Perception of Heart beat and Temperature using Arduino Uno and sensing movements of coma patient by Mems sensor

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***Abstract*:** The project is named as "Perception of Heart Beat and Temperature using ARDUINO UNO and sensing movements of Coma patient by MEMS sensor ". Today health is more important than wealth. This project has different types of sensors which are used to measure the health parameters of human being and all these sensors are embedded into a controller through wireless network. In this system we are monitoring heart beat, temperature and position of a patient(who are in coma). Heart related diseases are increasing day by day; therefore, an accurate, affordable and portable heart rate and body temperature measuring device is essential for taking action in correct time. Such a device is more essential in a situation where there is no doctor or clinic nearby (e.g., rural area) and patients are unable not recognize their actual condition. Additional to the heart beat sensor and temperature sensor, MEMS sensor is used to monitor the positional changes in the person. The system gives information of heart rate, body temperature and position of person in 2D simultaneously acquired on the portable device in real time and shows it through the LCD and send that data to Bluetooth android application.

Key words : Heart Beat, Body Temperature, Arduino Uno, MEMS sensor**.**

I. INTRODUCTION :

This is essentially done by Arduino. Since Arduino can detect the condition by accepting contribution from an assortment of sensors and can influence its surroundings by controlling lights, engines, and different actuators. So Arduino is a principle part of this undertaking. Arduino coding is required for detecting heart rate and body temperature by utilizing arduino programming. Through this task I'm presenting Software and equipment execution.

1.1 SIGNIFICANCE:

In clinics, where patient's condition should be continually checked, it is typically done by a specialist or other paramedical staff. In creating nations like India because of scarcity of particular Doctors, it winds up troublesome when a similar specialist needs to screen numerous patients at the same time. Subsequently in such a condition, the specialist might be uninformed of the state of the considerable number of patients.

On account of a crisis, even a little deferral in treatment may represent a danger to quiet' s life. Consistent checking and watching the wellbeing parameters like temperature, pulse, and so forth is exceptionally troublesome today. It requires a labor to screen. In the event that incase the person reckless or occupied with various work or tiredness they can't screen the patient consistently. We are living in twentieth century in this century year, science and innovation advances an essential part. In this undertaking installed innovation has been utilized[1]. The wellbeing parameters are being estimated by utilizing diverse sorts of sensors. This qualities are given to the contribution of controller (arduino) to show on Bluetooth application in android portable device[2].

Figure. 1 shows the overview of the project when a finger tip is inserted in the heartbeat sensor and it senses the surrounding environment and sends that data through Bluetooth to the android mobile.

Fig. 1 : Overview of Designed work

II. COMPONENTS USED :

ARDUINO UNO: The Arduino microcontroller is an easy to use yet powerful single board computer that has gained considerable traction in the hobby and professional market. The Arduino is open-source, which means hardware is reasonably priced and development software is free. Arduino can sense the signals from environment through variety of sensors and can effect its environment by controlling actuators, lights and motors.

HEART BEAT SENSOR : This sensor is used to measure the heartbeat of a person and its result is said in terms if bpm means beats per minute.

LM35 TEMPERATURE SENSOR : This sensor is selected among all because it is the only sensor which measures body temperature approximately.

MEMS SENSOR : This sensor is used to monitor any movements in the position of a person who is in coma. Actually this sensor gives output in 3dimensional but for easy analyzing purpose we are using it in 2dimensional.

LCD DISPLAY: This is used to display the sensed heartbeat, body temperature and positional movements in 2D coordinates.

BLUETOOTH MODULE : This is used to send the sensed data to the android mobile by using some Bluetooth controlled android app[3].

ANDROID MOBILE : The sensed parameters are displayed on the android screen[4]-[7].

