



Healthcare Systems Based on Internet of Things (IoT)

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Abstract

Health is wealth as a proverb says in day-to-day life people face a lot of health care issues. Diagnosing a disease plays a major role. Internet of things plays an important position in diagnosing the sickness by using the usage of a few sensor gadgets for monitoring. The impact of the internet of things (IoT) on the headway of the clinical offerings enterprise is tremendous. The guiding of the medication 4.0 has added about a multiplied exertion to create stages, both at the device level as well as the fundamental programming stage. This imaginative and prescient has triggered the development of Healthcare IoT (H-IoT) frameworks. The utilization of synthetic Intelligence (AI) has changed the H-IoT frameworks at pretty plenty every level. Advances in data and communication technologies have brought about the emergence of the net of things (IoT). In the present day healthcare surroundings, the usage of IoT technology brings the ease of physicians and sufferers, in view that they are carried out to numerous scientific areas (together with actual-time monitoring, affected person records management, and healthcare control). in the incoming international of the net of factors (IoT) for healthcare, various, and allotted devices will gather, study, and transfer real-time clinical records to open, private or hybrid clouds, making it viable to build up, pile, and examine large facts streams in numerous new techniques, and activate context-structured alarms.

Disciplinary: Healthcare Management, Information Technology.

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1 Introduction

An IoT is a milestone in future generation embedded techniques that could affect the entire industrial field and maybe intended because of the interlinked of completely recognizable smart things and gear inside modern-day available community structure with additional blessings. Fitness care constitutes one of the satisfactory solicitation areas for the IoT [1]. Healthcare with

fabric and fashion designing introduced wearable clothes with the embedded tool will constantly observe the well-being of the patient. This truth might be obtainable to the doctors on the company from any place via IOT application [2]. The Internet of Things (IoT) has great advantages in answering the difficult sufferers with heart diseases as they could modify the company(carrier) mode right into an execute manner and set off the healthcare carrier based on patients' bodily position as opposed to their moods [3].

New internet of things (IoT) based predictive modeling by way of the usage of fuzzy cluster primarily based augmentation and cataloging for forecasting the sufferers with lung most cancers ailment via constant nursing and also to get better the healthcare via giving medical commands. The fuzzy clustering method empathized right here based totally on picture segmentation[4].

Healthcare has a foremost efficient application of IoT than the other fields. In terms of improvement for medical facilities, this suggests that an ordinary hospital often becomes a wise hospital. The use of IoT in the medical field can have monumental advantages like health condition monitoring, personal care, discovering new treatments for malady interference, and dominant diseases and designation. The IoT paintings is a topic that determines the huge unfold presence of 'objects' or 'things' like sensors, aerial phones, tags, and actuators. The entire priority is to have the higher addressing schemes to cooperate the close to with the aid of using associates collectively and censure to advances not unusual place targets. In hospitals especially intensive care unit, needs continuous and close monitoring to regress possibly in a crisis case, which will give more chance to save patients life. IP-based sensors can derive remotely the following information that has a relationship with the patient's health situations and sends them over the network to caregivers for further re-examine and analysis. Also, IoT Testbeds help in increasing the care to the patients. By manner of IoT, clinical records may be exchanged from one place to any other to diagnose the illnesses and set up for correct medicinal drugs to enhance the patients' fitness situations even at rural locations. This generation allows to supply healthcare offerings over a lengthy distance and additionally minimizes the value of healthcare offerings with the aid of using coping with the persistent illnesses with much less health facility stays, much less tour time, and shared clinicians.

IoT is primarily based totally on smart healthcare with the assist of clever gadgets and items that improves the healthcare tracking machine effectively, for this reason via way of means of lowering the inefficiencies of the present healthcare machine. Smart gadgets with new and upgraded technology complement the information accuracy to be collected, real-time accessibility of patient's situation, shrewd integration of information collected, keeping the incorporated information well via cloud service, etc. IoT together with clever gadgets reduces complexity and headaches inside the healthcare machine. The penetration of cell technology and clever gadgets over healthcare machines motive a massive effect on the globe. The full-fledged usage of M-fitness and E-fitness programs in today's global is made conscious to the human beings for enhancing and keeping the good first-class of life. Apart from ordinary tracking of sufferers' situations via the M-

fitness machine, the main goal is to teach them via recommendations of wholesome ingesting conduct and powerful exercise routines for enhancing their first-class of a wholesome life.

