A research on psychological impact for excessive using of smart devices with respect to social media addiction using Artificial Neural Network

Supervised By

Dr. Imran Mahmud
Associate Professor and Head
Department of Software Engineering
Faculty of Science and Engineering Technology
Daffodil International University

Submitted By

M R Khan Dipu
ID: 191-35-393
Department of Software Engineering
Faculty of Science and Engineering Technology
Daffodil International University

This Report Presented in Partial Fulfillment of the Requirements for the Degree
of Bachelor of Science in Software Engineering

Date of Submission: 27th November, 2022

APPROVAL

This thesis titled on "**A research on psychological impact for excessive using of smart devices with respect to social media addiction using Artificial Neural Network**", submitted by **M R Khan Dipu (ID: 191-35-393)** to the Department of Software Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of Bachelor of Science in Software Engineering and approval as to its style and contents.
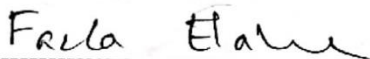
BOARD OF EXAMINERS

-- Chairman

Dr. Imran Mahmud
Head and Associate Professor
Department of Software Engineering
Faculty of Science and Information Technology
Daffodil International University

-- Internal Examiner 1

Afsana Begum
Assistant Professor
Department of Software Engineering
Faculty of Science and Information Technology
Daffodil International University

-- Internal Examiner 2

Dr. Md. Fazle Elahe
Assistant Professor
Department of Software Engineering
Faculty of Science and Information Technology
Daffodil International University

-- External Examiner

Mohammad Abu Yousuf, PhD
Professor
Institute of Information Technology
Jahangirnogor University
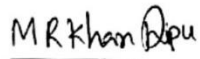
Date: 27-11-2022

DECLARATION

I hereby declare that I am conducting this research under the supervision of Dr. Imran Mahmud, Associate Professor and Head of the Department of Software Engineering at Daffodil International University. I further state that this work, or any element of it, was not proposed for a Bachelor's degree or graduation.

Supervised by:

Dr. Imran Mahmud
Associate Professor and Head
Department of Software Engineering
Daffodil International University

Submitted by:

M R Khan Dipu
ID: 191-35-393
Department of Software Engineering
Daffodil International University

 Date: 27-11-2022

ACKNOWLEDGEMENT

And, first and foremost, we express our profound thankfulness to Almighty God for His magnificent gift, which has enabled us to successfully complete the final year proposal.

First and foremost, we express our profound thankfulness and gratitude to Almighty God for His magnificent gift, which has enabled us to successfully complete this project. I am really pleased and desire to express our sincere gratitude to Dr. Imran Mahmud, Associate Professor and Head of the Department of Software Engineering at Daffodil International University in Dhaka. My supervisor's extensive knowledge and deep interest in the topic of "Artificial Neural Networks" is required to complete this research. His unending patience, intellectual direction, persistent encouragement, frequent and energetic supervision, constructive criticism, good counsel, reading numerous poor versions and correcting them at all levels, and reading and correcting them at all stages have enabled us to complete this project. Complete the final year proposal.

I would want to offer my heartfelt gratitude to the other faculty members and employees of Daffodil International University's SWE department.

Finally, I must express my gratitude to our parents for their enduring love and patience.

ABSTRACT

Social media addiction has the most contribution in the reason of excessive using of smart devices which is increasing day by day. Youth in nowadays is affected badly by the curse of social media addiction. Though smart devices are used in various purposes but the obvious fact is that the Youth overusing it for social media. The previous researches have come up with outcomes finding out the factors of using mobile phone and the addiction rate of using it as well as social media but there is not clear vision about the psychological and behavioral impacts and changes for excessive using of mobile phone and social media. This paper is a presentation of the psychological impact for excessive using of smart devices with respect to social media addiction. Through survey we collect data to research the behavioral impact psychologically and in the case of research we use Artificial Neural Network (ANN) as it performs traditional tools in detecting linear and non-linear relationships. The research is being initialized to know what a person feels without smart devices and how he acts if someone interrupt while using it as well as can social media blocks disturbing thoughts of life. There will be proper distribution of progress of works and contributions from the beginning to end in this paper.

KEYWORDS: smart devices, social media addiction, psychological impact, behavioral change.

