

# A Systematic Approach to detect and manage Academic Stress of University Students using Emotional AI

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**Abstract:** Stress is a prevalent issue that affects all of us at some point in our lives. The most common sort of stress that university students suffer is academic stress. This has a huge possibility of harming a university student's academic performance. According to the research findings stress is caused due to assignments on time submission, GPA Values, Modular Grades, and Loss of Hopes and Ambitions. Also, the personal coping mechanisms used by university students to manage academic stress are listening to music, watching videos, being motivated, and working hard, and wishful positive thinking. Moreover, the data gathered shows that there is a significant relationship between the ability to manage stress levels, gender, academic year, or university type of undergraduate students. Academic stress has become a part of university students' lives; at times, it encourages them to improve themselves and work hard; at other times, it has become a burden when they are unable to manage it. So, therefore, this research paper is concerned with proposing a system to detect stress levels and manage academic stress of university students through stress-releasing mechanisms that will assist university students in reducing stress levels caused due to many factors using various strategies. This proposed system uses Emotional Artificial Intelligence to detect students' emotions and identifies stress levels through Text Input (natural language processing), audio (voice emotion AI), video (facial movement analysis, physiological signals, and other factors), and system assists university students for various stress reduction techniques

**Keywords:** Academic Stress, Stress Reduction System, Emotional Artificial Intelligence

## 1. Introduction

The feeling of being overwhelmed or unable to cope with mental pressure is referred to as stress. Academic stress, on the other hand, is the body's response to academic demands that exceed students' adaptive capabilities. Academic stress has recently become a major concern for students around the world. As a result, students may fail in both their academic and career lives due to emotional stress. According to the World Health Organization, a student's physical and mental health must be adequate for them to actively participate in academics. Academic stress can cause university students to drop out of school or university, which is a problem. Academic stress has a negative impact. University students are under a huge amount of pressure as a result of their academics. Students' stress management abilities must be improved, and this is one way to do so. It is critical to developing coping techniques to overcome academic challenges. This proposed system uses Emotional Artificial Intelligence to detect students' emotions and identifies stress levels through sources like Text Input (natural language processing), audio (voice emotion AI), video (facial movement analysis, physiological signals, and other factors) and system assists university students for various stress reduction techniques.

### A. Research Problem

How to detect and manage academic stress levels among university students which affect their performance using a system with the aid of Emotion Artificial Intelligence.

### B. Research Aim

Propose a system to detect stress levels and manage academic stress of university students through stress-releasing mechanisms

### C. Objectives

- Identifying the academic stress-causing factors of university students
- Identifying the coping strategies used by university students to reduce academic stress.
- To Propose a System to detect and manage academic stress

### D. Limitation

The study's target population is all Sri Lanka's university undergraduate students, including state and private. However, surveying the entire population was impossible and impractical. As a result, a group of 300 students was chosen to continue this study.

Mobile applications, movies, audios, and online consultation services are now available to help people to cope with their stress as a result of technological advancements. However, there is currently no appropriate technological solution for stress detection and management among young university students. The usage of technology by the younger generation is growing at an exponential rate, and they have very tight schedules due to the demands of their daily lives. As a result, the goal of this study is to figure out how to use technology to help young university students to manage their academic stress while also achieving their academic and personal objectives.

## 2. Literature Review

Stress is a condition of mental pressure for a particular individual facing problems from environmental and social well-being. Young age is the critical period because at this time youth faces lots of changes in his/her life. Findings will help individual students, scholars, lecturers, and career and counselling centres. (Bhargava et al.,2018)

Stress has become part of student's academic life due to the various internal and external expectations placed upon them.