2 IoT in Healthcare

2.1 Healthcare Monitoring using IoT

The fundamental empowering advancements include the correspondence frameworks between the detecting hubs and the processors; and the getting ready calculations for generating a yield from the data accrued via the sensors. however, as of now, these empowering improvements are likewise upheld by some new improvements. The usage of artificial intelligence (AI) has modified the H-IoT frameworks at quite plenty each level. The haze/area worldview is bringing the figuring energy near the conveyed network and henceforth moderating numerous challenges concurrently. at the same time as the sizable statistics permit handling an enormous degree of statistics. furthermore, the Software Defined Networks (SDNs) deliver adaptability to the framework even as the blockchains are finding the most novel use instances in H- IoT frameworks. The Internet of Nano Things (IoNT) additionally, Tactile net (TI) are riding the development within the H-IoT programs. This paper dives into the ways those innovations are changing the H-IoT frameworks and acknowledges the future path for enhancing the quality of management (QoS) utilizing these new innovations. these architectures are driven by way of ML, facet computing, and new technologies like SDN blockchains. The vital intention of this paper is to systematically categorize and investigate the definitive study strategies regarding IoT software program techniques and procedures. It explores the expansion and boom of IoT, alongside its deployment in numerous software fields. The important regions blanketed in this look encompassing healthcare, environmental, clever city, commercial, industrial, and infrastructural components of IoT applications

2.1.1 Tracking the Healthcare using IoT

With the progression of PCs and data innovation, there has been a critical ascent in the utilization and advancement of electronic gadgets in clinical sciences, and with the unfurling of IOTs, the clinical IoT has gradually yet consistently entered itself into the lives of people. The clinical web of Things has been viewed as a manner by which innovation has helped in installing remote sensors in clinical types of gear which at that point gets joined with the around the world web and interfaces with patients, clinics, and clinical types of gear to utilize the new advancement in the model of present-day clinical.

2.1.2 Roles of IoT in Hospital Management

IoT is not always most effective utilized in the hospital treatment however additionally in medical institution control for offering protection to the sufferers with the aid of using tracking them in ordinary durations and additionally with the aid of using regulating the strength consumptions in hospitals. Problems like patient's protection at some stage in medical institution fires and additionally a few uncommon however circumstance referred to as vascular air embolism. Integrating sensors in hospitals to reveal environmental conditions has been proved growth to the

medical institution enterprise because it now no longer most effective offers precise enjoy to sufferers and additionally lessen labors needed. Some of the strategies getting used are Saline Holder for prevention of Air Embolism the usage of IoT, Gas Detection for stopping Hospital Fires. Motion tracking to lessen excessive strength consumption.

3 Related Works

Internets of Things (IoT) devices are made for remote observing in the healthcare sector to retain patient's healthy and authorizing health consultants to convey unexpected attention to the patients. It has improved patient fulfillment as communications with specialists have become stress-free and more proficient. Remote observing of patient's fitness aids to shrink the visit to the clinic and retains tracks of patient health condition records. IoT also has a vast influence on sinking healthcare charges and refining treatment results.

Archetype of computerized wifi - fitness monitoring system based totally on 3-tier architecture of wireless frame area network (WBAN) together with numerous gadgets for nursing cardiac patients in ICU of health center. In tier I, the Adriano Nano board based totally on the ATmega328P microcontroller is used to gather records from devices and direct to the provider the use of ESP8266 wifi wi-wireless declaration in tier II. In tier III triumphing, the Internet is used to show data to remote servers for additional use over IoT utility Thing Speak [2]. Uncial reviewed present pervasive healthcare programs which aim at specific wi-wireless residing situations like aged people living alone and disabled healthcare, or diseases along with Parkinson, coronary heart sicknesses, diabetes, and many others [3]. a new IoT primarily based Predictive model for predicting the lung most cancers disorder through the use of the affected medical photos which might be given as entering to the real-time software that has been advanced as prediction machine [4].

Wu et al. [5] proposed a low-cost WSN system incorporated with IoT which enhances the living environment. They address the air poor quality of the living environment and the system for smart monitoring and reporting the living conditions. The proposed system uses WSN XBee-based system incorporated in an IoT base. The IoT in their work is a wearable with sensors which indicate abnormal ranges in air quality along with the information such as the temperature, humidity, pressure in environment condition. Their proposed system contains the components such as Boost converter, RF module, MCU, CO₂, Temperature, Humidity, Pressure, Light sensors [5].

Omid et al. [6] proposed a system to find abnormalities in brain signals through the EEG using the dynamic warping of the time induced with clustering score calculation aspects. They propose a module to find the eye blink which leads to high amplitude noise. They design a wearable that automatically monitors the eye blink using the dynamic time warping score clustering[6].

4 System Architecture

Numerous sensors are precipitated to the patient's frame to collect crucial body parameters like temperature, SPO₂, heart price, pulse price etc. to be checked. The scheme is precious for cardiac patients and can be Used for toddler care and aged care and aged care in homes and hospitals.

