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Automatic Detection and Analysis of Stress Related Posts

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Abstract: Stress is a natural reaction to various stress-inducing factors which can lead to physiological and behavioral changes. If persists for a longer period, stress can cause harmful effects on our body. The body sensors along with the concept of the Internet of Things can provide rich information about one's mental and physical health. This project is based on the stress recognition algorithm using face images and Expressions which can recognize stress from images acquired with a general camera. Additionally, a CNN design that receives facial landmarks as input to take advantage of the fact that eye, mouth, and head movements are different from normal situations when a person is stressed.

Keywords: Stress detection, emotion detection, Internet of Things (IoT), machine learning.

I. INTRODUCTION

Stress is a natural reaction to various stress-inducing factors which can lead to physiological and behavioral changes. This project aims to analyze the stress level of human being by Facial Landmarks and also with bio sensors, which is a bio potential signal generated by the heart. If people are informed of their stress levels, they may become empowered to take some preemptive measures in order to minimize stress so that stress balance is achieved before it results to serious health problems Additionally body sensors can provide rich information about one's mental and physical health. Human stress is an imbalance state of an individual. Stimulus threatening homeostasis state of the individual is regarded as a stressor, which can be classified into physical one or psychologic one. It is impossible to avoid stress in a working environment. Nevertheless, if people are informed of their stress levels, they may become empowered to take some primitive measures in order to minimize stress so that stress balance is achieved before it results to serious health problems Stress management can be complicated and confusing because there are different types of stress — acute stress, episodic acute stress, and chronic stress. It comes from demands and pressures of the recent past and anticipated demands and pressures of the near future.

II. LITERATURE REVIEW

In [1] paper**,** The essence of the paper is to develop a stress detection mechanism and a stress level indicator circuit for measuring the stress level of human brain using the Electroencephalogram (EEG) Signal. Signals coming from the frontal lobe of human brain have been used for the measurement of stress. The brain signals of the thirty subjects are recorded while they are solving five mathematical question sets with increasing complexity. We assume that the subjects undergo through five different stress levels i.e. **'Relaxed'**, **'Less stressed'**, **'Moderately Stressed'**, **'High Stressed'** and **'Alarmingly Stressed'** while solving these question sets. After that recorded EEG data is processed and features are extracted. We design a feed forward neural network for classifying the stress level in human brain. We prepare a new question set consisting of easy as well as complex numerical questions for testing purpose. We record the EEG data of a subject while solving this question set. We extract six feature values from the processed EEG data of the subject. These data is fed to the designed feed forward neural network. The neural network predicts the stress level and the predicted stress level is indicated in the **'Stress Indicating'** circuit.

In [2] paper, Stress has become a significant cause for many diseases in the modern society. Recently, smartphones, smartwatches and smart wrist bands have become an integral part of our lives and have reached a widespread usage. This raised the question of whether we can detect and prevent stress with **smartphones and wearable sensors.** In this survey, we will examine the recent works on stress detection in daily life which are using smartphones and wearable devices.

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Although there are a number of works related to stress detection in controlled laboratory conditions, the number of studies examining stress detection in daily life is limited. We will divide and investigate the works according to used physiological modality and their targeted environment such as office, campus, car and unrestricted daily life conditions. We will also discuss **promising techniques, alleviation methods and research challenges**.

In [3] paper, Stress is a major problem of our society, as it is the cause of many health problems and huge economic losses in companies. Continuous high mental workloads and non-stop technological development, which leads to constant change and need for adaptation, makes the problem increasingly serious for office workers. To prevent stress from becoming chronic and provoking irreversible damages, it is necessary to detect it in its early stages. Unfortunately, an automatic, continuous and unobtrusive early stress detection method does not exist yet. The multimodal nature of stress and the research conducted in this area suggest that the developed method will depend on several modalities. Thus, this work reviews and brings together the recent works carried out in the automatic stress detection looking over the measurements executed along the three main modalities, namely, **psychological, physiological** and **behavioural modalities,** along with contextual measurements, in order to give hints about the most appropriate techniques to be used and thereby, to facilitate the development of such a holistic system.

In [4] paper, A stress detection system is developed based on the physiological signals monitored by non- invasive and non-intrusive sensors. The development of this emotion recognition system involved three stages: experiment setup for physiological sensing, signal preprocessing for the extraction of affective features and affective recognition using a learning system. Four signals: **Galvanic Skin Response (GSR), Blood Volume Pulse (BVP), Pupil Diameter (PD) and Skin Temperature (ST)** are monitored and 7otentio to differentiate affective states in a computer user. A Support Vector Machine is used to perform the supervised classification of affective states between **"stress"** and **"relaxed".** Results indicate that the physiological signals monitored do, in fact, have a strong correlation with the changes in emotional state of our experimental subjects when stress stimuli are applied to the interaction environment. It was also found that the pupil diameter was the most significant affective state indicator, compared to the other three physiological signals monitored.