2.2 BLOCK DIAGRAM OF DESIGNED WORK:

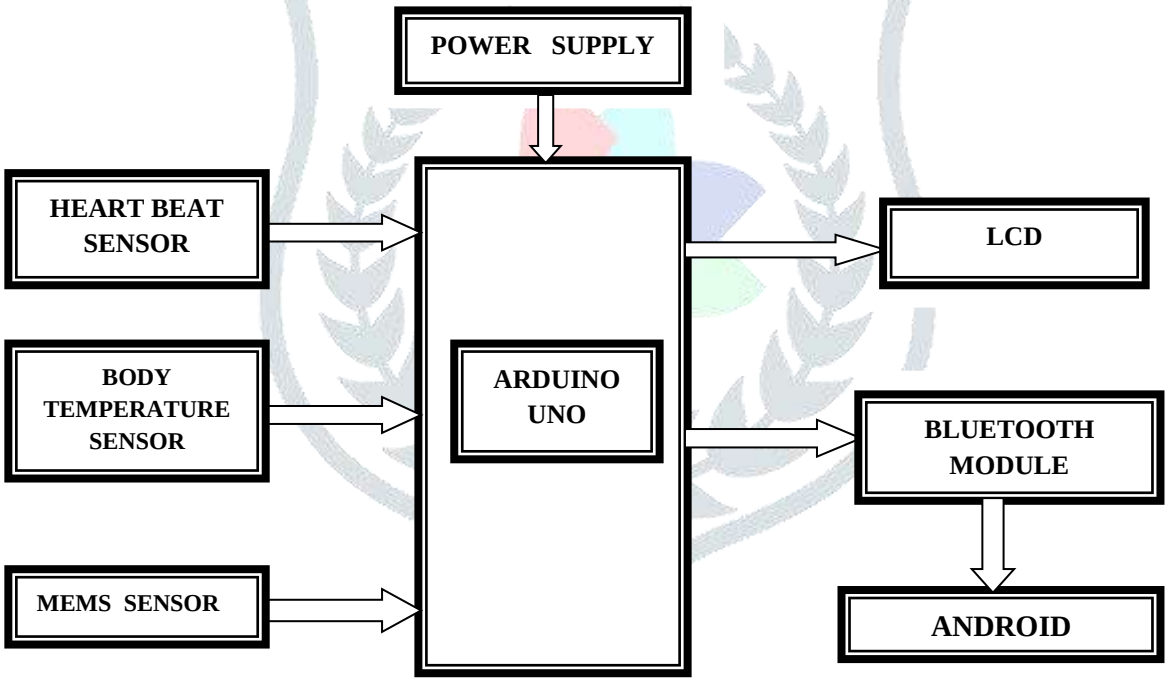

Fig. 2 : Block Diagram of Designed work

III. SENSING MECHANISM:

3.1 HEARTBEAT SENSING :

Heart beat is sensed by the sensor in beats per minute[8]. The standard behind the working of the heart beat sensor is photoplethysmograph. As indicated by this standard, changes in the volume of blood in any organ is estimated by the adjustments in the force of the light going through that organ. Fig. 3 shows the heart beat sensor. The finger is inserted in the clip to sense the heart beat of the person.

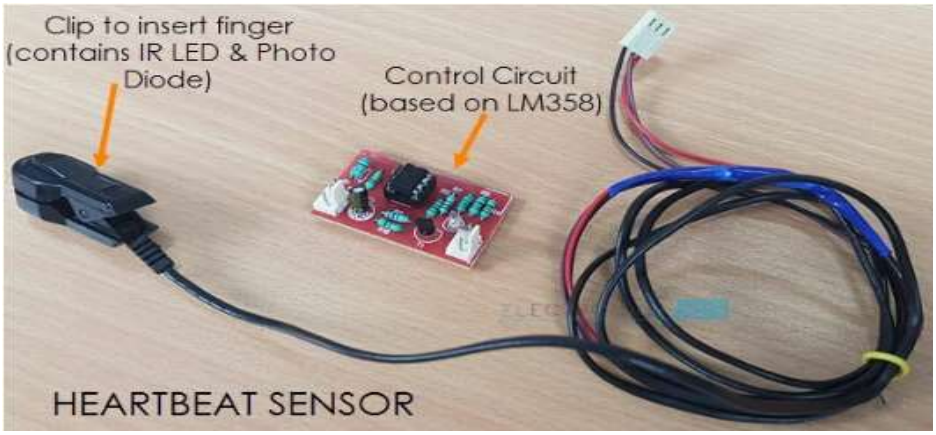

Fig. 3 : Heart Beat Sensor

3.2 BODY TEMPERATURE SENSING :

The body temperature is measure by LM35 or LM34 in which we can Measure the temperature in Fahrenheit. Fig . 4 shows the body temperature sensor[9]-[11]. The LM35 gadget has leverage over straight temperature sensors aligned in degrees Kelvin, in light of the fact that the client isn't required to subtract a substantial consistent voltage from its yield to acquire advantageous Fahrenheit scaling[18].