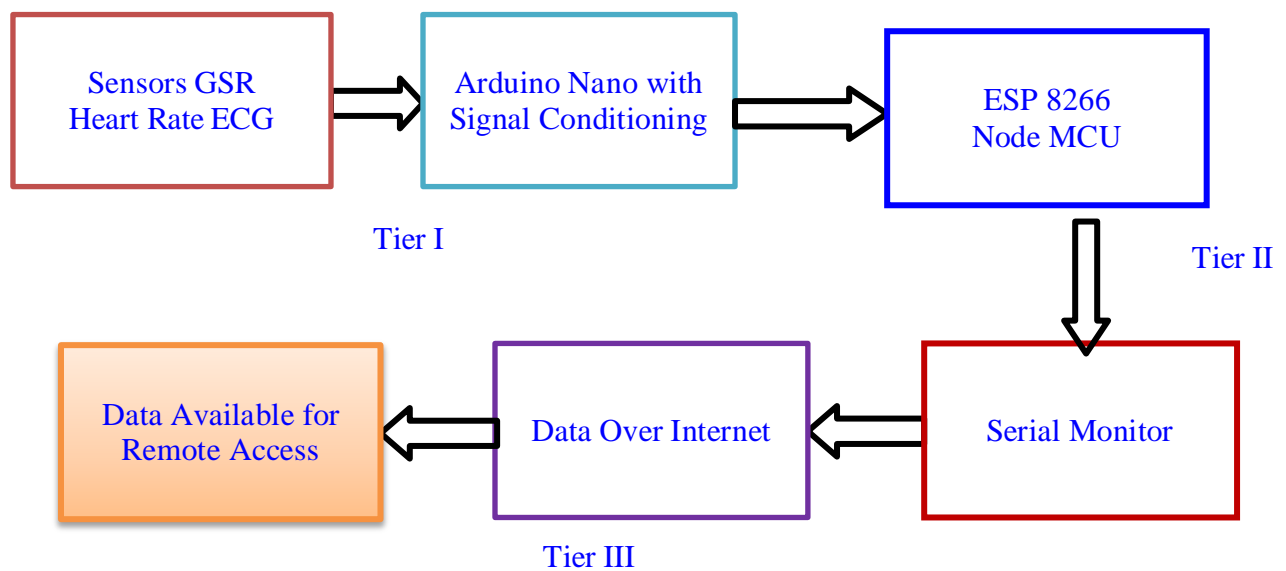


Figure 1: Representation of the block diagram of Tier I, Tier II, Tier III

ESP 8266 is used to express sensor data to the provider by the wireless announcement. Wi-Fi has been selected for the succeeding details:

- 1) ESP 8266 is used to explicit sensor facts to the issuer via wi- wi wireless statement. ESP 8266 has been selected for the successful built-in integration.
- 2) Because the scheme is utilized in the ICU room, for which wireless is better than Bluetooth or Zig Bee.
- 3) Wireless gives you very high-velocity permission to net associated with some extra talent previously identify wi wireless in the store.
- 4) Records conversation rate of wireless is 1mbps which is more than ZigBee.

IoT utility API factor speak is used to extract the data from the server and additionally to become aware of the legal customers. video display units frame parameters of the heart affected people like coronary heart rate, Temperature, and SPO2. It facilitates caregivers and sanatorium workforce to screen and keep affected person's body parameters constantly, Figure1.

Nearly wi-fi% correct outcomes are completed when as compared to conventional medical techniques and business gadgets like Fit v Bit. As a consequence, the system can determine wireless for the continuous monitoring of the cardiac patients in ICU of hospitals. the usage of this machine may be prolonged to care and display aged human beings staying all on my own at their houses and also for child care [2].

4.1 An IoT Model TO Predict Lung Cancer

Progressive IoT-oriented analytical Modeling is used to predict the lung most cancers photographs to be uploaded with the aid of the public. Fuzzy c is used for clustering. The threshold degree is fixed to extract the transition area successfully from lung most cancers photos. Preprocessing is the initial degree to clear out the undesirable and irrelevant records to gain the optimized results, see Figure 2.

