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A Competent Model for Sensing Fear Using Physical Parameters

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Abstract— **In today's world one of the area of focus is human security. Human security challenge is experienced all over the world, but in India it's a need of an hour to be focused due to the increased crime rate which have been doubled in a span of a decade. To face this challenge we need to work on the solution to procure crime rather than cure with the help of technology. For dealing with the situation prior crime the fear or indication has to be sensed. The feeling of fear can be sensed by sensing the physical parameters. The physical parameters – increase in heart rate, reduction in temperature and increase in level of oxygen can be instantly detected. The detected abnormal change instantly will be processed with the help of fuzzy logic. The fuzzy logic will be hardcoded in the microcontroller. The processed output will be analyzed for anxiety level. And depending upon the anxiety level, the alert is broadcasted to the nearby paired android device via Bluetooth. The alert will launch the android application which will collect the video clips of the environment. At the same time alert will be sent to registered number via an SMS which will contain the identity of the person and location of the person. With the help of that the person feeling endangered will get help in limited time. In order to reduce false alarm rates, the safety system is associated with the manual button.**

Index Terms**—Fuzzy logic, security, embedded system with ubiquitous computing, physical parameters of human being.**

I. INTRODUCTION

Ubiquitous computing is defined as computing over multiple computers at a time by its father Mark Weiser. This helps to enhance the computing with the computer in the physical environment. It is effective with the invisibility to the user. The computing ubiquitously can be enhanced with the embedded systems. The embedded systems include sensors for everyday use. The sensors are the converter that converts the physical quantity into signals which can be read by the observer or by instruments. According to the American National Standards Institute, which states the sensor as device which provides the output in signal such as optical, mechanical, and electrical. The following figure I.1 is of the sensor in general:

Figure I.1 Working of sensor [18]

The sensors should be selected depending upon various factors such as availability, sensitivity, cost, stability factors, error, etc. There are various types of sensors available as per there applications

A. Human security scenario in India

According to the report [1], the challenges faced by India in terms of security can be concluded as- there will be huge disparity with the advancement of the mass media, policies are state centric till it reforms to the transparent government. These challenges that India faces are likely to persist till 2025.

We need to be more careful whatever the scenario be. Hence we need an automated systems which sense the environment and if the crime would happen there, safety measures should be taken to reduce the crime rate. In short we need to identify the fear or panic for the security measures.

In the following paper have the literature review, problem statement and the proposed model for the problem statement and conclusion with respect to the proposed solution.

II. LITERATURE REVIEW

Various other authors have study to detect the anxiety level with different approaches. We shall discuss in brief about their approaches.

According to [13], the author describes the involvement of the human in the robotic system to detect the anxiety level. In this paper the approach towards the detection of anxiety level happens with the help of physiological parameters such as electrocardiograph, electromyography and electrodermal activity. The parameters are analyzed by the fuzzy logic implementation.

According to the affective communication for implicit human-machine interaction paper, again the anxiety level is detected with the help of physiological parameters involved in [13] paper. In this paper author takes the different approach for the signal analyses that is decision tree learning. In this paper it also gives the comparative study between the fuzzy logic approach and the decision tree learning approach.

According to the author of remote measurement of cognitive stress via heart rate variability [4], the cognitive stress- the type of stress which is visible on the face, is detected with the help of image processing. The image of face of a person is captured and remotely the data is extracted from the face. The data extracted from the face are heart rate variability, breath rate, and heart rate. Depending upon these parameters the anxiety level is detected. The parameters are analyzed by two approaches which are Naïve Bayes classification and the support vector machine classification.

In the medical review of the human being we studied that the main physiological parameters are pulse rate, blood pressure, temperature and the oxygen saturation level of the blood.

In all the above papers we discussed, the systems were not mobile. After the study of various papers and the medical review of the human being we conclude the use of physiological parameters such as pulse rate, body

temperature and the oxygen saturation level for the anxiety level detection.

III. Problem Statement

The problem is to provide the timely security measures to the person in danger by sensing the physical parameters like body temperature, pulse rate and oxygen saturation in the blood. The parameters need to be sensed and analyzed for the further reaction. The system should be built to suit the different age group of society. The system should not be adhere to the location.

IV. Proposed Solution

The system for fear detection is divided into some parts such as

1. Data Gathering module
2. Data Analysis module
3. Data Transmitting module

The block diagram can be divided into two division. One is the user division having all the hardware components that is sensors, micro-controller, GSM and GPS module, and other is the SMS receiver. The following figure IV.1 shows the block diagram of the proposed model

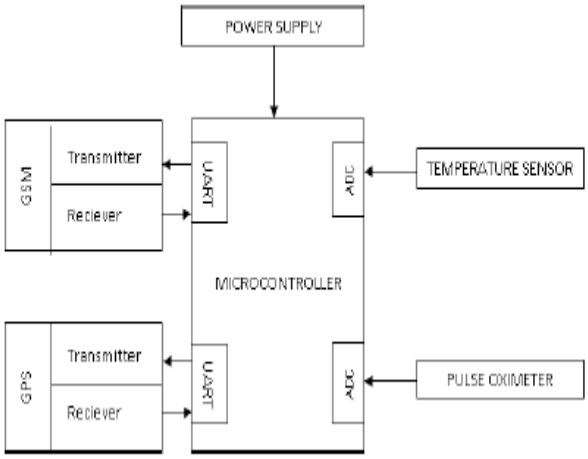

Figure IV.1 Block diagram of the Proposed Model

Depending upon the proposed model there are hardware as well as software requirements. The hardware and software requirements are as follows