Adolescents are particularly vulnerable to the problems associated with academic stress. Understanding sources of stress would facilitate the development of effective counselling modules and intervention strategies this study has proposed sources of stress that would facilitate the

redevelopment of effective counselling modules and intervention strategies by school psychologists and counsellors to help students alleviate stress. The drawback is that there is no recommended technological invention to detect stress and emotions. (Reddy et al., 2018)

Here this study has found that Stress is one of the top five threats to academic performance among college students globally. No study has assessed the practice of stress management behaviours and associated factors among undergraduates at Mekelle University, Tigray, Ethiopia, 2019. The study found that the majority of the students had a poor practice of stress management behaviours. The drawback is that there are no suggestions about stress detection and stress relaxation methods for stress levels of students. (Hailu et al.,2020)

### Use of Technology

This research has developed a system to detect the stress and strain that people nowadays are facing. This software captures the image from the camera and after processing makes the decision. The drawback here is that this study has only used the approach of capturing images from a camera; there is no voice recognition or text analysis used to estimate stress levels, and also there are no stress-relieving mechanisms proposed through this study. (Rajasekar et al., 2020)

This study has developed a system that uses a machine learning approach in stress detection using sensor technology. Data provided from a physical activity tracker device Fitbit. The drawback is that, even though this study has managed to identify stress using sensors and physical activities, there is no indication of stress-relieving techniques as a solution to stress. (Padmaja et al., 2018)

This research study has developed a system when a high-stress level is detected, it suggests the most appropriate relaxation method by analysing the physical activity-based contextual information. The drawback is that the system will suggest only a relaxation method for high-stress levels not for moderate stress levels. Moderate stress levels should also be reduced through appropriate relaxation mechanisms. (Can et al.,2020)

This study has identified that Stress has become a significant cause of many diseases in modern society. Recently, smartphones, smartwatches, and smart wristbands have become an integral part of our lives. The technology of detecting and preventing stress with smartphones and wearable sensors has been used. A gap in this study is identified is that the stress detection process is done using sensor technology, not through emotional Artificial Intelligence. (Said et al.,2019)

As this study states Stress is the body's natural reaction to external and internal stimuli. Despite being something natural, prolonged exposure to stressors can contribute to serious health problems. This study has proposed a stress-detection system that is non-invasive, only requiring a webcam to monitor the user's facial expressions. The research gap identified is that there is no Voice and Text Detection in this proposed system. (Almeida et al., 2021)

## Comparison

Table 1-Related Work Comparison

Related Work	Face capture and Detection	Voice Recognition and Detection	Text Analysis and Detection	Stress Releasing Mechanisms	Sensor Technology	Analyzing the physical activity-based contextual information	Bio Signals
Machine Learning Based Emotion Detection and Stress Relief Application	✓	✗	✗	✗	✗	✗	✗
Machine learning approach for stress detection using wireless physical activity tracker	✗	✗	✗	✗	✓	✗	✗
How to relax in stressful situations: A smart stress reduction system Healthcare	✗	✗	✗	✓	✗	✓	✗
Stress detection in daily life scenarios using smart phones and wearable sensors: A survey	✗	✗	✗	✗	✓	✗	✗
Facial Expression Recognition System for Stress Detection with Deep Learning	✓	✗	✗	✗	✗	✗	✗
Emotional Stress Recognition System for Affective Computing based on bio-signals	✗	✗	✗	✗	✗	✗	✓
Proposed System: Emotion Detection and Stress Reduction System	✓	✓	✓	✓	✗	✗	✗

### Research Gap

The suggested research solution differs from the existing systems since it combines three technologies: face capture and detection, speech recognition and detection, and text analysis and detection, which have not been combined in one system in previous studies.

## 3. Methodology

### A. Data Collection

A survey was created to get enough responses covering the area of university students from both state and private universities. The contribution of this study is to identify the main stress factors and personal coping strategies used by university students under Academic Stress. Information was collected using a Google form and then entered into a database, such as an excel sheet, to track and organize the data. The questionnaire was distributed among the target sample using social media platforms such as WhatsApp, Facebook & Instagram a reached up to 300 responses. Quantitative data was deciphered using descriptive analysis.

