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# Smart Stress Management A machine learning approach with IoT and Psychoinformatics

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***Abstract :*** Psychoinformatics is a new field that combines the principles of psychology and computer science to study human behavior and mental processes. It involves the use of data analytics, machine learning, and artificial intelligence to analyze large datasets of human behavior. We abstract the information regarding stress in human which considers age, gender, pulse rate etc.. from the psychoinformatics data. Stress forms an unpleasant emotional state in our life. But it is must and should to inform the person about his or her unhealthy lifestyle. It is very hard to predict age using heart rate as it is non-linear but by using person's heartbeat, we can predict whether that person is fit, unfit and overtrained or not by considering person's age. To detect stress beforehand Machine Learning (ML) is used to alert the situation when person is in risk and also used to predict the situation of patient and Internet of Things (IOT) is used for communicating the patient about his or her stress condition.

***IndexTerms* – Stress Detection, Machine Learning, IoT, Psychoinformatics**

## I.INTRODUCTION

Stress plays a wide role in affecting different aspects of our life including our thinking ability and physical health. An IOT device named BPM sensor is used to detect the stress level of a person using their heartbeat reading. Here, Node MCU is used as a development board and also python is used for programming language.

One major area of impact is in the collection and analysis of data related to human behavior. **Psychoinformatics** researchers use advanced data analytics, machine learning, and artificial intelligence to analyze large datasets of human behavior. This allows them to gain insights into how people think, feel, and behave, and to identify patterns and trends that may not be apparent through traditional research methods. This helps in identifying stress based on various human behaviors. So, for the dataset used for machine learning we consider psychoinformatics to give the best analysis of human behavior and stress detection.

By considering stress and heartbeat we can identify many things about a person body condition, which ultimately help in avoiding unhealthy lifestyle. As in medical industry each application will be used in different ways.

The available datasets will provide data about user resting heart rate and elevated heart rate and remaining available ones contain data of 200 individuals which is not enough to implement a Machine Learning algorithm. The heartbeat of a person depends on their age and activities.

Some areas of study within psychoinformatics include: • Natural language processing: analyzing the content and sentiment of text data, such as social media posts and chat logs • Social network analysis: examining the structure and dynamics of social networks, and how they influence behavior • Machine learning: developing algorithms that can learn from data to make predictions and classify behavior • Virtual reality: using immersive technology to study behavior in simulated environments.

Psychoinformatics can also help to advance our understanding of the factors that influence human behavior, and how we can promote positive changes in behavior. By analyzing large datasets of behavior, researchers can identify the underlying factors that contribute to stress in human beings. With that analysis we understand the major contributing factors for stress and try to build a machine learning model that detects stress using the analyzed data. We take input from the user using a bpm sensor for the pulse rate and other factors are entered manually by the user. With this the prediction of stress in the person begins.

## II. REVIEW OF LITERATURE

**[I]** This research creates a structure to identify and examine stress and anxiety emotions based on facial expressions captured in videos. The researchers established a methodical approach to produce various emotional states, including neutral, relaxed, and stressed/anxious, through different stressors. The study mainly focused on involuntary and semi-voluntary facial cues to objectively determine the representation of emotions. Features under investigation included eye-related events, mouth activity, head motion parameters and heart rate estimated through camera-based photoplethysmography. A feature selection procedure was employed to select the most robust features followed by classification schemes discriminating between stress/anxiety and neutral states with reference to a relaxed state in each experimental phase. In addition, a ranking transformation was proposed utilizing self-reports in order to investigate the correlation of facial parameters with a participant perceived amount of stress/anxiety. The results indicated that, specific facial cues, derived from eye activity, mouth activity, head movements and camera-based heart activity achieve good accuracy and are suitable as discriminative indicators of stress and anxiety.

**[II]** Stress is a part of life it is an unpleasant state of emotional arousal that people experience in situations like working for long hours in front of computer.
Computers have become an integral part of our daily lives, and we spend a significant amount of time using them. As a result, our emotional state can be affected by the various experiences we have while using them. While it is difficult to completely avoid using computers, it is possible to control usage when feeling stressed. It is essential to monitor the emotional well-being of individuals who spend prolonged periods in front of a computer for safety reasons.
We detect an individual emotion in each video frame and the decision on the stress level is made in sequential hours of the video captured.

