

## Modern Health Care System Using Internet of Things - Challenges and Prospective

### Solutions

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**Abstract:** Health is a sustainable development area that is one of the main topics of the world. The Internet of Things is a process that enables various devices and sensors to interact and exchange information. Internet of Things is a technology that has gained widespread popularity due to its ability to monitor and control various devices such as mobile platforms and healthcare systems. Due to the increasing medical costs, public healthcare has been considered an important area of concern. The emergence of Wireless Sensor Networks (WSNs) has led to the creation of new technologies that can help improve the quality of life. The emergence of Internet of things has brought about various advantages for the healthcare industry. Its continuous growth is being utilized for various applications such as remote monitoring of patients, diagnosis and treatment of diseases, and many more. In this paper, we discussed the various components of IOT that are used in healthcare monitoring systems. They are also considered as the building blocks for the future of healthcare monitoring system.

**Key words:** Health care, IoT, Sensors, Applications of IoT, Wireless Monitoring system

### 1. Introduction

Due to the increasing number of people suffering from chronic illnesses and the strain on the healthcare system, the demand for medical resources is extremely high. The rise of Internet of Things has created new opportunities in healthcare. The rise of IOT has been widely attributed to the increasing popularity of AI and machine learning. With the combination of these two, AI has become more prevalent in various processes [1].The Internet of Things can help improve the efficiency of healthcare facilities by monitoring the conditions of the patients and their caretakers. It can also prevent diseases and provide better care for the patients [2].Through the use of technology, hospitals can provide better care and services to their patients, which in turn contributes to the economic prosperity of the country [5].Unfortunately, the healthcare system is struggling due to the increasing number of people living with chronic illnesses and the lack of resources.

The Internet of Things is a relatively new field of research that has yet to be widely used. Although it has plenty of definitions, its main goal is to enable the exchange of data between various devices [7].This paper talks about various IoT technologies used in healthcare namely, remote sensing, wearable technology, sentiment analysis, blood sugar level monitoring, etc[8].

Internet of Things has investigated its reasonableness for medical care and has featured a few past works identified with medical care IOT frameworks. Examination in related fields has shown that health care monitoring is practical. Patients can be observed at home instead of in clinics in distant health checking framework with the lessening strain on emergency clinic assets like specialists and beds. Truth be told, there are not many drawbacks of distant wellbeing checking which incorporate the security hazard that accompanies having a lot of delicate information put away in a solitary data set. It is crucial for actually take a look at routinely the sensors of individual for checking precisely and probability of separations from medical care frameworks might emerge, if the patient was out of cell range or their devices might run out of battery.

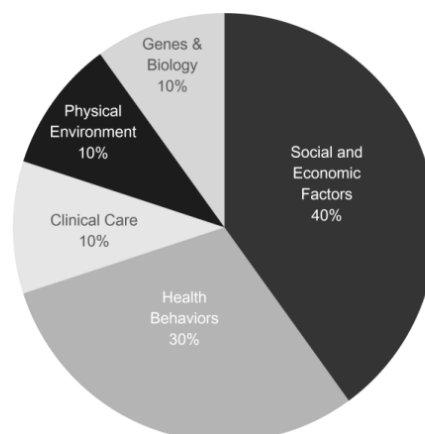


Fig.1. Determinants of Health

## 2. Literature Review

This technology empowers atomization inside an outsized scope of ventures, likewise as permitting the social occasion of enormous information. Hailed on the grounds that the driver of the Fourth mechanical unrest [9], Internet of Things innovation has as of now found business use in regions like brilliant leaving, accuracy horticulture [10, 11], Extensive exploration has likewise been led into the use of IoT for creating insightful frameworks in regions including gridlock minimization [12], primary wellbeing checking [13], crash staying away from vehicles [14], shrewd networks [15]. While the previously mentioned fields show up incomprehensibly unique to medical services, the examination directed inside them confirms the believability of an IoT-based medical services framework. Existing frameworks in different fields have demonstrated that remote observing of articles, with information assortment and detailing are attainable. this will accordingly be extended an as overseers, specialists, crisis administrations, and medical care habitats. Cloud advancements are generally explored because of their value in huge information the board, handling and examination. A few related works have overviewed the writing on utilizing cloud innovations for IoT purposes like savvy framework [16] and versatile distributed computing for PDAs [17] further related works have inspected the condition of cloud driven medical care. the use of cloud innovation for wellbeing record stockpiling is considered during which likewise outlines cloud advances as a whole field. Another sensor-based framework is implied in [18], fully intent on checking patients' enthusiastic states.

