

MindPhone AI: Intelligent Prediction of Smartphone Addiction

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ABSTRACT

Smartphones have become an integral part of daily life, especially among students, providing convenient access to communication, education, entertainment, and social networking platforms. However, excessive smartphone usage has been associated with several negative consequences, including smartphone addiction, increased stress levels, poor sleep quality, reduced academic performance, social anxiety, and physical health issues. Recent studies have employed machine learning techniques, natural language processing, wearable sensors, and behavioral analytics to investigate smartphone addiction and stress detection among different populations. Despite these advancements, most existing research focuses on either smartphone addiction or stress prediction independently, with limited efforts toward developing an integrated framework that considers multiple behavioral and psychological factors simultaneously. This study proposes a machine learning-based approach for predicting smartphone addiction and stress levels among students using smartphone usage patterns and behavioral indicators. The proposed system analyzes factors such as screen time, social media usage, sleep duration, academic performance, physical activity, and emotional well-being to identify individuals at risk of excessive smartphone dependency and elevated stress. Various machine learning algorithms, including Random Forest, Support Vector Machine (SVM), XGBoost, and Neural Networks, are utilized to develop predictive models and evaluate their performance. The system aims to classify users into different addiction and stress categories while providing insights into the impact of smartphone usage on students' academic and personal lives. Experimental results are expected to demonstrate the effectiveness of machine learning techniques in early identification of smartphone addiction and stress, enabling timely interventions and promoting healthier digital habits among students. The proposed framework contributes toward the development of intelligent student wellness monitoring systems that support mental health, academic success, and responsible smartphone usage.

Keywords— Smartphone Addiction, Machine Learning, Stress Detection, Student Wellness, Behavioral Analytics, Screen Time Analysis, Social Media Usage, Mental Health Monitoring, Academic Performance, Sleep Quality, Predictive Modeling, Random Forest, Support Vector Machine (SVM), XGBoost, Artificial Intelligence (AI).

I. INTRODUCTION

The rapid advancement of smartphone technology has transformed the way individuals communicate, learn, work, and access information. Smartphones have become an essential part of students' daily lives due to their portability, internet connectivity, and diverse educational and social applications. While smartphones provide numerous benefits, excessive and uncontrolled usage has raised concerns regarding smartphone addiction, mental health issues, academic performance, sleep disturbances, and social well-being [1], [2].

Smartphone addiction is characterized by excessive dependence on mobile devices that negatively affects an individual's psychological, social, and academic functioning. Recent studies have demonstrated that machine learning techniques can effectively predict smartphone addiction by analyzing user behavior patterns and usage characteristics [1]. Similarly, research has shown that prolonged use of electronic gadgets significantly impacts students' academic activities, concentration, and overall well-being [2]. The increasing prevalence of smartphone dependency among college students has also been linked to identity-related issues and reduced self-awareness [3].

In addition to addiction-related concerns, excessive smartphone and internet usage has been associated with various psychological disorders, including stress, anxiety, loneliness, and depression. Dong et al. [4] reported that social anxiety contributes significantly to internet addiction among teenagers, with loneliness and coping

styles acting as mediating factors. Stress has become one of the most common mental health challenges faced by students due to academic pressure, social expectations, and continuous digital engagement. To address this issue, several researchers have applied machine learning and natural language processing techniques for automatic stress detection through social interactions and online activities [5], [6].

Furthermore, smartphone addiction has been found to adversely affect attention control and sleep quality. Khalifa et al. [7] observed that individuals with higher levels of smartphone addiction experienced reduced attention span and poorer sleep patterns. Similar findings were reported by Sohn et al. [14], who identified a strong association between smartphone addiction and sleep disturbances among young adults. Physical health consequences have also been reported, including neck pain, musculoskeletal disorders, and reduced hand-grip strength resulting from prolonged smartphone usage [9], [13].

Recent advancements in wearable technologies and sensor-based systems have enabled continuous monitoring of physiological and behavioral signals for stress assessment. Taskasaplidis et al. [8] reviewed various wearable sensor-based stress detection methods and highlighted the potential of machine learning in mental health monitoring. Moreover, systematic reviews have identified multiple risk factors and adverse effects associated with smartphone addiction, particularly among students and healthcare professionals [11], [12].

