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A Survey on Sensor Tools for Healthcare Applications

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Abstract: In this paper, various sensor tools used for healthcare application is studied. All the technology which have been developed for Health care applications are much advanced and more efficient. Sensors are first being introduced in mobiles for sensing activities such as proximity, gyro and accelerometer. But now the medical researchers have moved a step in introducing new and innovative feature in sensor. They are using sensor during the surgery, for sensing and detecting blood glucose level etc. All these new innovations have led the medical field to reach a new milestone and this technology is also very useful for the Doctors to detect the disease of the patient in prior and to treat the patients at the correct time using Sensors.
Keywords: Medical field, Health care, Sensors, Smart Phone, Patient

I. INTRODUCTION

The Sensor tools has been widely used for many healthcare applications. It is an innovative technology and many companies are stepping forward to this development in the medical field. Many sensor tools developed are used today and many more sensors are still in the developing stage. There are various sensor tools which are used in today's world and new sensors are yet to be developed according to the current needs of the society

II. SENSORS

A sensor is a device which detects the properties of any physical object and records the sensed values from those object and sends the signals to the Controller. Mostly the sensors are used with electronics equipment but nowadays, its use are also found in medical field. Sensor find its application everywhere nowadays. The invention of sensors are really a boon to us. Sensors have been compacted and the inventors have made such that there is nothing that can withstand its capability.

III.HEALTH CARE APPLICATIONS

The sensors are being used in mobiles applications but nowadays it is also used in various healthcare applications also. The medical industry also found out new innovative features of implementing sensor in healthcare applications. The growth of medical field is tremendous and they are developing for a faster, accurate and reliable results

The various sensors used in Health Care applications are

1) *Pressure sensor*
2) *Temperature sensor*
3) *Image sensor*
4) *Accelerometer*
5) *Biosensor*
6) *Implantable sensor*
7) *Ultrasonic sensor*
8) *Position* sensors

A. Pressure Sensor

It is mainly focused to check or monitor the patient condition at high accuracy. They are used to measure differential pressure. They are generally used according to the type of the patient. Depending upon the patient these sensor can be ingested in respiratory system or if they cannot be installed in respiratory they can be given to the patient through drug delivery system.

They are widely used in blood pressure monitoring, surgical fluid management, kidney dialysis ,machines. The main usage of pressure sensor is in Anaesthesia delivery machine. With this technology we can provide fully 24*7 patient information.

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B. Blood Pressure Sensor

Under pressure sensor let us see about blood pressure sensor in brief. This particular sensor has a big market. It is used monitor blood pressure level in human and also give an detailed report about pulse rate. It uses oscillo metric technique..For this sensor, there are some specification under which it must work. There are two types of blood pressure sensors.

The first Blood Pressure sensor is sphygmomanometer, which is popularly called as blood pressure cuff. There are 3 types in blood pressure monitoring namely Automatic, aneroid and mercury. This is a special type of blood monitoring which uses batteries and the even print our blood pressure readings. This will be very useful for the physically challenged people who can monitor their blood pressure in their homes. we can use this anywhere. It is portable

The second Blood pressure sensor is monitor pressure during surgery which is called as mercury sphygmomanometer. This a long lasting device and this is an contradict to automatic. But this sensor will not be useful for physical challenged people and it is also very bulky to carry, so this is not portable.

Every time during the surgical period, the patient undergoes 2 or 3 times anaesthetics so 3 external pressure sensor are used. This are usually fitted in the end of blood filled tube.

C. Temperature Sensor

This temperature sensor is similar to the thermometer, but it uses NTC thermistor for sensing the sensitivity in the body temperature. NTC thermistor is a micro sensor that will replace the traditional one. The main key feature of this sensor is that it is extremely accurate and it detects the temperature so fast(less than 0.3 sec). The traditional thermometer need calibration but this thermistor sensor doesn't need calibration.

It is widely used in digital thermometer, medical incubators, neonatal intensive care and for organ transplant system temperature. Soon its going to play its role in day today life.

D. Image Sensor

An image sensor is a sensor which converts an image into an electrical signal. It uses CMOS(Complementary Metal Oxide Semiconductor) sensor.

Recently FORZA SILICON corporation have bought an alternative for endoscopy by using this sensor. This endoscopy is used majority in the places where it is so dangerous to carry out the surgery. Endoscopy test is a familiar test, which is carried out to view the internal organs by ingesting an endoscope which contains an camera at the tip. This method is actually a little tedious and it causes a pain like death, so it cannot be done for little kids as they cannot bare the pain.

So an alternative approach to endoscope is CMOS sensors, which have been used which minimizes the whole setup of endoscope. The sensors have been fixed in the endoscope and the miniature of the cameras have been introduced.

They are widely used in dental imaging, radiography, artificial retinas, fluoroscopy, cardiology and their main use is in endoscopy.