Hardware Requirements

- Temperature Sensor LM35
- Pulse Oximeter
- GSM module
- GPS module
- Bluetooth Module
- Arduino Board

Software Requirements

- Arduino IDE
- Android IDE

The Data gathering module has the hardware components such as Temperature sensor, pulse oximeter. The data transmitting part utilize the hardware component called GSM, Bluetooth and GPS module. The data analyzing module has Arduino board. The hardware and the software are discussed as follows:

A. Temperature sensor

The multiple options available from Resistance temperature detector, thermistors, integrated chip sensors, thermocouples we decided to go with the IC's for its linearity and inexpensive qualities over the other options. In the IC sensors we will be using LM35 sensor for temperature detection of the skin.

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ^{0}Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies of ±0.25^{o}C at room temperature and ±0.75^{o}C over a full −55^{o}C to +150^{o}C temperature range [12]. Following figure IV.2 is of the LM35

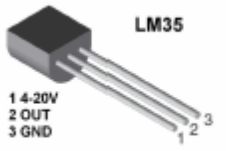

Figure IV.2 Temperature Sensor LM35

It can be used with single power supplies, or with plus and minus supplies. As it draws only 60 µA from its supply, it has very low self-heating, less than 0.1^{o}C in still air. The LM35 is rated to operate over a −55^{o}C to +150^{o}C temperature range [12].

B. Pulse sensor

The measurement of pulse rate can be done by electrocardiograph and photoplethysmograph, phonocardiography, etc. Since we also need to calculate the oxygen saturation in the blood, we will use photoplethysmograph which will calculate the pulses and the saturation level in the blood. The photoplethysmograph can be done by the device called as pulse oximeter. The device gives the digital value of the pulse and saturation level using the reflected IR rays. Following figure is of the pulse sensor to be used.

Figure IV.3 Pulse oximeter

C. GSM Module

We will be using SIM900 module which can be shown in the following figure IV.4

Figure IV.4 GSM module SIM900

D. Bluetooth Module

The Bluetooth module we are using is HC05. The hardware features are as follows:-

Typical- 80 dBm sensitivity, Up to +4dBm RF transmit power. Low Power 1.8V Operation, 3.3 to 5 V I/O. PIO control. UART interface with programmable baud rate. With integrated antenna. With edge connector. Following figure IV.5 is the figure of the Bluetooth module we will be using:

Figure IV.5 Bluetooth Module

E. Arduino Uno

In the data analysis module we will be using Arduino uno development board which has ATmega328 micro controller in it. Following figure IV.6 is of Arduino uno

Figure IV.6 Arduino Uno

F. Software Requirements

We will be using Arduino IDE which is freely available for development of embedded c programs for the Arduino board. We will be using Android studio as the IDE for the android application development.

V. Algorithm For The Above Proposed Solution

The algorithm for the detection of the fear with the help of reading of the sensors is as follows:

BEGIN
1. Initialize count, all pins and ports in use of Arduino
2. Initialize GSM, GPS, Bluetooth module
3. Broadcast the Bluetooth connection and pair with the android phone
4. Read analog data from the sensors
5. Convert analog data to digital data using ADC
6. If
a.temperature < 22^0 C
b.Pulse rate >110 beats per minute(bpm)
c.Oxygen saturation ≥ 100%
Then
a. Increment count
b. If count > 120
i.Reset count = 1
ii.Fuzzify the inputs depending on the membership function
iii.Defuzzify the fuzzified input
If (crisp < 0.7)
a) Get the GPS location
b) Send SMS to the registered number
c) Trigger to the paired android device
d) Launch the camera in video mode
Else
Go to 4.
Else
Go to 4.
Else
Go to 4.
END

We first initialize all the ports, UART and ADC channels. Then we read the data from the sensors. Once the data is read its values are checked with respect to the ranges we define. For the temperature the decrease is found and should be less than 22^oC. Similarly we check the blood saturation level beyond 100 percent and pulse rate increased beyond 110 bpm. Once all the condition is detected we check for the time. If the condition persist over 2 minutes we apply the fuzzy logic. In fuzzy logic, we first fuzzify all the inputs depending upon the membership function of each input. After getting fuzzified output for all the inputs we now defuzzify the output to get the crisp output. We check the crisp value. If value is below 0.7 we get the location with the help of gps receiver and send the sms to the registered number as the threat notification. Along with this we trigger the paired android device to launch the camera in the video mode to shoot the environment. If in between any condition goes wrong we read the input again to analyze.

VI. Conclusion

The project mainly depends on the real time range of values of the body temperature, pulse rate and oxygen level in the blood. The result varies and so the failure and the success ratio. The parameters value can be changed depending upon the changes observed for the efficiency of the proposed model. The different situation may occur that have the same range of the values so the implementation and testing should be rigorous for the efficient detection of the fear. The system may prove efficient for the normal human but may change for person with different body conditions.

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