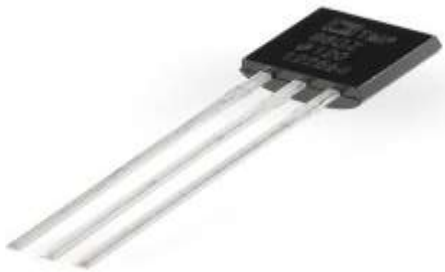

Fig. 4 : Body Temperature Sensor

3.3 MEMS SENSOR :

It has 5pins, specifically Vcc, GND, X,Y and Z OUT pins. This is a 3-dimentional however in this we are utilizing just 2dimentional axis just i.e. X-axis and Y-axis. Fig. 5 depicts the MEMS sensor.

By detecting the mounting point, the sensor can help with adjusting for the gadgets mounting edge, and in this manner makes it conceivable to utilize ACCELEROMETER FACTSHEET MEMS 3-AXIS ACCELEROMETER[12]-[13] ordinary SMD innovation in high thickness sheets, and furthermore to understand the exact recognition of the tendency edge[14]. An interface IC inside the sensor bundle additionally has temperature detecting and self-analysis capacities[15].

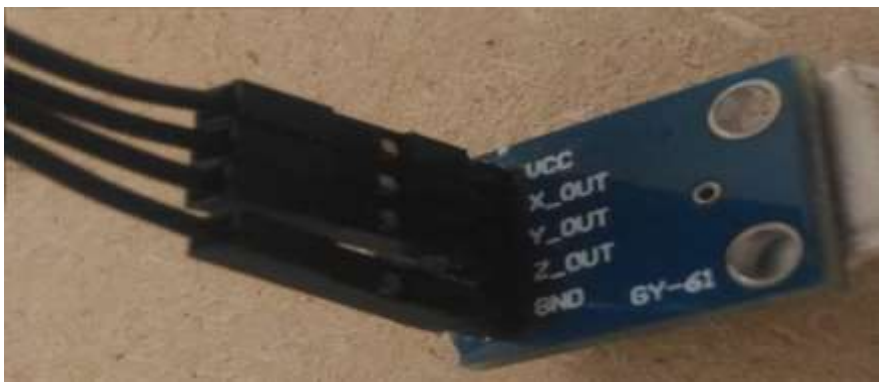

Fig. 5 : MEMS Sensor

3.4 ARDUINO UNO :

The Arduino UNO which is shown in Fig.6 is a generally utilized open-source microcontroller board in light of the ATmega328P microcontroller and created by Arduino.cc. The board is outfitted with sets of advanced and simple information/yield (I/O) sticks that might be interfaced to different extension sheets (shields) and different circuits.

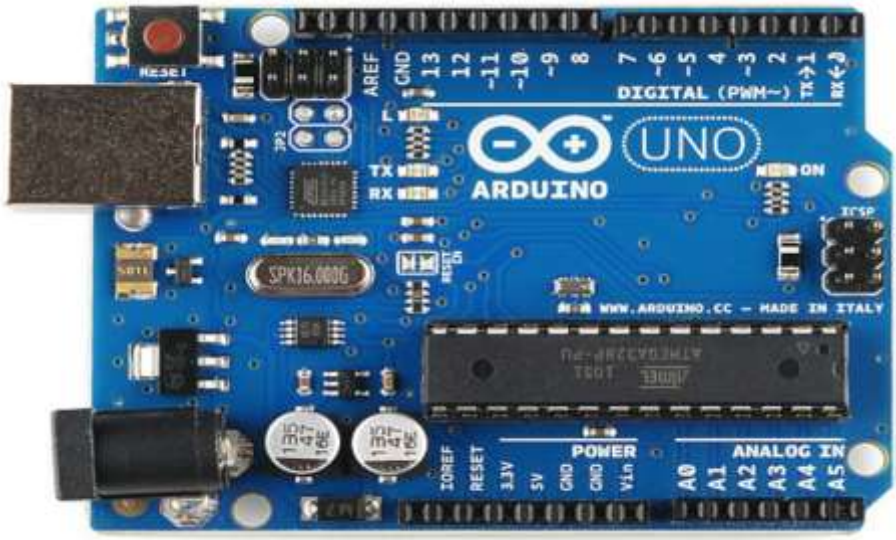

Fig. 6 : Arduino Uno Board

The board highlights 14 Digital pins and 6 Analog pins. It is programmable with the Arduino IDE (Integrated Development Environment) by means of a sort B USB link. It can be fueled by a USB link or by an outside 9 volt battery, however it acknowledges voltages in the vicinity of 7 and 20 volts. It is additionally like the Arduino Nano and Leonardo. The equipment reference configuration is dispersed under a Creative Commons Attribution Share-Alike 2.5 permit and is accessible on the Arduino site. Format and generation documents for a few adaptations of the equipment are additionally accessible. "Uno" implies one in Italian and was denoted the arrival of Arduino Software (IDE) 1.0