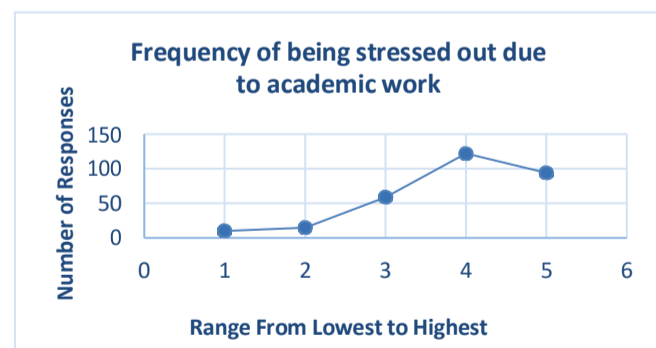


Figure 1-Frequency of being stressed out due to academic work

Out of 300 respondent's majority of the respondents have felt stressed out due to academic work

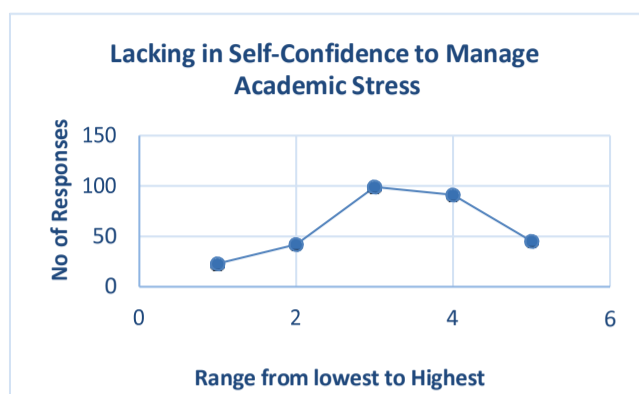


Figure 2-Lack of Self-Confidence

As indicated in the above Line chart, the majority of university students lack the confidence to manage all of the academic work stress, so proposing an effective stress reduction system is more appropriate.

In addition to that, a questionnaire was sent, and an interview session was kept with a counsellor to collect and analyse data regarding the identification of stress and advice given to manage stress. According to the information acquired from the counsellor, looking at a student's physical appearance stress can be detected psychologically. Students' stress levels can be determined by looking at their eyes, skin, hair, mood, how they are dressed, and how they speak. In addition, the counsellor also stated that dark circles under the eyes, thinning hair, always pre-occupied, not paying full attention when engaged in conversation, short-tempered, addiction (caffeine, nail-biting, etc), absentminded, lack of concern about how one is dressed, binge eating, physical pains, and breathlessness are some of the symptoms that can be identified from a student who is under stress. The counsellor also mentioned that empathetic listening and asking the right questions can help to identify psychological stresses in students. The thoughts and feeling or habits that a student goes through will lead to his/her stress which can be identified by talking to the student such as improper time management, frustration, irritability and edginess, insomnia or disturbed sleep, confusion and forgetful, racing thoughts, difficulty in concentrating and processing new information, worry over Peer pressure, parental pressure on academic performance, Unhappy, insecure feeling, feeling hopeless, Less sociable, hostile behaviour if these factors are identified while engaging in a conversation with the student, it can then be identified as the causes for the stresses a student is going through. Counsellor assures that identification of stress is possible by analysing the writing style and content. If the messages are very negative, rushed, and make no proper sense, consist of a lot of complaints that stress can be identified through text messages on the things the student has said in the messages and from the style of writing. However, it is not highly recommended since there is a tendency for misinterpretation. The stress coping solutions that counsellors suggest for students who are struggling with academic stress are to get enough sleep to keep both the mind and body more alert and active, to get organized and be systematic by maintaining a to-do list and prioritizing your work, Optimism helps to turn negative stresses into positive stresses, pray for guidance in the right direction and to believe in themselves.

