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PSYCARIA - EMOTION DETECTOR FOR A PSYCHIATRIST

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ABSTRACT

Every person will experience stress around the world, some healthy, called EUSTRESS and some unpleasant, named DISTRESS. Good pressure and stress promote success. Stress damages people's lives and health and causes various diseases. On the other hand, psychiatrists have a hard time treating their patients owing to a lack of time. They need innovative and intelligent equipment to treat their patients. We prepared a device that can detect a person's POSITIVE and NEGATIVE emotions through a smartwatch and a gadget that can sense body temperature, respiration, and heart rate. After witnessing these parameters, it can store the results on a website depending on the patient's condition. For example, the psychiatrist observed one patient for at least seven days regarding the days' results stored on a website. After seven days, the report is generated. The goal of psychiatrists in keeping their patients for seven days is to assess their emotional health and determine if they need to adjust their treatment. This system detects eight positive and negative emotions through heartbeat, respiratory, and body temperature sensors. These sensors are incorporated by utilizing machine learning. Web-based apps interpret sensor readings. Psychiatrists will analyze and report the website's results.

Keywords: *Body Temperature, Emotion Detector, Emotional Health, Emotion Recognition, Heart Rate Variability, Web-based Application.*

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1. Introduction

An emotion detector product for a psychiatric patient includes three sensors: heartbeat, body heat, respiratory sensor, and a questionnaire form. Inputs are stored on the web taken from the patient, where an algorithm will tell the patient's current mood, and the data will be saved in the database for further use. This project is undertaken to help out stressed patients and solve the difficulties of psychiatrists through a wristwatch and a gadget. Stress is a condition that can badly affect a person's life. It can destroy a person's physical and psychological health—the stress victim persons involved in many diseases like shortness of breath, headache, etc. Stress is often becoming a cause of death; it is also found in kids, and recognizing the symptoms of stress in kids is not easy for psychiatrists. Sometimes, their manual methods for diagnosing stress in patients are not time-efficient; by observing these problems, we have to create this device to solve the issues of psychiatrists and stressed patients. If this requirement is not fulfilled, people hide their emotions; as a result, they show aggression towards others and even self-injury. Psychiatrists cannot determine the patient emotions accurately due to lack of time; they cannot handle a large number of patients. In some cases, patients do not show their feelings before the psychiatrists. Our system provides easiness to psychiatrists as it is time-efficient, accurate, and user-friendly.

The web-based application is integrated through the hardware. Psychiatrists will interpret the results through this website. This system is developed to recognize the person's emotions smartly or provide ease to the psychiatrists, specifically to comfort stressed patients. This device can detect eight positive and negative emotions stress involves negative emotions. The need to see eight emotions is that through this device, we have to find that there are only negative emotions in persons or possess positive feelings. These emotions are detected through sensors then readings of emotions are stored on a website. Depending on the patient's condition, psychiatrists will observe the patient for seven days, and then after seven days, the report is generated through a website. So that the psychiatrists will be able to recognize the patient's condition accurately and how severe the disease is and then suggests the patient treatment depending on their condition. The emotion detector project will accomplish all necessary phases, including the system's design, testing, and implementation.

The main objective of the emotion detector project is to provide a robust and efficient way for psychiatrists to check their stressed patients smartly by using an intelligent device. Our project aims to save patients from irritating methodology because the manual method sometimes becomes annoying for psycho patients. Our system will provide a technological alternative to the manual procedure. One more objective of our project is to provide this project at a lower cost to provide the feasibility of our deal fell.

2. Backgrounds and Literature Review

Emotion detection has become one of the most important aspects to consider in any project related to Affective Computing. Due to the almost endless applications of this new discipline, the development of emotion detection technologies has opened up a pretty profitable opportunity in the corporate sector. In recent years, many start-up enterprises have emerged, dedicated almost exclusively to a specific type of emotion detection technology. This paper presents a thorough review of current technologies to detect human emotions. To this end, we explore the different sources from which emotions can be read, along with existing technologies developed to recognize them. We also explored some application domains in which emotion detection technology has been applied (Garcia, Penichet & Lozano, 2017).

Emotions are important in daily living. It is a non-voluntary mental state that causes physiological changes. Monitoring these changes, which are impressions of emotional shifts, might help uncover issues early on before they become problematic. Human-machine interaction relies heavily on emotion recognition—past methods for detecting and evaluating human emotions varied. Text, facial expressions, speech, bodily motions, and physiological signs are often employed. A physiological-signal-based emotion-recognition system. Skin temperature, heart rate, and skin conductance sensors provide these signals. The microcontroller processes amplified and filtered sensor signals. The microcontroller wirelessly delivers data to a computer for data analysis and emotion recognition. This project observed happy (excited), sad, angry, and neutral emotions (relaxed). The data comes from healthy 18-72-year-old men and women. K-means clustering divides data into four categories (emotions). The GUI communicates with the hardware and displays real-time emotions for the monitored period. The created system recognizes emotions at 86.25 percent as derived by Quazi (2012).

Automatic recognition and interpretation of social signals transmitted by voice, gestures, mimics, etc., will be necessary for next-generation interfaces, paving the way for more intuitive human-computer interaction. For example, Social Signal Interpretation (SSI) is a real-time social signal recognition methodology. SSI supports sensor devices, filter and feature algorithms, machine learning, and pattern recognition tools. In addition, it enables developers to add additional components using SSI's C++ API and helps front-end users design pipelines with a text editor (Wagner, Lingenfelser & Baur, 2013).

The detection of emotion is becoming an increasingly significant subject for human-computer interaction as the advantages of emotion recognition become more evident and realizable. Emotion recognition can be done by several means, one of which is using bio-sensors. Bio-sensors possess several advantages over other emotion recognition methods. First, they can be both unobtrusive and resilient against various environmental variables, which other types of emotion detection have difficulties overcoming. This research offers a way to teach computers to distinguish emotions by utilizing various signals from several distinct bio-sensors. Specifically, we detail the approach we followed to elicit emotions and teach our system to distinguish them. We also provide a set of preliminary data which indicates that our neural net classifier can get accuracy rates of 96.6 per cent and 89.9 per cent for recognition of emotional arousal and valence, respectively (Dzedzickis, Kaklauskas & Bucinskas, 2020).

Human-computer interaction research focuses on recognizing user emotions. Facial expressions, aural signals, body poses, gestures, etc., can be used to discern emotions, but physiological signals are more valuable because they are spontaneous and uncontrollable. This research discusses using physiological clues to recognize emotions. Describe physiological signals and sensors. Emotion models and elicitation methods are described by Wioleta (2013).

2.1 Image processing-based Emotion recognition

This device aims to build an emotion detection system that can analyze the primary facial expressions of humans. This study constructs a frame of the emotion recognition system, including face detection, feature extraction, and facial expression classification. A skin detection process is adopted first to pick up the facial region from a complicated background in part of face detection. Those feature points are found by detecting lip, mouth, and eyes, eyebrows, as depicted in Figure 1. Moreover, with these facial feature points changing, the emotional state's characteristic values are computed. The experiment has shown that the proposed strategy is effective (Luoh, Huang & Liu, 2010).

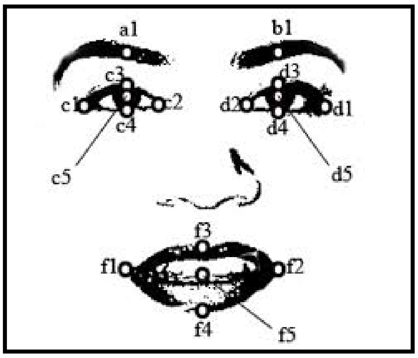

Figure 1. Image Processing-based Emotion recognition (Source: Emotion Recognition with Image Processing and Neural Networks, Computer Science, Semantic Scholar (2009)).

2.2 Multimodal Emotion Recognition

People express their emotions through multiple modalities, such as their speech, face, and body in everyday life. It means that a system that attempts to interact with humans, taking into account their emotional state or attitude, needs to process, extract, and analyze a variety of cues provided through their speech, facial expressions, hand, and body pose.

