SMART BP AND STRESS DETECTION

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Abstract- Stress is a significant issue that has a profound impact on human life, leading to various health-related ailments such as cardiovascular disease, diabetes, depression, asthma, and more. While someone may appear physically healthy, their internal state of well-being can be compromised by stress. Consequently, technologies capable of automatically recognizing an individual's stress levels can serve as powerful tools to help people adjust their lifestyles and achieve a better balance of stress. One such technology is wireless networks utilizing sensor technology, which can be utilized to measure an individual's stress levels. This paper focuses on the implementation of Galvanic Skin Response (GSR) in conjunction with a heart rate sensor to effectively measure stress levels.

Keywords: Stress, Health-related diseases, Cardiovascular disease , Galvanic Skin Response (GSR) , Heart rate sensor , Measuring stress levels.

I . INTRODUCTION

In today's fast-paced modern lifestyle, stress has become an increasingly prevalent issue, negatively impacting individuals' physical and mental health. Managing stress effectively and monitoring blood pressure regularly are vital for maintaining overall well-being, particularly cardiovascular health.

This project focuses on the development of a stress and blood pressure detection system using Arduino, an open-source electronics platform known for its versatility and user-friendly nature. By harnessing the capabilities of Arduino and integrating various sensors, we aim to create an affordable and practical solution for monitoring stress levels and blood pressure.

The proposed system will utilize physiological sensors such as heart rate sensors and galvanic skin response (GSR) sensors to capture real-time data related to stress indicators. Additionally, blood pressure sensors will be incorporated to provide accurate and reliable blood pressure measurements. Leveraging Arduino's programmable features, advanced algorithms and signal processing techniques will be implemented to analyze the acquired sensor data. This analysis will offer valuable insights into an individual's stress levels and blood pressure fluctuations, enabling early detection and timely intervention.

The significance of this project lies in its potential to empower individuals to actively manage their stress levels and monitor their blood pressure conveniently from their own homes. By providing real-time feedback and actionable information, the system will facilitate informed decision-making and encourage the adoption of healthier lifestyle choices.

The outcomes of this project hold great value for both individuals and healthcare professionals. Individuals will gain a better understanding of their stress patterns, enabling them to implement appropriate stress management techniques and make necessary adjustments to their daily routines. Healthcare professionals can benefit from the data collected by the system, supporting accurate diagnoses, personalized treatment plans, and remote patient monitoring.

II . LITERATURE SURVEY

[1] Stress is a normal part of human experience, but chronic or inappropriate stress can harm the body. Monitoring stress in real-time can provide immediate feedback for early intervention. A study involving 60 participants found changes in heart rate variability and heart rate between resting and stress states, emphasizing the importance of considering baseline anxiety and stress levels for accurate stress measurement.

[2] This paper compares stress detection methods and focuses on using EEG signals as a non-invasive tool for stress detection. Fractal dimension algorithms (Higuchi, Katz, and Permutation Entropy) are utilized for feature extraction. Classic machine learning algorithms are employed for classification based on accuracy, precision, and sensitivity. The paper introduces a novel architecture using EEG analysis in MATLAB, fractal dimension for feature extraction, and machine learning techniques such as Random Forest and Artificial Neural Network. The goal is early-stage stress detection, analyzing different stress levels, and providing coping strategies to enhance performance.

[3] This research focuses on emotion recognition using EEG signals, which provide insights into emotional states that individuals may not be able to express. Multiple machine learning techniques, including SVM, K-nearest neighbor, Linear Discriminant Analysis, Logistic Regression, and Decision Trees, were tested with and without dimensionality reduction using PCA. The DEAP Dataset, a multimodal dataset for analyzing human affective states, was used. Binary class classifiers were trained on time segmented epoch data, and different classification models showed better accuracy and recall for different emotional states. The findings emphasize the need for using diverse classification models to identify various emotional states.

[4] This study focuses on stress detection using commercially available smartwatches. While previous studies rely on electrodermal activity (EDA) sensors, this study explores the sensors present in market smartwatches and accessible to third-party developers. It examines the accuracy of stress detection using different sensor combinations and analyzes variations in detection rates among study subjects. The experiments utilize the WESAD dataset and reveal that EDA signal is not essential for user-independent stress detection. Commercial smartwatches can effectively recognize stress with sufficiently large window sizes, although recognition rates vary significantly among study subjects.

[5] Smartphone technology has spread rapidly around the globe. According to a report released by the Korea Information Society Development Institute, about 95% of Koreans aged more than 30 years old owned smartphones. Recently, blood pressure (BP) measurement using a photoplethysmography-based smartphone algorithm paired with the smartwatch is continuously evolving. In this document, the Korean Society of Hypertension intends to remark the current results of smartphone / smartwatch-based BP measurement and recommend optimal BP measurement methods using a smartphone device. We aim to increase the likelihood of success in implementing these new technologies into improved hypertension awareness, diagnosis, and control.