E. Accelerometer

This sensor is used in mobile. It actually sense the gyroscope of the mobile device. It senses the twist and turns of the mobile device. Apart from mobile, this sensor is used also as a health care application. It is a technique used to identify the sensors located or positioned in our body. This sensor is wearable and can be done at ones comfort. This can also used as a band. It senses the movement of the body ,skin temperature, body temperature. As we all know the temperature is completely different in body areas. So one who places this sensor, must find the correct place to position so that it doesn't create any chaos. It gives very accurate results. This sensor is mostly so similar to the reflexes. It is widely used in heart pacemaker, blood pressure etc

F. BioSensor

Biosensor are enzyme based. They are used in monitoring the blood glucose level and also to find the infectious disease. This sensor is used to differentiate the quality of food in the food industry. In medical field, it is mainly used to detect interleukin heart disease that is severe asthma problems. There are different types of biosensors such as immune sensor. The DNA biosensor, magnetic biosensor, thermal biosensor, magnetic biosensor, piezoelectric biosensor. It is widely used to check the blood glucose level and cholesterol level of the user.

G. Implantable Sensor

This sensor is used in sensing the temperature inside the human body. Even though there are many alternatives used to sense the temperature inside the body but they are so bulky and costly. So implantable sensor are built with micro fabrication and nanofabrication, thus they can be used to produce the desired outcomes. These sensors are compactable and small in size. They can

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able to send the data even in a wireless manner. They minimise the possibility of failure. This sensor is a initial step in developing the future sensor. Still researchers are doing their research using this sensor.

H. Ultrasonic Sensor

During pregnancy, an ultrasound fetal test is taken. This test helps to project the image of the unborn with the help of ultrasound waves. Likewise, this ultrasound sensor is a boon to women which is used to provide images of breast which gives a detailed view of enlarging or change in the breast. It uses linear array to produce ultrasound. This will be very useful for preventing the breast cancer.

I. Position Sensor

This position sensor deals with the position of an object. While taking MRI scans and CT scans, it is very important for the physicians to note the position of the patient so that the image could be very accurate. This sensor plays a major role here. It helps to ensure the position is very correct and also accurately. It is also used in ambulance. Ambulance are equipped with this sensor in order to lift the stretcher correctly without a small damage to the patients. Most of the hospitals use this sensor in the bed to ensure whether the bed is in correct position or not. Nowadays the surgery are carried by robot without human intervention so this sensor is really a welcoming thing to this era.

IV. SENSORS IN SMART PHONES FOR HEALTH CARE

Nowadays, the role of smat phone is very vast. Smartphones are not only used for normal purpose, they play a very important role in healthcare. We all know the fact that smart phones has various sensors but a major improvement is that,they have equipped with sensor used for healthcare.

The Various sensor Apps used in smart phones are :

1.Point Of Care HIV Check

2.Blood Culture

3.My Cancer Diary

V. WEARABLE SENSORS

This is a sensor used to monitor peoples health condition periodically. This is a wearable sensor, which are similar to reflexes. This wearable sensor is made of fabric sensor, so a person can wear it like a dress. This sensors monitors various healthcare parameters such as ECG, shoulder articulation, etc. If a person suffering from bad health condition but he is unable to go for a clinic to check his health condition, then the user can use this wearable sensor and knows the current health status at his place itself. This sensor is equipped with amplifier, microcontroller, radio chip and antenna.

Consider a person with poor immune and health condition, he is using this wearable sensor so that his health conditions are periodically monitored by the care taker. This data passes either through Bluetooth or wireless network or some kind of usable network which passes to the caretaker.

VI. COMPARISON OF VARIOUS SENSORS IN HEALTH CARE APPLICATIONS

TABLE I : TYPES OF SENSORS FOR HEALTH CARE

Types of Sensors	Features	Applications
Pressure	❖ Measure Differential Pressure ❖ Can be ingested in respiratory system, ❖ Can be given to the patient through drug delivery system	❖ Monitoring the blood pressure monitoring ❖ surgical fluid management ❖ kidney dialysis
Temperature	❖ NTC thermistor is a micro sensor ❖ NTC thermistor is used to sense the sensitivity in the body temperature. ❖ It is extremely accurate ❖ It doesn't need calibration ❖ This will be very useful for the physically challenged people who can monitor their blood pressure in their homes	❖ digital thermometer ❖ medical incubators ❖ neonatal intensive care ❖ organ transplant system temperature

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Image	❖ It is sensor is an sensor which converts image into electrical signal ❖ It uses CMOS(complementary metal oxide semiconductor)sensor ❖ The sensors have been fixed in the endoscope and the miniature of the cameras have been introduced	❖ dental imaging, ❖ radiography ❖ artificial retinas ❖ fluoroscopy ❖ cardiology
Accelerometer	❖ This sensor is used in mobile. It actually sense the gyroscope of our mobile. It sense the twist and turns of our mobile ❖ It is a technique used to identify the sensors located or positioned in our body ❖ It is also a Wearable sensor . It senses the movement of the body ,skin temperature, body temperature	❖ heart pacemaker ❖ monitoring the blood pressure
Biosensor	❖ It is Enzyme based ❖ It is used to detect interleukin heart disease that is severe asthma problems ❖ It is used to differentiate the quality of food in the food industry	❖ monitors the blood glucose level ❖ find the infectious disease
Implantable	❖ sense the temperature inside the human body ❖ These are built with micro fabrication and nanofabrication they can be used to produce the desired outcomes	❖ It can be used in a wireless environment to sense the temperature
Ultrasonic	❖ It is a boon to women which is used to provide images of breast which gives a detailed view of enlarging or change in the breast. ❖ It uses linear array to produce ultrasound	❖ This will be very useful for preventing the breast cancer
Wearable	❖ This sensor is made of fabric sensors. So a person can wear it like a dress ❖ It monitor the users health condition periodically ❖ The sensed data passes either through Bluetooth or wireless network or some kind of usable network which passes to the caretaker	❖ It is used to periodically monitor the patient health, especially for the patients who are under an observation and in remote location