Conversely, all of the signals can convey emotional messages to a user. Different kinds of information not used in natural communication but potentially relevant to interfaces come from emotion-related somatic and cortical changes. The state-of-the-art emotional research calls for a coherent treatment of all these issues. Work in this area is beginning to develop, and the proposed session brings together leading researchers in it so that the multimedia community can engage with the developments. Multimodal emotional sign extraction and emotion recognition have been major limiting factors in developing emotion-oriented systems. Tackling these sessions focuses on extracting dynamic features and signs from each modality separately, combining the modality outputs, and recognizing the user's emotional state, considering the vibrant psychological background and existing knowledge or demands from both the analysis and synthesis perspective. It foresees a unified framework for human-computer interaction (HCI). The machine can recognize its user's emotional state and generate expressive avatars that appropriately respond to the extracted user's emotional signs. Multimodal sign extraction involves speech, visual, and physiological signal processing, segmentation, dynamic feature extraction, single-mode classification, statistical analysis, multimodal synchronization, recognition models, fuzzy reasoning, and context analysis. However, the study of emotion is, in fact, a multidisciplinary endeavor.

Consequently, the aspects mentioned above cannot be considered independently from the emotional, psychological theories, and emotional representations and the knowledge about interrelations adopted and used for synthesizing the same signs in embodied computational agents (ECAs). Novel multimodal emotion analysis techniques of broad applicability need to be taken into account and provide solutions for different emotional models, e.g., discrete, continuous, and temporal, for a variety of expressive parameters, e.g., related to face, gestures, and speech, as well as for synchronization and integration of modalities (Kollias, Karpouzis & Kostas, 2016).

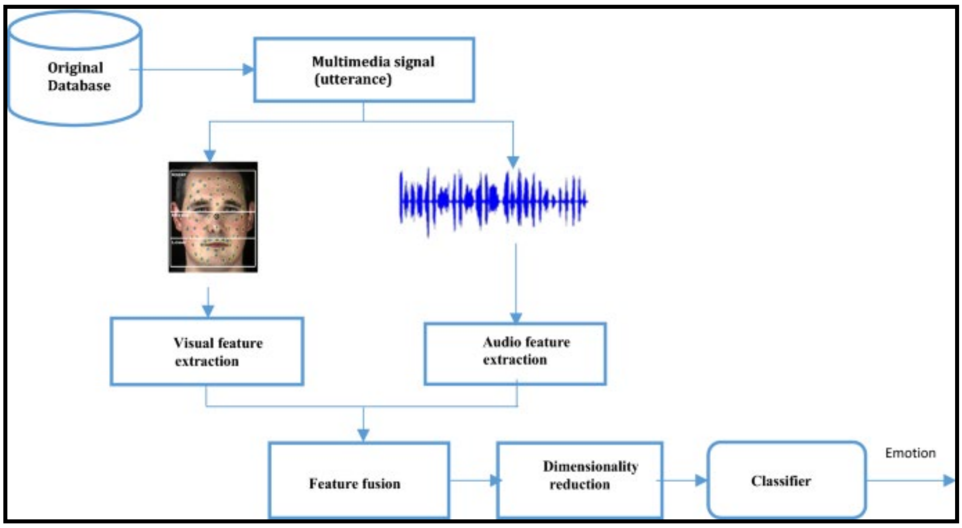

Figure 2. Multimodal Emotion Recognition
Source: A Multimodal Emotion Recognition System Using Facial Landmark Analysis (2019)

Redundant information, noisy data from single-modal feature extraction, and classical learning algorithms make recognition difficult. A deep learning-based multimodal fusion emotion recognition system for speech is proposed as shown in Figure 2. First, single-modality feature extraction algorithms are put up. Voice employs the CNN-LSTM network, and video facial expression uses the Inception-Res Net-v2 network. LSTM is used to capture correlations between and within modalities. After chi-square feature selection, separate modalities are fused to create a unified fusion feature. Finally, LSTM's fusion data characteristics are fed into LIBSVM for ultimate emotion recognition. Experimental results demonstrate that the suggested method's recognition accuracy on the MOSI and MELD datasets is 87.56 and 90.06 per cent. It laid the groundwork for multimodal integration in emotion recognition (He, Yang, Pan & Wang, 2021).

2.3 EQ-Radio emotion recognition

Figure 3 shows that physiological measurements, such as ECG and EEG signals, are more robust because they are controlled by involuntary activations of the autonomic nervous system. However, existing sensors that can extract these signals require physical contact with a person's body, interfering with the user experience and affecting her emotional state. Then one approaches EQ-Radio to detect signs wirelessly, but the results are not so accurate. In contrast, our system detects emotions through three sensors (heartbeat, respiration, and body temperature); that's why our project has a chance to produce more accurate results compared to the existing systems (Zhao, Adib & Katab, 2016).

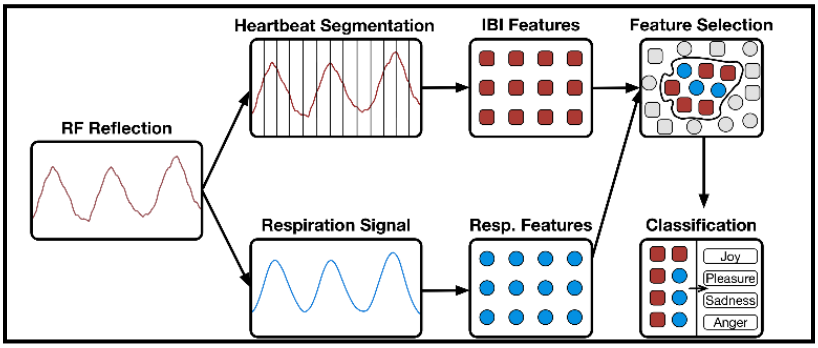

Figure 3. EQ-Radio emotion recognition
Source: Emotion recognition using wireless signals, 2016

3. Problem Statement

Through the use of a wristwatch and an accessory, this initiative is being carried out to assist those who suffer from stress and ease the burdens placed on psychiatrists. The condition known as stress can harm a person's life and can be detrimental to their physical and mental health. Stress victims are involved in various disorders, such as headaches and shortness of breath. By observing these issues, we were forced to conclude that we needed to develop this device to provide a solution to the challenges faced by both psychiatrists and stressed patients. Stress frequently plays a role in people's decisions to take their own lives, and it can also be found in children. Recognizing the symptoms of stress in children can be difficult for psychiatrists, and sometimes the manual methods they use to diagnose stress in patients take up too much time. People who fail to meet this need tend to repress their feelings, leading to aggressive behavior against others and even self-harming behaviours. Unfortunately, due to a lack of time, psychiatrists can sometimes not accurately determine their patients' emotions. This may be because they cannot manage many patients they see or because the patients themselves do not show their true emotions when they are in the psychiatrist's presence. Because it is accurate, time-efficient, and user-friendly, our technology makes life easier for psychiatrists.

4. Analysis and Design

Psycaria's analysis and design illustrate the process of analyzing an issue and coming up with a solution to that problem. Systems analysis reveals useful insights when all aspects of the issue are investigated. Systems design is most efficient when multiple potential solutions may be put forward.

4.1 Actor Use Case

An actor in the Unified Modeling Language (UML) "specifies a role played by a user or any other system that interacts with the subject". For example, figure 4 depicts two actors, each playing their role. One is a psychiatrist, and the other is a patient. The psychiatrist will take readings of the temperature, respiration, and the patient's heartbeat and take user information to maintain a record. In the end, generate a report about the patient's emotions, and the patient will give all the leads to the psychiatrist.