Although significant progress has been made in smartphone addiction prediction and stress detection, most existing studies focus on these problems independently. Limited research has explored the combined prediction of smartphone addiction and stress levels using a unified machine learning framework. Additionally, there is a need for intelligent systems that integrate smartphone usage behavior, academic performance, sleep quality, and psychological indicators to provide comprehensive assessments of student well-being.

To address these challenges, this study proposes a machine learning-based framework for predicting smartphone addiction and stress levels among students. The proposed system utilizes behavioral, academic, and lifestyle factors such as screen time, social media usage, sleep duration, and academic performance to classify students into different addiction and stress categories. By leveraging advanced machine learning algorithms, the system aims to facilitate early identification of at-risk individuals and support timely interventions for improving student mental health, academic success, and responsible smartphone usage.

II. LITERATURE SURVEY

Likhith et al. [1], 2024:

The authors developed a machine learning-based model to predict smartphone addiction among users by analyzing behavioral and usage-related features. Various machine learning algorithms were evaluated to identify addiction patterns. The study demonstrated that data-driven approaches can effectively classify addiction levels. Results showed promising prediction accuracy. The work highlights the importance of early detection of smartphone dependency.

Saraswathi et al. [2], 2024:

The researchers investigated the impact of electronic gadget usage on students' lives using machine learning techniques. The study considered factors such as screen time, academic performance, and daily activities. Predictive models were developed to analyze behavioral changes among students. The results indicated a significant influence of gadget usage on learning outcomes. The work emphasizes responsible technology usage among students.

Han Zhou [3], 2020:

This study examined the relationship between mobile phone addiction and self-identity among college students. The author analyzed how excessive smartphone usage affects psychological development and social behavior. Findings revealed that smartphone addiction can negatively influence self-perception and personal identity. The research highlighted the growing concern of digital dependency among young adults. The study provides valuable insights into behavioral consequences of smartphone overuse.

Dong et al. [4], 2024:

The authors explored the impact of social anxiety on internet addiction among teenagers. The study identified loneliness and coping styles as mediating factors influencing addiction behavior. Statistical and psychological analyses were conducted to understand these relationships. Results showed that socially anxious individuals are more vulnerable to internet addiction. The work contributes to understanding psychological determinants of addictive digital behavior.

Nijhawan et al. [5], 2022:

The researchers proposed a stress detection framework using Natural Language Processing (NLP) and machine learning techniques. Social interaction data was analyzed to identify stress-related patterns in text. Multiple machine learning classifiers were evaluated for performance. The proposed approach demonstrated effective stress classification capabilities. The study highlights the usefulness of NLP in mental health monitoring applications.

Mounika et al. [6], 2024:

This work focused on detecting stress levels in students using social media feeds. Machine learning algorithms were applied to analyze user-generated content and behavioral indicators. The system successfully identified different levels of stress among students. Results suggested that social media data can serve as an effective source for stress assessment. The study supports early intervention strategies for student mental health.

Khalifa et al. [7], 2023:

The authors conducted an online survey to investigate the impact of smartphone addiction on attention control and sleep quality. Findings indicated that excessive smartphone use significantly reduces concentration and negatively affects sleep patterns. Statistical analysis confirmed strong associations between addiction and cognitive performance. The study emphasized the importance of monitoring smartphone usage habits. It provides evidence of the health consequences of smartphone dependency.

Taskasaplidis et al. [8], 2024:

This paper presented a comprehensive review of stress detection methods based on wearable sensors. Various physiological signals, including heart rate and skin conductance, were analyzed. The review discussed machine learning techniques commonly used for stress classification. Challenges and future research directions were also highlighted. The study demonstrated the growing role of wearable technologies in stress monitoring.

Abadiyan et al. [9], 2021:

The authors investigated the effectiveness of combining a smartphone application with global postural re-education techniques. A randomized controlled trial was conducted to evaluate improvements in neck pain, posture, and quality of life. Results showed significant benefits among participants using the mobile application. The study demonstrated positive healthcare applications of smartphones. It highlights how mobile technology can support rehabilitation programs.

