

IoT Application: Human Emotions Management System

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Abstract: *Mental stress, depression and anxiety are the major problems in our community, as these are the source of many health issues like hypertension, heart attack or even sudden deaths and self-annihilation. To reduce stress, it is necessary to predict it in its early stages before turning into chronic and irreversible damages. Generally, all these problems can be detected by counselling, questioner or observing a person for a long time. But we will focus on changes that occur in human body when he/she is in stress, depression or anxiety. We will monitor the heart beat and detect emotional changes occurred in a person when he/she is in stress, depression or anxiety. On detecting we will send an intimation message to their family member so that they will help that person to come out of his/her situation.*

Index Terms: GSR Sensor, ECG, Stress, Anxiety, Depression

I. INTRODUCTION

INTERNET of things (IoT) is a network of devices in which physical objects are connected through the internet. These objects contain Embedded innovation to collaborate with internal states or the external environment. At the point when these objects detect and convey, it changes how and where choices are made, and who makes them. It is a modern wireless communication technology having its application areas in different enhanced domain areas. The basic idea of this thought plan is the unavoidable closeness around us of an collection of things or articles, for instance, Radio-Frequency Identification(RFID) labels, sensors, actuators, cell phones, and so forth. IoT has its application under different domains such as personal home automation system, smart environment, medical and health Care, smart metering, smart grid, and smart water monitoring system, energy management and so on. With the improvement of computers and data technology, there has been important improvement in the use and development of electronic devices in medical sciences, and with the flowering of IoTs, the medical IoT has slowly however steady penetrated itself into lives of people. The Internet of Things in medical Field had been seen as a way in which technology has helped in embedding wireless sensors in medical devices which then gets linked with the world wide web and interacts with patients, hospitals and medical devices to make use of the new development in the model of modern medical.

A. Application Domains in Health Care

1) Health Care: Fitness Care, Disease Prevention, Food Monitoring.

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2) Home Care: Mobile Health, Self-Management.

3) Acute Care: Hospital, Nursing Home, Speciality Clinic.

B. Challenges in Health Care

1) Adherence monitoring: Doctors don't have the way to more readily survey whether their patients are following endorsed treatment that may incorporate prescription, recovery activities, and preventive exercises. For example, diet shirking. It is very regular that absence of grip expands the danger of hospitalization and subsequently, builds the monetary weight for patients and their families.

2) Restricted and Anticipated time: The expansion in the people brings about expanded illness and incapacity limits specialists to inspect every patient with quality time. Due to the brief timeframe of screening, doctors come up short on the everyday schedule of the patient. For example, physical movement, diet, rest and public activity, every one of these traits are similarly significant in the determination and treatment process.

3) Combination of multiple devices and protocols: The decent variety of gadgets engaged with systems is another test for the achievement of IoT in medicinal services. Assuring that different gadgets are associated with one another and that numerous patients discuss viably with one another is an issue. The difficulty lies in the way that numerous gadget producers don't have a concurred set of correspondence conventions and measures. Although an assortment of cell phones can be associated with the system and effectively gather information, diverse correspondence conventions confound the collection procedure [7].

The security challenge, which includes managing credentials and controlling access to tolerant patient requests and classified data. For instance, medicinal services suppliers are permitted access to gadgets in light of interest from the patient's sensor gadgets, yet the Internet association utilized might be an open or shaky Wi-Fi arrange that can without much of a stretch be man-in-the-middle.

TABLE I: Literature Review of Existing Methods

Title of the Paper	Methodology	GSR	ECG	Drawbacks/Limitations
Detecting stress during real world driving tasks using physiological sensors	This work presents strategies for gathering and breaking down physiological information during real world driving undertakings to decide a driver's relative stress level [1].	Yes	Yes	if we are fixed to only one type of sensors there are chances for missing some emotions and change in levels of depression and anxiety and some of the emotions can't be perfectly found by ECG sensors/GSR sensors
Activity aware mental stress detection using physiological sensors	This work suggests some experiments have been conducted in the real world [2]. The target of this analysis was to test the possibility of utilizing appropriate sensors and remote innovation to evaluate the automatic capacity and stress level in the mobile setting [3].	Yes	Yes	They estimated drivers' Stress responses by checking numerous physiological signs, for example, ECG, GSR, electromyogram (EMG), and respiration in a prescheduled route setting
ECG and GSR measure and analysis using wearable systems	A wearable depression monitoring framework is proposed with an application-specific framework on-chip (SoC) arrangement. The SoC is intended to accelerate the separating and highlight extraction of pulse inconstancy (HRV) from the electrocardiogram (ECG) [4]. They have expressed the representation intensity of NCPA for the depiction of cardiovascular beats. The portrayal power was showed by high paces of effective grouping in the segregation issue among ischemic and ordinary beats [5].	Yes	Yes	Wires represent the simplest and least expensive manner to transfer information from the sensors to the most unit. However, this approach is intrusive and presents the chance of wire tangling, which can result in failure of the system.
Wearable Depression Monitoring System with Heart-rate Variability	They have considered the impact of Stress/anxiety states on EEG signals during video meeting [8].	No	Yes	The smart phone application trains and classifies the user's scale with 71% of accuracy
ECG analysis using nonlinear PCA neural networks for ischemia detection	This work presents a machine learning approach for pressure discovery on individuals utilizing wearable physiological sensors with the last point of improving their personal satisfaction [10].	No	No	The method is designed to work on a file-to-file basis, meaning that training is done for each patient separately
Detection of stress/anxiety state from EEG features during video watching		No	No	There is not an accurate map- ping of stress and anxiety to the model
Stress Detection using Wearable Physiological Sensors				The approach is able to analyse the state of the subject at any instant and decide about his/her stress situation