Date: 27-11-2022

TABLE OF CONTENT

©Daffodil International University   Date: 27-11-2022

Date: 27-11-2022

LIST OF FIGURES

ABBREVIATION

GSD - Global Software Development

ANN - Artificial Neural Network

NECM - Normalized Expected Cost of Misclassification

FNN - Feedforward Neural Network

CBOs - Community-based Organizations

CHAPTER ONE

INTRODUCTION

1.1 Introduction

Addiction to social media has become the core reason for excessive using of smart devices. Many researches were implemented to get a clear vision of the reasons of using mobile phone as well as the bad impact of smart devices. This study examines the connection between social media addiction and the behavioral facts of human. Artificial Neural Network (ANN) is used in this research to measures the hypothesis and find out the accuracy of the data. Importantly how a person feels without smart phone and how he or she reacts against the interruption while using smart devices are thought to be analyzed through this study. According to the findings, person who spend more time using smart device has social media addiction in most cases, it interrupts their sleep and hurt their eyes as well as they yell or act annoyed when someone interrupt while using smart devices and they feel boring without smart devices. This study come up with some information that, those who have smart device and social media addiction think they can block their disturbing thoughts of life with it but they feel low stem as a result of excessive use of smart devices. Relating with the previous studies it is confirmed that the term addiction to smart device and social media addiction causes mental health problem in most cases. The literature review is provided to represent the existing works on the term of addiction of social media and smart device. The findings indicate that most of the users are agreed about late night use of mobile phone and the impact of it in their health and behavior. Moreover, there are a separation of facts of using smart device where one is for social media addiction and the other is general purpose. Also, gaming is another term for excessive use of smart devices. Whatever the fact is, negative impact of the facts impact on the socialization and country as the present generation is the motivator for upcoming generation.

 Date: 27-11-2022

1.2 Motivation

So many studies are there on the term of smart device and social media addiction. But the fact is that smart device and social media addiction are related to each other. Social media addiction is one of the reasons for using excessive smart device but smart device is the only key to use social media. In the virtual world people find happiness nowadays. As a result, behavioral effects are being spread in the real world. This research indicates the effect of smart devices and social media addiction on human mental health.

1.3 Research Questions

- How does a person act if someone interrupt while using smart device?
- What is the accuracy?

1.4 Research Objective

- To analyze how does it effect on a person without having smart phone who has addiction on it.
- To test the accuracy.

1.5 Thesis Organization

This report consisted of six distinct chapters. Which are capable of broadening the understanding of "Psychological Impact" in a more concise manner.

I'll discuss the introduction, motivation, and research questions in the first sector, and the projected conclusion in the final.

Following that, I'll talk briefly about other comparable works and the types of obstacles I encountered.

This was the most significant section since I discussed the model and how it functioned. How I used my data after gathering it. The analysis of the results is also mentioned. Discuss the outcome. I'll finish my thesis after I analyze the data. In this section, I'll provide an overview of my entire thesis.

CHAPTER TWO

LITERATURE REVIEW

2.1 Literature Review

(Md. Saiful Islam et al., 2010) submitted a study article based on PSPU & PSMU grading. They employed statistical analysis, hierarchical regression analysis, association analysis, and descriptive analysis. The mean PSPU and PSMU scores were 20.8 6.8 (out of 36) and 14.7 4.8, respectively (out of 30). According to a hierarchical regression analysis, PSPU and PSMU were positively connected with younger age, insufficient sleep, social media use, television viewing, anxiety, and depression. Furthermore, being female, having a nuclear family, living in an urban area, engaging in irregular physical activity, performing poorly on academic assignments, and avoiding earning activities were associated with PSMU, whereas being male, married, having a lower-income family, and drinking alcohol were associated with PSMU.

(Naveenta Gupta et al, 2016) investigated the effects of mobile phone usage patterns on students' mental health, sleep quality, and academic achievement at a medical university. They used Sample Data Collection and Statistical Analysis. All 1,000 students had a cell phone, with approximately 76.4% of them having a smart phone. While some people used mobile phones primarily for downloading games, music, and films, as well as for fashion, others used them to arrange events, communicate, and in emergency situations. Mobile phone use at night was substantially (p 0.0001) related with difficulty getting up, weariness throughout the early hours, a deterioration in study habits, difficulty focusing, a rise in missed courses, and arriving late to class. Total time spent on mobile devices was substantially (p 0.05) and highly significantly (p 0.001) related with a deterioration in study habits, a rise in missing classes, and coming late for classes.

According to Md. Mahbobor Rahaman (2017), 19.7% of respondents strongly agreed and 26.6% agreed that they spend more time with their mobile phone than their friends and family members on average. According to the findings of this study, 46.3% of respondents said they used their phones more frequently. Mobile phones have a huge impact on our

©Daffodil International University   Date: 27-11-2022

society, community, and nation. This result indicated the horrible news that because people in Bangladesh were shut off from civilization, they were attempting to believe evil thoughts that could jeopardize human life. One of the primary causes of the increase in crime in Bangladesh is that the bulk of the younger generation spends more time on their phones than on volunteer activities.

According to Abu Shams Mohammad Mahmudul Hoque (2018), digital gadget addiction has a significant impact on the performance of Bangladeshi SMEs. Given this, the beta coefficient for the influence of digital device addiction on Bangladeshi Gen Z lifestyle was.864, indicating that every unit rise in digital device addiction increased Bangladeshi Gen Z lifestyle by.864. As a result, the theory was confirmed.

(2019, Lai-Ying Leong et al.) The research model predicts social media addiction with an 86.67% accuracy rate. Gender, time spent, entertainment, agreeableness, and addiction all have linear relationships. Neuroticism and social media addiction have a nonlinear relationship. Sample Data Collection, Artificial Intelligence, and SEM - neural network were their methodologies.

Akmar Hayati Ahmad Ghazali and Kalaivani A/P Munusamy (2020), The results revealed a modest level of smartphone addiction. According to the findings, young people's addiction to cell phone use may have an effect on their daily life. The assertions were graded highest to lowest based on their average score.

