Automated Fear Detection using Smart Watch Sensors for Women Safety

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Abstract - *Day by day the safety of the Women is getting worse. We can reduce these kinds of situations with the help of technology. Nowadays smartwatches have become very common among all the people including women. All the leading smartphone brands are focusing equally on their smartwatches. Also these smart watches not only show the time, but also comes with basic sensors like the temperature and heart rate sensor with it, which can be used to monitor their exercise, sleep and more. By taking this as an advantage we can use these sensors to get data of the user and check if the user is in danger or not. We also can automate the process as well using the received data. The heart rate sensor senses the heart rate of the user and checks if he is in danger or not. And if the user is in danger, the app automates the process. We automate the process with an android app which is connected with the watch as well. The app automatically sends the location as an SMS to all the emergency numbers and also makes a call to the highly prioritized number according to the user.*

Keywords: **Automation, Technology, Safety, Location, Call, Smart Watches, Heart rate sensor**

I. INTRODUCTION

Artificial Intelligence is an approach to make a computer, a robot, or a product to think how smart humans think. AI is a study of how the human brain thinks, learns, decides and works, when it tries to solve problems. And finally this study outputs intelligent software systems. The aim of AI is to improve computer functions which are related to human knowledge, for example, reasoning, learning, and problem-solving. The objectives of AI research are reasoning, knowledge representation, planning, learning, natural language processing, realization, and ability to move and manipulate objects. There are long-term goals in the general intelligence sector. Computer science attracts AI in the field of science, mathematics, psychology, linguistics, philosophy and so on.

Automation is the control of machines and processes by independent systems through the use of various technologies which are based on computer software or robotics. Industry implements automation to increase productivity and reduce labor costs. Industrial automation utilizes various industrial communication devices such as programmable logic controllers (PLCs), programmable automatic controllers (PACs) which are used to control the industry. In industries, control strategies use a set of technologies implemented to achieve the desired result, making automation systems necessary in industries.

II. LITERATURE SURVEY

A. Finding the emotions of the person using the signals obtained from the smart watch.

David Pollreisz and Nima TaheriNejad [1] gives a study of the emotions of a person using the signals from the smart watch. The smart watch these days emits certain physiological signals, like the heart rate, blood pressure rate etc.. So by using these signals they tried to find the emotional state of the person. The motive of this project was to find all the emotions of the person throughout the day and finally collect all the emotional status of the particular person. These data in future can be used in AI in future

B. Fear Detection and Visual Awareness using bodily expression

Bernard M. C. Stienen and Beatrice de Gelder [2] mention strongly about the facial expression along with their bodily expression. They used a person's facial expression and also found their body expressions for that so that they can predict it with perfection. They made this in order to detect the emotions of a person using his body expressions. Mainly they focused on fear detection (i.e). To detect a fear of a person using his facial and body expressions.

C. EmoDB to find the different moods of a person

Marius Dan Zbancioc and Silvia Monica Feraru [9] researched about the various moods of a person using EmoDB. They mainly focused on finding the difference between the anxiety and fear of a person. They used EmoDB to find it.

III. PROPOSED WORK FOR AUTOMATIC FEAR DETECTION USING WEARABLES

The wearables have become a very important part of everyone's life. It can be used in many useful ways to make life easier. These wearables are becoming very common among all