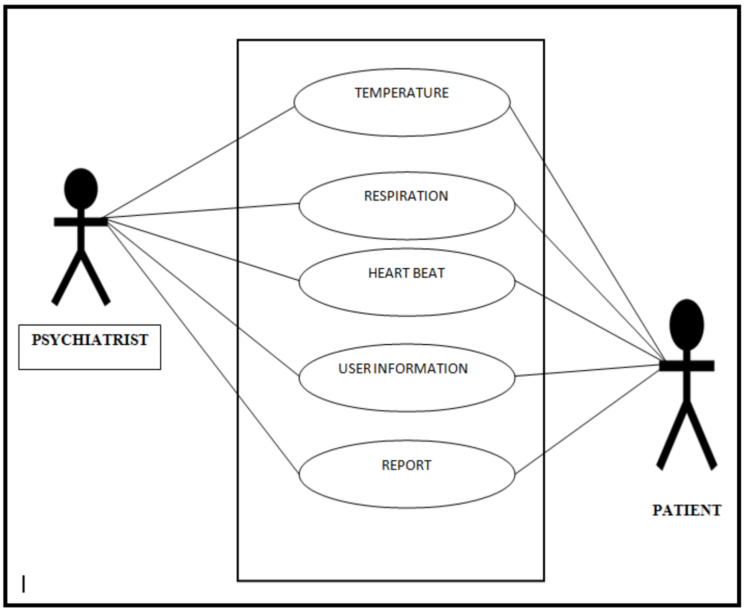

Figure 4. Actor Use Case Diagram

4.2 Context Diagram

The context diagram shown in Figure 5 clearly defines a Web-Based Application as the basic central unit of an entire system under development. For example, the body sensor will detect the body temperature and translate the detected readings through a Bluetooth device to a web-based application. Similarly, two other sensors, the heartbeat and respiratory sensor, will detect the heartbeat and respiration rate of the human body and send these sensed readings to the Web-Based Application through a Bluetooth device.

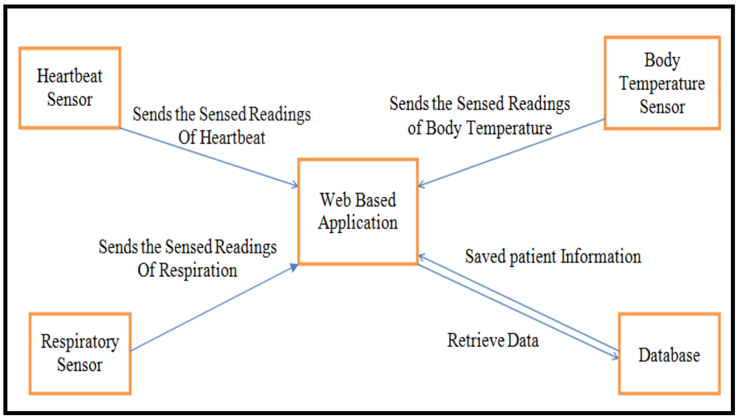

Figure 5. Context Diagram

A machine learning algorithm is implemented into the web-based application through which this application evaluates the emotions concerning the readings when the final feeling is recognized about the patient. Then this emotion is saved into the database of the Web-based application. After that, the psychiatrist will generate a report about the patient's feelings. The database is generated into the Web-based application that stores the patient information and helps retrieve data about the patient.

4.3 Workflow

The workflow diagram of our project depicts the flow of tasks or actions from one person or group to another. This diagram typically consists of symbols representing actions or individuals connected by arrows indicating the flow direction. The workflow diagram shows the work performed by different apparatuses and the people involved (patient and psychiatrist).

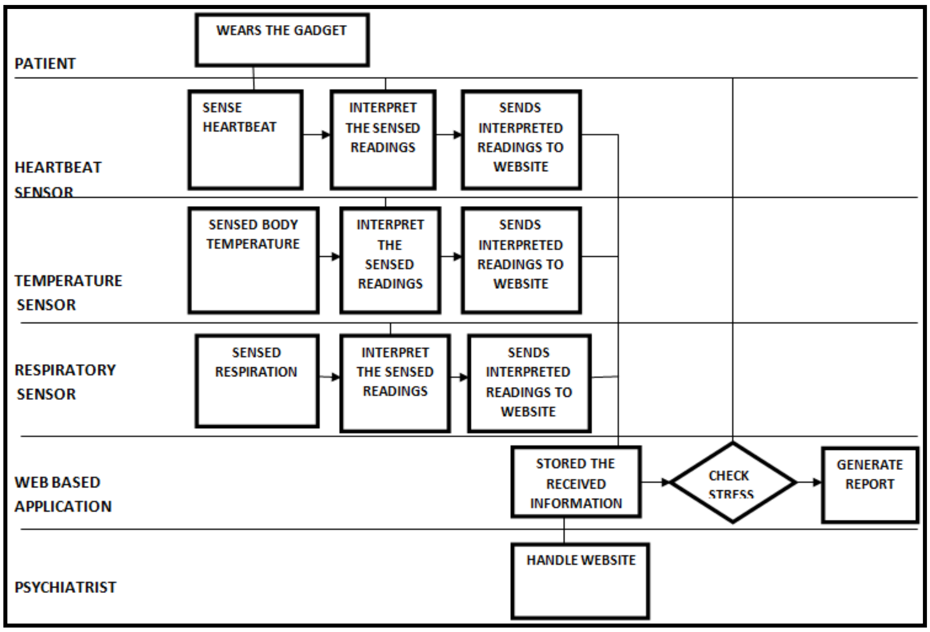

Figure 6. Workflow Diagram

The patient must only wear the gadget on their chest or hands during treatment. This gadget is wearable, and the patient can easily carry it.

The psychiatrist handles the website, and a straightforward questionnaire is added to the Web-based application that is only filled up by the psychiatrist at the website and checks whether it is an existing patient or to visit for the first time.

The heartbeat sensor is responsible for sensing the patient's heartbeat rate and sending the sensed readings to the website. The respiratory sensor is responsible for discerning the patient's respiration rate and transmitting the sensed readings to the website, as proposed by Pujar (2017).

The Photoplethysmograph is the idea behind how the Heartbeat Sensor works. This principle says that changes in how bright light passes through an organ can be used to measure changes in how much blood is in that organ.

A heartbeat sensor usually has an IR LED as the light source and a photodetector, such as a photodiode, an LDR (Light Dependent Resistor), or a phototransistor, as the detector. In a transmissive sensor, the light source and detector are placed so that they face each other, and the person's finger must be placed between the transmitter and receiver. On the other hand, a reflective sensor has the light source and detector right next to each other, and the person's finger must be placed in front of the detector.

A heartbeat sensor comprises a sensor and a control circuit. The clip-on Heartbeat Sensor's sensor comprises an infrared LED and a photodiode. The signal is transmitted to a microcontroller via a control circuit made up of an Op-Amp IC and a few additional components. Observing the Heartbeat Sensor's schematic will provide light on how it operates.

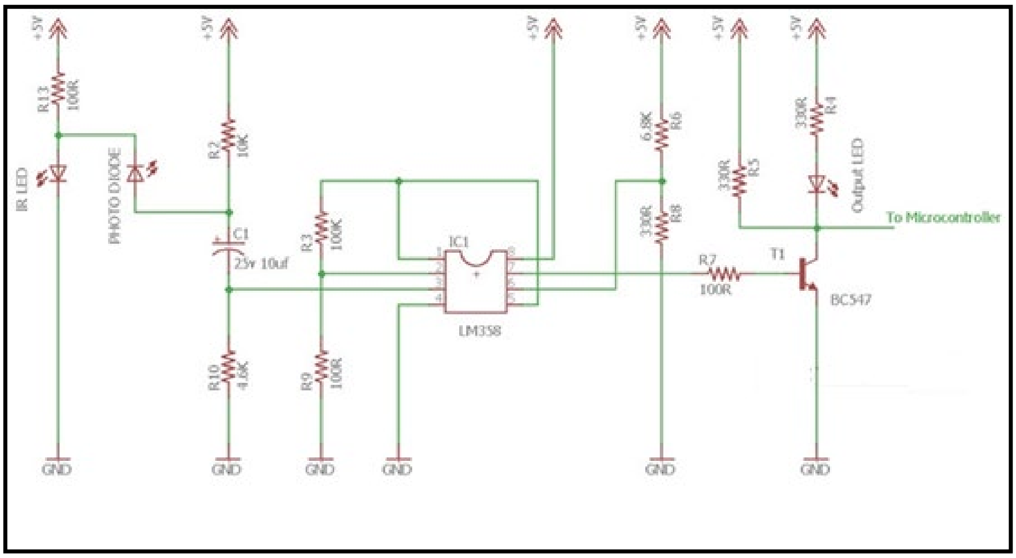

Figure 7. Control Circuit

Source: https://www.electronicshub.org/heartbeat-sensor-using-arduino-heart-rate-monitor/

