consumption and mood disorders. Prior to the submission of the assessment, users must answer all the questions.



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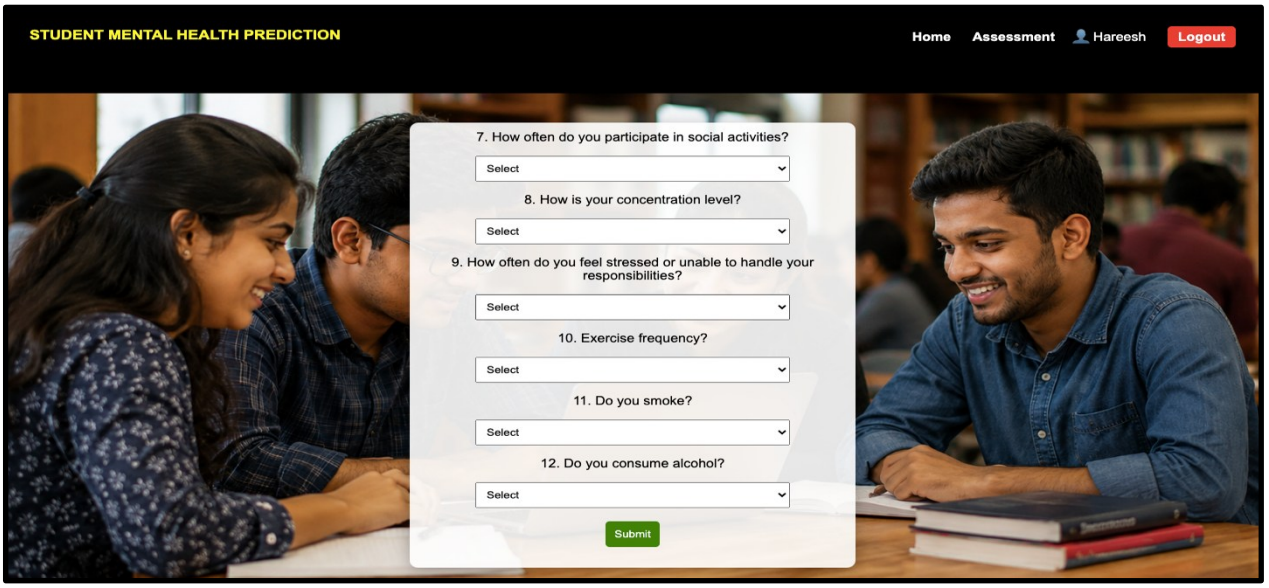


*Figure 4: Mental Health Assessment Questionnaire*

**Assessment Result and Personalized Suggestions**

Once submitted a questionnaire, the system reads the appropriateness of the response using a trained Support Vector Machine (SVM) model and outputs a class of mental health status—either Healthy, Moderate, or High Risk. The overall assessment score, together with the prediction, is also presented.

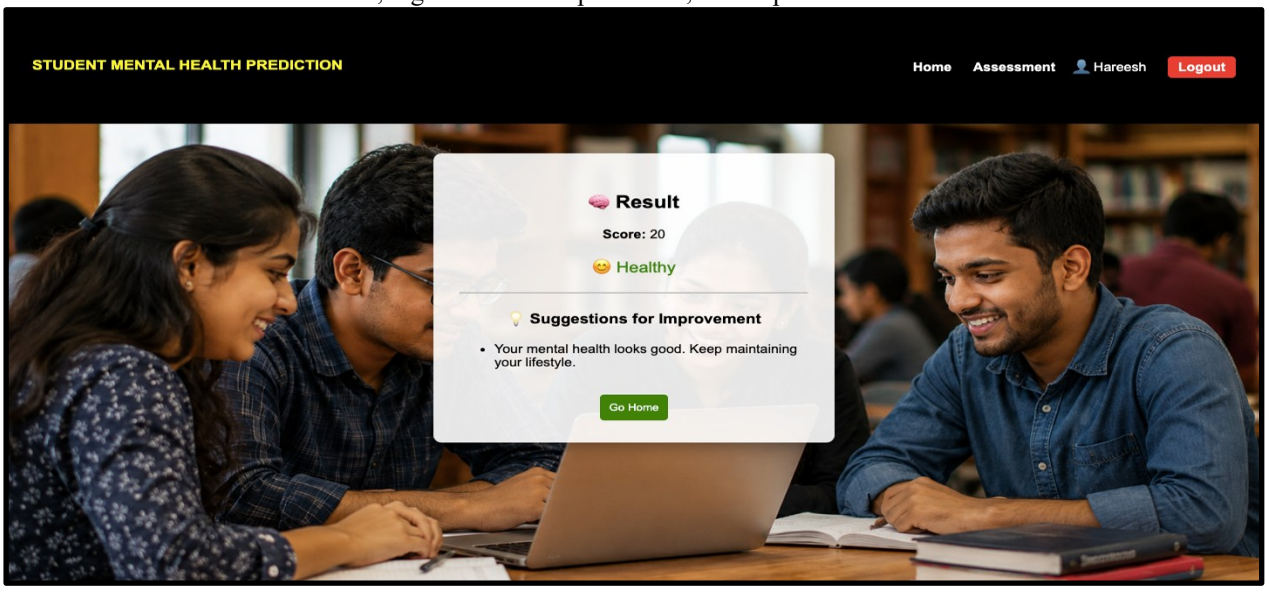


*Figure 5: Assessment Result with Personalized Suggestion*

## CONCLUSION

The Mental Health Prediction of Students Using Machine Learning system, proposed in this paper, is a very effective machine learning based approach to the early detection of students' mental health conditions based on the answers given by the students in the questionnaire. The model based on Support Vector Machine (SVM) classifier and Flask web application accurately classifies whether a student is in the Healthy, Moderate or High Risk category regarding their Mental Health status. The proposed Label Encoding, Feature Scaling techniques utilized for this preprocessing steps helps the model to be more accurate in prediction results and achieved results of 98.32% maximum accuracy. The table of classification report and the confusion matrix suggests that the proposed model does well in classification of different mental health categories with good precision, recall and

 

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f1. It also has the ability to offer personal mental health suggestions, ensure assessment history management, set up administrator monitoring and monitoring by way of an SQLite database. Overall, the proposed system provides a glimpse into the potential of machine learning in assisting educational institutions to identify students early who need psychological support and hence, to facilitate timely intervention and contribute to the mental well-being of students.

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