IV. PROCESSING DATA:

Body temperature calculation : Temperature of a body using arduino microcontroller can be sensed using the temperature sensor and can be analyzed by following expressions.

Body Voltage to Temperature change:

Temperature in degree Celsius,

$$\text{Temp} = \text{Output voltage} * 0.48828125 \quad \ldots\ldots \quad (1)$$

Celsius degree to Fahrenheit degree change:

Temperature Calculation:

$$\text{Tempf} = (\text{Temp}*1.8) + 32 \quad \ldots\ldots \quad (2)$$

Heart beat calculation :

$$\text{Sum} = \sum_{i=1}^{30} freqmeasure.read[] \quad \ldots\ldots \quad (3)$$

$$\text{Frequency} = \text{F\_CPU} / (\text{Sum}/30) \quad \ldots\ldots \quad (4)$$

$$\text{BPM} = \text{Frequency} * 60 \quad \ldots\ldots \quad (5)$$

In the above expressions,

BPM means Beats Per Minute
Temp means temperature in Celsius.
Tempf means temperature in Fahrenheit degrees.

V. GENERAL ANALYSIS :

HEART BEAT :

Heart rate is estimated by utilizing two numbers. The first number is called systolic heart rate which measures the weight in our veins when your heart pulsates. The second number is called diastolic heart rate which measures the weight in

your veins when your heart rests between beats. In the event that the estimation peruses 120 systolic and 80 diastolic, you would state "120/80 mmHg."A heart rate less than 120/80 mmHg is typical[16]. A heart rate of 140/90 mmHg or on the other hand more is too high. Individuals with levels in the middle of 120/80 and 140/90 have a condition called pre-hypertension, which implies they are at high risk for high heart rate[17]-[21].

Typical : Systolic rate is lesser than 120 mmHg and diastolic rate is lesser than 80mmHg.

In danger (pre-hypertension) : Systolic rate is higher than 120– 139 mmHg and diastolic rate is higher than 80– 89 mmHg.

High : Systolic rate is 140 mmHg or higher diastolic rate is 90 mmHg or higher.

BODY TEMPERATURE :

Normal: The average normal temperature is 98.6°F (37°C). But "normal" varies from person to person.

Abnormal: Oral, temporal artery temperature

Fever : 100.4°F (38°C) to 103.9°F (39.9°C)

High fever : 104°F (40°C) and higher

VI. WORKING OF DESIGNED WORK:

In this system we are monitoring heart beat, temperature and position of a patient .After that we are displaying data on LCD and send data to Bluetooth android application.

When we place finger in the heartbeat sensor then LEDs in the different components will starts blinking indicating that they are sensing the data from the finger of the person. As well as heart beat sensor temperature sensor is used to monitor the temperature of the patient but the temperatures of the human body are in accurate to detect by these LM35 sensor so it will show the room temperature along with the heartbeat of the person. And additional to these two MEMS sensor is used to detect any positional changes in the person (who are in coma).

Actually these MEMS sensor is 3dimentional but it is not possible to show the results in 3D view in this we are using 2dimentional so it shows the results in 2D view i.e., X and Y axis. This sensor will show positional movements in both X and Y axis as shown in below Fig. 7 .

VII. RESULTS AND DISCUSSIONS :

When a person's finger is placed in the heartbeat sensor it detects the analog signals from the finger and send those analog signals to microcontroller ARDUINO UNO. This controller will take the inputs from all sensors and convert the analog input into digital output. This output displayed on the LCD and is sent to android mobile by using Bluetooth module. Heartbeat ,body temperature and human positional movements are displayed at once. This ARDUINO will sense the signals continuously and send those signals to both LCD and android mobile. If the values measured by MEMS sensor exceeds its cutoff i.e., in this we made 500, then it will as shows as CHANGE IN MOVEMETS.