The above circuit displays a pulse-detecting finger heartbeat sensor. Every heartbeat changes the amount of blood in the finger and the IR LED light travelling through it, which the Photo Diode senses. The photo diode's output is delivered to the first op-non-inverting amp's input through a capacitor that prevents DC components. The first op-amp was a non-inverting amplifier with a factor of 1001. The first op-output amp is fed to the second, which works as a comparator. The second op-amp triggers a transistor, which sends a signal to an Arduino microcontroller. LM358 is the Op-amp in this circuit. It has two op-amps on a chip, and a BC547 is used. An attached LED blinks when a pulse is detected.

The following graphic provides a schematic representation of the Arduino-based Heart Rate Monitor that incorporates the Heartbeat Sensor. The sensor consists of a clip that may be used to secure the user's finger and three pins that can link it to VCC, GND, and Data.

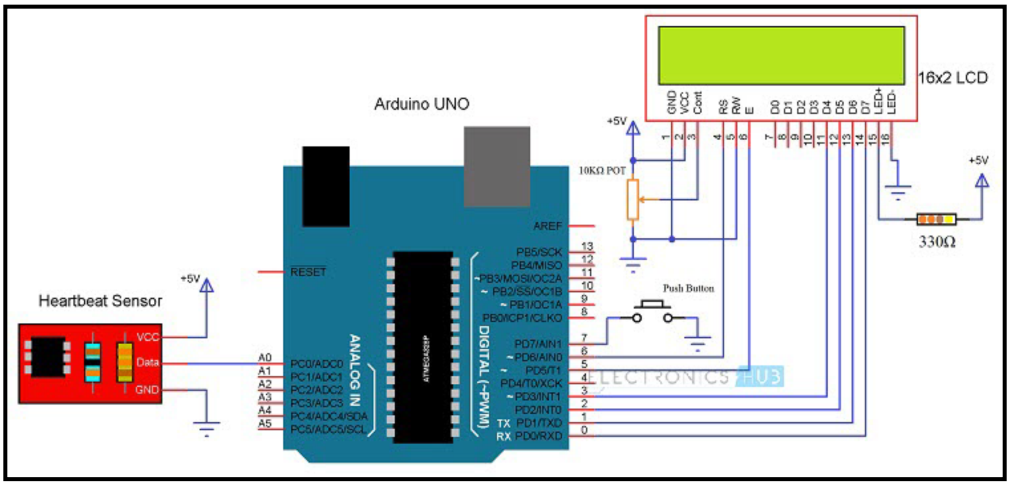

Figure 8. Circuit of Arduino-based Heart Rate Monitor using Heartbeat Sensor

Using a heartbeat sensor, an Arduino-based heart rate monitor system has a very simple circuit design. First, we connected a 162 LCD to the Arduino UNO so that the heartbeat readings are shown in beats per minute (bpm).

The LCD Module's four data pins (D4, D5, D6, and D7) are connected to the Arduino UNO's Pins 1, 1, 1, and 1. Also, Pin 3 of the LCD is connected to a 10K potentiometer (contrast adjust pin). The LCD's RS and E pins (3 and 5) are connected to the Arduino UNO's Pins 1 and 1. Next, connect the Heartbeat Sensor Module's output to Arduino's Analog Input Pin (Pin 1).

The body temperature sensor is responsible for sensing the patient's temperature and sending the sensed readings to the website. All these sensors are attached to the gadget, and these sensors have Bluetooth devices. Through Bluetooth, all tasks will be interpreted into the Web-based application. The Web-Based Application stores all these readings in the database generated for this application; also, one machine learning algorithm is implemented. Depending on the temperature it senses, a temperature sensor sends out a voltage signal that changes. It has three pins: one connects to the ground, another to 5 volts, and the third sends a variable voltage to the Arduino, like the analogue signal from a potentiometer. Several different kinds of temperature sensors are available. The TMP36 is a useful model because its output voltage is directly related to the temperature in degrees Celsius. We had put the TMP36 temperature sensor on the breadboard with the rounded part facing away from the Arduino (this is the default orientation). Also, we had put the temperature sensor in row E of the breadboard, as shown in figure 9. The left pin of the temperature sensor is connected to the 5V voltage rail, the middle pin to A0 on the Arduino, and the right pin to the GND rail.

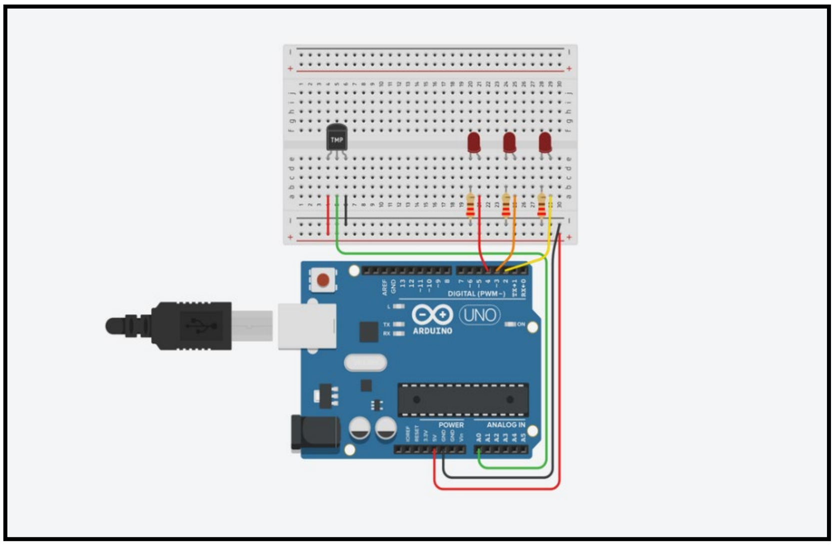

Figure 9. Temperature sensor
Source: https://www.makerguides.com/lm35-arduino-tutorial/

As observed in Figure 10, the module has only two pins. Moreover, that is I2C. I2C interface module sends or receives data. This interface must provide barometric pressure and temperature. Below is an ARDUINO BMP180 circuit schematic. The module is linked to +5V or the ARDUINO UNO Vout pin, as shown in the circuit diagram. A higher voltage than +5V can destroy the module. The figure shows I2C's interface. Connect the module SDA PIN to the ARDUINO SDA and SCL to the ARDUINO SCL. Connecting to the BMP180 sensor module is not easy—complex data interchange between ARDUINO and module. The protocol must be followed to send or receive data from a module. This procedure requires precise steps. Beginners will find these steps difficult. So utilize module-specific libraries. Libraries facilitate communication. Download and use these libraries in programmes. After including the header file, ARDUINO automatically decodes the relevant data. We can run the desired functions once we get this data.

