

Simulation for remotely detecting Asthma attack using Gaming console-Kinect

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Abstract— The main aim of this research paper is to explore the use of a device which can perform the dual function of detecting an asthma attack without the intervention of any specialist for potential victim and also notify the emergency services. Attack can be tackled if it is detected in short time and appropriate measures are taken instantly. The research paper illustrates how a device called '**Kinect**' can further be used to detect an asthma attack and the symptoms experienced along with it. It explains the steps of how this hardware could be programmed for the detection of attack. If an attack is recognized by the system an alarm is sounded and an alert sms is sent to relatives and emergency services. Using Skype a person round the victim can have a video conferencing with doctor and simultaneously take immediate action. Thus a person can be saved by programming this hardware for such medical safety purpose.

Index Terms — Asthma attack prevention, Asthma attack detection, Kinect, Xbox

1 INTRODUCTION

Asthma is a respiratory condition marked by attacks of spasm in the bronchi of the lungs, causing difficulty in breathing. It is usually connected to allergic reaction or other forms of hypersensitivity. It is a common chronic inflammatory disease of the airways. Asthma attack can be termed as a serious medical emergency if appropriate measures are not taken at the time of attack.

Some 300 million people currently suffer from asthma. It is the most common chronic disease among children. [1]

It is noted that, around 250,000 deaths have been caused due to asthma. [1]

Most of the sufferers are children and they need intensive care and attention. There are chances of attacks which can be stop from getting worse if appropriate measures are taken immediately. There are some commonly occurring symptoms like wheezing, tightening of chest, etc. faced by the victim experiencing asthma attack. In this research paper the basic steps are shown which can be followed for programming a motion sensing device (Kinect) for detecting asthma attack by tracking some common symptoms. In addition, it also send's message to relatives and emergency services about such crucial situation.

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2 OBJECTIVE OF 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 asthma attack. This device can be installed in indoor areas like office and workplace, at living places or any indoor places where any asthma patients would be present. And if 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 this method:

- 1) This method will measure the breath rate of a person continuously without any need of interaction with any other device.
- 2) Asthma attack detection will be confirmed by following:
 1. By tracking shortness of breath, or very rapid breathing.
 2. Tracking the position of hand and matched with predefined skeletal position of coughing, chest pain, etc.
 3. Sound of Severe wheezing when breathing both in and out and sound of coughing.
- 3) When 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 ac-

tion (like aspirin tablet), till the ambulance is reached to the patient by doing video conferencing.

In addition the system will blow alarm which makes victim aware about attack as well as, 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.

3 PREVIOUS STUDY OF DEVICE

3.1 Kinect System:

Xbox one is a gaming console developed by Microsoft (Fig 1). 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 their 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. [2] Figure 2 gives a brief view about the working of Kinect. The mind blowing thing is, this gaming console is extended to healthcare to a greater extent for example, guiding old age people, in surgery etc. [2]