 According to Sara Thomée (2020), the studies found (n = 290) were mostly concerned with "problematic mobile phone usage" (dependence/addiction) and "problematic mobile phone use" (frequency or length of use in relation to mental health symptoms) (such as depression, anxiety, and sleeplessness). The number of papers published in the prior five years, in particular, has increased significantly over that time span.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Working Process

The research process was aimed to investigate the psychological and behavioral factors for excessive use of smart devices and social media addiction. The overall research process was dedicated to obtain at least one objective as outcome. In the purpose of obtaining outcome and fulfill the objectives quantitative method was used to collect data. It accepted user input for details about the addict's identity, like Gender, and Study, uses time of social media and other related stuffs.
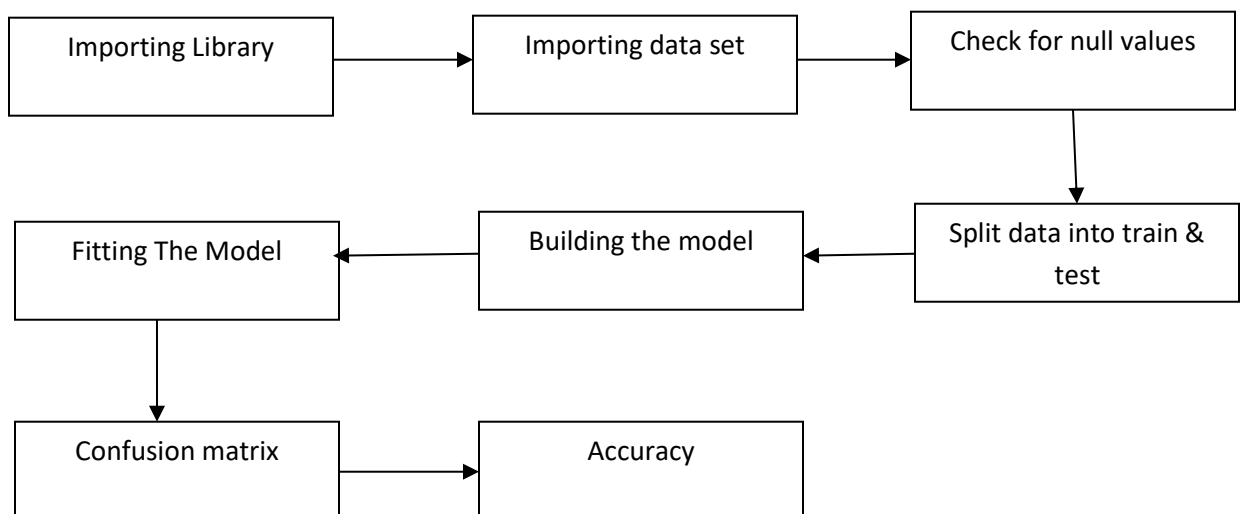
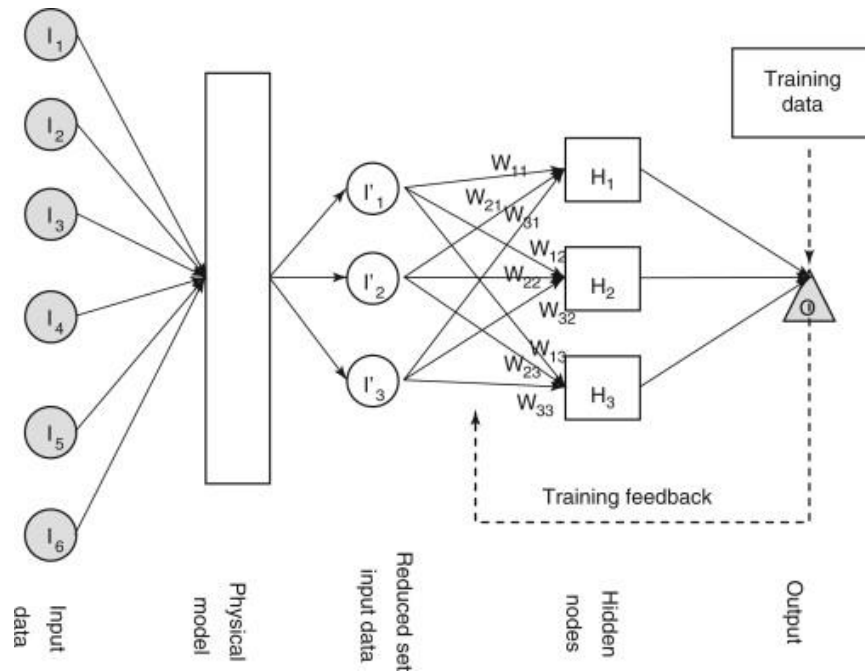Figure 3.1.1: Research Process.

3.2 Proposed Model

Figure 3.2.1: Proposed Model

3.3 Workflow

First of all, a survey paper was created through google form. The survey consisted of 11 multiple-choice questions were the first 3 questions were about the person and rest 8 were related to the majorly needed information for research. The goal was to collect survey responses from 500 users but unfortunately 100 responses could be gathered from the survey. Questions asked in survey were:

1. Gender?
2. Age?
3. What is the level of study?
4. How much time do you use smart devices?
5. How much time do you spend maximum time on using social media?

