Stress Detection using Android Application

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Abstract - *In the world of today, stress has become an unavoidable factor of everyone's lifestyle. The analysis of stress experienced by individuals entitles stress management and prevention with the aim to prevent psychological and physiological harm from extravagant amount of stress. In this work, we present an android application which will detect stress levels using various signals from different sensors like accelerometer, biometrics, heart rate present in the mobile phone which will notify the user who has exceeded the average line of stress and if the stress has reached its extreme level an alert message will be sent to the person whose contact number will be provided by the user at the time of registration which will also be verified. In this application, we will additionally provide helpline number for people who appear to be under stress. This application will not only help the user to understand their personal stress patterns in a more efficient way but will also provide the physician with a trustworthy data.*

Key Words: stress detection, heart rate, step count, android studio, mobile sensors, exercise

1. INTRODUCTION

In modern society, working environments are becoming more stressful. Stress represents a kind of mental tension that is experienced by each person in his daily routine. Human stress leads to mental as well as social problems, lack of clarity at work, limited working relationship, depression and lastly commitment of suicide in severe cases. Stress is a key factor that causes physical or mental tension. Stress is, furthermore, a condition observed by almost everyone of a different age group. It can be both helpful and harmful and if it is harmful, it needs to be managed properly in his/her primary stages. This mobile application will help to keep the daily stress levels in check. Android OS is the standard operating system used by mobile devices. Therefore, it will be more flexible in developing a mobile application as well as more feasible in reaching the intended user. The fundamental purpose of this project is to develop an android application for stress detection and management which will help to reduce stress levels of the person. This will also help to minimize health issues.

2. LITERATURE SURVEY

The paper [1] refers to predicting stress based on questionnaire and usage of smartphone. The stress will be detected by the behaviour of the user because of the answers given by the users. The users need not expose their names. The user session is taken into consideration. Results show significant correlations.

The authors in [2] give a description about detecting stress using smartphones, Vital Jacket, disposable electrodes, GPS receiver, Netbook PC for bus drivers. The netbook is the device which will detect stress with the help of true sensors present in the Vital Jacket. The GPS receiver used was a Bluetooth device that was placed close to a bus window and transmits GPS information to the netbook via Bluetooth.

The authors in their work [3] have spoken a couple of mobile answer for the first recognition and management of stress supported continuous watching of heart rate variability (HRV) and discourse information (activity, location, etc.). A central contribution is that the automatic standardization of measured HRV values. This is often crucial as HRV varies greatly among individuals. A data mining element identifies perennial stress things in order that individuals will develop applicable stress shunning and header ways. A feedback component based on breathing exercises helps users relax.

The paper [4] refers to detection of the stress using remote sensing that means using equipment which are of non-contact type. It will be detecting and classifying stress based on respiratory signals using Kinect sensor. Kinect sensor is an image processing technique. It senses the fluctuations and deduce the respiratory signals. To detect stress only the respiratory system is considered.

The paper [5] refers to the potential of mobile phones as stress detectors in working environments. The data was collected in an unconstrained environment with unknown stressors. Accelerometer data is used to characterize subjects' behaviour by extracting time domain and frequency domain features. Then, statistical models were built to classify different self-reported stress levels.

2.1 SUMMARY OF RELATED WORK

The overview of the comparison of different parameters are given in Table 1

Table -1: Summary of the literature survey

Literature	Advantages and Disadvantages
[1] Smartphone Based Stress Prediction	Advantage: Portability is simple and easy to carry. Disadvantage: Data is predicted using questions, which are not always reliable.
[2] A Mobile Sensing Approach to Stress Detection and Memory Activation for Public Bus Drivers	Advantage: The data is collected from all possible situations like from electrodes, smartphones, GPS. Disadvantage: The external hardware is used to collect data and the data collected is of less accuracy.
[3] Mobile Stress Recognition and Relaxation Support with Smart Coping: User-Adaptive Interpretation of Physiological Stress Parameters	Advantage: The stress is detected at any situation by monitoring HRV. Disadvantage: The stress level which is detected is not much accurate as the data is inadequate.
[4] Remote Detection and Classification of Human Stress using a Depth Sensing Technique	Advantage: It is non-contact type of sensing. It uses imaging system. Disadvantage: Detection is based on respiratory system only. The setup is big.
[5] Automatic Stress Detection in Working Environments from Smartphones' Accelerometer Data: A First Step	Advantage: Smartphone is used as a medium to detect stress which makes the project of low cost Disadvantage: It takes a lot of time to detect stress. Accelerometer is not always reliable as it is less robust and have fixed sensitivity.