II. LITERATURE SURVEY

Some of the previous works describing the usage of the GSR, ECG, the methodology followed with its advantages and disadvantages are discussed in the Table 1. Which gives a proper guidance for the work which we have proposed.

III. SYSTEM DESIGN

A. Stress

Stress is an impulse of Physical Tension and also could be a bodys methodology for reacting to any form of interest. It aims to be brought about by both great and terrible encounters. At the point when individuals feel worried by

something going on around them, their bodies respond by discharging synthetic substances into the blood. Different types of stress are Acute stress, Episodic acute stress and Chronic stress [11].

B. Anxiety

Anxiety is the point at which a person feels stressed long after the actual event has passed. This consistent feeling of being stressed, despite the fact that the stimulus doesn't exist any longer is what is classified as anxiety. These emotions simply beat under the surface and show themselves in you as a persistent day by day anxiety, dread, or frightful inclination in the pit of your stomach or chest, especially



when you're reset in an awkward circumstance, or are relied upon to come back to the area of a damaging occasion. Stress over friends and family, menaces, work pressures, all these are instances of continuous focused on emotions that can be called tension. Social uneasiness is something that has been seen to be on the ascent [8].

C. Depression

Depression is something beyond feeling down. While about us all vibrate pitiful, cranky, or down every once in a while, individuals who are discouraged have these emotions significantly more strongly and for longer periods of time, often for weeks, months, and even years. They think that it's difficult to work, and because of the disgrace appended, do a great deal to shroud their downturn. Depression is one of the most well-known psychological illnesses we have in the society today, and it has been evaluated that one of every five individuals will encounter it at some phase in their life. Depression is ordered as far as its seriousness: mellow, moderate and extreme [12].

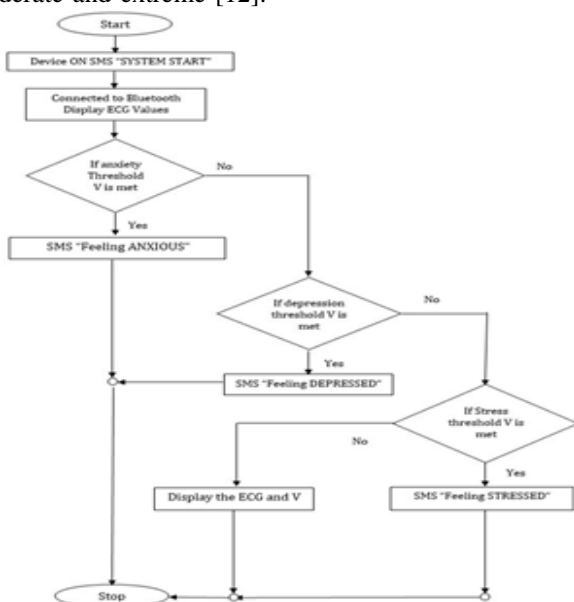


Fig. 1: Process Flow of Human Emotions Management System

Figure 1 describes about the work flow of the project. The device gets switched on and it send a SMS as system alert from the GSM module and it will connect to the Bluetooth module when the pairing is done and it will display the ECG values. Based on the ECG Values it is going to check if the anxiety threshold is met or not if it is met it is going to send a message as feeling anxious. If the anxiety threshold is not met it is going to check if the depression threshold is met or not if it is met it is going to send a message as feeling depressed. If the depression threshold is not met it is going to check if the stress threshold is met or not, if it is met it is going to send a message as feeling stressed. If the stress threshold is not met it is going to display ECG Values and threshold V.

IV. EXPERIMENTAL SETUP

A. Arduino Mega 2560

The Arduino Mega 2560 is a microcontroller board. It has 54 digital input/output pins, 16 analog inputs, 4 UARTs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset

button.



Fig. 2: Arduino Mega 2560

A. GSR Sensor

GSR represents galvanic skin reaction, is a technique for estimating the electrical conductance of the skin. It estimates changes in sweat organ action on the skin as a sign of physiological or mental excitement, utilizing changes in skin conductivity. During stress, opposition of skin drops because of expanded emission in perspiring organs [6].



Fig. 3: GSR Sensor

A. ECG

Electrocardiogram (ECG) signal can be utilized so as to identify whether the individual is Stressed. Electrocardiography is a technique utilized in estimating the electrical movement of the heart. The ECG records the electrical movement that outcomes when the heart muscle cells in the atria and ventricles contract. Fig.4 is the ECG hardware that is commonly utilized for pulse observing [9].