©Daffodil International University Date: 27-11-2022

6. How often do you think using social media can block out disturbing thoughts of your life?

7. How often do you feel boring without smart devices?

8. Do you feel interrupt in sleeping?

9. Does it hurt your eyes overusing smart device?

10. Do you feel low stem for using smart devices for long time?

11. How often do you yell or act annoyed if someone interrupt while using smart devices?

Before being transmitted to an artificial neural network, every data was saved in a.csv file. Following that, Artificial Neural Networks generated output and transferred it to the report generator, where all conclusions were established based on the data provided by the

Artificial Neural Network.

Gender	Study	time	Limitation	Disturb	boring	sleep	eyes	low stem	bother
Female	University	4 to 5 Hours	Yes;No	Frequently	Requently	Yes	Yes	Maybe	Frequently
Male	University	2 to 3 Hours	Yes	Frequently	Often	Yes	Yes	Maybe	Frequently
Male	University	4 to 5 Hours	Yes	Frequently	Often	Yes	Yes	Maybe	Often
Male	University	4 to 5 Hours	No	Rarely	Rarely	Yes	Yes	Maybe	Sometimes
Female	University	Less than 2 Hours	No	Often	Sometimes	No	No	Maybe	Frequently

Figure 3.3.1: A part of Responses from Survey

 Date: 27-11-2022

3.4 Responses overview

What is your Gender?
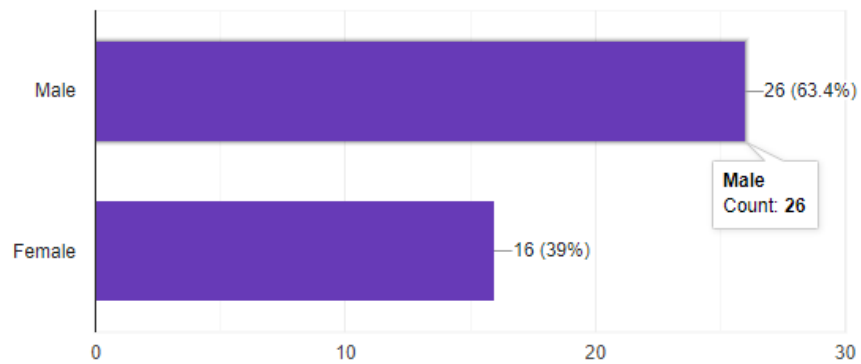
1 responses

Figure 3.4.1: Question-1 Overview

You are a student of ?

