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A SURVEY ON RECENT TRENDS IN HEALTHCARE SYSTEMS

Mrs. Mounica B*[1], Neeraj[2] & Abhinav[3]
*[1]Assistant Professor, Department of Information Science, New Horizon College of Engineering, Bengaluru, India.
[2&3]Student, Department of Information Science, New Horizon College of Engineering, Bengaluru, India.

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Abstract
Technology plays a major role in monitoring various medical parameters and post operational days. The latest trend in Healthcare communication method using IoT is adapted. Internet of things (IoT) serves as a medium for the healthcare and plays important role in wide range of healthcare applications. A microcontroller is used as a gateway to communicate to the various sensors such as temperature sensor and pulse sensor. The sensor data is picked up by the microcontroller and sent to the network through Wi-Fi or Bluetooth and which provides real time monitoring of the health care parameters. The data is accessible to the doctors anytime. The controller is also connected with various alerting methods to alert the caretaker about variation in sensor readings. The prime concern in this method is that the data transmission to the destination has to be secure and made to allow only authorized users to access the data. The security issue can be addressed by transmitting the data through the password protected Wi-Fi module that will be encrypted by standard encryption methods and the users/doctor can access the data by logging to the HTML webpage. At the time of extremity situation alert message is sent to the doctor through GSM module triggered by the controller. This system is efficient with low power consumption capability, easy setup, high performance and time to time response.

How Iot Is Connected To The Network

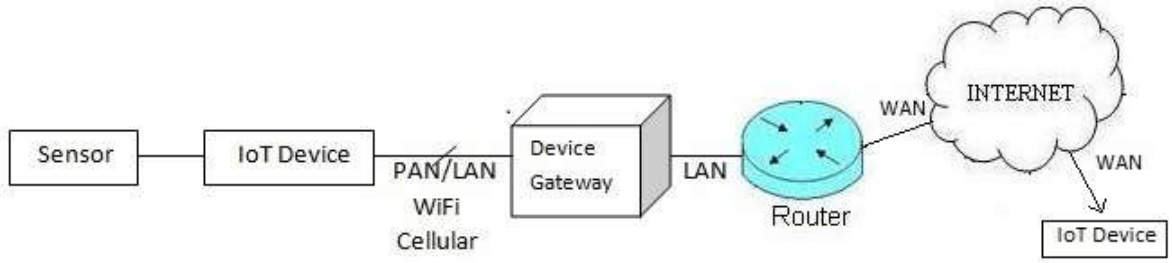

Fig. 1

Introduction
The recent yet promising trend in healthcare is shifting the routine medical checks and other health care services from hospital to the home environment. Thus, patient can get accurate health care more easily even in case of emergencies. This also reduces the hospital load by shifting the possible tasks to the home environment. The major advantage is reduction of expenditure. Patients can avoid the consultation fee charged by the doctors for every visit. Therefore, there is need of a technology to be implemented in the health industry to develop advanced health care techniques and use them for the easy monitoring of patients from anywhere, preferably home environment. Monitoring of the patient includes checking the physical conditions of the patient and their medication details. Given the right medicines at right time, the condition of a patient getting worse can be reduced. It is challenging for elderly people to take right medication at the right time, because of their memory problems. So, poor medication fidelity is a major problem in healthcare sector. IoT became popular in 1999. Computers could manage and inventory the objects and people if they were equipped with proper identifiers. Everything in IoT is uniquely identifiable through its embedded computing system but is able to interoperate

within existing Internet infrastructure. There is an expert estimation that the IoT will impact almost 50 billion objects by 2020. With the use of IoT, embedded sensors, tags etc. have developed. Wearable sensors can be integrated with IoT to get clearer details. An android application is used with medicine box to make the system more user-friendly. Implementation of different technologies at the right time like IoT could make a major change in the medical field. A popular IoT based medical system includes a featured medicine box which is wirelessly connected to the hospital administration. Hospital administration keeps an eye on the routine details through a webpage that is managed by the hospital side. An android application is installed on the patient's smartphone as well as in doctor's smartphone. Through this application, patients could view their prescriptions, could make appointments and get notifications regarding medicine intake. Doctors can view their patient details. Another prominent feature is the chat option provided. Both doctor and patient could chat using the application. Medicine box is provided with different compartments. Whenever patient opens a wrong compartment, the patient will be alarmed through a buzzer. The medication history will be updated automatically in the hospital webpage. An LED on top of each compartment indicates the correct box. The LED glows at appropriate times. If wrong compartment is open, a buzzer alarms the patient.

