Heart rate sensor using ESP - 32 for stress detection

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Abstract:

Stress produces serious physical and mental injury that is challenging to identify. To identify irregularities that could result in chronic illnesses, it is crucial to constantly evaluate stress levels. IoT-based wireless networks provide the ability to use sensors to measure stress levels and broadcast the data for quick action. The effects of stress can be profound and seriously detrimental to an individual's physical and mental health. Even though a person seems to be in good physical health, stress can still exist in the body and lead to a number of chronic diseases. Stress can also affect mental stability, which can cause additional problems. As a result, regular stress monitoring is crucial for diagnosing.

Keywords— Stress, mental health, chronic diseases

I. In this project we are trying to find stress levels and conclude the possible mental disorders associated with those stress levels, this is in turn achieved using the electrocardiographic output received using IOT. Electrocardiography or ECG is a technique for gathering electrical signals which are generated from the human heart. When someone experiences physiological arousal then the ECG sensor allows us to recognize the level, however, it is also used for understanding the psychological state of humans. So, an AD8232 sensor is used to calculate the electrical activity of the heart. This is a small chip and the electrical action of this can be charted like an ECG (Electrocardiogram). Electrocardiography can be used to help in diagnosing different conditions of the heart.

I. LITERATURE REVIEW

The last decade of the 19th century witnessed the rise of a new era in which physicians used technology along with classical history taking and physical examination for the diagnosis of heart disease. The introduction of chest x-rays in 1895 and the electrocardiograph (electrocardiogram) in 1902 provided objective information about the structure and function of the heart. The original electrocardiograph employed a string galvanometer to record the potential difference between the extremities resulting from the heart's electrical activation. In the first half of the 20th century, several innovative individuals set in motion a fascinating sequence of discoveries and inventions that led to the 12-lead electrocardiogram as we know it now.

Electrocardiography today is an essential part of the initial evaluation for patients presenting with cardiac complaints. Specifically, it plays an important role as a non-invasive, cost-effective tool to evaluate arrhythmias and ischemic heart disease (2). As a first line diagnostic tool, health care providers at different levels of training and expertise frequently find it imperative to have the ability to interpret electrocardiograms; however, a high rate of misinterpretation has been noted among non-specialized physicians especially among trainees (3). It is likely that an understanding of the electrical basis of electrocardiograms would reduce the likelihood of error. An understanding of the disorders behind electrocardiographic phenomena could reduce the need for memorizing what may seem to be an endless list of patterns.

II. PROPOSED SYSTEMS

There are many existing technologies in the market which are working on stress detection. With respect to that we have developed a system that is less costly and very easy to use. It's a real-time application that lets people detect their stress levels and possible issues associated with it and decide on further actions to be taken..

III.MATERIALS AND METHODS

i) ESP32:

ESP32, like Arduino, is a development board. ESP32 is created by Espress if Systems with a series of SoC (System on a Chip) and modules which are low cost with low power consumption. This new ESP32 is the successor to the well-known ESP8266(became very popular with its inbuilt Wi-Fi). ESP32 not only has Built inWi-Fi but also has Bluetooth and Bluetooth Low Energy.

ii) Arduino IDE setup:

Using Board management, Arduino allows the installation of third-party platform packages.

- From the Arduino website, install Arduino 1.6.8.
- Open the window after starting the software

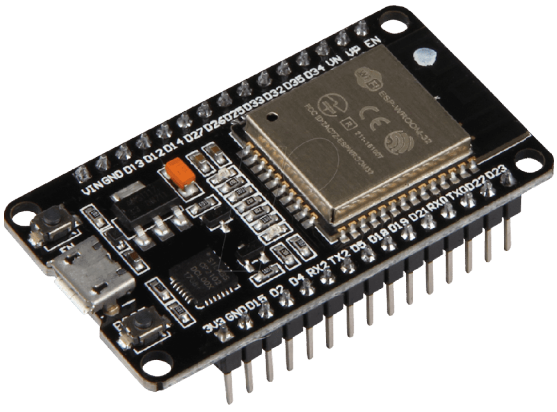


Figure1: ESP32

iii) Installing with Boards Manager:

Using Boards Manager, Arduino now permits the installation of third-party platform packages starting with version 1.6.4. Packages for Windows, Mac OS, and Linux are available (32 and 64 bit).

- Install the most recent upstream Arduino IDE (version 1.8 or later). The most recent version can be found on the Arduino website.
- Then Start Arduino. Now we must open the Preferences window.
- Enter https://raw.githubusercontent.com/espressif/arduino-esp32/gh-pages/package_esp32_index.json into the Additional Board Manager URLs field. You can add multiple URLs, separating them with commas.
- Open Boards Manager from Tools > Board menu and install esp32 platform Hardware implementation:

IV.AD8232:

The AD8232 ECG sensor is a commercial board used to calculate the electrical movement of the human heart. This action can be charted like an Electrocardiogram and the output of this is an analog reading. Electrocardiograms can be very noisy, so to reduce the noise the AD8232 chip can be used. The working principle of the ECG sensor is like an operational amplifier to help in getting a clear signal from the intervals simply.