Fig. 7 : Heartbeat and Temperature display on LCD

The above Fig. 7 shows results displayed in LCD, the heart beat per minute bpm as 61, temperature as 19 and positional movements as X and Y as 394 and 329. As well as results are sent to the android mobile through the Bluetooth module are shown in below Fig. 8.

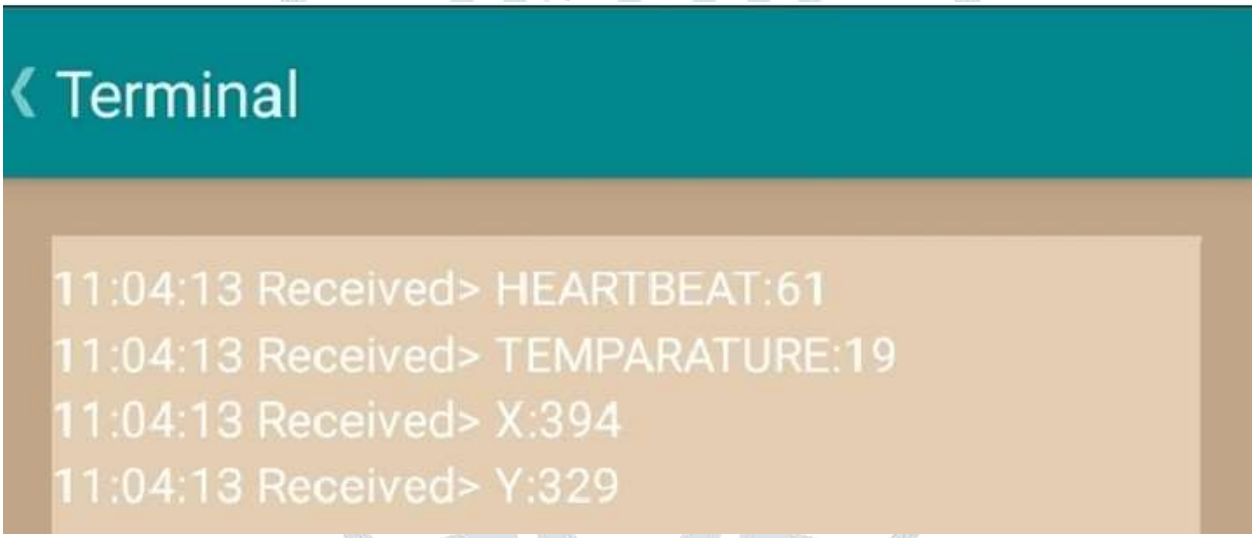

Fig. 8 : Heartbeat, Temperature and Position(2D) Displayed in Android App

CONCLUSION:

Biomedical engineering is one of the applications which uses both engineering principles as well as techniques in the medical field. It helps to improve the patient's health. Thus , We have designed a system to monitor the heart beat, temperature and position of a patient through wireless technology i.e., Bluetooth. Heart beat is measured through heartbeat sensor clip (consists of LED LDR and op-amp) , temperature is measured by using LM35 temperature sensor and in additional to that MEMS sensor is used to monitor the changes in the movements of the body. Hence these parameters are measured and transmitted and displayed in a certain distant location. This project will eventually reduces man power needed to monitor the patients in very near future.

FUTURE SCOPE:

- Blood weight, ECG ,EEG and other wellbeing parameters are likewise estimated.
- Continuous observing and future finding can be performed by means of a similar framework (TELEMEDICINE).
- By utilizing single framework we can screen in excess of one patient in better places at once.

REFERENCES :

[1] Priya, B . , Rajendran, S . , Bala, R. and Gobbi, R., "Remote Wireless Health Monitoring Systems, " Innovative Technologies in Intelligent Systems and Industrial Applications- CITISLA, pp 383 - 388, 2009.

[2] S. Patel, K. Lorincz, R. Hughes, N. Huggins, J. Growden, D. Standaert, M. Akay, J. Dy, M. Welsh, and P. Bonato, "Monitoring Motor Fluctuations in Patients With Parkinson's Disease Using Wearable Sensors," IEEE Trans. on Information Technology in Biomedicine, vol. 13, no. 6, Nov. 2009

[3] L. Shu, X. M. Tao, and D. D. Feng, "A wearable, wireless electronic interface for textile sensors," in Proc. IEEE Int. Symp.Circuits Syst. (ISCAS), Paris, France, 2010, pp. 3104–3107.