Big data management is vital in this framework, as they mean to draw joins between enthusiastic reactions and physiological changes. A lot of physiological information are put away in the cloud module, coordinated adequately to empower information digging strategies for the extraction of significant data. Empowering AI through suitable enormous information the board in the cloud is considered in [19]. The authors distinguish that distributed storage is helpful for putting away high volumes of information so that worth can be separated from it. In this framework, physiological boundaries and recurrence of clinical visits are both put away in the patient's wellbeing record. An incredibly careful work on cloud for medical care is introduced in [20].

In this work, all administrations of cloud advancements are used to make a vigorous framework. Patients are observed by their WBANs, with their information put away in the cloud safely. A mark based admittance control system keeps unapproved clients from getting to information in the cloud. Large information the executives for medical services isn't only a hypothetical idea. It is now being executed in specific areas of the planet. In Australia, the Government has as of late presented the My Health Record conspire [21]. Content/discover this uses distributed storage techniques. A patient's My Health Record can contain data about any sensitivities, conditions, current prescriptions and medicines, pathology test results, also, analytic pictures. The patient can choose who approaches these records under typical conditions. In an crisis where the patient can't give the actual data (for example they are oblivious after a mishap), then, at that point, restricted time crisis access can be conceded to the reacting medical services suppliers so that the patient can get the most ideal treatment quickly [22].

The advantages of cloud innovations for large information the board are clear. It considers basically limitless extra room, the arrangement of numerous helpful administrations, and empowers openness for patients and specialists. This gives patients more authority over their own medical services, and all the while empowers specialists to give more appropriate medicines without evening meet with their patient face to face. A few analysts have recognized the handiness of computational offloading in medical care conditions. In [23], readings from WBAN sensors are communicated to a cell phone, where some essential preparing happens. The data is then communicated forward from cell phone to cloud, where exceptional preparing happens utilizing highlight choice and arrangement strategies. In [24], distributed computing is utilized to deal with the intricate crude information and send the significant outcomes back to the Patient through their detecting framework. This is a solid idea, as it considers the preparing force of cloud to be used by complex sensors, while likewise empowering the patient to quickly get to their outcomes and offer them with a specialist on a case by case basis. Computational offloading for information handling is utilized in [25] to decide states of ECGs and assess whether the shape is predictable with congestive heart failure.

In [24], cloud computing is utilized to handle the complicated raw information and send the significant outcomes back to the patient through their detecting framework. This is a solid idea, as it takes into account the preparing force of cloud to be used by complex sensors, while additionally empowering the patient to quickly get to their outcomes and offer them with a specialist depending on the situation. Computational offloading for information preparing is utilized in [25] to decide states of ECGs and assess whether the shape is reliable with congestive heart failure.

### 3. Application of IoT

**A. Open APS:** Open APS represents Open Artificial Pancreas framework. Utilizing open source programming patient can ceaselessly screen the glucose level through associated gadget. Because of safety and viable troubles such associated gadgets have set aside some effort to come to showcase. [26]

**B. Hand Hygiene Compliance:** Maintaining hand cleanliness is a reasonable counteraction measure to try not to build number of deaths, long periods of clinic stay and expenses. Medical care Acquired Infections (HAI) are contaminations that are neither present nor incubating when a patient is conceded to emergency clinic. These are hazards that medical clinics should control to deal with the medical care financially wellbeing for patients. These can be preventable by Hand Hygiene (HH) practice by experts. [26]

**C. Tracking during Cancer Treatment:** Information about patients will be gathered with the assistance of action trackers. Patients will wear an action tracker for some time of months till the treatment over. This kind of trackers assists with estimating the action level, logging craving level and all information will be saved to patients advanced mobile phones through explicit application. [27]. this will help in diagnosing the patient's conditions each moment and treatment can be further developed much better. This gadget following is especially helpful for malignancy treatment.