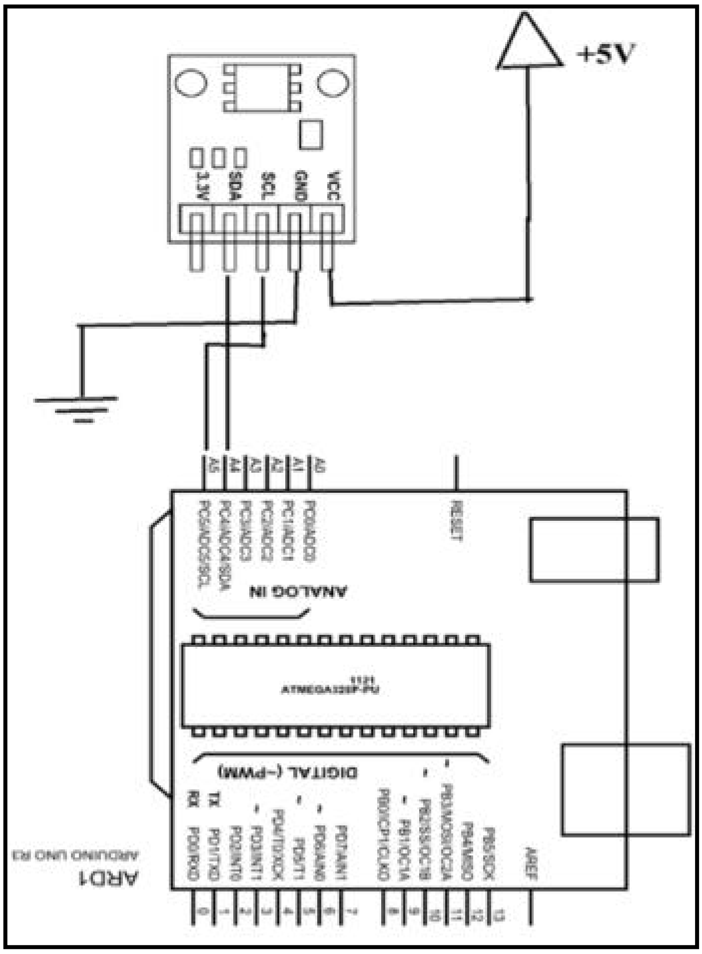

Figure 10. Respiratory sensor

Source: https://www.apogeeweb.net/circuitry/bmp180-pinout-feature specification.html

This machine-learning algorithm helps to evaluate the positive and negative emotions of the patient also. This algorithm categorizes these emotions by their respective percentages and recognizes whether the patient has positive or negative emotions. After getting one final result about the patient's emotion, determine whether this resulting emotion is negative or positive if the patient has a negative emotion that shows stress. Finally, the psychiatrist will generate a report about the patient's feelings, and data is maintained about the patient in the Web-based application database. Figure 6 gives the graphical depiction of the whole machine learning algorithm explained above in the form of a workflow diagram.

4.4 Entity Relationship

Entity-relationship (ER) diagrams are graphical representations of entities and their relationships to organize data in databases or information systems. Our project needed an ERD for these reasons. First, changing a database schema directly in SQL might be problematic, so we must plan the changes carefully to prevent destroying production data. The ERD lets us stay secure. We had to anticipate database design ideas using ER diagrams so we could discover problems and make corrections before implementing the changes. It is harder to diagnose database faults when it has multiple tables and requires complicated SQL to retrieve the needed information. By creating an ERD, we may visualize a database's schema. We can find and view entities' properties and relationships. All of this helps us evaluate databases and see problems. For example, our project generates a database into a Web-based application that records the patient's name, address, NIC number, and telephone number. It also maintains facts about patient visits, indicating whether it is an existing or new patient.

Figure 11 shows patient information tables, a login page, an end-of-treatment page, patient visits, emotion readings, sensors, and questionnaires.

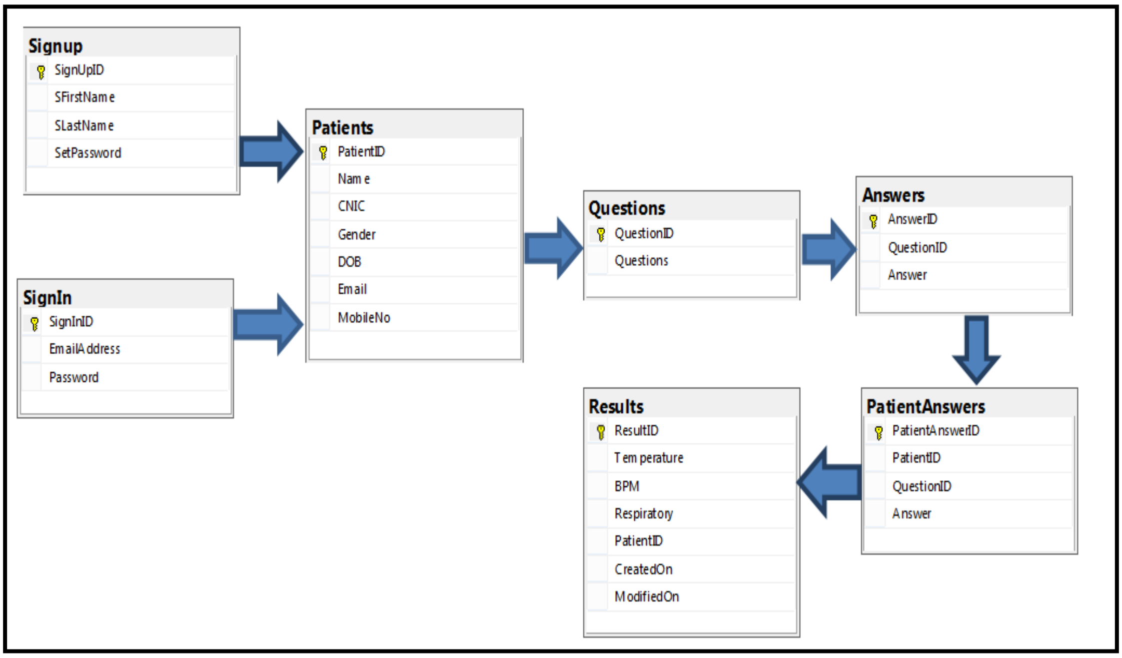

Figure 11. Entity Relationship Diagram

5. Methodology

In this system, the patient must wear a gadget on their chest that will be easy to carry. It is designed for stressed patients who wear this gadget for treatment, so the psychiatrist interprets their readings on the web-based application through sensors. Three sensors are attached to this gadget that help sense the human heartbeat, temperature, and respiration with the help of heartbeat, body temperature, and respiratory sensors. In this system, one questionnaire is added that helps increase the system's accuracy. Our system detects eight emotions and categorizes them into four positive and four negative emotions. Four positive emotions include excitement, happiness, contentment, and relaxation) while four negative emotions are (anger, anxiety, depression, and sadness). A graph is made that helps to determine the hyper states of these two types of emotions. The psychiatrist handles the whole system. Implementing a machine learning algorithm on a web-based application helps to categorize emotions. These emotions can be ordered in terms of percentages. When one emotion is evaluated through this algorithm, psychiatrists generate a report about the patient's feelings.

System integration is a process in engineering that combines the parts of subsystems into a whole system (a collection of subsystems that work together so that the entire system can do what it is supposed to do). It verifies that the subsystems work and are also used in information technology.

From the perspective of information technology, hardware refers to the physical part of any device. However, the software is in the form of instructions, and hardware is the thing on which software can be stored and run. The hardware in our project is related to the heartbeat sensor by Electronics Hub (2017), respiratory sensor, and body temperature sensor as experimented with by Grusin (2017).

The photoplethysmography principle is the foundation for the heartbeat sensor. It does so by measuring the variation in blood volume that occurs via any body organ, which produces the variation in light intensity that occurs through that organ (avascular region). When it comes to applications in which the user wants to monitor the heart rate, the timing of the pulses is of greater significance. Since the blood absorbs light, the signal pulses are comparable to the heartbeat pulses. The rate of heartbeats determines the flow of blood volume, and since the blood absorbs light, the signal pulses are equivalent to the heartbeat pulses. We are going to incorporate the sensor into the device. We will also establish a connection to the website so that the values that we get from the sensor can be interpreted on the website.

The following are some of the functions performed by the heartbeat sensor (Valenza, Lanatà, Scilingo & Barbieri, 2013) in our project:

- detects the victim's heartbeat rate
- interprets the information detected
- sends the information that has been interpreted to a web-based application.

This sensor allows you to measure body temperature. The temperature of the human body helps to detect emotion due to the characteristic changes in body temperature. For example, it can see the person's readings in Fahrenheit. We will integrate this sensor into the gadget and connect it to the website so the lessons we will obtain through this sensor can be interpreted on the website.