the people. People started using them seamlessly in day to day life. All the smartphone companies are giving equal importance to their wearables also like Samsung, Apple, Xiomi, Honor, Realme etc.. These wearables also come with all the basic sensors needed to get the necessary data from a person. It comes with the heart rate sensor which is used to find the heart rate of a person. So, we can use this sensor to find the data from a person and automate the process. The heart beat of a person plays a very important role when a person is in fear. The heart beat rises to a very enormous amount when the person in danger. If the danger is existing for a very long time it remains in the same state for a long time. When a person is in danger the person enters into a condition known as the Combat Breathing, during this condition a person inhales through his nose and exhales through this mouth. This is called combat breathing. And this condition happens only when the person is in danger. So during this condition it is very difficult for our brain to react to that situation. In that kind of situation our brain will not be able to react in a normal manner, so it is very difficult for a person to alert someone through their mobile that they are in a dangerous situation, especially for girls it is very difficult for them to take their mobile from their bag and open their mobile and then try to call someone regarding the situation. So why don't we automate the process. We can identify if a person is in danger using the heart rate sensor available in the wearables and automate the process of intimating someone that the particular person is in danger. So, basically the heart rate sensor senses if a person is in danger using the heart beat of the person and if it finds that the person is in danger, if the person is in danger it sends the data that the person is in danger to the android app. The person can register and login in the app via OTP. He / She can add four emergency numbers in the app with the highest prioritised number as the first number. And also he can trigger the manual emergency button from the app itself, and also he can turn on the bluetooth within the app which connects to the bluetooth of the watch. And it listens for data from the watch, When the watch sends data that the person is in danger, then the app sends the location of the person in the form of latitude and longitude to the emergency numbers, so that the emergency number persons can know that the person is in danger and also know his /her location and also makes a call to the highest prioritised number given by the person, so that the person can hear what exactly is the situation and react accordingly. And also it switches on the flash of the mobile so that it can be used to distract the attacking person. Nowadays all the smartphones are coming with a high volt LED Flash with it. So when this flash is shown very close to the attacker's eyes, he will be distracted and will see black dots and a little unsteadiness. It may last for 10 seconds. By using this time he/she can try to escape from the situation.

DEVICE USED

We have tried to reproduce a setup very similar to the smart watches using arduino nano, heart rate sensor and the bluetooth module. The Bluetooth will be connected to the +5V, GND, TX and RX pins of the Arduino Nano. The heart rate sensor has three pins. It will be in turn connected to the +5V, GND and the A0 (Analog Pin) of the Arduino Nano. And finally the arduino will be connected to the power source to give power supply to the microprocessor. Sometimes, when high voltage of current passes through the supply, there is a high possibility for the circuit or the components to burn. So to get rid of that please use a resistor when the components are connected to the +5V in the Arduino Nano.
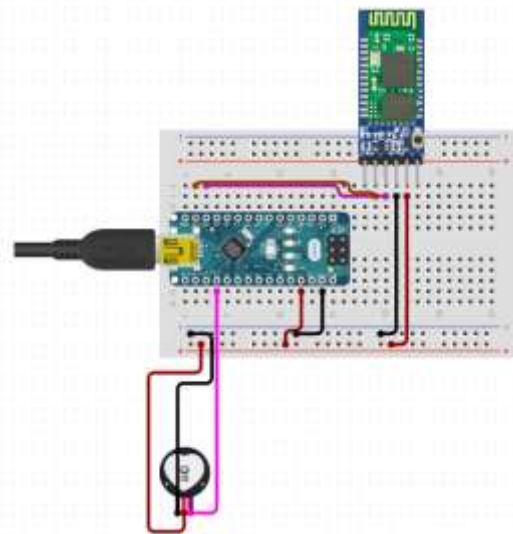

Figure 1: Wearables

Figure 2: Reproduced Circuit

Now regarding the mobile app, at the time of registration the user will enter his mobile number, username and password to register. And to login he has to enter his correct username and password and also enter the OTP sent to his number. So after login he can view his profile, update his profile, enter emergency numbers, update the emergency numbers, raise an emergency manual and also start the tracking process for automation and connect the app with the wearable
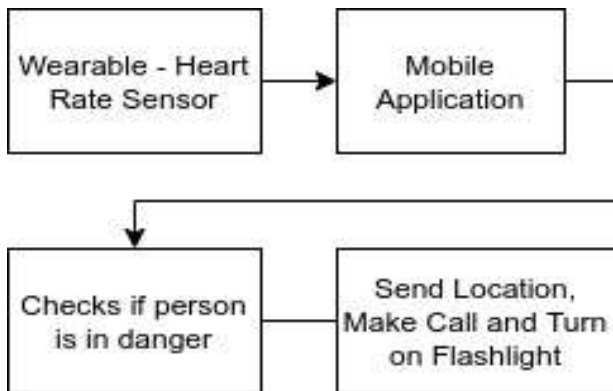
BLOCK DIAGRAM

Figure 3: Block diagram

The block diagram explains in a detailed manner about the project. The wearable has the heart rate sensor. It is connected to the mobile application. If it finds that the person is in any danger, it sends the location as SMS, makes a phone call to the given number, and also turns on the flashlight of the mobile.