41 responses

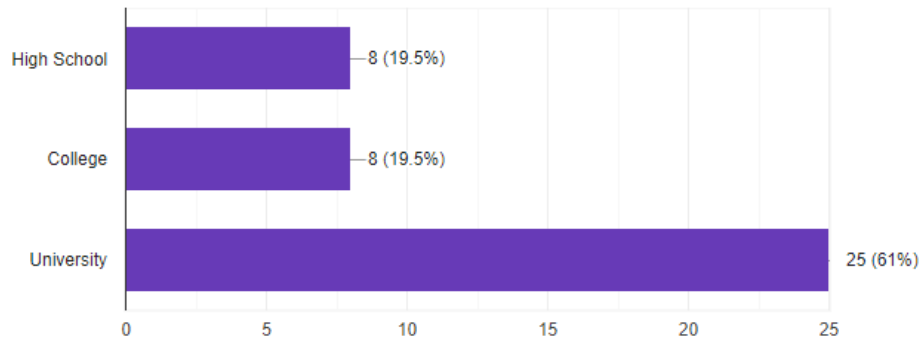Figure 3.4.2: Question-2 Overview

©Daffodil International University   Date: 27-11-2022

How often do you use Internet?   Copy

41 responses

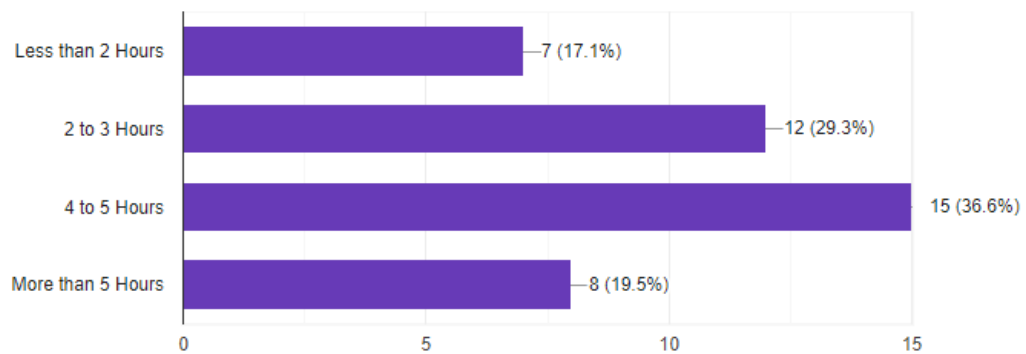Figure 3.4.3: Question-3 Overview

Do you spend maximum time on using smart devices?   Copy

41 responses

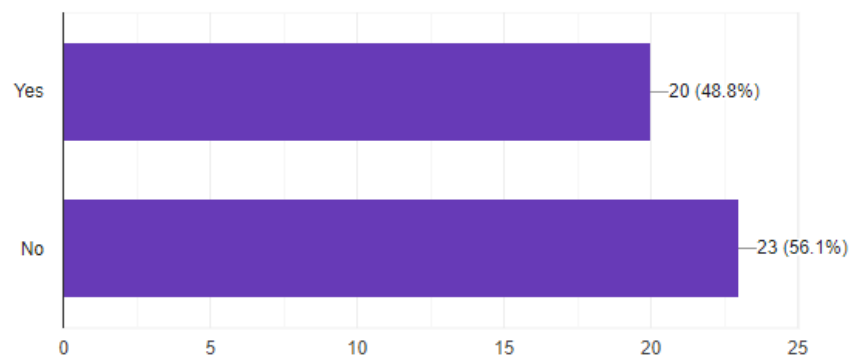
Figure 3.4.4: Question-4 Overview

©Daffodil International University   Date: 27-11-2022

How often do you block out disturbing thoughts about your life with soothing thoughts of the smart devices?

41 responses

Figure 3.4.5: Question-5 Overview
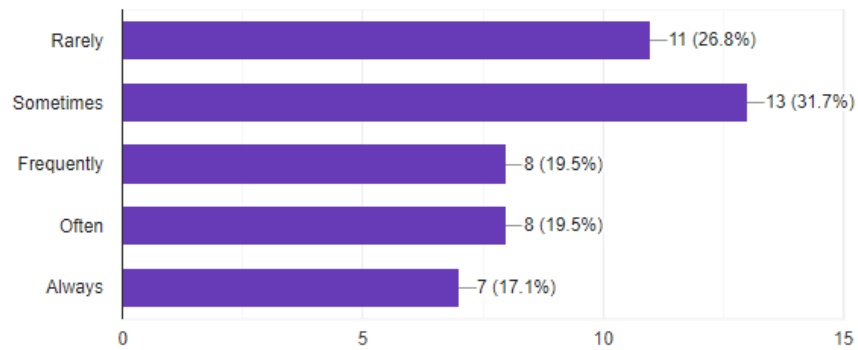
Date: 27-11-2022

CHAPTER FOUR

RESULT AND DISCUSSION

4.1 Discussion

Artificial neural networks are being used to produce the proper output for the input that has been provided. Data collected from the survey is used to perform the technique. As the ANN technique is flexible and can be used in linear or non-linear data to enhance a performance test. In the case of performing ANN data need to be divided into train and test data and as a result the outcome from two side can measures the overall accuracy of the data. Moreover, to test hypothesis model this technique is very effective and perfect. Studying some of the research related technique ANN technique was selected as this research to be analyzed.