In [5] paper, Analysis of autonomic nervous system activity is a subject of increasing interest in the fields of health care and handicap management, as it provides information on the emotional, sensorial, and cognitive states of the patient. In this context, the simultaneous measurement of several physiological signals using small, discreet, mobile devices is required, in order to unobtrusively obtain such information under real-life conditions. We have therefore developed an ambulatory device which enables the measurement of **heart rate, electrodermal activity, and skin temperature with noninvasive sensors.**

Wireless communication and local data storage on a memory card enables the device to be used during in-situ experiments for the analysis of autonomic nervous system activity. We have used this instrumentation in a study for the objective evaluation of stress in the blind when walking in urban space, through the analysis of electrodermal activity of **blind pedestrians** who independently followed a charted course involving a range of urban conditions. Experimenting in real-life settings has lead to the definition of novel, more pertinent parameters for the analysis of physiological signals in the study of autonomic nervous system activity. Results from these experiments have identified, for the first time, some rather surprising obstacles or events which give rise to an increased stress for the blind. These results were very encouraging for the use of such ambulatory devices for experiments under real life conditions.

In [6] paper, In this paper, a Brain-Computer Interface (BCI) for classifying EEG correlates of chronic mental stress is proposed. Data from 8 EEG channels are collected from 26 healthy righthanded students during university examination period and after the examination whereby the former is considered to be relatively more stressful to students than the latter. The mental stress level are measured using the Perceived Stress Scale 14 (PSS-14) and categorized into stressed and stress-free groups.

The proposed BCI is then used to classify the subjects' mental stress level on EEG features extracted using the Higuchi's fractal dimension of EEG, Gaussian mixtures of EEG spectrogram, and Magnitude Square Coherence Estimation (MSCE) between the EEG channels. Classification on the EEG features are then performed using the K-Nearest Neighbour (K-NN) and Support Vector Machine (SVM). The performance of the proposed BCI is then evaluated from the inter-subject classification accuracy using leave-one-out validation The results showed that the proposed BCI using features extracted by MSCE yielded a promising inter-subject validation accuracy of over 90% in classifying the EEG correlates of chronic mental stress

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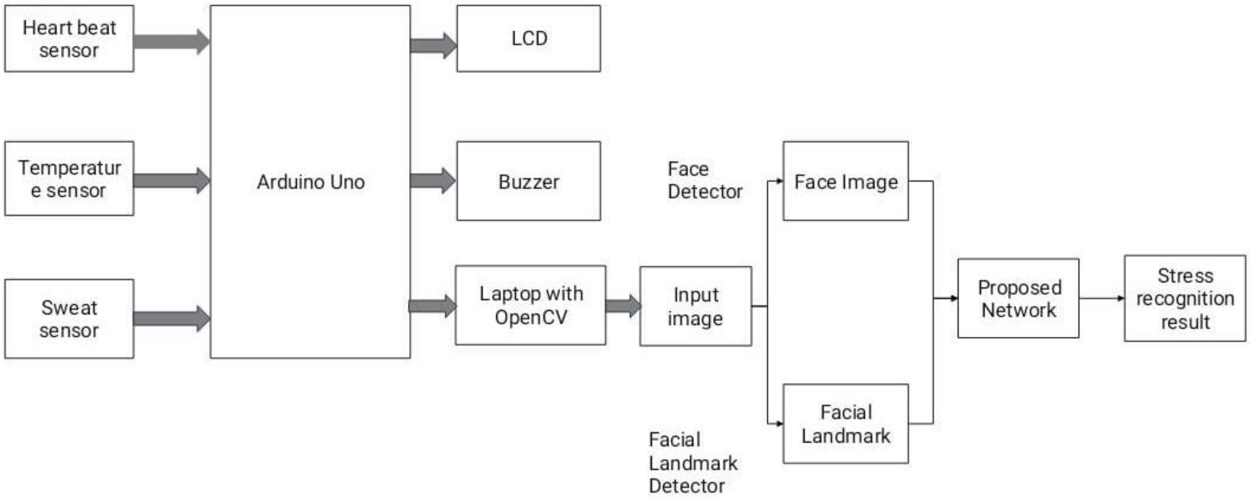
III. METHODOLOGY



The diagram above, illustrates Read Facial Emotions Using Facial Landmark Techniques. Read Temperature, sweat and heartbeat sensor Values Compare sensor values with threshold values. If Sensor Values showing stress level as high compare with Facial Emotions. If Comparison Matches with Stress Values intimate to Concerned Persons.