### A. The High-Level Architecture of the System

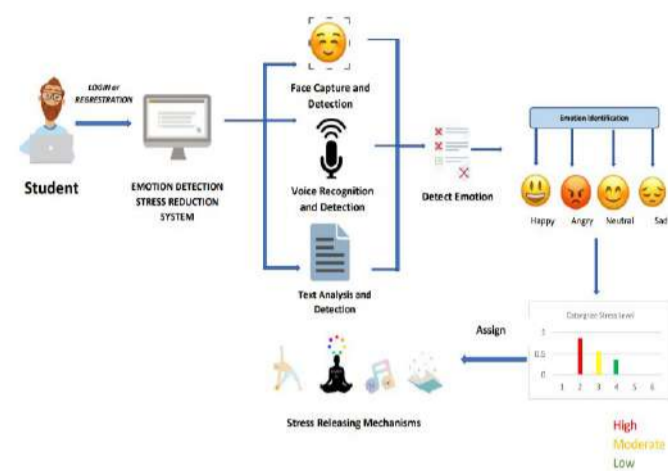


Figure 3-System Architecture

Emotional Artificial Intelligence is proposed to detect the stress levels and the emotions of the University students

When a student logs on to the system after registering, they are directed to these three technologies to detect their academic stress levels and emotions.

- 1. Face Capture and Detection-** When a student faces his/her face the web camera enabled in the system can detect and capture the students who are under stress by detecting these such as deeper lines around the middle of the eye's forehead, undereye, and lips are identified. Identification of rashes and pimples on the skin of the face. Dark circles, swollen eyes, and a pale complexion of the face are all detected by the system. Lip biting, pursed lips, inner corners of lips pushed down, inner corners of eyebrows lifted, and eyelids lose are all signs of emotional sadness and stress.
- 2. Voice Recognition and Detection-** This system has a voice assistant enabled that asks questions from the logged-on student. A certain number of questions are asked to assess the students' stress levels. The conditions like muscles in the chest, throat, neck, jaw, and vocal folds tighten a shift in tone, and clearing the throat when speaking is identified as signs of stress through the system.
- 3. Text Analysis and Detection-** Textual data is used to detect stress in this case. It has been recognized based on the responses that students type into the system in response to the questions. The system recognizes unusual texting patterns and styles. When the responses are not consistent, words like "hmm," "I'm not sure," "I guess," and "will see" are used to answer questions that are being identified using the system.

Using these three technologies Emotions of students are detected and categorized as Happy, Angry, Neutral, and Sad, and also whether the stress level is High, Low, or Moderate. Afterward, University Students are directed to numerous stress-relieving mechanisms and strategies

through the system. In addition to that students can also request appropriate and other best solutions from the voice assistant enabled in the system.

#### A. Design Diagrams for the Proposed System

The figures represent the Class diagram and the Use Case diagram which explain the process of the proposed Emotion Detection and Stress Reduction System for university students