[4] Warren, Steve, Jianchu Yao, G. Edward Barnes. "Wearable sensors and component-based design for home health care." In Engineering in Medicine and Biology, 2002. 24th Annual Conference and the Annual Fall Meeting of the Biomedical Engineering Society EMBS/BMES Conference, 2002. Proceedings of the Second Joint, vol. 3, pp. 1871- 1872. IEEE, 2002.

[5] P. Kakria, N. Tripathi and P. Kitipawang, "A Real-Time Health Monitoring System for Remote Cardiac Patients Using Smartphone and Wearable Sensors", International Journal of Telemedicine and Applications, vol. 2015, pp. 1-11, 2015.

[6] M. Navale, S. Damare, R. Chavan, R. Dube, and S. Patil "Android Based Heart Monitoring and Reporting System", International Journal of Advanced Research in Computer and Communication Engineering Vol. 3, Issue5, May 2014

[7] N. Indumathy and K. K. Patil "Medical Alert System for Remote Health Monitoring Using Sensors and Cloud Computing". International Journal of Research in Engineering and Technology, vol. 3, no. 04, pp. 884-888, 2014.

[8] M. M. A. Hashem, R. Shams, Md. A. Kader and A. Sayed, "Design and development of a heart rate measuring device using fingertip," 3rd IEEE International Conference on Computer and Communication Engineering (ICCCE'10), Kuala Lumpur, Malaysia, May 11-12, 2010.

[9] R.G. Jamkar and R.H. Chile "Microcontroller based Temperature Indicator and Controller", Journal of Instrument. Society of India 34(3) Pp.180-186, Sept-2004.

[10] Carlo Alberto Boano, Matteo Lasagni, Kay Romer and Tanja Lange, "Accurate Temperature Measurements for Medical Research using Body Sensor Networks".

[11] M. Varela, D. Cuesta, J. A. Madrid, J. Churruca, P. Miro, R. Ruiz, and C. Martinez, "Holter Monitoring of Central and Peripheral Temperature: Possible Uses and Feasibility Study in Outpatient Settings," Journal of Clinical Monitoring and Computing, vol. 2009, no. 23, pp. 209–216, May 2009.

[12] Cantherm Ltd., "MF51E: High Precision NTC Thermistors for Extremely Accurate Temp. Measurement," Mar. 2006.

[13] Mitra, S. and Acharya, T. (May, 2007) "Gesture Recognition: A Survey", IEEE Transactions on Systems, Man and ybernetics, vol. 37, pp. 311-324

[14] Ajinkya Raut, Vineeta Singh ,Vikrant Rajput and Ruchika Mahale "Hand sign interpreter" In International Journal of Engineering And Science (IJES) Volume 1,pp.19-25 2012

[15] Tufte, O.N., Chapman, P.W. and Long, D. (1962), "Silicon diffused-element piezo-resistive diaphragms", Journal of Applied Physics, Vol. 33 No. 11.

[16] C. T. Huang, C. L. Shen, C. F. Tang, and S. H. Chang, "A wearable yarn-basedpiezo-resistive sensor," Sens. Actuators A, Phys., vol. 141,no. 2, pp. 396–403, 2008.

[17] H. Shim, J.H. Lee, S.O. Hwang, H.R. Yoon, and Y.R. Yoon, "Development of heart rate monitoring for mobile telemedicine using smart phone", 13th International Conference on Biomedical Engineering (ICBME 2008), Singapore, 2008, pp. 1116-1119.

[18] Souvik Das "The Development of a Microcontroller Based Low Cost Heart Rate Counter for Health Care Systems" International Journal of Engineering Trends and Technology Volume4 Issue2- 2013.

[19] Archana S. Ghotkar, Gajanan K. Kharate "Vision based Real Time Hand Gesture Recognition Techniques for Human Computer Interaction" in International Journal of Computer Applications (0975 - 8887) Volume 70 –No. 16, May 2013

[20] Lee, L.K., Kim, S., Choi, Y.K. and Lee, M.H. “Recognition of hand gesture to Human computer interaction” in IEEE transactions on Industrial Electronics, vol, 3, pp. 2117-2122.

[21] P. Kakria, N. Tripathi and P. Kitipawang, "A Real-Time Health Monitoring System for Remote Cardiac Patients Using Smartphone and Wearable Sensors", International Journal of Telemedicine and Applications, vol. 2015, pp. 1-11, 2015.