VII. CONCLUSION

The study of various Sensors used in the medical field for Health care has been widely discussed in this paper. These sensors are small devices and are used for monitoring the various parameters of a human and for detection of a disease using the sensed values. Each sensor can be used to measure or monitor the health condition of the user. These sensors are used for a variety of applications even in a mobile and wireless environment. In the future, the smart health management systems can be created using the various sensors and some more new sensors are yet to be developed according to the current needs of the society.

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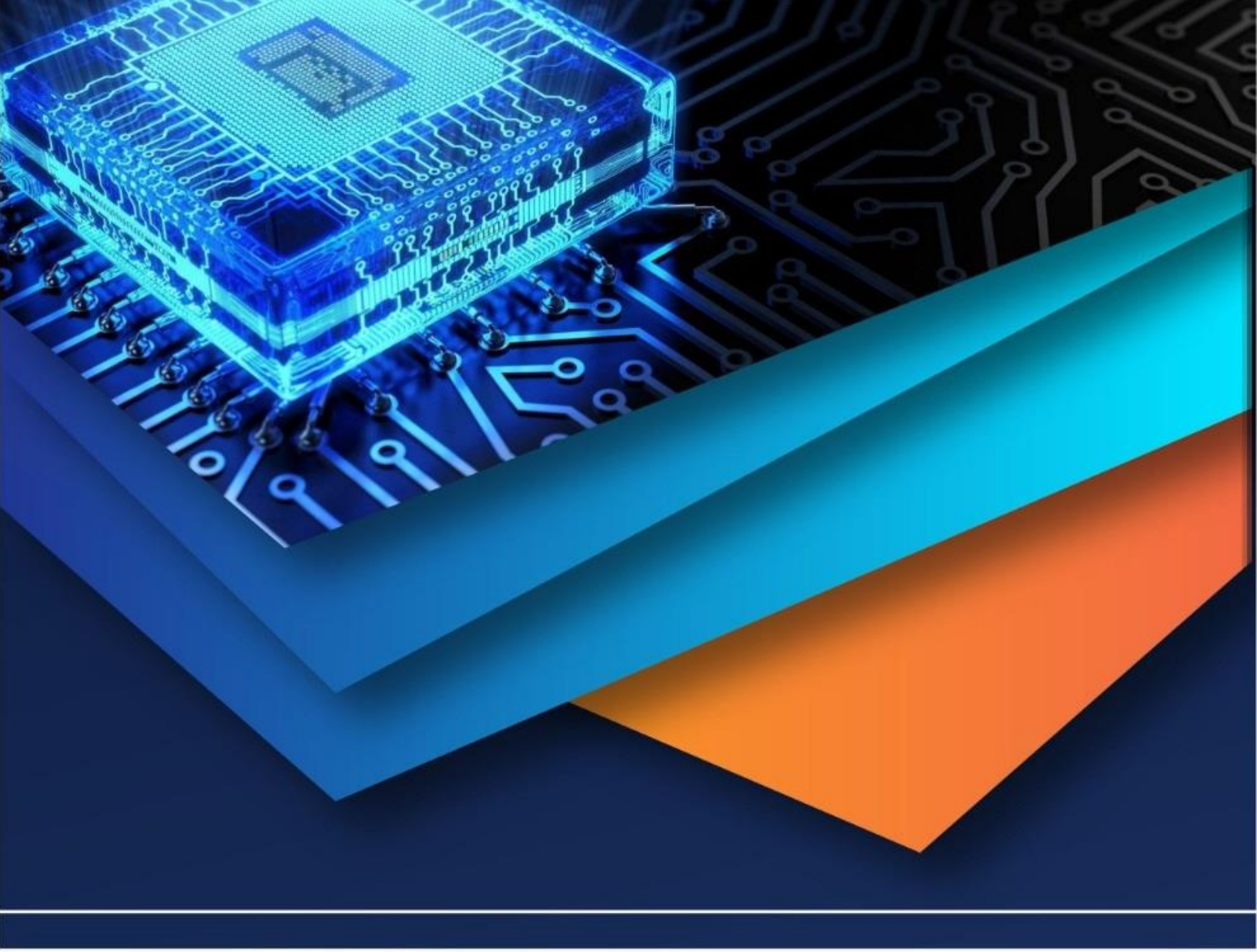

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