Heart attack detection and Medical attention using Motion Sensing Device-Kinect

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Abstract- The main aim of this research paper is to illustrate the use of a device which can perform the dual function of detecting a heart attack without the intervention of any specialist for potential victim and also notify the emergency services. Stroke can be tackled if It is detected and appropriate measures are taken instantly. The research paper illustrates how a device called **'Kinect'** can used to detect a heart attack and the symptoms experienced along with it. A step by step guide to its working in an event of heart attack and the how the use of GSM system and Skype feature can be used for sending an alert sms to relatives and emergency services. As well as, provides video conferencing option with doctor. Which is explained in the paper .In all the best chance for survival of a patient who experiences a heart attack and quickest medical attention can be ensured.

Index Terms- Kinect, Xbox one, Heart attack, Myocardial infarction, Heart attack detection.

I. Introduction

Heart attack is a serious threat in today's world. Myocardial infarction (from Latin: Infarctus myocardii, MI) or acute myocardial infarction (AMI) is the medical term for an event commonly known as a heart attack. A heart attack is a serious medical emergency in which the blood supply to the heart is suddenly blocked, usually by a blood clot.

Heart disease is the number one cause of death for both men and women in the United States. About 600,000 people die of heart disease in the United States every year–that's 1 in every 4 deaths. Every year about 715,000 Americans have a heart attack. Of these, 525,000 are a first heart attack and 190,000 happen in people who have already had a heart attack.

Therefore this research is based on finding the method which can track heart attack in case it occurs at home. . As well as, the research gives a rough idea of the method for detecting heart attack and automatically informing the emergency services about the critical situation. [3]

II. Objective of the device

2.1 Review Stage

This research aims at illustrating the advantages of device Kinect, which is a gaming device. By utilizing few features of this gaming device we can implement this system to life saver equipment in the situation of heart attack. This device can be installed in indoor areas like office and workplace, at living places or any indoor places where any heart patients would be present. And if the heart stoke occurs, then system will get alerted and will send sms to the relatives and will call the ambulance. Another aspect of this device is to collect data like heart beat, live video recording of the patient and sending it directly to the doctor, and if any person is present around the victim, he can have video conferencing with doctor by built-in Skype feature and can take relevant action as directed by doctor till the emergency services reach.

2.2 Significance of the method

1) This method will measure the heart rate of a person continuously without any need of interaction with any other device.

2) The heart attack detection will be confirmed by following methods
   1. By sudden drop down in heartbeat.
   2. Tracking the position of hand and matched with predefined skeleton position of chest pain or arm pain
   3. At the end the sudden fall of patient on the ground will track by Kinect by tracking position of legs and head.

3) When heart attack occurs, by monitoring the data and the watching the situation of patient, doctor can guide the victim or person around the patient for appropriate action (like aspirin tablet), till the ambulance is reached to the patient.

4) In addition this system will alert the friends/relatives by sending sms by using sms trigger circuit which will be connected to the Kinect device through controller.

III. Previous study of device

A. Kinect System:

Xbox box one is a gaming console developed by Microsoft. The Console includes a newly upgraded Kinect 2.0 motion sensing peripheral. Kinect is a motion sensing device which can interact with users by tracking there gesture and spoken commands. Kinect 2.0 has a new additional feature of detecting heart rate of a person, individual joints in form of skeleton and moment of such joints precisely. [5]Figure gives a brief view about the working of Kinect.
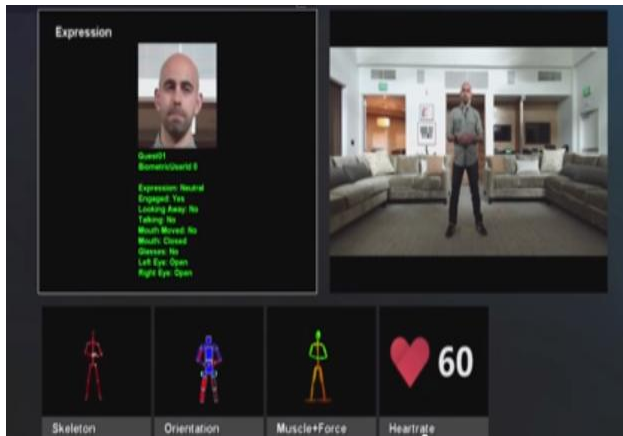
Figure 1

Kinect tracks human body and joints in the form of skeleton. There are 25 individual joints used in tracking. The precision is taken very deeply by tracking even joints of thumbs. Figure shows skeleton tracking of individual joints in Kinect. [5]
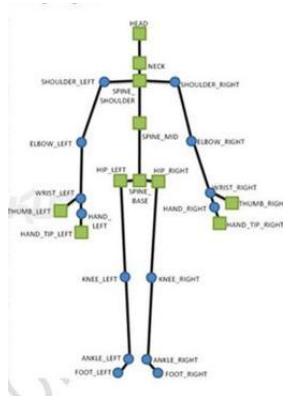

Figure 2

B. These features can be further extended for detecting heart attack:

Kinect 2.0 has an extraordinary feature of measuring heart beat of a person. Microsoft's Kinect sensor uses changes in skin color to monitor heart rate. The new Kinect camera can recognize slight changes in skin color as blood passes through a person's body. By knowing the speed of the blood, the camera can then determine how many beats per minute the heart needs to make in order to reach that speed.[4] This feature of measuring heartbeat can be used in detecting heart attack. Kinect will keep on monitoring the heart rate of victim continuously. If a sudden fall in heartbeat is measured then it can be thought that it is a sign of heart attack. After detecting this sudden change in heart rate, Kinect will further search for common symptom which are more

likely to occur during heart attack. The rough idea can be taken from the figure 3.