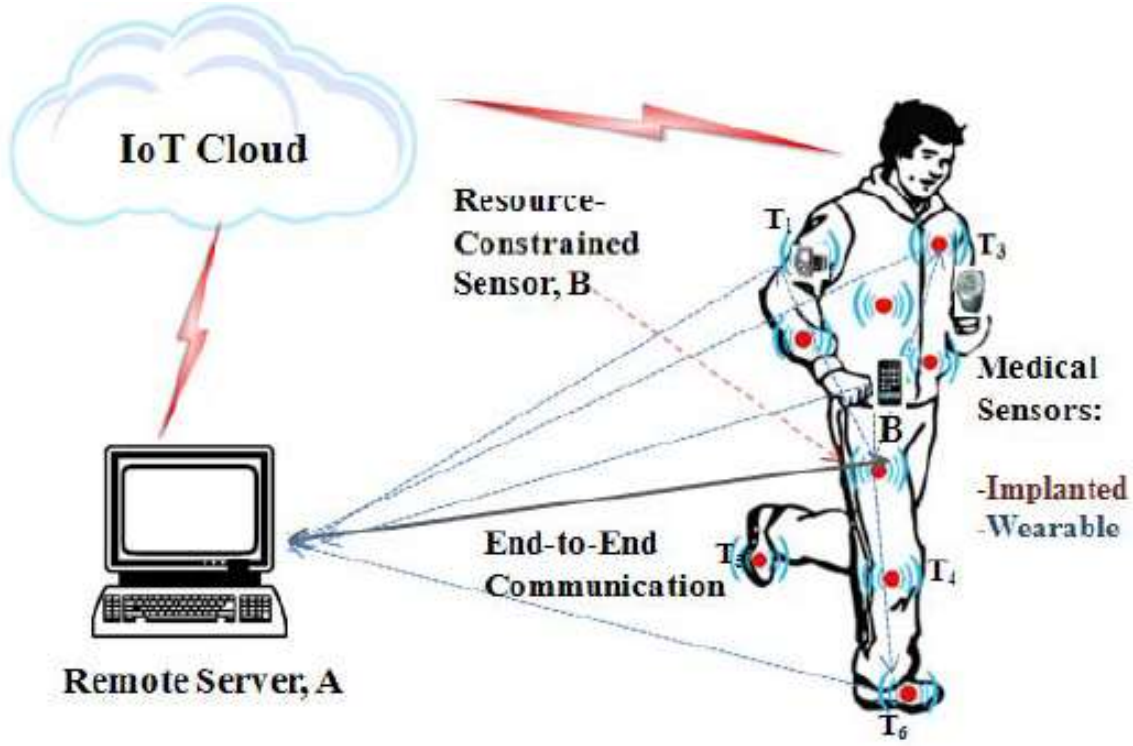

Fig. 2

Literature Survey

David Niewolny describes in his paper how the Internet of Things is revolutionizing Healthcare systems. The main concern is people have limited time, awareness and accuracy, which implies they won't be able to get data about things networked in the real world consistently. The solution to the issue is to empower devices to collect information without any human interference. A smart health monitoring chair is demonstrated by H. Baek , G. Chung, K. Kim, and K. Park for non-invasive bio-signal measurement. However, these solutions are almost specially implemented using off-the-shelf components. Its size, rigid nature, and short battery life become limiting factors for long-term use. Remote monitoring of medication uses ZigBee technology was proposed by A. J. Jara, M. A. Zamora-Izquierdo, and A. F. Skarmeta for obtaining sensor values. ZigBee transfers sensor values efficiently but when there is a requirement of continuous data transmission, ZigBee isn't efficient. Reducing sampling rate solves the above problem but affects the quality of signals.