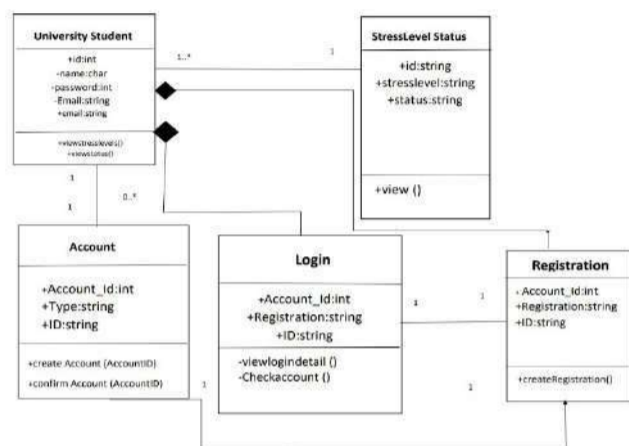


Figure 4-Class Diagram

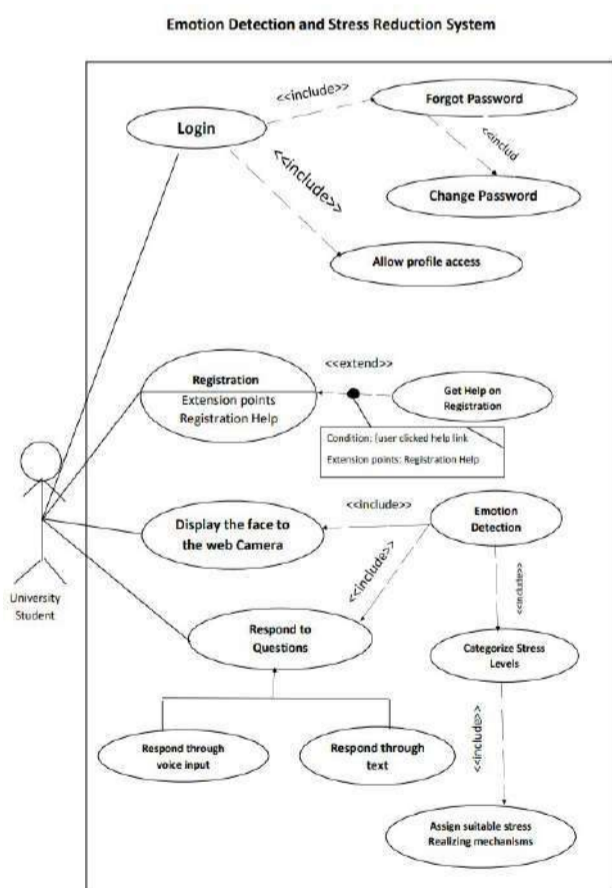


Figure 1-Use Case Diagram

#### A. Proposed System Design

The proposed system is named “Serene” which is being calm during a Stressful Situation.

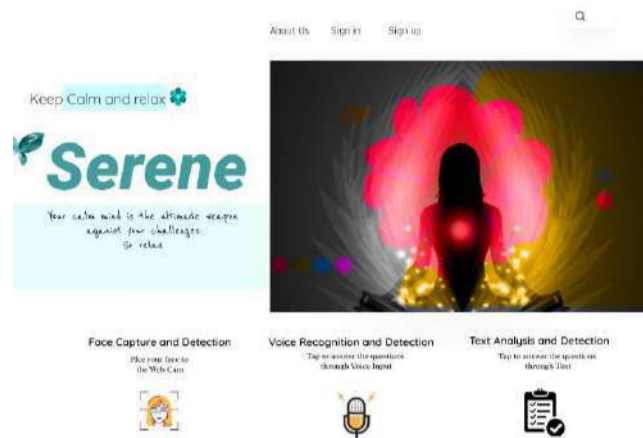


Figure 6-Proposed Design Interface for Emotion Detection

After the emotion detection process, the proposed system directs university students to use these stress coping mechanisms to manage academic stress levels. **Ultra-hypnosis** uses breathing exercises with breathing in and breathing out, **Time Tracker** when a student starts doing something, he or she can set a new timer, and this time tracker will track the time. When the student finishes the activity, they must terminate the timer by indicating what they have been doing at the time, and this generates a weekly report of analytics of what projects, assignments, and other academic work they have been working on, as well as the time spent on them. Students can do **exercises, workouts, yoga, and meditation** to calm down stress. This system includes **audio** of books and articles related to motivational content. It allows students to design and organize module-related colourful **mind maps**. It includes **reminder alerts** of assignment deadlines, project and research paper submission reminders, submission reminders, and pop-up notifications. **Art and audio therapies, Self-Care reminders to remind students to drink water and stay hydrated** which shows many litres of water a student should drink according to their BMI, and **Community Forms** allow students to talk with another about what they are feeling. **Wall Planner, Calendar, Workload**.