Working Principle:

- The primary task is to identify the hardware components which are suitable for this work. In this block diagram, there is a microcontroller Arduino Uno, Sweat Sensor (GSR Sensor), a heartbeat sensor (Electrodes) circuitry, a Message MODEM and LCD Display.
- Arduino Uno is a microcontroller board based on the ATmega328P. It is programmable microcontroller that collects the data from the sensors and transmitting it to the laptop.
- The heartbeat sensor used here is TCRT1000 which is an infrared light emitter and detector, measuring variations in light caused by changes in blood flow, which can be used to monitor heartbeat or pulse rate.
- Temperature sensor is a device that detects and measures temperatures changes in our body, which might increase during stress.
- A sweat sensor is designed to detect the presence of moisture(sweat) on the skin's surface, often associated with emotional states like stress.
- LCD is used to display the temperature level, sweat and heartbeat level, ultimately showing the person is in stress or not.
- Laptop with OpenCV this software library processes the input image from the camera.
- Facial landmark detector identifies specific features like eyes, nose, mouth to extract relevant information.

IV. HARDWARE AND SOFTWARE DESCRIPTIONS

Arduino UNO
It receives the processed EEG data transmitted wirelessly from the brainwave sensor. The Arduino UNO then processes this data further, analysing the brainwave patterns to identify specific commands or intentions. Once the commands are recognized, the Arduino UNO generates control signals that can be used to interface with external devices like computers or assistive technologies. This allows LIS patients to communicate, control their environment, or operate devices using only their brainwave activity.

Features Of Arduino UNO
I. The Arduino Uno is designed to be user-friendly, with a simple setup and a large community of users and resources.

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II. It has 14 digital input/output pins and 6 analog input pins, allowing it to connect to a wide range of sensors and actuators.

III. The Arduino Uno can be expanded with various shields and modules to add additional functionality, such as Wi-Fi, Bluetooth, and motor control.

Figure: Arduino UNO

HEARTBEAT SENSOR

Detects light reflected from or transmitted through the body part will fluctuate according to the pulsatile blood flow caused by the beating of the heart.

TEMPERATURE SENSOR

The DS18B20 Waterproof Temperature Sensor Probe is a highly reliable and versatile digital temperature sensor widely used in various applications due to its accuracy, durability, and ease of use. It operates over a broad temperature range of -55°C to +125°C making it suitable for a environment that has extreme temperature.

TEMPERATURE SENSOR

the sensor consists of a conductive grid on the detection plate, which becomes more conductive when moisture, such as sweat, makes contact with it. The amount of moisture directly affects the electrical conductivity between the plate's conductive tracks, enabling the sensor to detect varying levels of sweat.

BUZZER

A piezoelectric buzzer, a compact electronic component that produces a distinct beeping sound. It operates on the principle of the piezoelectric effect, where a piezoelectric disc converts electrical energy into mechanical vibrations, resulting in audible sound.

LCD

A **liquid-crystal display** (**LCD**) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals.

SOFTWARE REQUIREMENTS

Open-CV (Open Source Computer Vision Library) is an open-source computer vision and machine learning software library. It provides a wide range of tools and functions for image and video processing, including various algorithms for object detection, feature extraction, image filtering, and more. Open-CV is written in C++ and has bindings for Python and other programming languages, making it accessible for developers working on different platforms.

Embedded C is one of the most popular and most commonly used Programming Languages in the development of Embedded Systems. Embedded C is a specialized version of the C programming language designed for developing software for embedded systems, which are compact computing devices integrated into hardware.