Figure 3

C. Some of the common symptoms of heart attack can also be tracked with the help of Kinect:

The most common symptom is chest pain. It is likely to occur to 89.7% of the stroke victim during the attack. [1] It could be made possible for Kinect to detect this symptom by the help of motion sensing feature through individual joints. The position of the skeleton for the chest pain can be predefined in the system. The posture of body during chest pain would be as shown in fig. 4 i.e. the hand would be on the left side of chest. The position of the skeleton will be as such the joint of hands/hand would me approximately below the joint of the left shoulder (Fig. 5). As Kinect can track motion of the joints, if such a posture is tracked in addition to heart rate drop. It can be concluded as a heart attack.
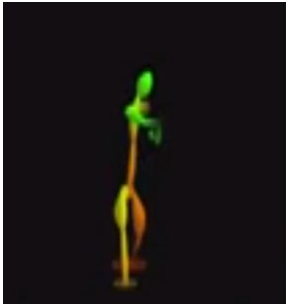

Figure 4

Figure 5

Figure 5

Another symptomis, the pain in the upper part of the left arm. Around 67.3% people face this symptom. [1] The detection is similar as that of chest pain and it can be used for arm pain symptom also. The normal position of the person facing arm pain is likely to be the same as shown in fig. 6. The device can be programmed as such that when a gesture is made like the joint of hand/hands is between the left shoulder and elbow, can help in concluding a heart attack along with the heart rate drop.

In special cases where the heart is on the right side or at the middle, the positions are fed accordingly to program.

Figure 6

The immediate falling down of the person after pulse rate drops and not getting up to the standing position in a certain time period is an indication of medical emergency. (Similar to position shown in fig. 7) Kinect can track that the body is not getting up and lying on the floor by detecting two parts of the skeleton- 'skull and foot' of the victim. At this point also the message will be triggered to the relatives/friends and emergency services.

All afore mentioned symptoms are the most commonly occurring symptoms at the time of heart attack. So in addition to the immediate drop in heart rate, such symptoms can be helpful in concluding a heart attack.

C. Significance of GSM system in research:

The significance of GSM is that when Kinect detects a heart attack, an alert will be sent to relatives/friends and to ambulance by using external attachment to the Kinect called SMS triggering circuit. This circuit will send alert notes to relatives and the address of the location of the patient to the ambulance service.

D. Significance of built-in Skype system in research

Instant action taken by the person around the victim in case of heart attack can many times be a life saver act to a patient till the ambulance is reached. In most of the situation because of instant shock and fear a person around patient can't take decision perfectly and instantly. For solving this problem an approach of live video conference with doctor or health care centre can be done to guide the person near to victim for taking immediate action till emergency service arrives.

Kinect has capability to distinguish between a patient and other person present at the spot as shown in figure 8. Another special feature of the system is live video conference by using Skype, which is built in feature of Kinect. The video conferencing can be established by using Skype and it can be done as it is connected via. Wi-Fi or Ethernet. By this doctor or health care expert can communicate and can give instructions for immediate action or advice some protective measures to the person around the victim by seeing the situation of victim till the ambulance has reached.

Figure 8

IV. METHODOLOGY

We learned about the device and features of device which we are using for this concept. Now we are going to discuss how the device will work? Simple steps are given below which will give knowledge about working of device.

1) The device will detect heartbeat of person continuously in given premises. If any sudden fluctuation in heartbeat below some level is detected then the system will start working

2) After system detects low heart rate it will check the symptoms like chest pain, falling down and arm pain. These symptoms are detected by methods discussed above.

3) The following checks will be performed in step 3:
a) If the symptoms are detected then step 4 will be followed.
b) If the symptoms are not detected then the system will monitor heart beat for next few minutes. After monitoring the heart beats, following two possibilities may occur:

   i).Heart rate becomes normal-in this case the system stops.
   ii).Heart rate persists to be low- in this case step 4 will be followed.

4) The system will activate the sms trigger circuit by using controller, which is connected with Kinect. And the address location of the device or patient is send to the ambulance service. At the same time the friends and relatives of the patient are also notified about this.

5) After sending alerts, Kinect will try to detect other person in the given premises. If anyone is detected then the system will call the doctor or healthcare expert automatically through Skype. By using the inbuilt skype feature of Kinect, the video conferencing can also be done.

V. CONCLUSION

It is likely that next hour after heart stroke is very crucial for the victim. He can be saved if attention and medical help is given within an hour and in order to accomplish this requirement the described method and system can be installed which can detect heart attack instantly and after following the algorithm and the necessary treatment can be given in the intermediate time. In this way a gaming device can also be used as a life saver equipment. This idea can be of a great help, if implemented in real life.

VI. FUTURE ENHANCEMENT

The stroke can be identified more precisely if few more tests are added in detecting. Shortness in breathing is noted to be about 50.8%. [1] Lalit Mestha a principal scientist at the Xerox Research Center Webster, discussed in a recent interview how the Kinect's ability to detect the movements of 3D objects in a room can be used to detect the rise and fall of a patient's chest, calculate lung capacity, and tell whether a patient's respiratory status is improving or worsening. According to an article in Venture Beat, the affordable Kinect could also be programmed to act as an early warning system for breathing-shortening in heart attack. [2]

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