B. GSM Modul

GSM/GPRS module is employed to set up consistency among a PC and a GSM-GPRS framework. It is developed at Bell Laboratories in the year 1970. It operates at different frequencies like 850MHz, 900MHz, 1800MHz and 1900MHz.



Fig. 4: ECG Module

B. Wiring Diagram

available to be paired with your mobile so click on connect. The device gets paired up and will start plotting the graph.

Whenever the person is under stress or anxiety or depression an intimation message is sent to the family member or friend so that they can come out of their state. The below three figures are the text messages received to the mobile via GSM module when the

V. CONCLUSIONS

In our work we proposed a multi-model system that combines ECG and GSR sensors for intimating and monitoring the stress, anxiety and depression levels of a person. We used the ECG for monitoring the heart rate of the person by displaying the value on the LCD and as well sending this data via Bluetooth module to an app to plot the ECG graph on the mobile phone. The GSR sensor is placed on to the



Fig. 5: GSM Module

person is under stress, anxiety and depression. The figures 8,9 and 10 shows the messages received by the care taker/ say family member/ friend when the respective thresholds are met. Wiring diagram is representation of an electrical circuit in a pictorial manner. The wiring diagrams show the estimate locations and interconnections of receptacles, lighting, and permanent electrical services in an exceedingly building. it shows the different parts of a circuit as shapes, power and signal connection between the devices. Interconnecting wire routes could also be shown just about, wherever explicit receptacles or fixtures should air a typical circuit. Below is the Fig. 6 which tells how the wiring diagram looks like in our project.

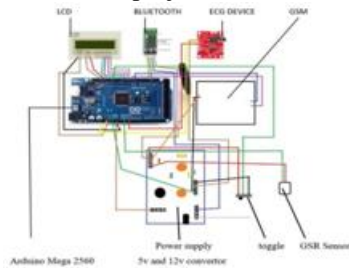


Fig. 6: Wiring Diagram

Figure 7 shows how the pairing is to be done with the HC- 05 and mobile app. ECG device sends its data via a Bluetooth module called HC-05 so that a graph can be plotted to monitor the heart rate. When the device id turned ON the HC-05 module is ON and then you need to turn ON the Bluetooth in your mobile to get connected. The HC-05 device will be



Fig. 8: SMS received when the person is under Stress

Fig. 9: SMS received when the person is in Anxiety



TABLE II: Test Cases on Execution

Test Case Description	Input Given	Output Expected	Actual Outcome	Observation
When device is ON the	Power is supplied to ON device	LCD should display SYSTEM STARTS, send SMS, devices must blink	As Expected	Successful
GSM initialization	When device is ON	LCD displays GSM initialized	As Expected	Successful
Bluetooth HC-05 Working the	Power is supplied to ON device	Starts to blink	As Expected	Successful
Pairing of Bluetooth HC-05 with mobile App	ON mobile Bluetooth	Display HC-05 as a device to be paired with mobile	As Expected	Successful
ECG Working the	Power is supplied to ON device	Starts to blink	As Expected	Successful
ECG placed onto person persons	Three strips placed on hands and leg	Displays the readings on LCD and graph on App	As Expected	Successful
ECG not placed onto a person on	Three strips not placed persons hands and leg	No graph is plotted on App	As Expected	Successful
GSR to detect stress display	Given a threshold value	When threshold met STRESSED	As Expected	Successful
GSR to detect anxiety display	Given a threshold value	When threshold met display ANXIETY	As Expected	Successful
GSR to detect depression display	Given a threshold value	When threshold met DEPRESSED	As Expected	Successful

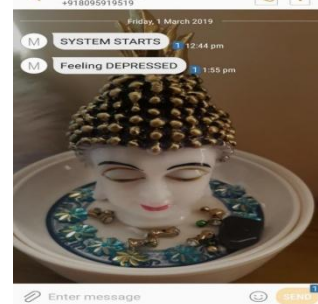


Fig. 10: SMS received when the person is in Depression

finger and it works on the skin conductance i.e. based on the sweat secretions and with the help of certain threshold values. When these thresholds are met an intimation message in the form of text SMS is sent to the saved contact details of that persons family or close friend intimating about their state so that they will help them to overcome from it, and also on the LCD display these states i.e. stressed /anxious/depressed id displayed if the person is in that state.

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AUTHORS PROFILE



Gunti Spandan is an Assistant Professor, Computer science and Engineering. GITAM School of Technology, Bengaluru Campus. Overall, He is having 6 years of teaching experience. He did his BE in Computer Science and Engineering from HMSIT College of Engineering Tumkur and his M. Tech in Computer Science and Engineering from School of Technology Jain University Bangalore. His area of research is Internet of Things, Cyber Security, He published papers in different areas like wireless sensor network, Internet of Things, and He is certified with Advanced RPA Professional by Automation Anywhere.



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