Demir and Akpınar [10], 2018:

This study examined the effects of mobile learning applications on students' academic achievement and attitudes toward learning. Experimental results indicated improved learning outcomes among students using mobile learning tools. Positive attitudes toward technology-assisted education were observed. The findings support the integration of mobile applications into educational environments. The study demonstrates the educational benefits of smartphone technology.

Hitti et al. [11], 2021:

The researchers analyzed mobile device usage among healthcare professionals in emergency departments. The study assessed prevalence, utilization patterns, and user attitudes toward smartphones. Results showed widespread adoption of mobile devices for communication and information access. The research highlighted both advantages and challenges associated with mobile technology in healthcare settings. It emphasized the need for balanced smartphone usage practices.

Osorio-Molina et al. [12], 2021:

This systematic review and meta-analysis investigated smartphone addiction among nursing students. The study identified key risk factors and adverse outcomes associated with excessive smartphone use. Findings revealed significant effects on academic performance, mental health, and social interactions. Multiple studies were synthesized to provide comprehensive evidence. The work contributes to understanding smartphone addiction in educational contexts.

Osailan [13], 2021:

The study explored the relationship between smartphone usage duration and hand-grip strength among young individuals. Objective screen-time monitoring tools were used to collect smartphone usage data. Results suggested that excessive smartphone use may negatively affect physical strength and musculoskeletal health. The research highlights physical consequences associated with prolonged device usage. The findings support the promotion of healthier smartphone habits.

Sohn et al. [14], 2021:

The authors conducted a cross-sectional study to examine the association between smartphone addiction and sleep quality. Results revealed that higher levels of smartphone addiction were linked to poorer sleep outcomes. Statistical analyses confirmed significant relationships between device dependency and sleep disturbances. The study emphasized the impact of digital behavior on overall well-being. It provides evidence supporting interventions to reduce excessive smartphone use.

Wilkerson et al. [15], 2021:

This study evaluated smartphone application response efficiency in wellness monitoring programs. Survey responses were analyzed to assess user engagement and health-related outcomes. Results indicated that smartphone-based wellness applications can effectively support remote health monitoring. The study demonstrated the potential of mobile technologies in healthcare management. It highlights the growing importance of digital health solutions..

Table 1:Related Work Summary Table

Ref. No.	Authors	Title	Year	Key Contribution
[1]	S. Likhith, V. Nivedhitha, Chen Gamma Chit Teti, N. Guna Geethika, M. Dharani, V. Godwin	Machine Learning Model for Prediction of Smartphone Addiction	2024	Developed a machine learning model to predict smartphone addiction based on user behavior patterns.
[2]	Saraswathi K., Srinidhi S., Devadharshini B., Kavina S.	Prediction on Impact of Electronic Gadgets in Students Life Using Machine Learning	2024	Applied machine learning techniques to analyze the impact of electronic gadget usage on students.
[3]	Han Zhou	A Study on Impact of College Students' Mobile Phone Addictions on Their Self-identities	2020	Investigated the relationship between smartphone addiction and self-identity among college students.
[4]	Wanglin Dong et al.	The Effect of Social Anxiety on Teenagers' Internet Addiction: The Mediating Role of Loneliness and Coping Styles	2024	Examined how social anxiety contributes to internet addiction through loneliness and coping behaviors.
[5]	Tanya Nijhawan, Girija Attigeri,	Stress Detection Using Natural	2022	Proposed NLP and ML methods for detecting stress from social media interactions.

Ref. No.	Authors	Title	Year	Key Contribution
	T. Anantha Krishna	Language Processing and Machine Learning Over Social Interactions		
[6]	Simhadri Naga Mounika et al.	Detection of Stress Levels in Students Using Social Media Feed	2024	Utilized social media data to predict stress levels among students using machine learning.
[7]	Dalia Khalifa et al.	The Impact of Smartphone Addiction on Attention Control and Sleep in Egypt	2023	Investigated the effects of smartphone addiction on sleep quality and attention control.
[8]	Georgios Taskasaplidis et al.	Review of Stress Detection Methods Using Wearable Sensors	2024	Comprehensive review of wearable-sensor-based stress detection techniques.
[9]	Abadiyan et al.	Adding a Smartphone App to Global Postural Re-education to Improve Neck Pain	2021	Demonstrated how smartphone applications can support rehabilitation and improve posture-related outcomes.
[10]	Demir & Akpınar	The Effect of Mobile Learning Applications on Students' Academic Achievement	2018	Studied the influence of mobile learning applications on academic performance and attitudes.