Figure.2 Continuously Tracking Tumour Motion During Cancer Treatment

**D. Connected Inhalers:** IoT here permits doctors to monitor if patients are rigorously following the treatment. Devices associated with versatile applications permit patients to get data. Propeller's Bruzhaler gadget associates its computerized stage through a sensor. This kind of associated inhalers gives extraordinary inspiration to patients. [28]

**E. Real Time Location Services:** Real Time Location frameworks can follow the predetermined area of individuals inside a specific region through remote organization. Specialists can utilize constant area administrations and track the gadgets for observing patients. Clinical contraption and gadgets like nebulizers, wheel seats, scales, defibrillators, siphons or observing supplies can be associated with sensors and found effectively with IoT. [29]



Figure.3 Real Time Location Services in Health care

**F. Connected Contact Lenses:** The technology called "inter scatter communication", works by changing over Bluetooth signals to wifi signals. This depends on existing strategy for correspondence called backscatter which permits gadgets to trade data. Bury disperse correspondence permits Bluetooth signs and wifi signs to talk one another .It would permit gadgets, for example, contact focal points to send information to different gadgets. To execute entomb disperse correspondence; the architects planned a contact focal point outfitted with a little radio wire and Bluetooth signal coming from savvy. The receiving wire on the contact focal point had the option to control that Bluetooth signal, encode information from contact focal points and convert it into a wifi signal that

could be perused by another gadget. Checking glucose levels is significant for patient with diabetes that should be possible with associated contact lenses.[30]

**G. Sentiment Analysis:** Using opinion investigation, one can break down the state of mind of each human with assistance of text examination. In computerized medication, disposition mindful wearable will screen the psychological wellness and prosperity. Also it educates the downturn disposition and assist patient with recuperating from it. The quantity of associated devices developing greatly and intended to bring positive social change. Measurable report says that in 2015, 4.9 billion associated things being used and it will arrive at 25 billion by 2020. To react esteem and emphatically transform us, these gadgets should be setting mindful. Feeling chip is appended to the associated gadgets that have optical sensor. It can understand feelings, looks, manner of speaking and physiology of an individual. To make these things conceivable, one should make their gadgets feeling empowers. The following wave in processing will be genuinely astute and mind-set mindful internet of things. [31]

**H. Coagulation Testing:** Coagulation is estimated by recording the thickness of blood at 100 millisecond spans in the wake of adding a reagent considered thromboplastin that starts coagulation. This is estimated in lab by dissipating light to a blood test. An organization named MicroVisk presents a home testing pack with a couple of cantilevers, which are drenched in a blood test and vibrated rapidly. Warfarin is utilized to treat patients experiencing pulmonary embolism and heart conditions clotting.[32]. Diet, liquor utilization, disease and exercise can likewise impact warfarin’s adequacy and body’s capacity to frame clusters. To keep away from dangers of thickening, drug portions ought to be overseen cautiously through customary checking of blood coagulation. For this the gadget comprises of miniature electromechanical sensors and will come to advertise inside three years.[33]

**I. Wheelchair Management:** Many researchers made for smart wheelchairs with full atomization for disabled people. These applications gives seat vibration control and screen the situation with the wheel seat client. This improvement shows that „things“ can develop into associated machines constrained by information. The gadget can screen the patient, client environmental factors for location accessibility.[34]