Figure 1

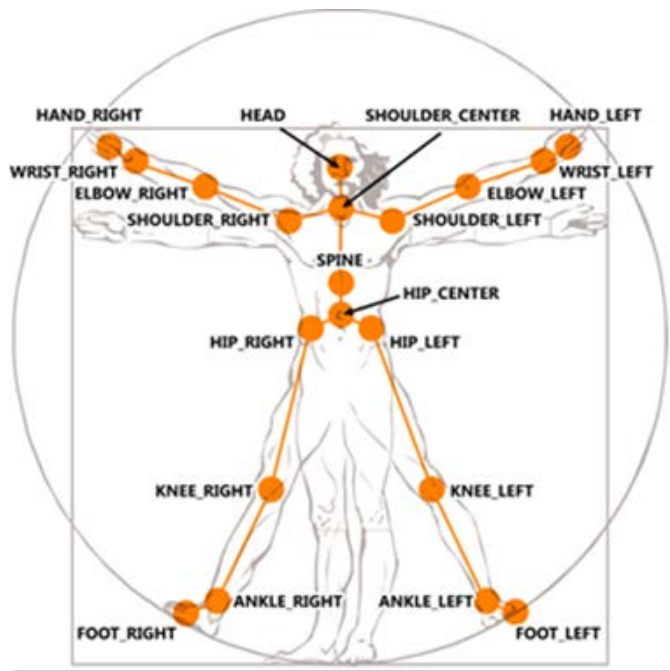


Figure 2

Kinect tracks human body and joints in the form of skeleton. There are 25 individual joints used in tracking. Figure 2 gives a rough idea about skeletal tracking using individual joints. The precision is taken very deeply by tracking even joints of thumbs. Figure 3 shows skeleton tracking of individual joints in Kinect. [3]

3.2 Use of Kinect:

Commonly occurring symptoms [4] in asthma attack are:

- Difficulty breathing, shortness of breath, or very rapid breathing
- Severe wheezing when breathing both in and out
- Coughing that won't stop
- Chest pain or pressure
- Pale, Sweaty Face
- Blue lips or fingernails
- Increased heart rate

Now, let's step-by-step see how these symptoms can be diagnosed by Kinect:

1) Determining breathe rate:

Victims suffering from asthma have a severe problem of breathing. And when attack occurs they have sudden change in their breathing rate i.e. it becomes high of it becomes low. This symptom can be diagnosed by constantly monitoring the breathe rate. Monitoring of breathe rate is possible by using Kinect. A Xerox researcher Lalit Mestha has used Microsoft's Kinect game sensor to measure how well a patient is breathing. He in one of his interview said that Kinect sensors can detect 3D shapes in a room, and this can detect the rise and fall of someone's chest. From that, Mestha said that information on air intake, or the air inhaled and exhaled during normal breathing — when calibrated with other info, the data can be used to calculate total lung capacity. And by taking normal breathing rate into reference, Kinect could be programmed for detecting low/high breathe rate. [5]

Thus it can be said that this symptom can be diagnosed using Kinect.

2) Recognizing severe wheezing:

Wheezing is, breathe with a whistling or rattling sound in the chest, as a result of obstruction in the air passages. Wheezing is commonly experienced by persons with a lung

disease. And during asthma attack severe wheezing is experienced while breathing in and out. Kinect has a feature of detecting speech i.e. it can sense the voice of any user. This feature can be extended for recognizing the intensive wheezing sound of a patient during attack.

3) Recognizing coughing that won't stop:

Coughing is the common problem with asthma sufferers. But this problem turns more intense at the time of attack i.e. non-stop coughing is faced by the victim. Figure 3 demonstrates the situation at this time. Kinect can track this situation by matching the skeletal position of the victim with the predefined condition of joints. The predefined position could be, as such the joint of any hand/hands (any) near the joint of mouth and vibration (as a person coughs he experiences some vibration). Probability of this symptom can be



Figure 3

made strong by adding the detection cough using the voice recognition feature. The sound produced during coughing can be tracked and this symptom can be detected.

4) Assuming chest pain:



Figure 4

There is chest pain in asthma victim due to chest tightening (as shown in fig 4). This symptom can also be detected by matching it with predefined position of the skeletal. The skeletal position would be as such the joint of hand is below the joint of the shoulder/shoulders.

5) Identifying color change:

The lip turns blue in many of the cases. Kinect can detect the color changes of the skin. And this feature can be extended to detect the color changes of lips.

6) Measuring heart rate:

Certainly during attack the heart rate increases from the normal level. Measuring the heart rate of a person can help in detecting this symptom. New Kinect 2.0 in Xbox one has the feature of detecting heart rate 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.

Figure 4 shows how heart rate is monitored by Kinect.



Figure 5

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. [6]

It is possible that all these symptoms are not experienced by the victim. But by measuring some of the major symptoms and calculating the probability it can be concluded that it is an asthma attack.