IV. RECOMMENDATIONS

These recommendations are based on the average heart rate value. When a person is in danger, the heartbeat of that particular person rises above 90 per minute. Our normal heart rate is around 60-80 beats per minute. So when the person is in danger it rises to 90 and above. By using these values we can tell that the person is definitely in danger.

Hear Beat	Time	Recommendation
<60	Per Minute	In normal relaxed condition
60 - 80	Per Minute	In a light fear, anxiety condition
>90	Per Minute	In fear that the brain recognizes fastly
>90	More than 10 Seconds	In danger

So according to the above table, when a person is in a normal and very relaxed condition his heartbeat will be less than 60 beats per minute. When the person is in normal condition with a small tension or fear the heartbeat will range somewhere between 60 - 80. When the person is in fear which the brain can recognize like getting afraid for an insect, the heartbeat ranges above 90 for 10 seconds. And when the person is in extreme danger, the heart beat gets above 90 and 100 and it stays at that level until the person comes out of that danger. So, that is the condition when we automate the process in our project.

FLOWCHART

As the flowchart below describes there are 6 major modules in our project. The first is the **Register** and **Login** module which is used for the user to register in the app and login into the app. The next is the **View Profile,** this is used by the user to view his own profile. This consists of his username, mobile number, and all the four emergency numbers. The next module is the **Update Profile**, this can be used by the user to update his profile. The user can update the emergency numbers, change the priority and also change his username if needed. The next module is the **Enter Emergency Numbers,** this module is used by the user to enter all the emergency numbers. Next is the **Emergency** module, this module is used by the user to manually trigger in case of any dangerous situation. This sends the user's location as an SMS to all the emergency numbers. And the last module is the **Start Tracking Process,** this is the main module of the project. This is where the automation takes place. By entering into this module, the used connects the mobile with the wearable device. After that the app constantly checks if the user is in danger or not. If it finds that the user is in danger, then it automates all the process, it sends the location to the emergency numbers, makes a call to the highest prioritised number and turns on the flashlight of the mobile. These are all the modules that are present in the mobile app.
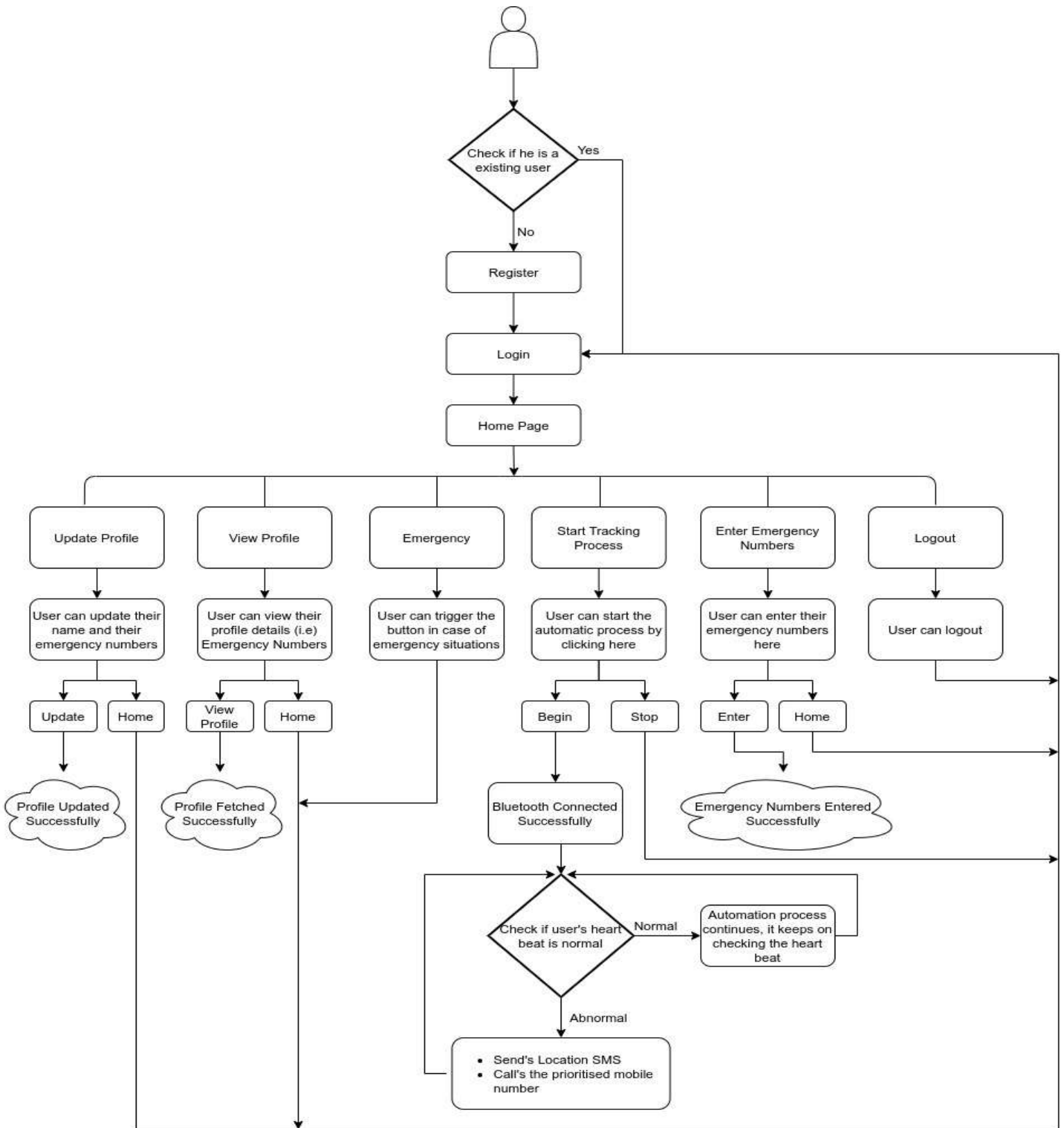
Figure 4: Flowchart for Automatic Fear Detection