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Basic Architecture

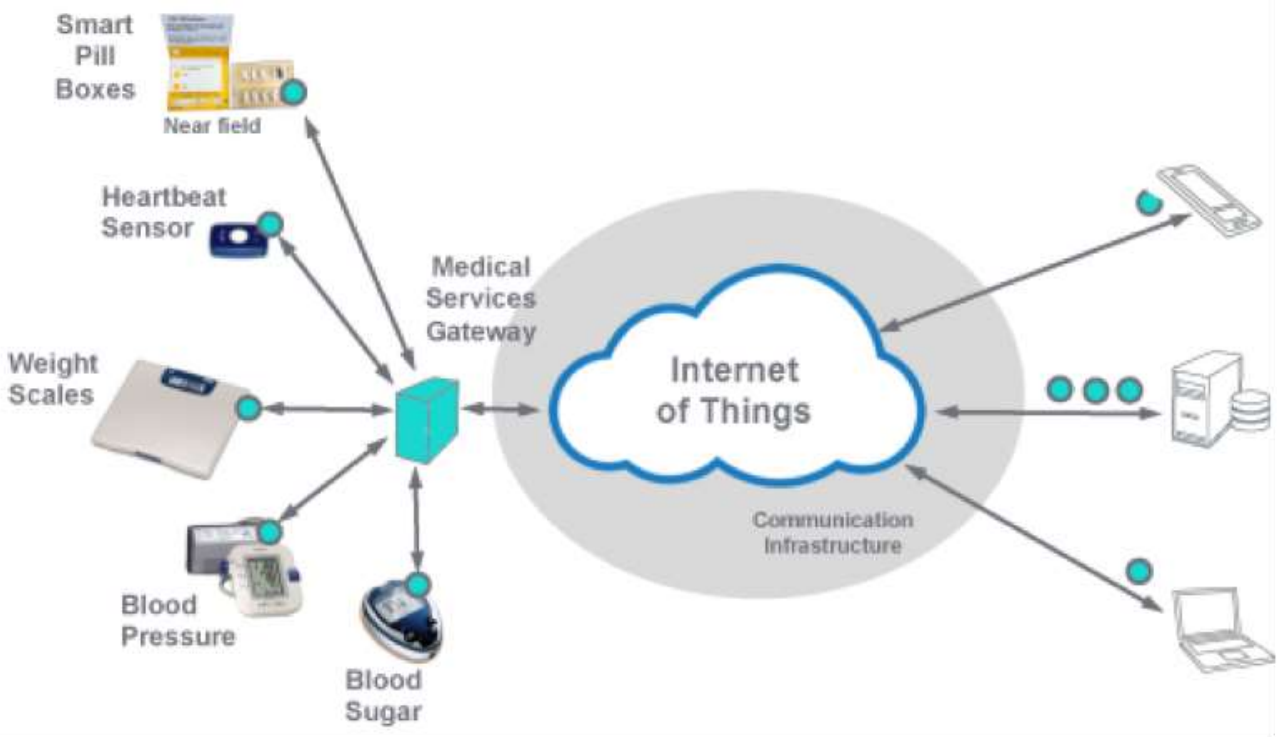

Fig. 3

Applications

Real Time Location Services
Through IoT, doctors can utilize ongoing area administrations and track the gadgets utilized for treating patients. Therapeutic staff may at times keep the gadgets in outside of anyone's ability to see zones which makes them hard to discover when another medicinal staff goes ahead the scene.

Medicinal mechanical assembly and gadgets like wheelchairs, scales, defibrillators, nebulizers, pumps or observing gear can be labeled with sensors and found effectively with IoT. Aside from constant area administrations, there are IoT gadgets that assistance in ecological observing also (checking the cooler temperature, for instance).

Predicting the Arrival of Patients in PACU
With the intercession of Internet of Things, clinicians can foresee the entry of patients who are recovering in the Post-Anesthesia Care Unit (PACU). They can likewise screen the status of patients progressively.

Hand Hygiene Compliance
There are hand cleanliness observing frameworks that would distinguish the level of cleanliness in a social insurance laborer. As per the Center for Disease Control and Prevention in the United States, around one patient out of each 20 gets contaminations from absence of appropriate hand cleanliness in doctor's facilities. Various patients lose their lives as consequence of clinic obtained diseases.