In the case of performing outcome, we have categorized our scoring points such as block disturbing thoughts, feel boring, yell, act annoyed, interruption in sleeping, low stem and hurting eye. We focus on gender, age and education and the duration of using smart device and social media. Applying the Artificial Neural Network (ANN), the data set were used to meet at least one objective. Train and Test data are displayed to the neural network and after performing required process the target outcomes are obtained with an effective accuracy rate.
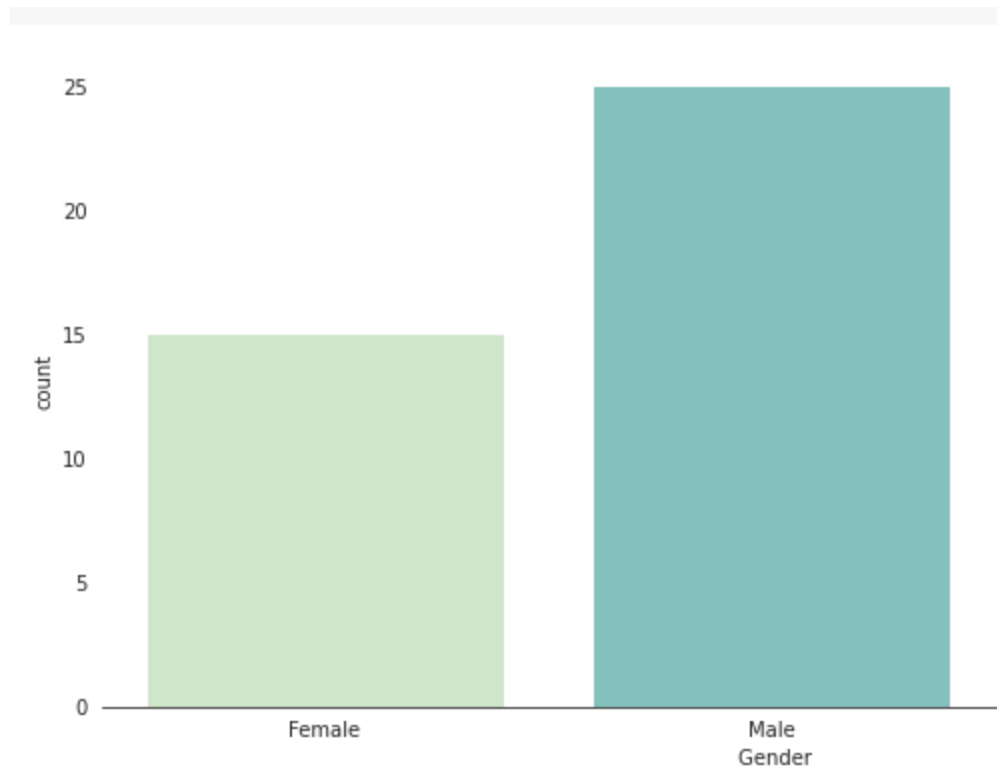
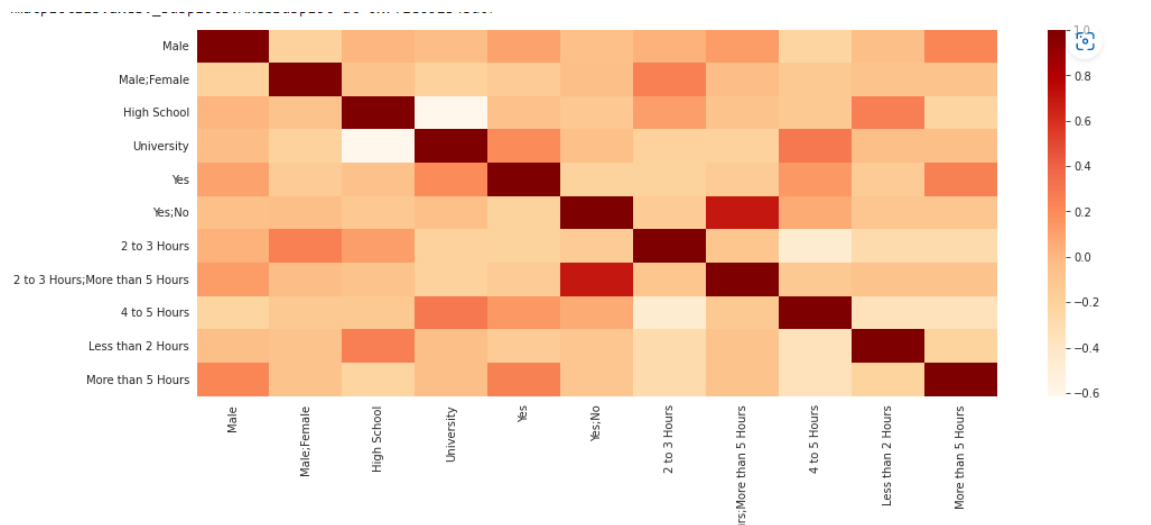Figure 4.1.1: Specified Addicted User Rate

Figure 4.1.2: Data Visualization

©Daffodil International University Date: 27-11-2022
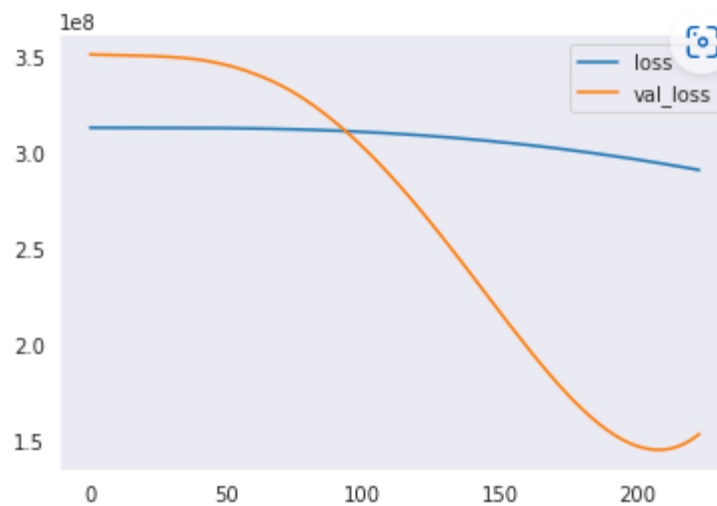
Figure 4.1.3: ACCURACY TEST

4.2 Result Analysis:

I obtained my result via the Google form response. According to the findings, excessive use of social media is harmful to one's health. The goal of this study was to determine the user's psychological impact. The interviews aided in explaining and expanding on the issues uncovered throughout the examination. With the help of a study, I discovered that those who spend more than 3 to 4 hours on social media have several issues, such as: hurting eyes, feeling bored without it, and live in a fancy world.