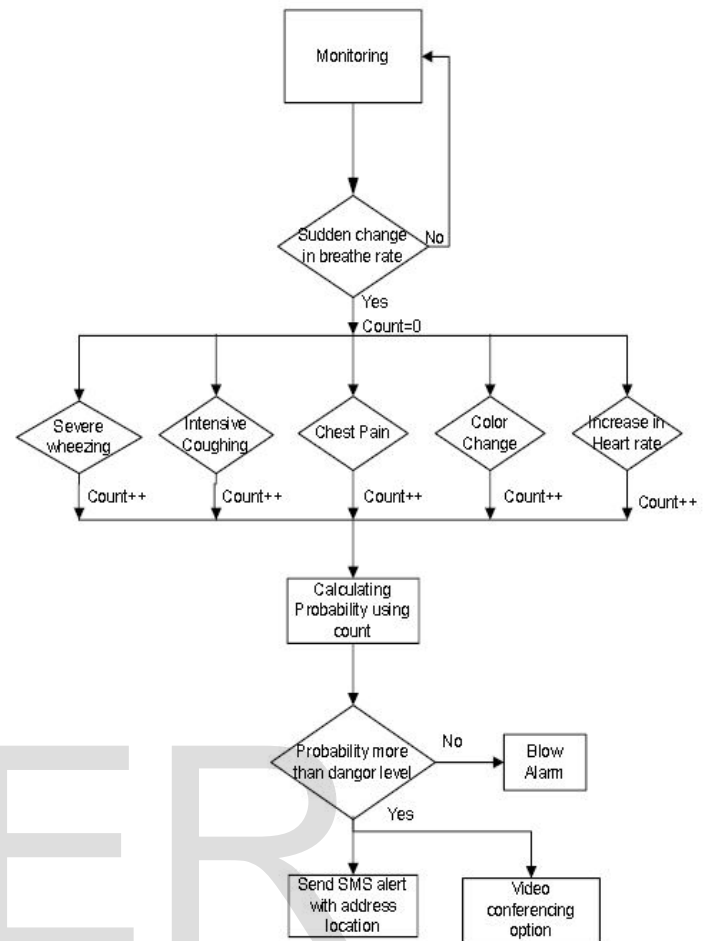
When the attack is detected it is necessary to aware the emergency services and the victim's relatives/friends. And also the victim should be made aware about the situation and for this an alarm is blown in the speaker attached with Kinect. In addition, if Kinect tracks any body other than the victim it makes him aware and gives him an option to make video conferencing

using built-in skype with doctor or health care service center to take immediate actions as guided.

4 METHODOLOGY

We saw 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 for tracking asthma attack.

- Step 1. The device will detect breathe rate of person continuously in given premises. If any sudden fluctuation in breathe is detected then system will get alerted and start looking for following symptoms.
- Step 2. After system detects fluctuation in breathe rate it will check the symptoms like recognizing sever wheezing, intensive coughing, chest pain, color change and increase heart rate. These symptoms are detected by process discussed above.
- Step 3. The probability will be incremented after each symptom.
- Step 4. The alarm will be blown at first if attack is detected in order to make victim or a person around the victim aware about the attack.
- Step 5. Then after system will activate the sms triggering circuit by using controller, which is connected with Kinect. And the address location of the device or patient is sent to the ambulance service. At the same time the friends and relatives of the patient are also notified about this by sms alert.
- Step 6. After sending alerts, Kinect will try to detect other person in the given premises. If anyone is detected then the system will establish a call to the doctor or healthcare expert automatically through Skype. By using the inbuilt Skype feature of Kinect, the video conferencing can also be done.



Flowchart 1

5 CONCLUSION

Asthma is likely to be seen more among small children who need attention and intensive care. As they are don't have much knowledge about what to do in this crucial time. They need guardian to look after their health. This system is a helping hand in such situation which gives guardian relief. By coding this device properly it can trace asthma attack to a greater precision

6 FUTURE ENHANCEMENT

One of the symptoms is sweaty face. Sweat can also add in concluding asthma attack as it is the most common symptom. If our face is sweating, it can be detected by identifying the reflection of light from our face. This is implemented in many of the games of Xbox one. On precisely detecting this symptom and programming Kinect it might give us a great help. [7]

The step by step working of the system is shown in Flowchart 1 which gives the brief idea of simulation for asthma attack detection.

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