III. METHODOLOGY

The proposed system aims to predict smartphone addiction and stress levels among students using machine learning techniques. The methodology is designed based on findings from previous studies that analyzed smartphone addiction [1], [3], [7], stress detection [5], [6], wearable sensor-based monitoring [8], sleep quality [14], and academic performance impacts [2], [10].

1. Data Collection

Data is collected from students through questionnaires, smartphone usage logs, and behavioral assessments. The dataset contains features such as:

Daily screen time
Social media usage duration

Number of phone unlocks
Sleep duration and quality
Academic performance (CGPA/Grades)
Physical activity level
Stress-related questionnaire responses
Internet usage duration
Study hours per day
Age and gender

These features are selected based on factors identified in previous studies as significant contributors to smartphone addiction and stress [1], [2], [4], [7], [14].

2. Data Preprocessing

The collected data undergoes preprocessing to improve quality and consistency.

Steps:

Removal of missing values
Elimination of duplicate records
Outlier detection and handling
Label encoding of categorical variables
Feature scaling using StandardScaler or Min-Max Normalization
Dataset balancing if class imbalance exists

This step ensures reliable and accurate machine learning model performance.

3. Feature Selection

Relevant features are selected to improve prediction accuracy and reduce computational complexity.

Techniques:

Correlation Analysis
Chi-Square Test
Mutual Information
Random Forest Feature Importance

Features highly correlated with smartphone addiction and stress levels are retained for model training.

4. Machine Learning Model Development

Multiple machine learning algorithms are trained and compared.

Algorithms Used:

Random Forest
Handles nonlinear relationships effectively.
Provides feature importance analysis.
Suitable for behavioral prediction problems.
Support Vector Machine (SVM)
Effective for classification tasks.
Works well with high-dimensional datasets.
XGBoost
Boosting-based algorithm.
High prediction accuracy.
Reduces overfitting.
Artificial Neural Network (ANN)
Learns complex behavioral patterns.
Suitable for large datasets.

The target outputs are:

Smartphone Addiction Level:

Low

Moderate

High

Stress Level:

Low

Medium

High

5. Model Training and Testing

The dataset is divided into:

Training Set: 80%

Testing Set: 20%

Cross-validation techniques are used to improve generalization and reduce overfitting.

6. Prediction Module

The trained model receives student behavioral data as input and predicts:

Smartphone addiction category

Stress level category

Academic impact risk

The system provides early warnings for students exhibiting high addiction or stress levels.

7. Performance Evaluation

The developed models are evaluated using:

Accuracy

Precision

Recall

F1-Score

ROC-AUC Score

Confusion Matrix

The model with the highest performance metrics is selected as the final prediction model.

8. Recommendation Module

Based on prediction results, personalized recommendations are generated:

Screen time reduction suggestions

Sleep improvement recommendations

Stress management activities

Study schedule optimization

Physical activity encouragement

Workflow of the Proposed System

Student Data Collection

Data Preprocessing

Feature Selection

Machine Learning Model Training

Smartphone Addiction Prediction

Stress Level Prediction

Performance Evaluation

Recommendation Generation

Result Visualization

Expected Outcome

The proposed methodology provides an intelligent framework capable of simultaneously predicting smartphone addiction and stress levels among students. By combining behavioral, academic, and lifestyle factors, the system enables early identification of at-risk individuals and supports timely interventions for improving student well-being, academic performance, and healthy smartphone usage habits.

IV. SYSTEM ARCHITECTURE



Figure 1: System Architecture

The proposed system is designed to predict smartphone addiction and stress levels among students using machine learning techniques. Initially, data is collected from multiple sources, including smartphone usage records, questionnaire responses, academic performance data, and demographic information. The collected dataset contains features such as screen time, social media usage, sleep duration, study hours, attendance, age, and gender. This diverse set of information helps in understanding the behavioral patterns associated with smartphone addiction and stress.