The associations in the hand cleanliness checking frameworks are done continuously and if a clinician draws close to a patient's bed without washing his hands, the gadget would begin humming. Also, that is not all. The data about the human services laborer, his ID, time and area will all be bolstered into a database and this data would be sent to the concerned experts.

Tighten Budgets and Improve Patient Journey
The human services industry needs to watch out for the financial plan and in the meantime have refreshed framework to give better patient encounters. Because of the consistent association between gadgets that IoT has made conceivable, it is currently workable for the restorative staff to get to patient data from the cloud the length of they are put away in there.

The objective is to give quality medicinal care to patients, and by spending a little sum on IT foundation, doctor's facilities can give great care to patients at reasonable rates. IoT intends to give better patient voyage by:

- Room lighting through individual control
- Communicate to family and companions through email administrations
- Immediate thoughtfulness regarding persistent necessities

Remote Monitoring
Remote healthcare checking is an imperative use of Internet Of Things. Through checking, you can give satisfactory medicinal services to individuals who are in desperate need of offer assistance. Consistently, bunches of individuals bite the dust since they don't get opportune and incite medicinal consideration. With IoT, gadgets fitted with sensors inform the concerned medicinal services suppliers when there is any adjustment in the essential elements of a man.

These gadgets would be fit for applying complex calculations and examining them so the patient gets appropriate consideration and medicinal care. The gathered patient data would be put away in cloud. Through remote checking, patients can essentially diminish the length of healing facility stay and maybe, even clinic re-affirmation.

This sort of mediation is a shelter to individuals living alone, particularly seniors. On the off chance that there is any interference in the everyday action of a man, alarms would be sent to relatives and concerned wellbeing suppliers. These checking gadgets are accessible as "wearables" as well.

Current Systems
The present frameworks depict the plan of a basic, minimal effort Microcontroller based heart rate with LCD yield. Heart rate of the subject is measured from the thumb finger utilizing IRD (Infra Red Device sensors and the rate is then arrived at the midpoint of and showed on a content based LCD). The gadget LCD showing the heart beat rodent and tallying values through sending beats from the sensor.

Disadvantages
- No temperature estimation.
- Remote observing is unrealistic.

Proposed Inclusions

1. Android And Web
An android application Health Care is produced and introduced on both patient's and doctor's cell phone. Both applications have slight contrast in their elements. Patients can see their own points of interest, can see their therapeutic subtle elements, can book meetings with the specialist and can visit with specialist. In the meantime specialist can see his patients subtle elements, his arrangements, can apply for leave, can see his meetings with comparing patients and can talk with patients. Both applications require the client to login. Login ID and secret

key is the same as given at the season of enrollment in healing facility. Wellbeing IoT likewise gives notice at the season of pharmaceutical. Patients and specialist enroll at doctor's facility. Doctor's facility server will contain all records of patient and specialist. It will store restorative subtle elements, remedy points of interest and history of medications picked by every patient. The incentive from temperature sensor is additionally recorded in the doctor's facility server. On the off chance that temperature goes past the breaking point SMS alarms and sent to the concerned individual. This takes the required measures at crisis circumstances. Healing center organization can view and check patient's records at whatever time.

2. Other Considerations

Smart sensors, which consolidate a sensor and a microcontroller, make it conceivable to outfit the energy of the IoT for medicinal services by precisely measuring, checking and dissecting an assortment of healthcare status markers. These can incorporate essential crucial signs, for example, heart rate and circulatory strain, and also levels of glucose or oxygen immersion in the blood. Brilliant sensors can even be consolidated into pill containers and associated with the system to show whether a patient has taken a planned dosage of prescription. For brilliant sensors to work successfully, the microcontroller parts must fuse a few fundamental abilities:

- ***Low-power operation*** is essential to keeping device footprint small and extending battery life, characteristics that help make IoT devices as usable as possible. Freescale, which has long offered low-power processing, is working now to enable completely battery-free devices that utilize energy harvesting techniques through the use of ultra-low-power DC-DC converters.

- ***Integrated precision-analog capabilities*** make it feasible for sensors to accomplish high accuracy easily. Advances inside microcontrollers which contain simple segments, for example, high-determination simple to-computerized converters (ADCs) and low-control op-amps are empowered.