V. RESULTS AND DISCUSSION

The results of the project are as follows. The mobile app checks if the person is in danger or not. If it identifies that the person is in danger it starts automating the process. It checks if the person is in danger or not by using his heart beat. When the person's heartbeat rises above 90 or 100, then it identifies that the person is in danger and it starts automating the process like sending the location as an SMS, making calls and turning on the flashlight of the mobile.

Future Enhancements

On talking about the future enhancements, a lot can be done in this project. The main future enhancement is adding more sensors to automate stuff. By adding more sensors like ECG sensor, sweat sensor. Adding these sensors will increase the accuracy of finding whether a person is in danger or not. Usually when a person is in short time danger like their mobile is lost, being afraid of an insect, losing their belongings in a public place etc.. These can be easily identified using the **ECG Sensor** using blood pressure. During these cases, our heart beat rises and when the brain senses the danger and identifies that it does not need any physical action, automatically our blood pressure reduces to normal level within 10 seconds. So if any danger needs physical action our blood pressure and heartbeat remains at a high level. So by using this we can identify it accurately whether a person is in danger or not. And also by using the **Sweat Sensor,** the sweat of a person can be identified. The chemical composition of the sweat changes in all kinds of situations. During danger the sweat secrets certain chemicals by which we can identify that a person is in danger. So, this sensor can also play a very vital role in identifying if a person is in danger or not. And also, another part regarding the app can be included to reduce the amount of danger to a person. Ordinary people will be able to join the app as a **Volunteer**. When a person is in danger the volunteer near the person will also receive a SMS of the

Location saying that the person is in danger. So that they can help in an easy and fast manner if the emergency numbers are very far away from the person. This increases the security of the person in all kinds of situations. And also police can have multiple mobile numbers to receive location SMS so that the nearest police can save the person with ease. These are the major future enhancements to be done in the project.