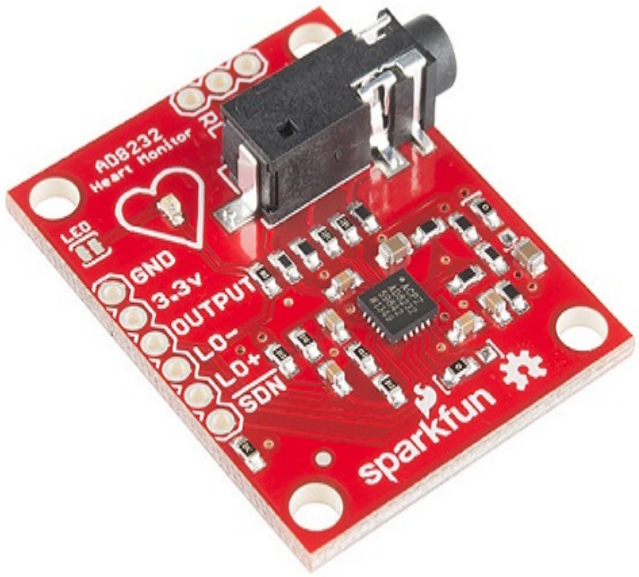


Figure2:AD8232

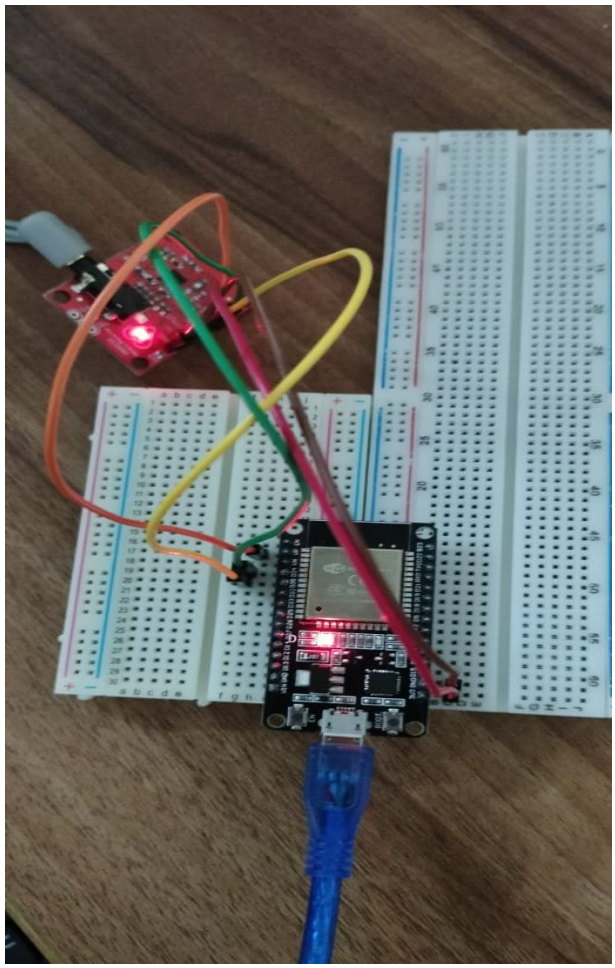


FIGURE:4 HARDWARE IMPLEMENTATION

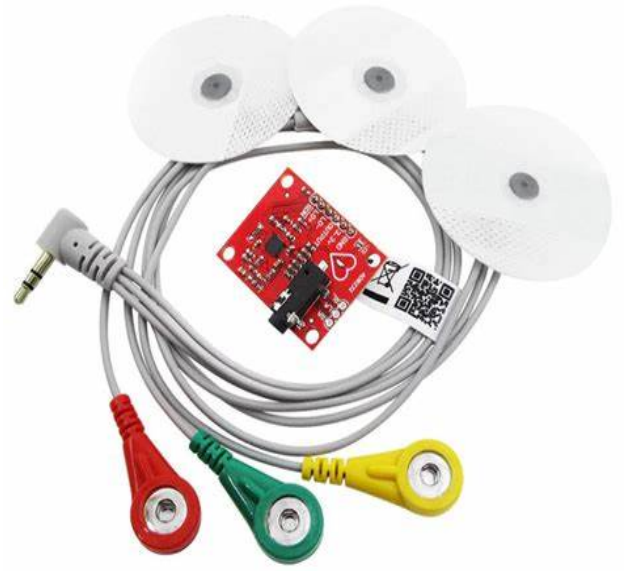
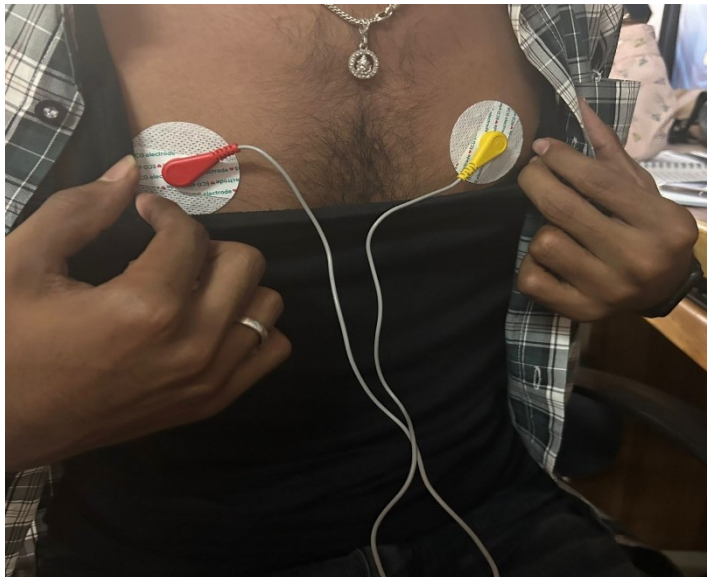


Figure3:ECG KIT CONSISTING OF ELECTRODES



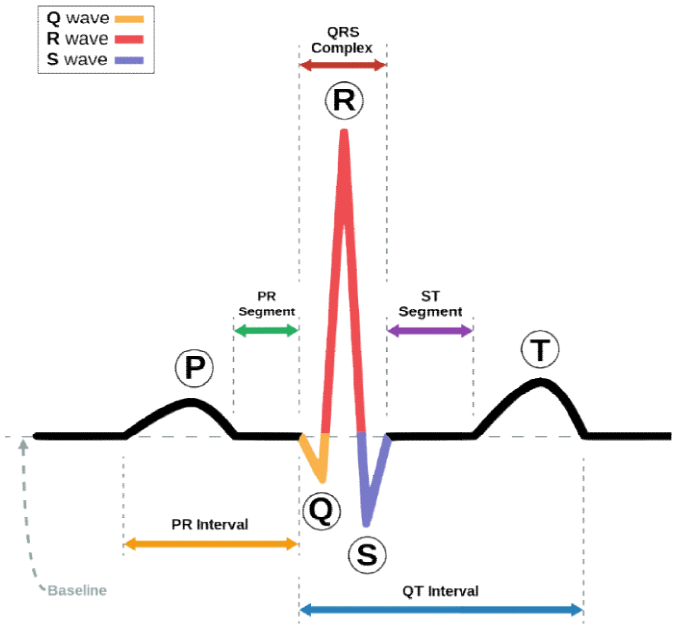


FIGURE:5 STRESS GRAPHS BASED ON SCENARIOS

There are three main components to an ECG:[13]

- The P wave, which represents depolarization of the atria.
- The QRS complex, which represents depolarization of the ventricles.
- The T wave, which represents repolarization of the ventricles.

During each heartbeat, a healthy heart has an orderly progression of depolarization that starts with pacemaker cells in the sinoatrial node, spreads throughout the atrium, and passes through the atrioventricular node down into the bundle of His and into the Purkinje fibers, spreading down and to the left throughout the ventricles.[13] This orderly pattern of depolarization gives rise to the characteristic ECG tracing.

V. PROCEDURE:

The first step:
Installing the prerequisites, that is the Arduino IDE for the execution of code. An account ready in Ubidots website for ecg visualization.
Step two: connect the ecg sensor to the esp32 board approximately using jumper wires and bread board
Step three:
Specify the baud rate, port number and type of board being used in the ide settings.
Step four:
Type the code required for our project in the ide, load the code to the esp32 through a c type USB cable, serial type. Build the project after connecting the electrodes to the human body.
Step five: Once the code is compiled, run it. Pressing the boot button while the code gets uploaded and later releasing it. The esp32 writing is performed and after it's over the serial plotter and serial _____ will display the output in graphical and numerical form.
Step six: open the Ubidots platform, the graphical representation of heartbeats is clearly visible. Hence connecting to Ubidots one can examine one's ECG at any time.
Step seven:
Develop a webpage to upload the graph output and obtain the results.
Step eight:
Enter the obtained graph output into the stress detection webpage developed and enter the values.

VI.CONCLUSION

Possible mental disorders based on the stress level calculated are displayed on the screen. This information can be a very precautious step taken towards early detection of mental health issues and deciding on the medication of the patient to overcome it. Hence, this project aims to decrease the aftermath and trauma that mental disorders can bring to oneself and their loved ones.

1. REFERENCES

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