The functions of the heartbeat sensor in our project include:

- senses the temperature of the victim.
- Interpret the information sensed.
- Send the interpreted information to the Web-based application

Through this concept, we will develop a respiratory sensor as depicted in Figure 8 from a – c, that helps determine the pressure of human breathing, and through this concept, we will get the person's respiratory rate. We will integrate this sensor into the gadget and connect it to the website so the readings we will obtain through this sensor can be interpreted on the website.

The functions of the heartbeat sensor in our project include:

- Senses the respiratory rate of the victim.
- Interpret the information sensed.
- Send the interpreted information to the Web-based application.

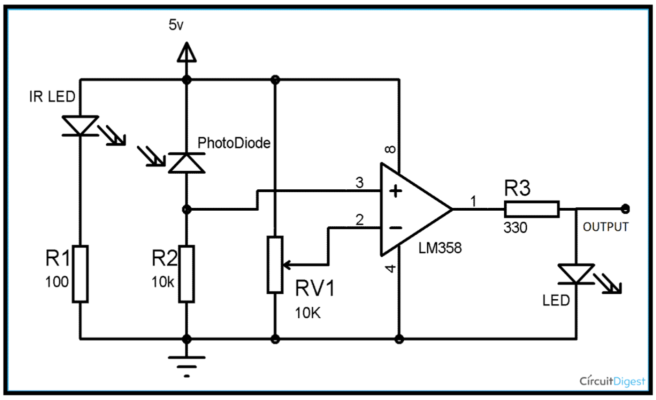

Figure 12 (a). Logic Diagram of Heartbeat Sensor

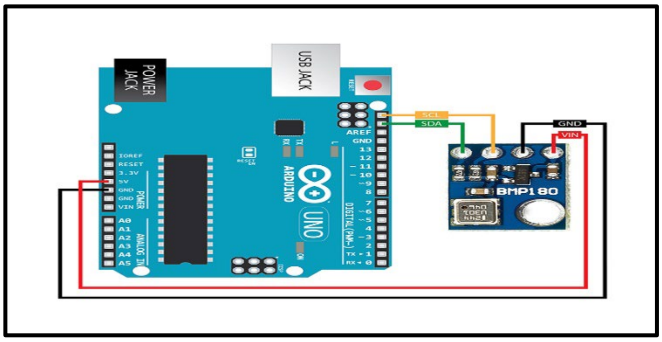

Figure 12 (b). Circuit Diagram of Respiratory Sensor

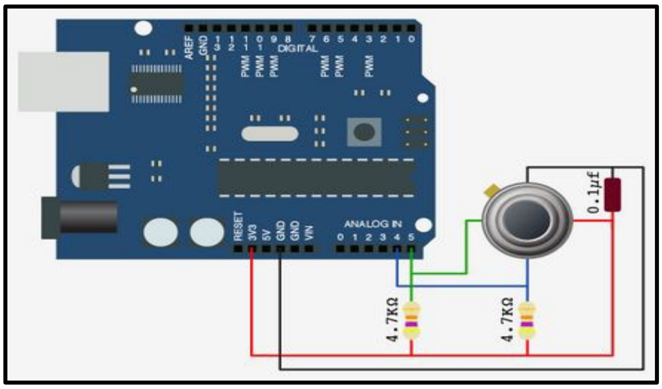

Figure 12 (c). Sensor-Circuit Diagram of Body Temperature

Software is a general term used for various programs to operate computers and related devices. Our system is a web-based application. The website framework is generated through MVC. This website is generated to receive information from these sensors (Respiratory, Heartbeat, and Body temperature). Figure 9 shows the Work Breakdown Structure depicted through the function of the Web-based application in our project, including:

- Compare the data received from the pre-defined condition.
- Check whether the patient has stressed or not
- Then, in the end, a report is generated about the patient emotions.

We arrange our website's graphic elements through layout design to produce a master plan or blueprint (such as colours, illustrations, headlines, body copy, and scale) for maximizing information flow and eye mobility. We construct the graphic elements' relative importance, relationships, and appearance. Before the final layout for printing or production, various forms (called roughs) are created to see alternative groupings and discover the ideal design for our website.

ASP.Net is used for the development of the website. Through programming, we have developed:

- Database for maintaining the record of a person's emotions
- An algorithm that provides help in the categorization of emotions
    - o Decision Trees are a type of Supervised Machine Learning (that is, you explain the input and the corresponding output in the training data) where the data is continuously split according to a certain parameter. Two components can be used to describe the tree: the decision nodes and the leaves. The leaves represent the decisions or the consequences in their entirety. The decision nodes are the points at which the data are divided.
- Added a simple questionnaire on this website, as shown in Figure 13.

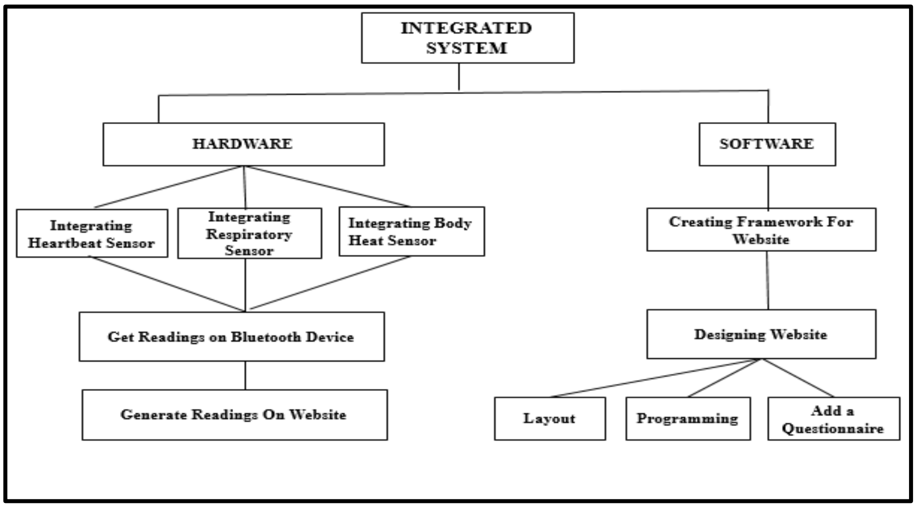

Figure 13. Work Break Down Structure

6. Implementation

As shown in Figure 14, A login page of our project Psycaria has been designed that only logs in by the psychiatrist consisting of First name, Last name, Email Address, and Password.

Figure 14. Login Page

Whereas Figure 15 is a mere depiction of the Registration Form created for the different types of users.

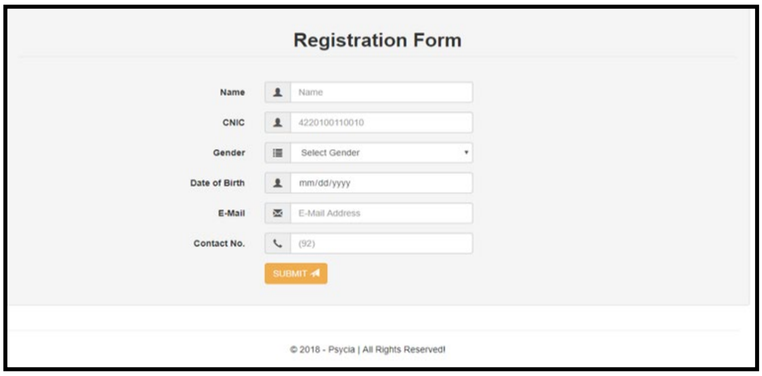

Figure 15. Registration Form

On the registration form, add the fields of Name, CNIC, Gender, Email Address, and Contact. No, these are the details of patients, and the questionnaire shown in Figure 16, contains just Yes/No-natured questions.