Figure.4 Automated Wheelchair

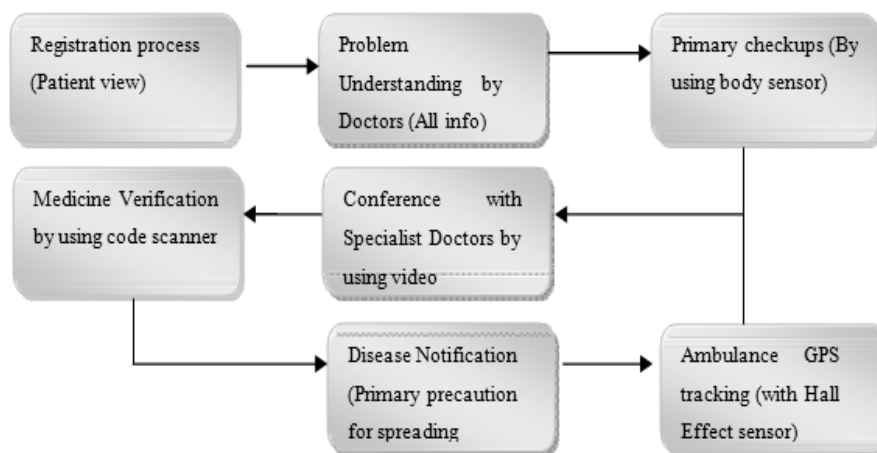


Figure.5 Techniques used in health Care System

**J. Electro cardiogram Monitoring:** Monitoring electrocardiogram is the electrical movement of the heart recorded by electrocardiography incorporates heart beat rate, recognizing fundamental rhythms, diagnosing myocardial ischemia.,etc. Wireless securing transmitter, a remote receiving processor and remote discovery calculation can be utilized for observing ECG signals.[35]

#### 4. Real Time Wireless Health Monitoring

We have examined the execution of the Wireless Health Monitoring System and its parts as follows:

**a. ECG Electrodes:** It is a gadget attached to specific part of the patient's body like arms, legs and chest during testing methodology. It identifies electrical flood when each time heart beats. The power that anode recognizes is transmitted through wire to a machine which makes an translation of the power into wavy lines recorded on the screen.

**b. LM35 Temperature Sensor:** The LM35 temperature sensors yield voltage is directly relative to the temperature in Celsius.

**c. Circulatory strain Sensor:** It is a gadget that actions the tension of the blood in the corridors as it is siphoned around the body by the heart.

**d. Blood Glucose Sensor:** is a clinical gadget uses to ascertain the blood glucose level.

**e. Microsoft Pro Tablet:** It is a portable PC incorporates show, battery and hardware in a unit. The framework works on similar head as the clinical expert utilized three terminals of ECG on the patient's body also, interfaces the Arduino safeguard with a temperature sensor, a blood glucose level sensor and a pulse sensor.

From the Arduino safeguard we associate a wireless node and the Tablet or the Smartphone that has Lab View programming running on it to take reading of the patient's physiological information. The information are saved by the time and introduced in a report design and the information is then distributed on the web by utilizing tablet or Smartphone so the patient's report can be gotten to by the approved medical care people from far off areas whenever.

#### 5. U-Healthcare System

Ubiquitous healthcare (U-health care) is a technology that guarantees expansions in productivity, precision and accessibility of clinical therapy. It is an arising innovation that gives advantageous medical care administration to patients, and to make it is not difficult to analyze patient's ailment. It guarantees expansion in the precision, effectiveness, and the accessibility of clinical treatment. So individuals can screen their wellbeing through online without visiting the medical clinic or center. Following graph shows some patients details in primary health centres and community health centres.

#### 6. Conclusion

In this paper, we discovered the significance and advantages of execution of IOT. The sensors in IOT will have a tremendous effect on each understanding's life. The information that is moving between and around the gadgets and in the middle individuals are galore in the event that you have older guardians living alone, and you are stressed over their wellbeing or security you can get a sign of their medical issue by associating gadgets with savvy sensors that would send movement information to your gadgets. This equivalent information can be shipped off their medical services experts also. By executing IOT innovation appropriately safely, more patients, with true serenity, can take part in their treatment utilizing IOT gadgets. Therefore, specialists and medical services labourers can all the more likely react to patients. Subsequently, the effect of these kinds of sicknesses, including diseases, hospitalizations, and demise rate, can be essentially decreased by utilizing sensors.

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