At the end of the processing, 80.33% accuracy could be obtained.

```
[1]:   import numpy as np
       import pandas as pd
       import tensorflow as tf
```

(+ Code) (+ Markdown)

```
[2]:   tf.__version__
```

[2]: '2.3.0'

Figure 4.2.1: Import Libraries

	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang
293	67	1	2	152	212	0	0	150	0
294	44	1	0	120	169	0	1	144	1
295	63	1	0	140	187	0	0	144	1
296	63	0	0	124	197	0	1	136	1
297	59	1	0	164	176	1	0	90	0
298	57	0	0	140	241	0	1	123	1

Figure 4.2.2: Tensor Flow Result

```
[15]:   from sklearn.metrics import confusion_matrix, accuracy_score
        cm = confusion_matrix(y_test, y_pred)
        print(cm)
        print("Accuracy: {:.2f}%".format(accuracy_score(y_test, y_pred)*100))
```

```
[[21  6]
 [ 6 28]]
Accuracy: 80.33%
```

Figure 4.2.3: Obtained Accuracy

©Daffodil International University   Date: 27-11-2022

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

The research was focused to find out the psychological impact and behavioral change for excessive using of smart device with respect to social media addiction. Though all the contribution were distributed perfectly, there may be any lack in findings but the data is enough accurate as well as the outcome is. Many researches are being done in this term of addiction and they are related to each other. This fact is not different in the case of implementing this research. Performing more research will gain more effective solution to drag a reduction of smart device and social media addiction.

5.2 Recommendation

The more research, the more solution can be obtained. This research is recommended by the author for further progress if possible.

- It will be a contribution.
- More easier.
- More accurate.
- More reliable.

REFERENCES

Md. Saiful Islam, Md. Safaet Hossain Sujan, Rafia Tasnim, Rashenda Aziz Mohona, Most. Zannatul Ferdous, Sk Kamruzzaman, Tanziha Yeasmin Toma, Md. Nazmus Sakib, Khairrun Nahar Pinky, Md. Riad Islam, Md. Abid Bin Siddique, Fahim Shariar Anter, Alomgir Hossain, Ikram Hossen, Md. Tajuddin Sikder and Halley M. Pontes.(2010): Problematic Smartphone and Social Media Use Among Bangladeshi College and University Students Amid COVID-19: The Role of Psychological Well-Being and Pandemic Related Factors

Naveenta Gupta, Sonia Garg, Khushdeep Arora. (2016): Pattern of mobile phone usage and its effects on psychological health, sleep, and academic performance in students of a medical university

Md. Mahbobor Rahaman (2017): The Effects of Mobile Phone Use on Human Behaviors: A Study of Developing Country Like Bangladesh.

Abu Shams Mohammad Mahmudul Hoque (2018) : DIGITAL DEVICE ADDICTION EFFECT ON LIFESTYLE OF GENERATION Z IN BANGLADESH .

Lai-Ying Leong, Teck-Soon Hew, Keng-Boon Ooi, Voon-Hsien Lee, Jun-Jie Hewa (2019): A hybrid SEM-neural network analysis of social media addiction

Kalaivani A/P Munusamy, Akmar Hayati Ahmad Ghazali (2020) : Effects of Mobile Phone Usage Behavior and Mobile Phone Addiction among Youth.

Sara Thomée (2020): Mobile Phone Use and Mental Health. A Review of the Research That Takes a Psychological Perspective on Exposure.

S. Kaur and R. K. Bawa, "Implementation of an expert system for the identification of drug addiction using decision tree ID3 algorithm," 2017 3rd International Conference on Advances in Computing,Communication Automation (ICACCA) (Fall), Dehradun, 2017, pp. 1-6.
Fehrman E., Muhammad A.K., Mirkes E.M., Egan V., Gorban A.N. (2017) The Five Factor Model of Personality and Evaluation of Drug Consumption Risk. In: Palumbo F., Montanari A., Vichi M. (eds) Data Science. Studies in Classification, Data Analysis, and Knowledge Organization. Springer, Cham.

X. Hu and Y. Tang, "Ann-Based Credit Risk Identificaion and Control for Commercial Banks," 2006 International Conference on Machine Learning and Cybernetics, Dalian, China, 2006, pp. 3110-3114.

P. Cui, Y. Guan and Y. Zhu, "Flood loss prediction of coastal city based on GMANN," 2017 International Conference on Grey Systems and Intelligent Services (GSIS), Stockholm, 2017, pp. 187-190.

P. Abhigna, S. Jerritta, R. Srinivasan and V. Rajendran, "Analysis of feed forward andrecurrentneuralnetworks inpredicting the significantwaveheight atthemoored buoys inBayofBengal,"2017InternationalConferenceonCommunicationandSignal Processing (ICCSP), Chennai, 2017, pp. 1856-1860.

M. Fallahnezhad, M. Vali and M. Khalili, "Automatic Personality Recognition from reading text speech," 2017 Iranian Conference on Electrical Engineering (ICEE), Tehran, 2017, pp. 18-23. doi: 10.1109/IranianCEE.2017.7985447.

Khemphila, A. andV.Boonjing, "Comparingperformances oflogistic regression,deElectronic copy available at: https://ssrn.com/abstract=3418535 12 Ankit Jughare et al./ICCIP2019 decision trees, and neural networks for classifying heart disease patients," 2010 International Conference on Computer Information Systems and Industrial Management Applications (CISIM), Krackow, 2010, pp. 193-198. doi: 10.1109/CISIM.2010.5643666

K. C. Pramodh and Y. Vijayalata, "Automatic personality recognition of authors using big five factor model," 2016 IEEE International Conference on Advances in Computer Applications (ICACA), Coimbatore, 2016, pp. 32-37.