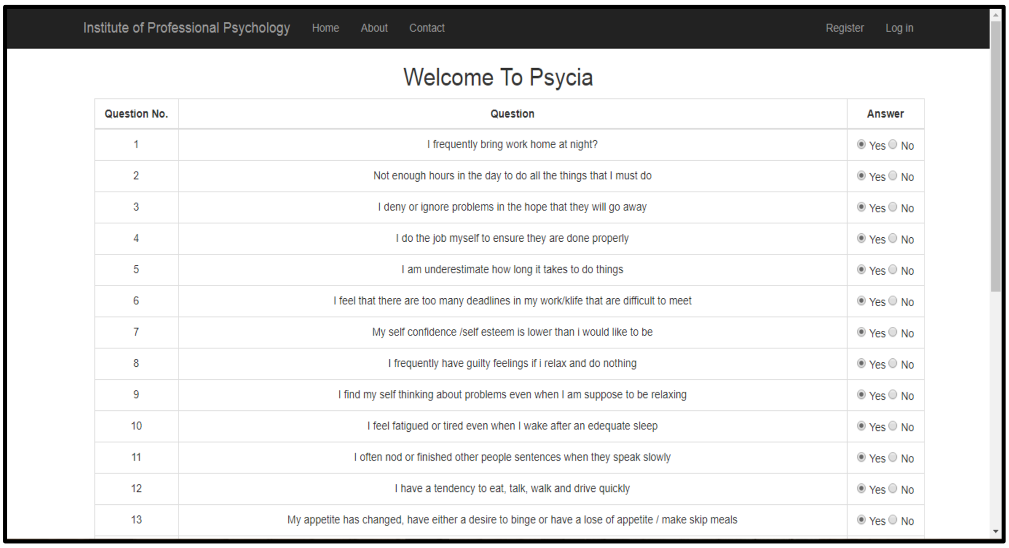

Figure 16. Questionnaire

7. Results

When the test is conducted, in the end, we obtain the final result about the emotion of the person, one such result is presented in Figure 17.

Figure 17. Result of human emotion

Based on the modules mentioned above, we obtain readings of the person's heartbeat, respiratory, and body temperature through the hardware, as shown in Figure 18. Based on these readings, the algorithm evaluates the final emotion of the person and, in the end, gives the result of the person's feelings.

When all these sensors are attached to the human body, we successfully achieve our results and get the final emotional impact on the person.

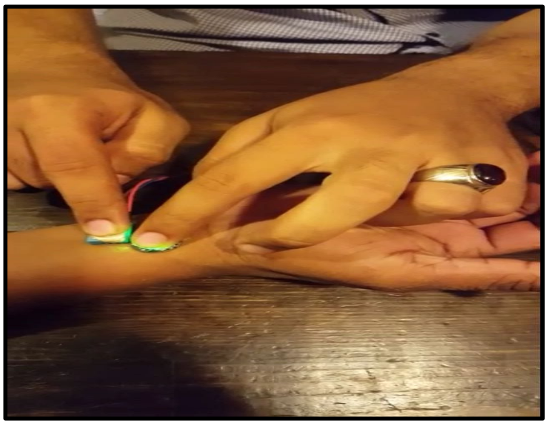

Figure 18. Readings of all three sensors

Once the sensors come in contact with the human interface, it starts generating the set of values we have been discussing in a manner as shown in Figure 19.

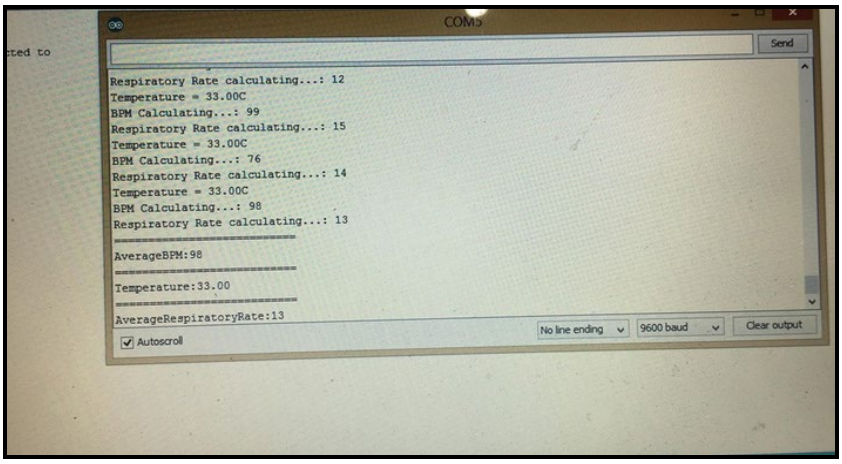

Figure 19. Readings of all three sensors

8. Conclusion

This project presents a smart technology that sensors can recognize a person's emotions. It also provides a technological alternative to manual systems, saving psychiatrists time and effort. Our method uses emotion recognition technology to identify stress indicators. The gadget in our approach serves as a detector for measuring heartbeat, respiration, and body temperature. The machine learning algorithm evaluates the person's emotions. Psycaria is a unique initiative that senses eight human emotions for stress. Psycaria recognizes both negative and pleasant emotions. Psycaria is an efficient and clever treatment for both psychiatrists and stressed patients. Psycaria protects stressed patients from deadly diseases. Psycaria addresses the issue of psychiatrists detecting how severe stress is in victims when they cannot articulate their emotions through words or when they feel angry when telling the psychiatrist about their condition. This identical instance is found in youngsters since kids cannot explain their situation clearly and do not grasp what they feel. Thus, such people who hide their emotions or sentiments do not express them in front of anybody, even a psychiatrist; therefore, this technology answers the greatest difficulty of psychiatrists.

No emotion-detecting equipment can quantify stress symptoms. Psycaria (a human emotion-detecting device) proposed this solution through emotion detection. This device also suggested accurate readings compared to existing solutions like the Facial Recognition. This device also measures mood swings, but this device's results are not precise because the Facial Recognition device physically measures mood, which sometimes proves wrong. For example, if a person is sad from the inside but shows a happy face from the outside (Cho, Pappagari & Kulkarni, 2019), this device Psycaria's sensor is more accurate than facial recognition.

9. Future Work

9.1 Emotion Recognition with Deep Neural Networks:

Neurons manage emotions better, so neural networks improve this project. Deep learning approaches can learn good representations for varied methodologies. For example, the gap between state-of-the-art deep neural network techniques and human performance is narrowing for several computer vision benchmarks. Networks learn feature hierarchies. Deeper hierarchies indicate a more abstract approach. This implies applying machine learning to facial analysis and emotion recognition. This study is based on a preliminary study and three emotion recognition articles.

Recurrent Neural Networks (RNNs) can handle this issue by summarising frames in a real-valued state vector updated at each step. RNNs enable data-driven aggregation learning. The second paper explores CNN's RNN for video emotion recognition. RNN outperforms pooling-based classification methods. It also fuses models at the feature and decision levels—the same activity pipeline as before, plus RNN.

An RNN's neuronal attention mechanism ignores possible distracters in input frames and focuses on task-related information. The approach uses a modular neural architecture with three components: a recurrent attention module that controls where to look, a feature-extraction module that represents what is seen, and an objective module that explains why the behavior is learned. Each module allows gradient-based optimization. Such a framework might construct an end-to-end emotion recognition solution. 2016

9.2 Neural Networks for Emotion Classification:

AI aims to understand the brain. Artificial neural networks were created to mimic human brain neural networks as shown in Figure 20. Brains have ten neurons. Each neuron has a cell body, dendrites that bring in electrochemical information, and an axon that sends it out. A neuron's axon produces output as proposed by Sun (2003).