[6] Sometimes mental stress needs to be control as it results in different dangerous suffering. Timely mental stress detection can help to prevent stress related health problems. The aim of this paper is to design an IoT base wearable, cost effective and low power smart band for health care that detect mental stress based on skin conductance. This band can monitor user's mental stress continuously and transmit the stress related data wirelessly to user's smart phone. It not only help the users in better understanding their stress patterns but also provide the physician with reliable data for a much better treatment. Inputs to this device are various signals from different sensors. By intelligently analyzing the correlation between these signals using machine learning algorithm, this band predicts that whether the subject is suffering from stress or not.

III. DESIGN

ARDUINO UNO

Arduino UNO is a microcontroller board based on the ATmega328P. It has 14 digitals input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button.

GSM (GLOBAL SYSTEM FOR MOBILE COMMUNICATION)

A GSM module has a RS32 interface for serial communication with an outside fringe. It regulates a simple transporter flag to encounter computerized info and demodulates to interpret the transparent data. GSM is an open and digital cellular technology for transmitting mobile voice and data services. A GSM digitalizes and reduces the data, then sends it down through a channel with two different streams of client data, each in it has own particular time slot.

GSR SENSOR

The GSR sensor measures the varying levels of the skin conducting the electric current. Higher levels of perspiration on the skin lead to a greater conductance of electrical currents. A higher level of conductivity of the skin after an event can therefore be interpreted as either positive or negative emotional arousal.

LM35 TEMPERATURE SENSOR

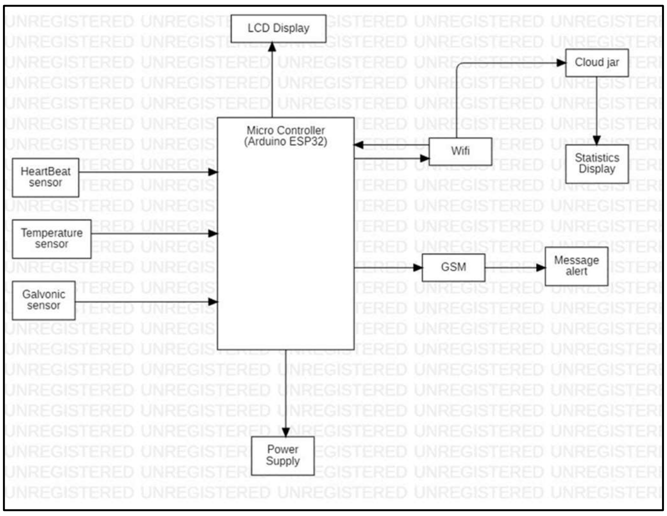
LM35 is a temperature measuring device having an analog output voltage proportional to the temperature. It provides output voltage in Centigrade (Celsius). It does not require any external calibration circuitry. The sensitivity of LM35 is 10 mV/degree Celsius. As temperature increases, output voltage also increases.

HEARTBEAT SENSOR

The KY-039 Finger Heartbeat Detection Sensor is a sensor that can detect a person's pulse or heartbeat. It is a small, portable sensor that easily connects to an Arduino or other microcontroller to read and analyse heart rate.

LCD DISPLAY

16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. The 16x2 intelligent alphanumeric dot matrix display is capable of displaying 224 different characters and symbols.



System Architecture

ESP8266 WIFI MODULE

The ESP8266 is inbuilt Wi-Fi module incorporated in SOC with transfer control protocol and internet convention stack that can provide controller to access WI-FI. For the wireless communication ESP8266 WiFi module is used for sending the data from the Arduino to the think speak server.

JUMPER WIRES

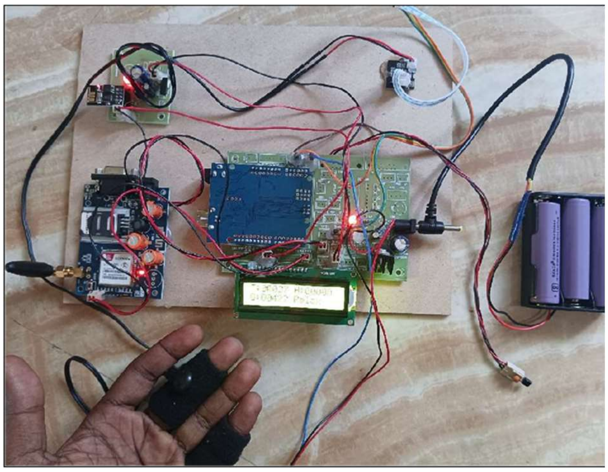
A jump wire is an electrical wire, or group of them in a cable, with a connector or pin at each end, which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.