- ***Graphical user interfaces*** **(GUIs)** enhance ease of use by empowering show gadgets to convey a lot of data in striking point of interest and by making it simple to get to that data. Applications processors with high graphics-processing performance support propelled GUI advancement.

- ***Gateways*** are the information hubs that gather sensor data, examine it and after that convey it to the cloud by means of wide area network (WAN) innovations. Entryways can be intended for clinical or home settings; in the last mentioned, they might be a piece of bigger network asset that additionally oversees vitality, excitement and different frameworks in the home. Medicinal gadget originators can likewise utilize the stage to make remote-access gadgets for remote monitoring.

- ***Wireless networking*** expels the physical limitations on networking forced by customary wired solutions like Ethernet and USB. Microcontrollers that support remote availability for gadgets in view of popular wireless standards, for example, Bluetooth and Bluetooth Low Energy (BLE) for individual area networks (PAN) utilized with individual gadgets and Wi-Fi and Bluetooth for neighborhood (LAN) in centers or doctor's facilities. That leads us to a key test for the IoT in healthcare services: standards.

Advantages

1. Decreased Costs

At the point when healthcare suppliers exploit the connectivity of the healthcare arrangements, quiet observing should be possible on an ongoing premise, subsequently fundamentally eliminating superfluous visits by specialists. Specifically, home care offices that are progressed are ensured to eliminate healing center stays and re-affirmations.

2. Improved Outcomes of Treatment

Connectivity of healthcare solutions through distributed computing or other virtual framework gives caregivers the capacity to get to continuous data that empowers them to settle on educated choices and also offer treatment

that is confirmation based. This guarantees medicinal services arrangement is convenient and treatment results are improved.

3. **Improved Disease Management**

At the point when patients are observed consistently, medicinal services suppliers can get to continuous information, infections are dealt with before they escape hand.

4. **Reduced Errors**

Accurate gathering of information, computerized work processes consolidated with information driven choices are an amazing method for eliminating waste, diminishing framework costs and in particular limiting on mistakes.

5. **Enhanced Patient Experience**

The connectivity of the human services framework through the web of things, spots emphasis on the requirements of the patient. That is, proactive medications, enhanced exactness with regards to finding, convenient mediation by doctors and improved treatment results result in care that is very trusted among patients.

6. **Enhanced Management of Drugs**

Creation and also administration of medications is a noteworthy cost in the healthcare business. And still, after all that, with IoT procedures and gadgets, it is conceivable to deal with these costs better.

Risks

Despite the fact that the Internet of Things is transformational in the medicinal services part, it likewise displays various difficulties given that healthcare information is sensitive. All things considered, when shared improperly, healthcare data may harm reputations or devastate careers in addition to other things. Besides, streamlining and digitizing healthcare information and its ensuing extended utilize is probably going to strain the server farms. As patient observing is extended to the utilization of gadgets that are wearable and at home, clinicians that are accused of checking those endless conditions and additionally the consideration of prescient examination expands requests on the server farm and office framework. Exclusive medicinal administrations powerlessness to share information between each different requires that a play and play arrangement that has a standard dialect be created to advance data sharing. Security of information is additionally another risk factor that is probably going to increment with an expansion in the level of information being shared. The volume of information will undoubtedly increment fundamentally, hence the need to shield this data from digital assaults.

Challenges To Be Addressed

- Security
- Trust
- Loss of privacy

Future Enhancement

IoT has wide range of applications that reach out from little frameworks like keen homes to critical frameworks like healthcare, military and organizations. Among these, healthcare and residential frameworks include traditional handling techniques that occasionally may not demonstrate proficient. The keen sensors technology will upset our life, social cooperation and exercises especially similarly that PCs have done a couple of decades back. An expansion in total populace alongside a critical maturing segment is compelling quick ascents in healthcare costs. The healthcare framework is experiencing a transformation in which nonstop checking of occupants is conceivable even without hospitalization. Propelled Sensors recognize anomalous circumstances by observing physiological parameters alongside different indications. Hence, fundamental help can be given in times of critical need. Smart sensor based technology keeps on progressing and gives critical chances to enhancing customized healthcare. Propels in adaptable gadgets, brilliant materials, and low-control processing and systems administration may diminish obstructions to make technology accessible, integrated, and cost efficient, unleashing the potential for ubiquitous monitoring.

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