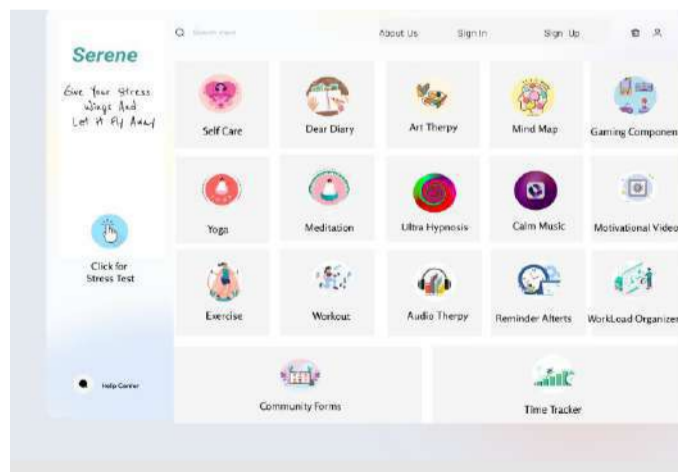


Figure 7-Proposed Design Interface for Stress Reduction

#### 4. Results and Discussion

The google form was analysed according to the data analysis plan and then the results were gathered. The below table shows the Demographic factors of the respondents regarding the ability to manage their Stress according to university, gender, and age categories of university students. The majority of the students are unsure about their ability to manage their stress levels. Moreover, it shows that there is a significant relationship between stress levels and gender, academic year, or university type of undergraduate students

Table 2-This pivot table depicts the Demographic Factors of Stress

Demographic Factors	University						Grand Total
	Private		Private Total	State		State Total	
	Female	Male		Female	Male		
<b>Age-Ability to Manage Stress</b>							
<b>18-20</b>	<b>11</b>	<b>4</b>	<b>15</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>17</b>
Maybe	3	3	6	1	1	1	7
No	4		4		1	1	5
Yes	4	1	5				5
<b>20-22</b>	<b>55</b>	<b>21</b>	<b>76</b>	<b>48</b>	<b>11</b>	<b>59</b>	<b>135</b>
Maybe	27	12	39	25	2	27	66
No	3		3	2	1	3	6
Yes	25	9	34	21	8	29	63
<b>22-24</b>	<b>41</b>	<b>18</b>	<b>59</b>	<b>40</b>	<b>27</b>	<b>67</b>	<b>126</b>
Maybe	13	8	21	19	7	26	47
No	4		4	2	1	3	7
Yes	24	10	34	19	19	38	72
<b>24-26</b>	<b>4</b>	<b>3</b>	<b>7</b>	<b>7</b>	<b>7</b>	<b>14</b>	<b>21</b>
Maybe	2	3	5	3	2	5	10
No					1	1	1
Yes	2		2	4	4	8	10
<b>above 26</b>							
Maybe					1	1	1
Yes					1	1	1
<b>Grand Total</b>	<b>111</b>	<b>46</b>	<b>157</b>	<b>96</b>	<b>47</b>	<b>143</b>	<b>300</b>

According to the below table assignments on time submissions are the most prevalent source of stress in the academic lives of university students. It is 209 out of 300 respondents, or 69.7%. Second, Project Deadlines received 160 out of 300 responses, or 53.3%. Other major sources of stress include Module Grades and GPA Values, although Losing Hopes and Ambitions has also had an impact on students'

Table 3-Common Sources of Academic Stress

Common Sources of Stress in Academic Stress		
Stress Factors	N	%
Module Grades	119	39.9
GPA Values	143	47.7
Assignments on-time submissions	209	69.7
Project Deadlines	160	53.3
Lack of Language Fluency	59	19.7
Difficulty in Balancing extra-curricular activities	49	16.3
Family Problems	43	14.3
Financial Problems	55	18.3
Isolation from parents	25	8.3
Health-related problems (Ex-Migran)	56	18.7
Personal relationship matters	51	17
No faith	44	14.7
Loss of Hopes and ambitions	86	28.7
Other	23	7.7

The below table shows the average and percentage values of positive and negative responses received by the survey respondents regarding the features of the proposed system.