3. METHODOLOGY

In this section, the complete workflow of the project is discussed. There are total three to four sensors which are required to perform the step count and the heart rate sensing. The sensors are the pedometer, accelerometer, camera sensing tool. In this, all mentioned sensors are required as well as the version of android OS must be at least lollipop. These are the primary requirements for the mobile application to perform adequately. The functions performed here are registration, detection, and conclusion of the stress level, represented using pie chart and simultaneously the SMS is sent to the registered mobile number.

The first process is to register the user using mobile number. The user can register from any part of the world, he/she is not restricted to India. The user is verified and authenticated using OTP. After the account is created, the app will ask for the user's normal heartbeat rate, the user must sit down and be calm before giving his/her normal heartbeat rate. The user must place his/her fingertip on the flash which is automatically switched on by the application. This normal heartbeat rate is then stored in the database for the further use. The heart rate is being calculated by the camera sensor, an average pink light is emitted and by the values produced we can get the bpm. After that, the user must select the number of steps, he/she can walk daily. The range is provided by the application. That is also saved in the database. The step count is calculated by the sensor available in the mobile phones. The mobile phones contain the pedometer and accelerometer sensors, by combining both we get the actual step count in the application. The step count has a time limit, it means count must be completed within 24hrs, because the next day the new step counter will start. So when the step count is completed within a short span of time, the app will give an alert/notification to the user that he/she has completed the steps and will ask to open the app and ask the user to again give his/her heart beat rate and then using machine learning algorithm the app will generate a pie chart of the stress the user is undergoing and if the stress levels are high then user will receive a SMS which will tell the user about the stress levels and also provide the contact numbers of expert/psychologist and a link to the exercise/yoga to divert their mind so that it will help in reducing stress.

3.1 SYSTEM ARCHITECTURE

In the last section, we discussed the workflow of the application. Now we see the working of the application step by step. Starting with the System architecture.

The system architecture is given in Figure 1. Each block is described in this Section.
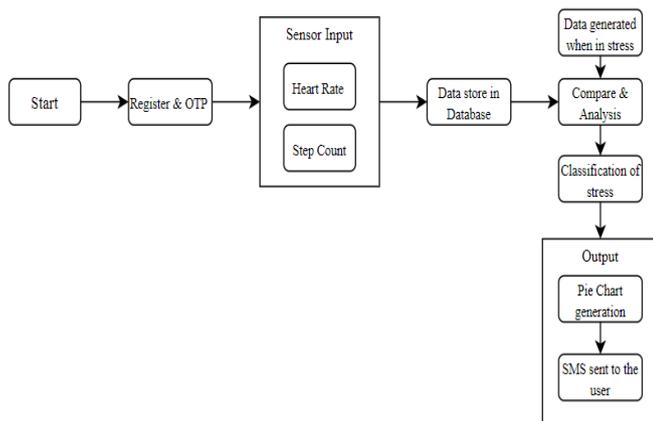
Fig -1: Name of the figure

A. **Register & OTP:** The User's mobile number is registered and verified using Firebase database at the backend. Phone Authentication is used to verify the mobile number using 6digit OTP.

B. **Heart rate:** The Application uses the Preview Callback mechanism to grab the latest image from the preview frame. After it processes to the YUV420SP data and take out all the red pixel values. It uses data smoothing in a positive number array to calculate the average red pixel value in the image. It determines the heartbeat when the average red pixel value in the latest image is greater than the smoothed average. The Application will take the average and wait for 10 seconds to calculate the beats per minute (bpm).