IV TECHNOLOGIES USED

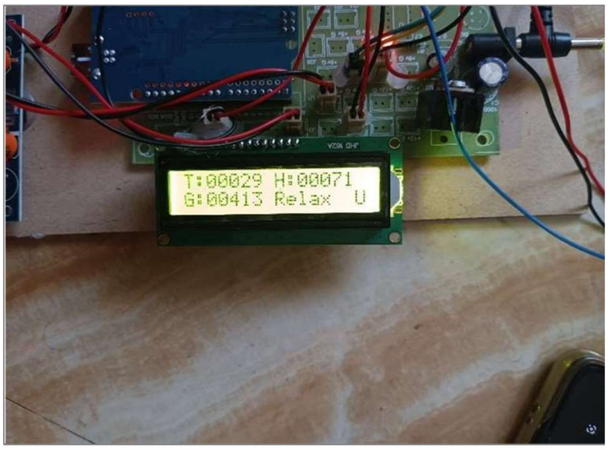
Arduino IDE : This software can also be used Aurdino UNO by installing the required libraries. Arduino IDE is an open-source software, designed by Arduino.cc and mainly used for writing, compiling & uploading code to almost all Arduino Modules. It is an official Arduino software, making code compilation too easy that even a common person with no prior technical knowledge can get their feet wet with the learning process. It is available for all operating systems i.e. MAC, Windows, Linux and runs on the Java Platform that comes with inbuilt functions and commands that play a vital role in debugging, editing and compiling the code. Each of them contains a microcontroller on the board that is actually programmed and accepts the information in the form of code. The main code, also known as a sketch, created on the IDE platform will ultimately generate a Hex File which is then transferred and uploaded in the controller on the board. The IDE environment mainly contains two basic parts: Editor and Compiler where former is used for writing the required code and later is used for compiling and uploading the code into the given Arduino Module. This environment supports both C and C++ languages.

V. RESULTS

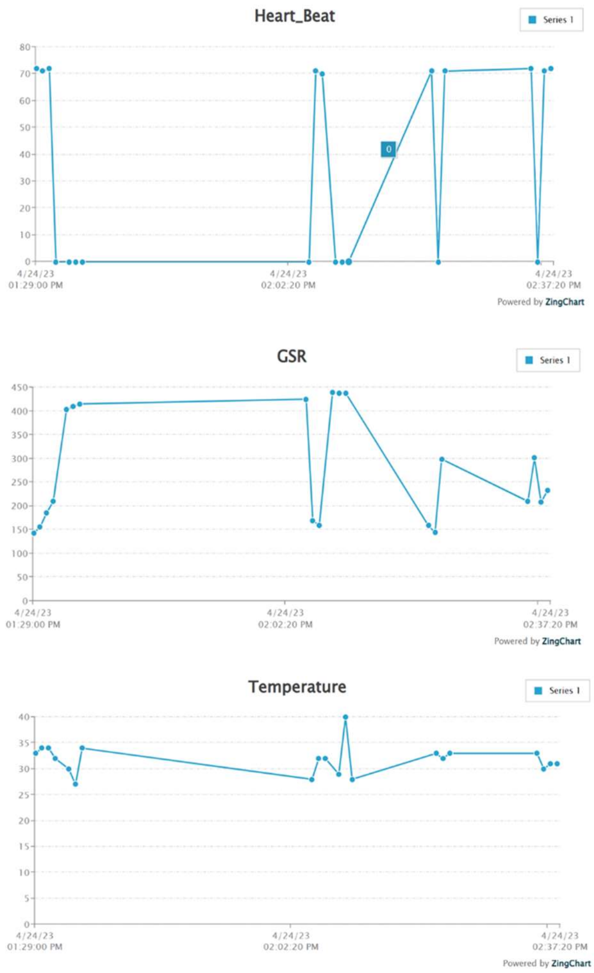
DEVICE SETUP



VALUES OF A PERSON



GRAPHICAL ANALYSIS OF THE SENSORS



ALERT MESSAGE TO THE USER

VI . CONCLUSION

Smart stress detection system is designed and developed using Arduino. The system successfully and accurately detects the stress levels using various sensors such as heartbeat rate, body temperature and skin conductance values. Based on the values of these sensors, the levels of stress are calculated and the information is transmitted using IOT to the concerned persons mobile for necessary action. The developed model is more flexible and consumes less power. It is very useful for personal monitoring and is very useful in taking care of disabled persons. This work can be extended by using ECG sensor,EEG sensor, Muscle sensor etc and this model can be built on a SOC device.

VII . REFERENCES

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