VI. CONCLUSION

In today's world of technology, anything is possible with today's technology. But still the safety of women is a big question mark. In a pool in 2018, India was ranked as the first country which was totally unsafe for women. I don't think things have changed in the past 2 years. It still remains the same. So to make sure that all the womens and people around us are safe, we can make the technology safeguard them. The wearables have now become very common among the people of today. They wear it with no discomfort. They also know how efficiently they can use them. Also they come with all the necessary sensors that can track the person's day to day activity like the heart rate sensor, ecg sensor etc.. So we can make use of these sensors to identify if a person is in danger or not. And also the world is moving very fastly towards Automation. We expect all the things to be automated in a seamless manner, so that it makes our lifestyle easier and simple. So we also have automated the process here using the app and the data received from the wearables. The app will make full use of all the features that our mobile provides like messaging, finding someone's location easily, make phone calls and have the flashlight in our mobile. These can be used in an efficient manner to save a person from danger. This project is not only applicable to girls. It can also be used by old people who get heart attack and stuff. Or incase of any medical emergency. Hope this project saves lives.

Output Screenshots

Figure 5: Register Page

Figure 6: Login Page

Figure 7: Receive OTP Message

Figure 8: View Profile

Figure 9: Update Profile

Figure 10: Enter Emergency Numbers
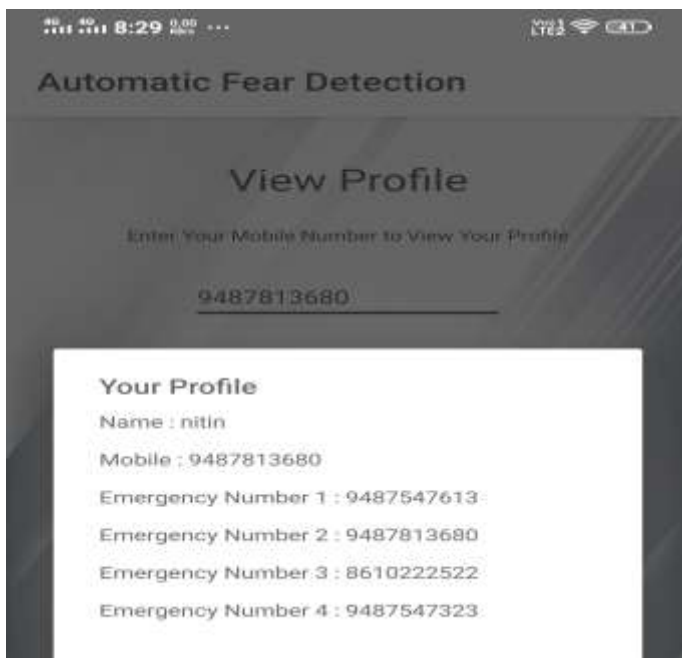
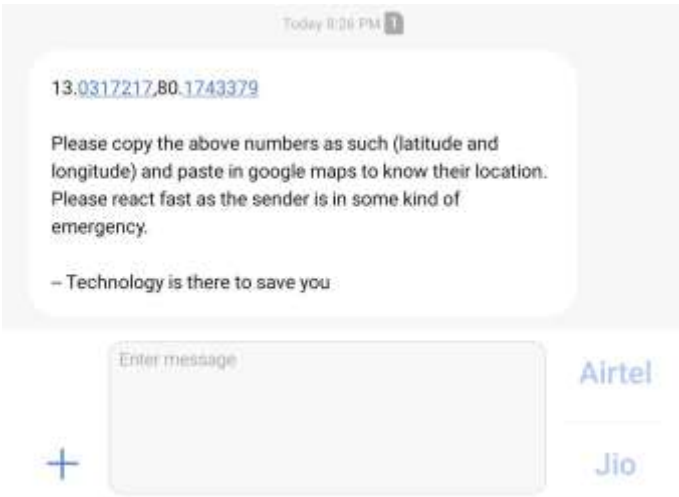**Figure 11:** Start Tracking Process

Figure 12: Get the location of the person

Demo Video

Please refer the below link to see the demo of the project

https://drive.google.com/open?id=1lDVi_T2UTB7oOIHn5ZJX9myGubJEMOXe

VII. REFERENCES

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