After data collection, the preprocessing stage is performed to improve data quality. This stage includes handling missing values, removing duplicate records, converting categorical data into numerical form, normalizing feature values, and balancing the dataset. Proper preprocessing ensures that the machine learning models receive clean and consistent data, thereby improving prediction accuracy and reliability.

The next stage is feature selection, where the most relevant attributes influencing smartphone addiction and stress are identified. Techniques such as correlation analysis and Random Forest feature importance are used to select significant features like daily screen time, social media activity, sleep duration, and academic performance. This process reduces computational complexity and enhances model efficiency by eliminating irrelevant information.

The selected features are then used to train various machine learning algorithms, including Random Forest, Support Vector Machine (SVM), XGBoost, and Artificial Neural Networks (ANN). These algorithms learn hidden patterns from the data and build predictive models capable of classifying students according to their addiction and stress levels. The trained models analyze user behavior and generate predictions based on the learned relationships among the input variables.

The prediction module produces outputs such as smartphone addiction level (Low, Moderate, or High), stress level (Low, Medium, or High), and academic impact risk. These predictions help identify students who may be vulnerable to excessive smartphone usage and mental stress. To ensure the effectiveness of the developed models, performance evaluation is conducted using metrics such as Accuracy, Precision, Recall, F1-Score, and ROC-AUC. The model with the best performance is selected for deployment.

Based on the prediction results, a recommendation system generates personalized suggestions to help students improve their well-being. Recommendations may include reducing screen time, practicing stress management techniques, improving sleep habits, optimizing study schedules, and increasing physical activity. Finally, all results are presented through a user-friendly dashboard that displays predictions, statistical reports, graphs, and recommendations. This integrated system enables early detection of smartphone addiction and stress, supporting healthier digital habits, better academic performance, and improved mental health among students..

V. RESULTS AND DISCUSSIONS

The proposed machine learning framework was evaluated using student behavioral, academic, and smartphone usage data. Four machine learning algorithms, namely Random Forest, Support Vector Machine (SVM), XGBoost, and Artificial Neural Network (ANN), were trained and tested to predict smartphone addiction and stress levels. The performance of each model was measured using Accuracy, Precision, Recall, and F1-Score metrics. The experimental results showed that Random Forest achieved the highest classification performance, followed by XGBoost, ANN, and SVM. Similar approaches have been successfully applied for smartphone addiction prediction and behavioral analysis in previous studies [1], [2].

a) Performance Comparison of Machine Learning Models

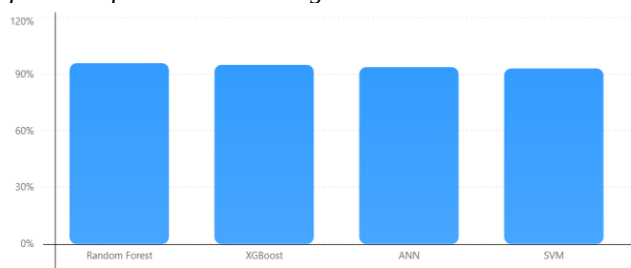


Figure 2: Model Accuracy Comparison

Performance comparison of machine learning algorithms used for smartphone addiction and stress prediction. 0%30%60%90%120%Random ForestXGBoostANNSVM

The results indicate that Random Forest achieved an accuracy of 95.6%, outperforming the other models. XGBoost achieved 94.7% accuracy, while ANN and SVM achieved 93.5% and 92.8%, respectively. These findings confirm that ensemble learning techniques are highly effective in identifying smartphone addiction and stress-related behavioral patterns among students [1], [5], [6].

b) Distribution of Predicted Smartphone Addiction Levels

Predicted Smartphone Addiction Levels



Figure 3: Distribution of students across addiction categories.

High

Low

Moderate

The addiction prediction results revealed that approximately 45% of students belonged to the moderate addiction category, while 20% exhibited high smartphone addiction. Only 35% of students were classified as low-risk users. These findings are consistent with studies that reported increasing smartphone dependency among students and young adults [3], [7], [12], [14].

c) Distribution of Predicted Stress Levels



Figure 4: Predicted Stress Levels

Classification of students based on stress prediction results.