C. **Step Count:** After the Heart rate is calculated, the step count is calculated using sensors. The pedometer is the main sensor which is used to calculate the step count.

D. **Pie Chart:** After both the data is collected the stress level is detected and a graphical representation of that data is given using pie chart.

E. **Message:** The final output is sent to the user's mobile device which contains the Alert/text message. The Alert/Text message contains the contact number of an expert or psychologist or doctor with the exercise link. Due to the provided link, the user can exercise and due to the suggestions given by the doctor, the user's stress can be kept in the normal form.

4. RESULTS

The screenshots of the working application are shown here:
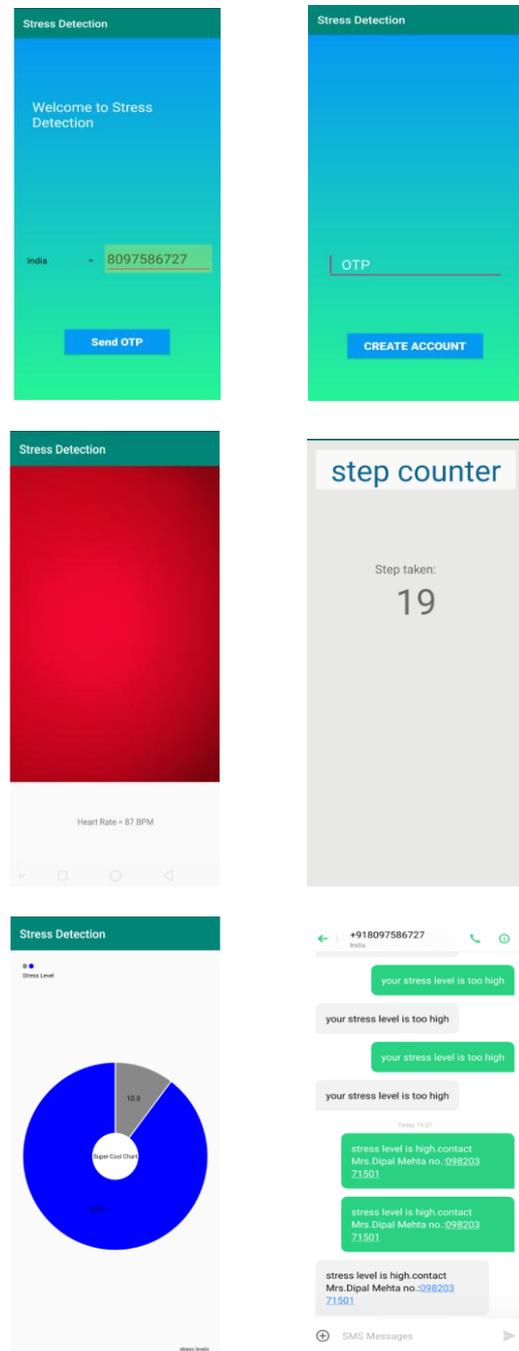
Fig -2: Screenshots of Working Application

5. CONCLUSION

We have proposed this android app with heart rate and step count sensors to detect stress. To overcome the daily stress, this app helps to control the stress by notifying his/her level of stress via SMS. SMS provides the medium of stress,

whether the stress is normal, medium, or high along with the consultant doctor's contact number. The doctor can monitor the user or guide the user to reduce the effects of stress on his/her body in real time. As the user will get the notifications about his/her stress, the user can help himself/herself combat negativity, anxiety and stress while fostering positive traits like empathy and gratitude. The app will encourage the daily act of kindness by maintaining the stress levels regularly with a list of suggestions provided by doctor as well as connection to a community of people who are committed to the principles of paying it forward with his/her calm and positive mind.

All these facilities are provided in a single application called Stress Detection app.

6. FUTURE SCOPE

•   If sleep detector sensor is implemented in smart phone, we can detect the sleep count.
•   If they provide Fingerprint sensor for all services, we can use it without restrictions.
•   Implementation in iOS for apple mobile phone user.
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Conflict of Interest Statement

The authors declare that they have no conflict of interest.

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