We employ a technique that allows us to train a model and analyze differences in predicting the features. Theano is a python framework which aims at improving both the execution time and development time of the linear regression model which is used here as a deep learning algorithm. The experimental results show that the developed system is well on data with the generic model of all ages.

**[III]** Stress disorders are a common issue among working IT professionals in the industry today. With changing lifestyle and work cultures, there is an increase in the risk of stress among the employees. Despite the efforts made by many industries and corporations to address mental health issues and create a more positive work environment, the problem remains a significant concern. This paper aims to use machine learning techniques to analyze stress patterns in working adults and identify the factors that strongly contribute to stress levels. The OSMI mental health survey 2017 responses of working professionals in the tech industry were used as the data source. After data cleaning and preprocessing, various machine learning techniques were applied to train the model, and their accuracy was compared. Boosting was found to have the highest accuracy. Decision trees were used to identify key factors that influence stress, including gender, family history, and availability of health benefits in the workplace. Based on these findings, industries can take a targeted approach to reduce stress and create a more comfortable workplace for their employees.

**[IV]** Chronic stress detection is an important factor in predicting and reducing the risk of cardiovascular disease. This study is a preliminary investigation aimed at developing a method to detect short-term psychophysiological changes by analyzing heart rate variability (HRV) features. The goal is to identify a set of features that can be used to detect changes that occur during chronic stress. The study used a wireless wearable ePatch® recorder to collect electrocardiograms (ECG) and elicited four different types of arousal using images, sounds, mental tasks, and rest. Linear and non-linear HRV features were analyzed to classify the different arousal stages. The results showed that sample entropy, detrended fluctuation analysis, and normalized high frequency features were effective in recognizing the neutral stage, acute stress stage, and baseline stage, with recognition rates of 90%, 80%, and 80%, respectively. Standardizing non-linear HRV features for each subject was found to be an essential factor in improving classification results.

**[V]** Stress, anxiety and depression in the workplace are detrimental to human health and productivity with significant financial implications. Recent research has been exploring the use of sensor technologies, such as smartphones and wearables, that contain physiological and movement sensors, for mood recognition. This study focuses on using these devices to recognize moods in work environments. The researchers propose a novel mood recognition framework that can identify five intensity levels for eight different types of moods every two hours. To facilitate self-reporting, the researchers have developed a smartphone app called 'HealthyOffice' that can provide the ground truth to the model. The system is evaluated through a small-scale user study that collects wearable sensing data in an office environment. The results of the study show promising results in reliably recognizing different perceived moods.

**[VI]** This paper uses data from social media and mobile devices to analyze the relationship between mood and consumer behavior, with the aim of developing new marketing strategies that take into account the emotional states of consumers.

**[VII]** This paper provides an overview of the use of machine learning in mental health research, including the development of predictive models for mental health outcomes and the analysis of large datasets to identify risk factors and treatment options for mental health disorders.

**[VIII]** This paper reviews the literature on the use of social media in mental health research, including the analysis of social media data to understand mental health symptoms and the use of social media platforms for mental health interventions.

**[IX]** This paper describes a machine learning approach that uses multiple sources of data, including smartphone data and physiological measures, to predict the risk of panic disorder with agoraphobia in patients.

**[X]** This paper uses machine learning algorithms to analyze cortisol levels and other data to predict the risk of developing post-traumatic stress disorder (PTSD) in combat veterans.

## III.METHODOLOGY

The prototype that was created can detect stress levels in individuals by analyzing the variability in their heart rate. It is also capable of identifying patterns in a person's heart rate when they are exercising at the gym. However, each device is unique to the individual and needs to be calibrated in order to work properly. During the calibration process, the person needs to be in a relaxed state and resting, which establishes a baseline. After calibration, the device utilizes this baseline (which differs for each individual) to determine if that person is experiencing stress or anxiety, is overtrained, or currently working out. The data from the heart rate readings are sent to a server.

The heartbeat readings are pushed to the server where they are filtered using a user's network id to keep track of readings for a particular individual. They are visually shown using a connected scatter plot.

## IV.WORKING MODEL

We begin by writing the code in Python for the Machine Learning part of the project. We analyze the dataset which comprises of age, gender and pulse rate for detection of stress. Later we work on the hardware section of the project where the pulse rate of a user is taken as input from the bpm sensor. Using this, we code the sensor and the server for connecting them and deriving the outputs.

