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IIoT Applications: Healthcare

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Introduction

Earlier so many people died due to lack of health care.
People forget about their health due to busy life.
IIoT makes the healthcare easier.
IIoT based healthcare service is cheapest.
ECG, blood pressure, glucose level, and temperature can be monitored from patient's home.
If any critical conditions are there, it sends alert.

Healthcare Challenges

Populations are ageing all over the world

Different diseases are increasing

Expenditure of hospitals and medical clinic are increasing

Largest Age Group

Populations are growing older

- Between 2017 to 2050, person's aged 60 years or over is expected to increase more than double.
- In 1980, there were 382 million older person all over the world.
- In 2050, it is expected to be 2.1 billion older person worldwide.

Telecare applications, smart home or telemedicine helps older people to live safely.

Increase of Diseases

Different diseases are increasing.

Telecare applications, smart home or telemedicine helps older people to live safely.

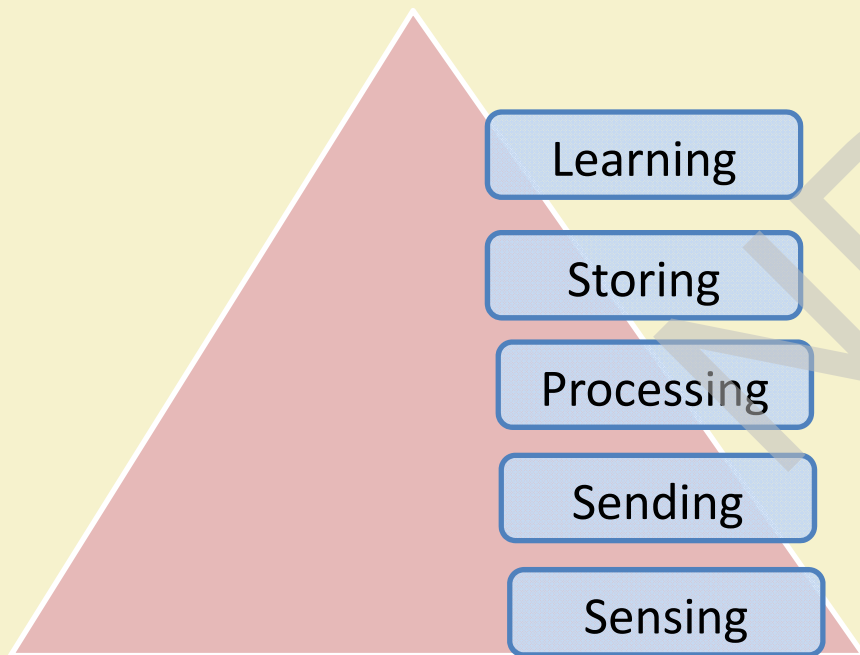
Continuous monitoring of patient's health reduces hospitalizing.

Sensors collect blood pressure, respiration, pulse rate, heart rate, and weight. It triggers alarm, if any abnormal situation is there

Reduce the Expenditure

- IIoT based healthcare device
 - Different wearable healthcare devices which reduce the cost of checkup.
- Remote monitoring
 - Patient's health condition can be monitored by sensors, which reduce the cost.
- In hospitals, smart beds can send notification about patient's activity.

IoT Healthcare Architecture



Source: Nguyen et. al, "A Review on IoT Healthcare Monitoring Applications and a Vision for Transforming Sensor Data into Real-time Clinical Feedback", in Proc. 21st Comp. Supported Cooperative Work in Design, IEEE, 2017

Benefits of IIoT in Healthcare

- Monitor patient's health condition remotely.
- Hospital staff can predict the arrival of a patient in PACU.
- Hygiene monitoring system can detect the cleanliness of hand.
- Medical staff can provide quality medical service with small budget using IIoT.

IoT Based Electrocardiogram Monitor

- Wireless ECG monitor.
- Bio signals are collected by ECG sensors.
- The collected data are sent to the cloud.
- Medical staffs can analyze the health related data in real time.
- QardioCore is an example of wireless ECG monitoring device.

IoT Based Glucose Level Monitor

- Diabetes is metabolic disease, glucose level is high.
- Monitoring the glucose level helps meal planning, physical activity, medication.
- Glucose sensor devices are used to check the glucose level.
- It notifies the doctors and patients if any abnormal situation occur.
- Dexcom develops continuous glucose monitoring devices.

IoT Based Blood Pressure Monitor

- Using IIoT device, the patient's blood pressure is measured and compared with the other blood pressure.
- Doctors can monitor patient's blood pressure in real time.
- Medicines can be prescribed based on this.
- iHealth BP5 is IoT based blood monitoring system.

IoT Based Body Temperature Monitor

- Wearable sensor to continuous monitoring human body temperature
- It measures skin temperature
- The WBAN is used to connect to gateway
- Kinsa smart thermometer is IoT based body temperature monitoring devices

IoT Based Oxygen Saturation Monitor

- Oxygen saturation= ratio of oxyhemoglobin to total hemoglobin
- Pulse Oximetry measures the oxygen saturation.
- IoT is integrated with Pulse Oximetry.
- Bluetooth is used for connectivity.
- Low cost device to remotely monitor patient's health.

IoT Based Contact Lenses

- The IIoT based smart contact lense support WiFi signal, connected with smart phone.
- It consists of micro camera, sensors.
- Sugar level can be measured by tears. Smart contact lenses can monitor the sugar level.
- It can monitors human health conditions.
- It can detect various diseases, if any abnormal situation is found.

IoT Based Asthma Treatment

- Asthma is lifelong disease, can be controlled, not cured.
- Inhaler is commonly used to give proper dose of drugs.
- Smart Inhaler can keep track via GPS.
- ADAMM Intelligent Asthma Monitoring device.
- Wearable device, connected with Bluetooth or WiFi.
- From the body temperature, cough rate, heart rate, it predicts pre symptoms of asthma attack.

Smartphone :Healthcare Solution

Electronic devices consist of sensors, which are supported by smartphone

Smartphone is used to monitor the health of user and detect diseases.

Smartphone's healthcare app provides low cost healthcare service.

- Diagnostic apps detect patient's health condition.
- Medical communication apps connect patients with hospitals.
- Medical education apps provide tutorials.

Smartphone Based Healthcare App

- Health Assistant: Keeps track of health condition
- Google Fit: Keeps track of different physical activity
- ECG Self Monitoring: Serves as ECG device, based on “ECG Self Check” software.
- Instant Heart Rate: Measures heart rate using smartphone’s camera
- Fingerprint Thermometer: Determine body temperature from the fingureprint

IoT Healthcare Technology

- Cloud computing: Provide facilities to shared resources.
- Big data: Includes health data generated from sensor nodes.
- Networks: WBAN, 6LoWPAN, WSN are part of IIoT based healthcare.
- Ambient intelligence: It involves continuous learning and analyze based on the learning.

IoT Healthcare Security Requirement

- Confidentiality: It ensures medical data is not accessible by unauthorized users.
- Integrity: It ensures medical data is not altered by any third party.
- Authentication: It ensures the identity from which the data is coming.
- Availability: It ensures the accessibility of data to valid users

IoT Healthcare Challenges

- Less computational capability, not able to perform expensive operations.
- Less on device memory.
- Energy limitation, sensor has low power battery.
- Not static, mobile devices. Designing mobile enabled algorithms are challenge.
- Designing scalable algorithm without compromising security is challenge.

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Thank You!!