Table 3-Features proposed for the system by survey respondents

Stress Reduction Features of the System	Evaluated Criteria (Positive and Negative) Responses	N	(%)	Avg
Meditation Guidance	Positive	278	92.6	0.92
	Negative	22	7.3	0.07
Yoga and Relaxation Exercise Guidance	Positive	272	90.6	0.90
	Negative	28	9.3	0.09
Calming and Relaxation Music Player	Positive	283	94.3	0.94
	Negative	17	5.6	0.05
Mind Maps	Positive	270	90	0.09
	Negative	30	10	0.1
Assignment due Date Reminder	Positive	258	86	0.86
	Negative	42	14	0.14
Academic Reminder	Positive	271	90.3	0.90
	Negative	29	9.6	0.09
Digital Notebook to keep records of your Daily Life	Positive	257	85.6	0.85
	Negative	43	14.3	0.14
Workload Organizer	Positive	272	90.6	0.90
	Negative	28	9.3	0.09
Gaming Component	Positive	203	67.6	0.67
	Negative	97	32.3	0.32
Selfcare Reminder	Positive	273	91	0.91
	Negative	27	9	0.9
Community Forms to Communicate with Others	Positive	248	82.6	0.82
	Negative	52	17.3	0.17
Motivational Video Clips	Positive	263	87.6	0.87
	Negative	37	12.3	0.12
Ultra-Hypnosis	Positive	227	75.6	0.75
	Negative	73	24.3	0.24
Time Tracker	Positive	262	87.3	0.87
	Negative	38	12.6	0.12
Audio and Art Therapy	Positive	240	80	0.80
	Negative	60	20	0.20

As per the finding from the survey, there is a high number of positive responses for Meditation Guidance, Yoga and Relaxation Exercise Guidance, Calming and relaxation music players, Academic reminders and many more.

The below table shows the personal stress coping strategies used by university students. Out of all the 300 responses received from the survey majority of the university students' coping mechanisms used to manage academic stress are listening to music, watching videos, being motivated, working hard, and wishful positive thinking.

Table 4-Personal Coping up Strategies

University Students Academic Stress Personal Coping Up Strategies		
Strategy	Number of Respondents	Percentage Value (%)
Focus on solving the problems causing stress	102	34.4
Seeking emotional Support and Guidance from Someone	94	31.3
Be motivated and Work Harder	154	51.3
Wishful Positive Thinking	144	4.8
Seek spiritual Support (ex: - Pray)	54	18
Meditation	65	21.7
Doing exercises yoga or some other physical activity	59	19.7
Learning new Skills	76	25.3
Avoidance/Ignoring the problem	72	24
Worry over the problems	33	11
Self-Blame	39	13
Tension Reduction by doing something else (Ex:- drinking, Smoking)	22	7.3
Listening to Music	206	68.7
Watching Videos	163	54.3
Using social media	180	60
Online Gaming	57	19
Other	25	8.3

## 5. Conclusion

Academic stress has the potential to negatively impact a student's mental health, academic performance, and overall well-being. The main sources of stress are academic-related concerns including Assignments on-time submission, GPA Values, Modular Grades, and Loss of Hopes and Ambitions. The personal coping mechanisms used by university students to manage academic stress are listening to music, watching videos, being motivated, and working hard, and wishful positive thinking. Moreover, it shows that there is a significant relationship between the ability to manage stress levels and gender, academic year, or university type of undergraduate students.

## 6. Future Work

In terms of future work, this proposed System is expected to be developed and implemented. Finally, it is intended to develop a comprehensive desktop program for university students to interact with the system in a pleasant and user-friendly manner while working on their academic work.

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## Acknowledgment

A special thanks go to my supervisor, Ms. KBA Madushi, for her invaluable assistance throughout this research. Thank you for all your support and feedback during this research. Further, my appreciation goes to all other senior and junior lecturers for their valuable comments and continuous support. Finally, also I would like to thank my colleagues for the support they offered us in the completion of this research.

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