## V. MODULES

*1) Function Requirements*

- *User signup:* By doing so, the user is added to the app's database.
- *User login:* The user connects into his or her account using this method by providing an e- mail address and a password.

*2) Non-Functional Requirements*

- Usability requirement
- Serviceability requirement
- Manageability requirement
- Recoverability requirement
- Security requirement
- Data Integrity requirement
- Capacity requirement
- Availability requirement
- Scalability requirement
- Interoperability requirement
- Reliability requirement
- Maintainability requirement
- Regulatory requirement
- Environmental requirement

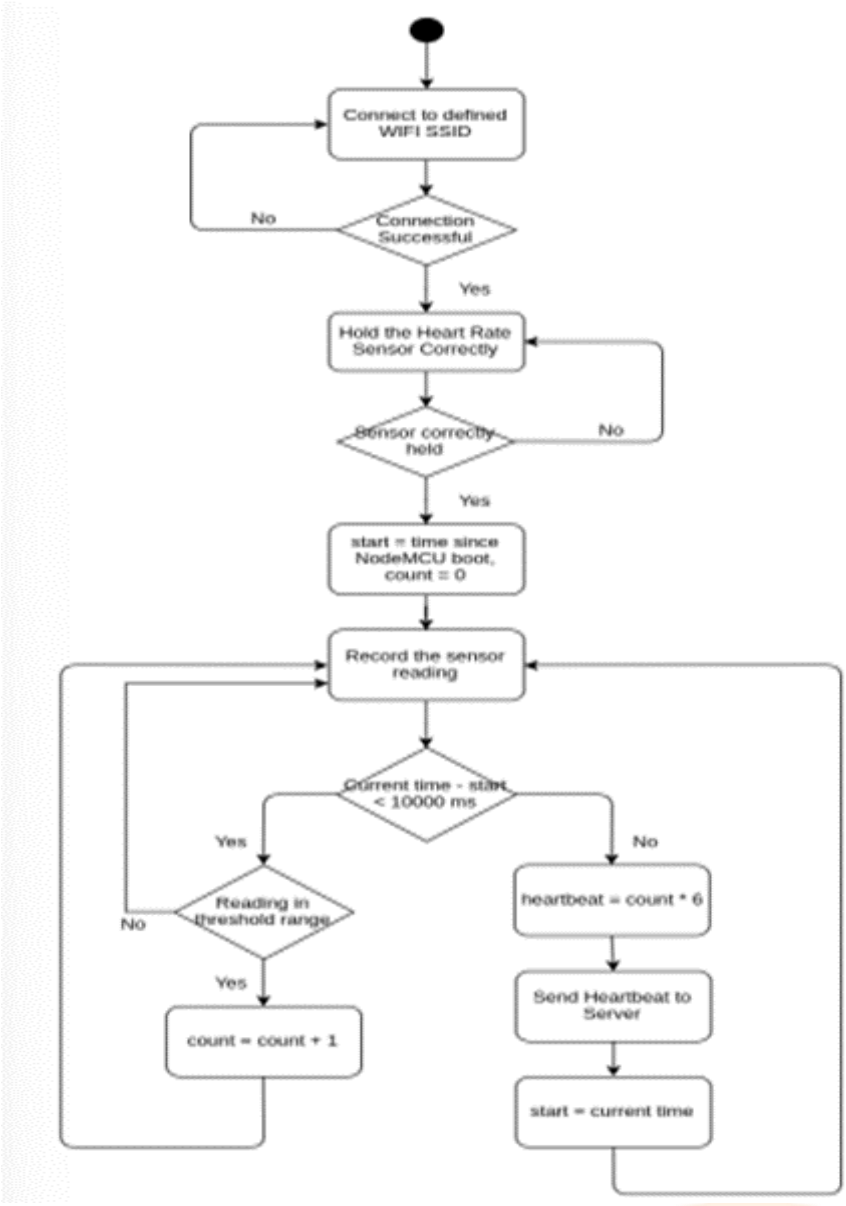



Fig: Flow Chart of Working model

## VI. TESTING

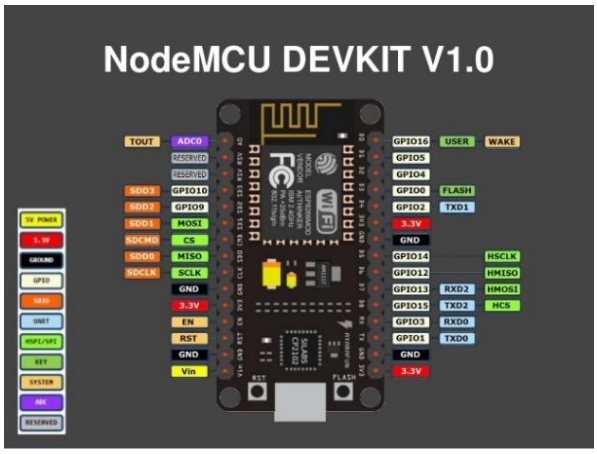
Software testing can begin as soon as there is executable software/program. Software testing is an examination used to offer information to stakeholders regarding the quality of the product or service being tested. Software testing can also give a corporation with an objective, unbiased picture of the software, allowing them to appreciate and comprehend the risks of software implementation. The practice of executing a program or application with the goal of detecting software bugs is one example of a test technique (errors or other defects). Software testing can give users and/or sponsors with objective, impartial information about the quality of software and the danger of it failing. When and how testing is undertaken, as well as the results, are typically determined by the entire approach to software testing or development.

## VII. HARDWARE AND IMPLEMENTATION

*1) Components Used:*

*A. ESP8266 NodeMCU WiFi Devkit:*

The ESP8266 is a microcontroller developed by Express if Systems that provides a Wi-Fi networking solution. It acts as a bridge between existing microcontrollers and Wi-Fi and is capable of running self-contained applications. This module has a built-in USB connector and several pin-outs, making it easy to connect to a laptop using a micro-USB cable and flash it without any issues, similar to an Arduino. Additionally, the ESP8266 is breadboard-friendly, allowing for easy integration into various projects.




*A.* *Pulse Sensor*

The Pulse/Heart beat sensor is a simple device that consists of an LED and an ambient light sensor on one side, and amplification and noise cancellation circuitry on the other side. The LED emits light that is directed towards a vein in the human body, such as the fingertip or earlobe. When the heart pumps and blood flows through the vein, the ambient light sensor on the sensor will detect the reflected light from the blood. By monitoring the changes in the amount of light detected over time, we can determine the heart rate. This process works by detecting the flow of blood and analyzing the changes in received light over time.