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V. RESULT

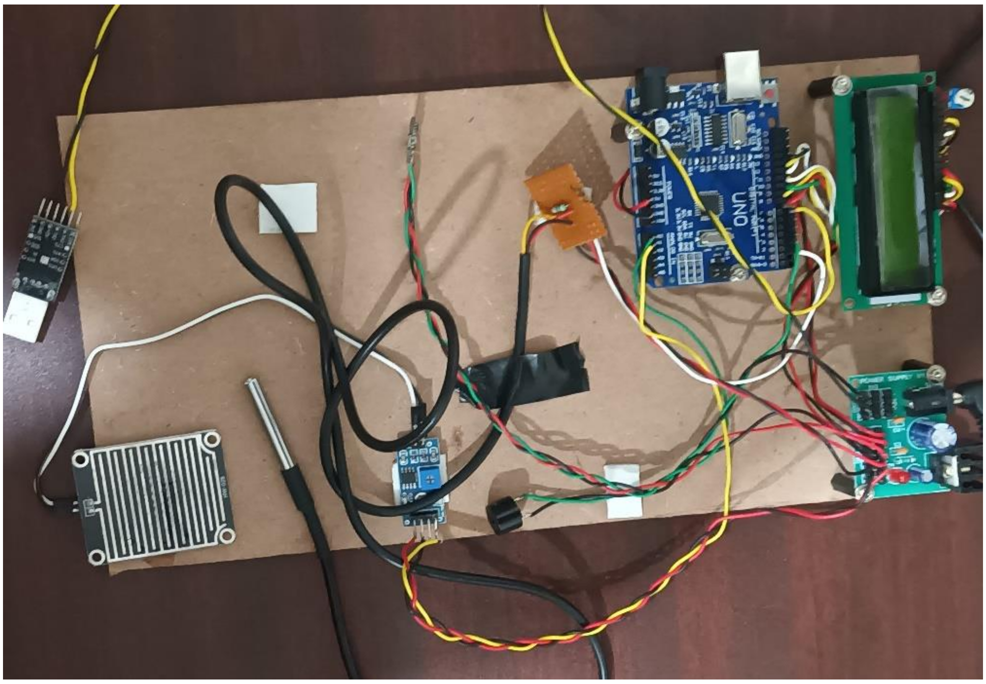

Figure: Complete Model

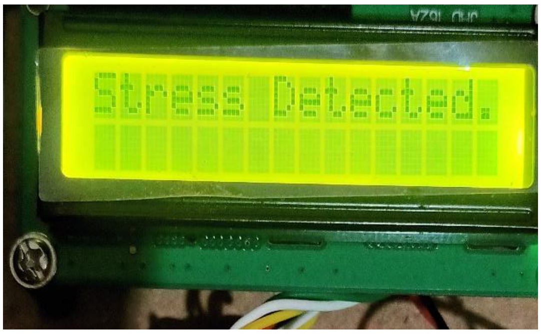

Figure: Detection of Stress through Sensors.

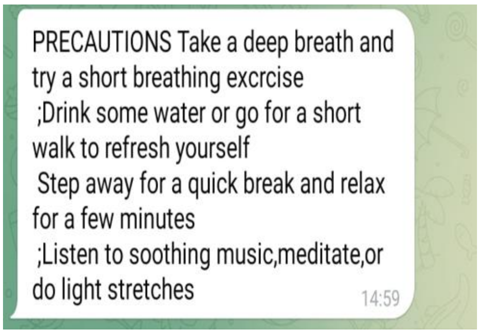

Figure: Intimation through Telegram.

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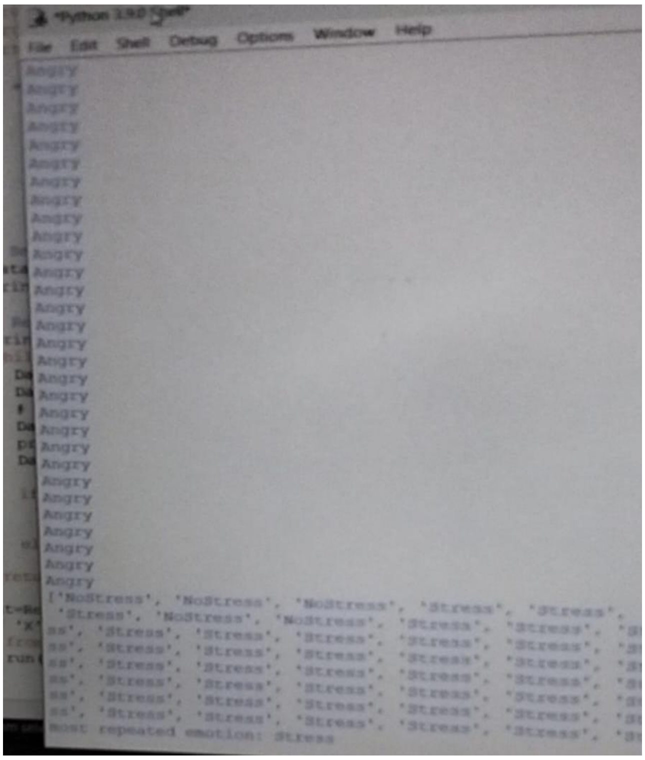

Figure: Emotion detection

VI. CONCLUSION

This project presents an innovative approach to stress detection and management by offering a proactive solution for monitoring mental health and well-being. The IoT-based stress detection system developed for mental health and well-being integrates advanced technologies to offer a comprehensive and innovative solution for stress monitoring. By incorporating sweat, temperature, and heartbeat sensors, the system provides real-time physiological assessments, detecting stress when threshold values are exceeded. The integration of facial emotion recognition further personalizes the system, analyzing emotional states to validate stress detection. Additionally, the system sends timely notifications and precautionary measures through Telegram, ensuring immediate communication and support. This multifaceted approach combines biometric data, emotion analysis, and effective communication to proactively address stress and promote mental well-being.

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