R.M.Favaretto,L.Dihl,S.R.Musse,F.VilanovaandA.B.Costa,"Using Big Five Personal- ity Model to Detect Cultural Aspects in Crowds," 2017 30th SIBGRAPI Conference on Graphics, Patterns and Images (SIBGRAPI), Niteroi, 2017, pp. 223-229.

Korpinen L, Pääkkönen R: Physical symptoms in young adults and their use of different computers and mobile phones. Int J Occup Saf Ergon, 2011, 17: 361–371.

Kim SH, Kim KU, Kim JS: Changes in cervical angle according to the duration of computer use. J Korean Soc Phys Med, 2013, 7: 179–187.

Bae SS, Kim BJ, Lee KH: A study of muscle imbalance of head, cervical and shoulder region. J Korean Soc Phys Ther, 2001, 13: 769–776.

Lee JI, Song HS: The correlation analysis between hours of smartphone use and neck pain in the Gachon university students. Acupunct, 2014, 31: 99–109.

So YJ, Woo YK: Effects of smartphone use on muscle fatigue and pain and, cervical range of motion among subjects with and without neck muscle pain. Phys Ther Korea, 2014, 21: 28–37.

Wright EF, Domenech MA, Fischer JR Jr: Usefulness of posture training for patients with temporomandibular disorders. J Am Dent Assoc, 2000, 131: 202–210.

Evcik D, Aksoy O: Correlation of temporomandibular joint pathogenesis, neck pain and postural differences. J Phys Ther Sci, 2000, 12: 97–100.

Zonnenberg AJ, Van Maanen CJ, Oostendorp RA, et al.: Body posture photographs as a diagnostic aid for musculoskeletal disorders related to temporomandibular disorders (TMD). Cranio, 1996, 14: 225–232.

Kwon M, Kim DJ, Cho H, et al.: The smartphone addiction scale: development and validation of a short version for adolescents. PLoS ONE, 2013, 8: e83558.

D'Attilio M, Epifania E, Ciuffolo F, et al.: Cervical lordosis angle measured on lateral cephalograms; findings in skeletal class II female subjects with and without TMD: a cross sectional study. Cranio, 2004, 22: 27–44.

Swinkels RA, Swinkels-Meewisse IE: Normal values for cervical range of motion. Spine, 2014, 39: 362–367.

PLAGIARISM REPORT

Turnitin Originality Report

Processed on: 15-Dec-2022 13:19 +06
ID: 1981838150
Word Count: 3768
Submitted: 1

191-35-393 By M R Khan Dipu

Similarity Index	Similarity by Source	
30%	Internet Sources:	16%
	Publications:	3%
	Student Papers:	27%

21% match (student papers from 08-Dec-2022)
Submitted to University of Asia Pacific on 2022-12-08

1% match (Internet from 06-Aug-2022)
http://dspace.daffodilvarsity.edu.bd:8080/bitstream/handle/123456789/8150/171-35-196%20%2825%25%29.pdf?isAllowed=y&sequence=1

1% match (Internet from 09-Dec-2022)
http://dspace.daffodilvarsity.edu.bd:8080/bitstream/handle/123456789/4812/P14790%20%2810_%29.pdf?sequence=1

1% match (Internet from 26-Oct-2022)
http://dspace.daffodilvarsity.edu.bd:8080/bitstream/handle/123456789/8362/171-35-188.pdf?isAllowed=y&sequence=1

1% match (Internet from 19-Nov-2021)
https://www.pubfacts.com/author/+Pinky

1% match (Internet from 05-Mar-2021)
https://archive.org/details/peel?and%5B%5D=firstCreator%3AI&sort=creatorSorter

---

1% match (Internet from 08-Nov-2022)
http://www.njppp.com/?mno=207004

1% match (student papers from 01-Jun-2006)
Submitted to University of Derby on 2006-06-01

1% match (Internet from 23-Sep-2022)
https://www.mecs-press.org/ijitcs/ijitcs-v9-n11/IJITCS-V9-N11-5.pdf

---

< 1% match (Internet from 26-Oct-2022)
http://dspace.daffodilvarsity.edu.bd:8080/bitstream/handle/123456789/8265/173-35-263%20%2813%25%29.pdf?isAllowed=y&sequence=1

< 1% match (Internet from 21-Nov-2022)
http://dspace.daffodilvarsity.edu.bd:8080/bitstream/handle/123456789/7259/201-25-874%20%2c%2011_.pdf?isAllowed=y&sequence=1

< 1% match (Internet from 20-Mar-2022)
https://pdfcoffee.com/study-on-garments-inspection-mia-shohel-pdf-free.html

---

< 1% match (Internet from 26-Sep-2022)
https://open.uct.ac.za/bitstream/handle/11427/13175/thesis_hum_2014_ndlovu_s.pdf;jsessionid=6AA04B8D1BD19E2A0386930086BDB3sequence=4

Date: 27-11-2022