**VIII. OUTPUTS:**

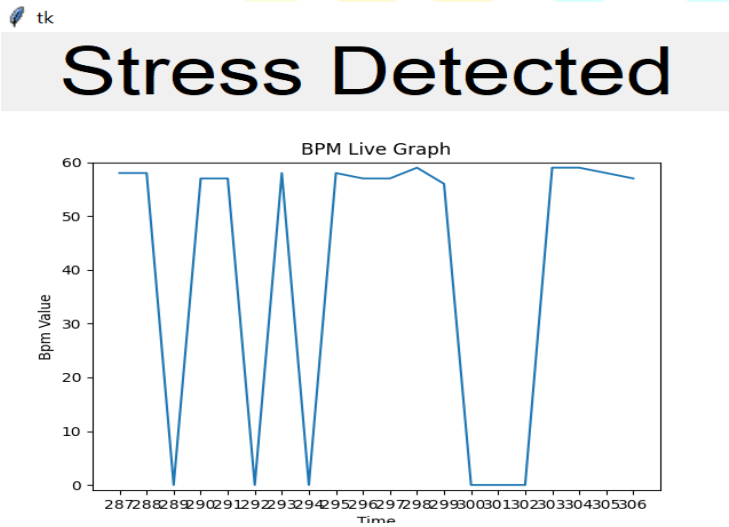



Fig: Live Stress Detection

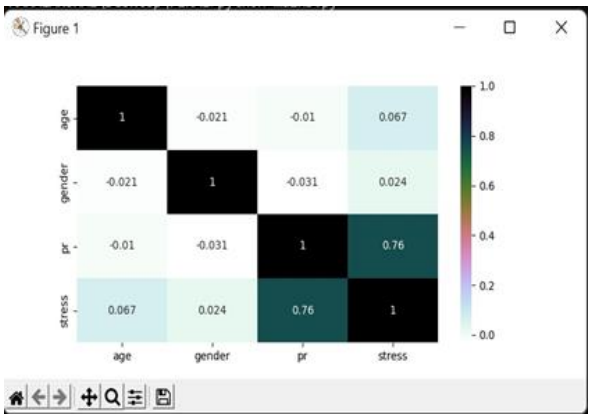
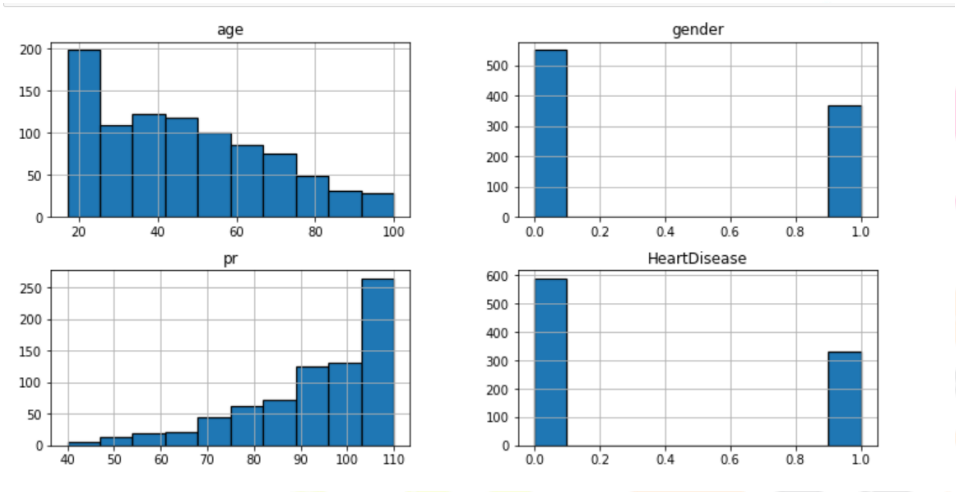



Fig: Histogram of the dataset




## IX. CONCLUSION AND FUTURE SCOPE

This article discusses the uses of heart rate monitoring and provides a basis for future research. However, the challenge faced is the lack of reliable data as machine learning algorithms require dependable data to provide accurate readings and predictions. To overcome this challenge, heart rate readings from various individuals need to be collected. This research can be integrated with health monitoring and safety devices to provide better results. The study also considers a person's daily activity pattern to determine the time of exercise and stress. Furthermore, the research can potentially determine a person's mood using heart rate measurements and galvanic skin response. High accuracy is needed for crucial analysis like Arrhythmia and stress, which requires more data preferably from sources such as health bands, smartphones, and smartwatches. To achieve more accurate modeling, neural networks can be used, which work well with datasets that have a high number of features

## X. REFERENCES

[**I**] Stress and anxiety detection using facial cues from videos. AUTHORS: G. Giannakakis, D. Manousos, F. Chiarugi

[II] Detection of Stress Using Image Processing and Machine Learning Techniques. AUTHORS: Nisha Raichur, Nidhi Lonakadi, Priyanka Mural

[III] Machine Learning Techniques for Stress Prediction in Working Employees. AUTHORS: U. S. Reddy, A. V. Thota and A. Dharun

[IV] Classification of acute stress using linear and non-linear heart rate variability analysis derived from sternal ECG. AUTHORS :Tanev, G., Saadi, D.B., Hoppe, K., Sorensen, H.B

[V] HealthyOffice: Mood recognition at work using smartphones and wearable sensors. AUTHORS:Zenonos, A., Khan, A., Kalogridis, G., Vatsikas, S., Lewis, T., Sooriyabandara

[VI] "Using Big Data to Understand the Relationship Between Mood and Consumer Behavior" by Andrew T. Stephen and Olivier Toubia (Journal of Consumer Research, 2018). T

[VII] "Machine Learning for Mental Health: A Review" by Sameer Antani and L. Rodney Long (IEEE Journal of Biomedical and Health Informatics, 2018).

[VIII] "Social Media and Mental Health: A Review of the Literature" by Holly Peek, Daphne Koinis-Mitchell, and Jessica S. Sells (Journal of Medical Internet Research, 2016).

[IX] "A Novel Machine Learning Approach to Predict Panic Disorder with Agoraphobia Using Multimodal Data" by Masanori Isobe and colleagues (Scientific Reports, 2020).

[X] "Predictive Modeling of PTSD Using Cortisol and Machine Learning Algorithms" by Douglas C. Johnson and colleagues (Journal of Traumatic Stress, 2018)