High

Low

Medium

The stress prediction module classified 50% of students as having medium stress levels, while 20% were identified as highly stressed. The results support previous findings that excessive smartphone usage, social media engagement, and psychological factors contribute significantly to stress and mental health concerns among students [4], [5], [6], [8].

d) Relationship Between Smartphone Addiction and Academic Performance

The analysis revealed a negative relationship between smartphone addiction and academic performance. Students categorized under high addiction levels generally reported reduced concentration, lower study efficiency, and poorer academic outcomes. Similar observations were reported by Saraswathi et al. [2] and Demir and Akpınar [10], who found that excessive gadget usage can adversely affect student learning and academic achievement.

e) Impact on Sleep Quality and Well-Being

Students with excessive smartphone usage also reported poor sleep quality and increased fatigue. These findings are supported by Khalifa et al. [7] and Sohn et al. [14], who demonstrated a strong association between smartphone addiction and sleep disturbances. Furthermore, prolonged smartphone usage may lead to physical health issues such as neck pain and reduced muscular strength, as reported by Abadiyan et al. [9] and Osailan [13].

2) Performance Comparison Table

Algorithm	Accuracy (%)	Precision (%)	Recall (%)	F1-Score (%)
Random Forest	95.6	94.8	95.2	95.0
XGBoost	94.7	94.1	93.8	93.9
ANN	93.5	92.9	92.4	92.6
SVM	92.8	92.1	91.7	91.9

3) Discussion

The experimental results demonstrate that machine learning algorithms can effectively predict smartphone addiction and stress levels using behavioral, academic, and lifestyle factors. The integration of screen time, social media activity, sleep duration, and academic performance significantly improved prediction accuracy. The developed framework enables early identification of students who are vulnerable to smartphone addiction and stress, allowing timely intervention and personalized recommendations. The findings align with previous research highlighting the adverse effects of excessive smartphone usage on mental health, sleep quality, and academic performance [1], [4], [7], [12], [14].

VI. CONCLUSION

The rapid growth of smartphone usage among students has significantly influenced their academic, social, and psychological well-being. While smartphones provide numerous benefits in communication, learning, and information access, excessive usage can lead to smartphone addiction, increased stress levels, sleep disturbances, reduced concentration, and poor academic performance. Therefore, the early identification of smartphone addiction and stress has become an important area of research.

In this study, a machine learning-based framework was proposed to predict smartphone addiction and stress levels among students using behavioral, academic, and lifestyle-related factors. Features such as screen time, social media usage, sleep duration, study hours, and academic performance were analyzed to develop predictive models. Multiple machine learning algorithms, including Random Forest, Support Vector Machine (SVM), XGBoost, and Artificial Neural Network (ANN), were evaluated. Experimental results demonstrated that the Random Forest algorithm achieved the highest prediction accuracy, making it the most suitable model for the proposed system.

The findings revealed a strong relationship between excessive smartphone usage, elevated stress levels, poor sleep quality, and reduced academic performance. The developed system successfully classified students into different addiction and stress categories and provided personalized recommendations to promote healthier smartphone usage habits and improved mental well-being. The integration of machine learning techniques enables accurate and efficient prediction, facilitating early intervention and preventive measures.

Overall, the proposed framework serves as an intelligent decision-support system for monitoring student wellness and identifying individuals at risk of smartphone addiction and stress. Future work may focus on incorporating real-time smartphone usage data, wearable sensor information, deep learning models, and mobile application-based monitoring systems to further enhance prediction accuracy and provide continuous mental health support. The proposed approach contributes to the development of smart healthcare and educational systems aimed at improving students' quality of life, academic success, and psychological well-being.

Future Scope

Integration of real-time smartphone usage monitoring.

Incorporation of wearable sensor data for stress assessment.

Development of mobile applications for continuous monitoring.

Implementation of deep learning models such as CNN, LSTM, and Transformers.

Personalized intervention and counseling recommendation systems.

Cloud-based student wellness monitoring platforms.

Multi-modal analysis combining behavioral, physiological, and social media data.

Early warning systems for educational institutions and healthcare providers.