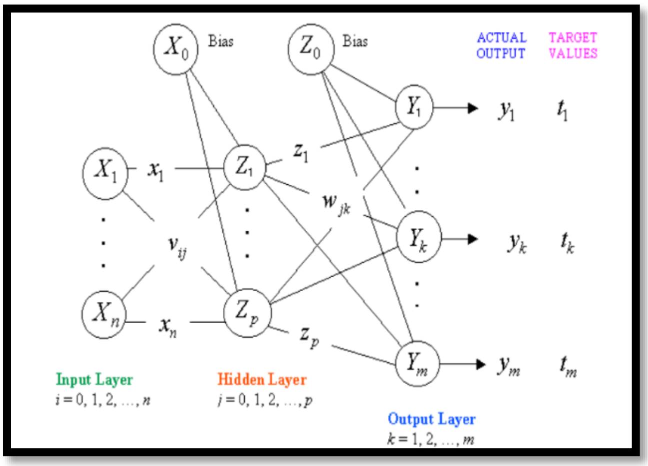

Figure 20. The complete figure of one hidden layer network with multiple neurons

Give details on neural network design for emotion recognition. The Face Tracker inputs 12 neural network input nodes to get 12 features. Multiple networks include 2–7 output nodes representing emotion types. Neural networks have one or two hidden layers and 1 to 29x29 hidden nodes. Training automatically adjusts the learning rate, momentum number, and sigmoid activation function parameter. Few networks consider Powell's method, while others incorporate practical ways, i.e., picking the peak frames of the emotion data sequence, sorting the training set, eliminating some emotions, normalizing the output, setting the threshold to the weights, etc. The test results use Kahou (2016) and the authentic database. Sigmoid was the activation function. The following sections describe all parameters and their experimental combinations.

9.3 Emotion Recognition using Wireless Signals:

As much more concepts and research are made that can tell you, understanding someone else's emotions can be a challenging task. Facial expressions aren't always reliable: A smile can conceal frustration, while a poker face might mask a winning hand. They detect emotions through sensors, but it could also become a wireless system to detect persons' emotions using wireless signals in the future (Zhao, Adib & Katab, 2016).

9.4 Emotion recognition using web mining:

Web Mining is a technology that uses text, photos, and audio files to extract documents from the web so that patterns can be explored and analyzed. Mining the web can also extract the opinions and thoughts of people who use social media to analyze their feelings. Microblogging allows social media users to talk about their lives, express their ideas, and discuss current events. Twitter, Facebook, and Instagram are three examples of currently popular micro-blogging platforms. Other messaging apps like WhatsApp, Telegram, and WeChat are also available.

Everyone has the right to speak their mind and share their perspectives on virtually any topic in this social media space. However, borderless access on social media platforms enables users to publish content on any topic of their choosing to split up. In most cases, it can lead to opinion disagreements, and even worse, it may spark intense disputes over a topic on various social media platforms. Due to these concerns, immature users, such as teenagers, may experience shifts in their emotional state. For example, the status updates (tweets) and subsequent replies on social media platforms like Twitter represent the range of emotions that users are experiencing at any given moment (retweets). Consequently, in severe circumstances, individuals risk developing mental diseases such as sadness and feelings of isolation.

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We are overjoyed in all modesty and gratefulness to acknowledge our appreciation to all of those who have helped us to put these concepts together, much above the level of simplicity and into something tangible. We are overwhelmed. We want to use this opportunity to extend a heartfelt expression of appreciation to the administrations of each of our universities for the substantial support they provided in assisting us and making it possible for us to carry out the research work with such diligence. Without the support and understanding of our families and friends, none of our endeavors, no matter how difficult, will ever be finished to our satisfaction. Throughout this article, our support staff assisted us in accumulating information and data and conducting research, and we would like to express our gratitude to them. In conclusion, each author of this study owes a debt of gratitude and praise to the other authors for their thoughtful support and timely correspondence, even though we all lived in different parts of the world, which contributed to the singularity of the research.

References

Administrator, (2017, November). Heartbeat Sensor using Arduino (Heart Rate Monitor). A post at *Electronics Hub* is available at *https://www.electronicshub.org/heartbeat-sensor-using-arduino-heart-rate-monitor/.*

Jaejin C., Raghavendra P., Purva K., Jesus V., Yishay C., & Najim D. (2019, November). Deep neural networks for emotion recognition combining audio and transcripts. *arXiv:1911.00432v1 [eess.AS]*.

Andrius D., Arturas K., & Vytautas B. (2020, January). Human Emotion Recognition: Review of Sensors and Methods. *MPDI*, Sensors 2020, 20(3), 592.

Garcia G. J. M., Penichet Victor M. R., & Lozano Maria D. (2017, September). Emotion detection: a technology review, Interacción. In Proceedings of the *XVIII International Conference on Human-Computer Interaction*.

Mike G. (2017). Barometric Pressure Sensor Hookup. A post at *Spark Fun* is available at *https://learn.sparkfun.com>tutorials>under-pressure*.

Jingsha H., Jin Y, Li P., & Jianxi W. (2021, July). Multimodal Fusion Emotion Recognition Method of Speech Expression Based on Deep Learning. *Frontiers in Neurorobotics*.

Ebrahimi K. S. (2016). *Emotion recognition with deep neural networks*. The University of Montreal.

Stefanos K., Karpouzis, & Kostas. (2016). Multimodal Emotion Recognition. *Frontiers in Neurorobotics*.

Leh L., Chih-Chang H., & Hsueh-Yen L. (2010). Image processing-based emotion recognition. In *International Conference on System Science and Engineering, 2010 IEEE.*

Ravi P. (2017, April). How a heartbeat sensor works. In *Embedded World*.

Tauseef Q. M., (2012, February). Human Emotion Recognition Using Smart Sensors, Electronics and Communication Engineering - School of Engineering and Advanced Technology Massey University Palmerston North, New Zealand. A post at *academia.edu* is available at *https://scholar.google.com.pk/scholar?q*.

Yafei S. (2003, August). Neural Networks for Emotion Classification. At *Leiden Institute of Advanced Computer Science*, 1105, 1105.6014.

Valenza G., Citi L., Lanatà A., Scilingo E. P., & Barbieri R. (2013). A nonlinear heartbeat dynamics model approach for personalized emotion recognition. In *35th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)* on (pp. 2579-2582) doi: 10.1109/EMBC.2013.6610067.

Johannes W., Florian L., Tobias B., Ionut D., Felix K., & Elisabeth A. (2013, October). The social signal interpretation (SSI) framework: multimodal signal processing and recognition in real-time. In Proceedings of the *21st ACM international conference on Multimedia*.

Wioleta S. (2013). Using physiological signals for emotion recognition. In *6th International Conference on Human System Interactions (HSI*), 2013 on (pp. 556-561) doi: 10.1109/HSI.2013.6577880.

Mingmin Z., Fadel A., & Dina K. (2016, October). Emotion Recognition using Wireless Signals. In *MobiCom'16 ACM*.

Razak Z. I., Abdul-Rahman S., Mutalib S. & Abdul Hamid N. H. (2018). Web Mining in Classifying Youth Emotions. *Research Initiative Group of Intelligent Systems. Malaysian Journal of Computing 3 (1): 1–11, 2018. https://ir.uitm.edu.my/id/eprint/43157.*

W. Widanagamaachchi, A. & Dharmaratne, (2009), Emotion Recognition with Image Processing and Neural Networks, *Computer Science, Semantic Scholar.*

Rahdari F, Rashedi E. & Eftekhari M., A Multimodal Emotion Recognition System Using Facial Landmark Analysis (2019), *Iranian Journal of Science and Technology, Transactions of Electrical Engineering volume 43, pages171–189.*

Zhao M., Adib F., & Katabi D. (2016), Emotion recognition using wireless signals, *Conference on The 22nd Annual International Conference on Mobile Computing and Networking (Mobicom'16).*

Iggy, BMP180 Sensor: Pinout, Feature, Specification, 20 Jan 2022 *https://www.apogeeweb.net/circuitry/bmp180-pinout-feature specification.html.*

Makers Guide, Benne, Published: October 27, 2020 - Last updated: March 2, 2022, LM35 analog temperature sensor with Arduino tutorial, *https://www.makerguides.com/lm35-arduino-tutorial/*

Electrnoics Hub, Heartbeat Sensor using Arduino (Heart Rate Monitor), November 4, 2017 *https://www.electronicshub.org/heartbeat-sensor-using-arduino-heart-rate-monitor/*