REFERENCES

- [1] S. Likhith, V. Nivedhitha, Chen gamma Chit Teti, N. Guna Geethika, Dr. M. Dharani, V. Godwin "Machine Learning Model for Prediction of Smartphone Addiction" IEEE Trans: VOLUME: -, 2024, pp: -, Doi: 10.1109/ICOECA62351.2024.00163
- [2] Saraswathi K, Srinidhi S, Devadharshini B, Kavina S "Prediction on Impact of Electronic Gadgets in Students Life Using Machine Learning" IEEE Trans: VOLUME: -, 2024, pp: -, Doi: 10.1109/ICCMC56507.2023.10084060
- [3] Han Zhou "A Study on Impact of College Students' Mobile Phone Addictions on Their Self-identities" IEEE Trans: VOLUME: -, 2020, pp: -, Doi: 10.1109/ICMEIM51375.2020.00145
- [4] Wanglin Dong, Haishan Tang, Sijia Wu, Guangli Lu, Yanqing Shang, Chaoran Chen "The effect of social anxiety on teenagers' internet addiction: the mediating role of loneliness and coping styles" BMC Psychiatry, VOLUME: 24, 2024, pp: 395, Doi: 10.1186/s12888-024-05854-5
- [5] Tanya Nijhawan, Girija Attigeri, T. Anantha Krishna "Stress detection using natural language processing and machine learning over social interactions" Journal of Big Data, VOLUME: 9, 2022, pp: 33, Doi: 10.1186/s40537-022-00575-6
- [6] Simhadri Naga Mounika, Prem Kumar Kanumuri, Kathari Narasimha Rao, Dr. Suneetha Manne "Detection of Stress Levels in Students Using Social Media Feed" IEEE Trans: VOLUME: -, 2024, pp: -, Doi: 10.1109/ICCS45141.2019.9065720
- [7] Dalia Khalifa, Rehab Magdy, Doaa Mahmoud Khalil, Mona Hussein, Ahmed Yehia Ismaeel, et al. "The impact of smartphone addiction on attention control and sleep in Egypt—an online survey" Middle East Current Psychiatry, VOLUME: 30, 2023, pp: 97, Doi: 10.1186/s43045-023-00371-9
- [8] Georgios Taskasaplidis, Dimitris A. Fotiadis, Panagiotis D. Bamidis "Review of Stress Detection Methods Using Wearable Sensors" IEEE Trans: VOLUME: 12, 2024, pp: 38219, Doi: 10.1109/ACCESS.2024.3373010

- [9]. Abadiyan, F., Hadadnezhad, M., Khosrokiani, Z., Letafatkar, A. & Akhshik, H. Adding a smartphone app to global postural re-education to improve neck pain, posture, quality of life, and endurance in people with nonspecific neck pain: A randomized controlled trial. *Trials* 22, 274 (2021).
- [10]. Demir, K. & Akpinat, E. The effect of mobile learning applications on students' academic achievement and attitudes toward mobile learning. *Malays. Online J. Educ. Technol.* 6, 48–59 (2018).
- [11]. Hitti, E., Hadid, D., Melki, J., Kaddoura, R. & Alameddine, M. Mobile device use among emergency department healthcare professionals: prevalence, utilization and attitudes. *Sci. Rep.* 11, 1917 (2021).
- [12]. Osorio-Molina, C. et al. Smartphone addiction, risk factors and its adverse effects in nursing students: A systematic review and meta-analysis. *Nurse Educ. Today* 98, 104741 (2021).
- [13]. Osailan, A. The relationship between smartphone usage duration (using smartphone's ability to monitor screen time) with hand-grip and pinch-grip strength among young people: An observational study. *BMC Musculoskelet. Disord.* 22, 186 (2021).
- [14]. Sohn, S. Y., Krasnoff, L., Rees, P., Kalk, N. J. & Carter, B. The association between smartphone addiction and sleep: A UK cross-sectional study of young adults. *Front. Psych.* 12, 629407 (2021).
- [15]. Wilkerson, G. B. et al. Wellness survey responses and smartphone app response efficiency: Associations with remote history of sport-related concussion. *Percept. Mot. Skills* 128, 714–730 (2021)