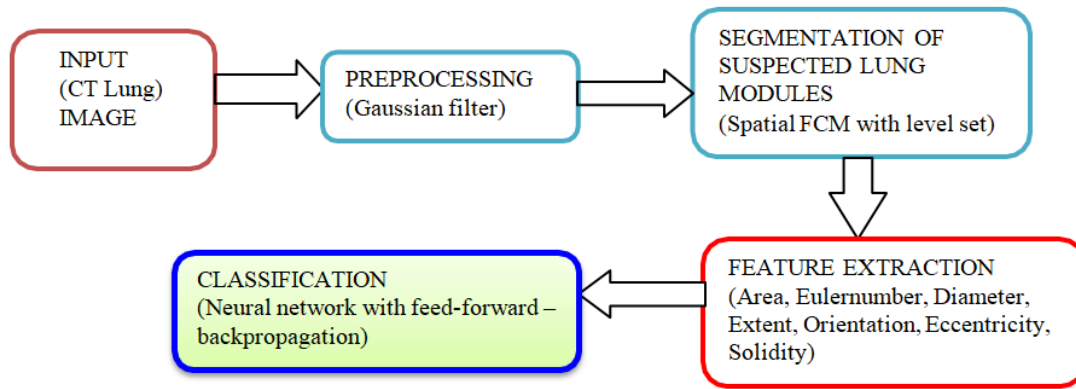


Figure 2: Block Diagram for Preprocessing

Fuzzy C-means clustering is used to make the characteristic or working go with the flow easily as it an unmanaged clustering technique. To make the history as white the intensity price is about 255. The threshold is used to get the transition area of the pictures. Transition regions allow segregating photograph items from the noisy heritage.

Novel picture categorization technique known as Hybrid Temporal affiliation Rule with selection Tree class (HTARDTC) is for efficient illustration categorization with dynamism. in this method takes desire over the medicinal images by way of the segmented pictures as input. The records fee is designed for the procedure desire making through the usage of all the features of image as input.

Novel Predictive Modelling based totally on IoT has been deliberate and completed on these paintings to predict the lung most cancers diseases as online submission through transitional extraction, clustering, and type. picture segmentation by using the use of transition vicinity extraction method has been carried out effectivel [4].

5 Findings and Discussion

IoT has changed medical care in an assortment of ways in the course of recent years and will keep on doing as such for quite a while to return. Here are the IoT applications in medical care everybody has to think about which strikes the everyday life is listed.

5.1 Blood Glucose Monitoring

Patients who experience the ill effects of diabetes can have gadgets with sensors embedded in them, just underneath their skin. The sensors in the gadgets will send data to a patient's cell phone when their glucose levels get excessively low and will record chronicled information for them as well. Thusly, patients can likewise advise when they are destined to be in danger for low glucose levels later on, just as in the present.

5.2 Cancer Assistive Systems

Typically the correct therapy for a disease persistent depends on something beyond their weight and age. Their ways of life and wellness levels likewise assume a colossal part in what the legitimate treatment plan for them will involve. Action trackers track a patient's developments, exhaustion levels, hunger, and so forth additionally, the information gathered from the tracker

before treatment and after treatment has begun will mention to medical care experts what changes should be made to the suggested therapy plan.

5.3 Chronic Cardiac Vascular Monitoring and Reporting

Patients can wear gadgets that screen their pulses, and that can decide if they have hypertension. Medical care suppliers will approach detailing of patient's heart screen information when they need to pull it during tests and tests. The wearable gadgets can even caution medical services experts when patients are encountering arrhythmias, palpitations, strokes, or out and out coronary episodes. Ambulances would then be able to be dispatched in an ideal design, which can be the distinction among life and demise.

5.4 Healthcare Hospital Assistive Systems

People can wear something that appears as though adornments yet are intended to caution relatives or companions if there should arise an occurrence of a crisis. For example, if an individual is wearing a clinical ready wristband and dropped up in the center of the evening, individuals they assign to help on account of a crisis would be promptly told on their cell phones that their assistance was required.

5.5 Internal Sensors in Patient Body

Patients would now be able to swallow gadgets with sensors that resemble pills. When the sensors are ingested, they hand-off data to a patient's portable application that will assist them with following the appropriate measurements for their meds. Most drugs are not taken as endorsed because of carelessness or other human mistakes. This ingestible sensor attempts to guarantee patients are taking the correct meds, at the perfect time, in the correct measurements. Some ingestible sensors are likewise being utilized to all the more precisely determine patients to have things like touchy gut disorder and colon malignancy.

5.6 Medicine Dispensers

Gadgets would now be able to be embedded in a patient that administers the drug with consistent portions for the duration of the day. Patients will be told when they need to top off their meds. Specialists can likewise be educated regarding missed portions during routine visits.

5.7 Distant Sensor and Communications

Remote sensors are being utilized in labs and clinic coolers to guarantee blood tests, chilled drugs, and other biomedical materials are constantly kept at the appropriate temperatures.

5.8 Identifiable Inhalers

IoT inhalers are mentioning to patients what they're doing or encountering to cause asthma assaults, by communicating data to their cell phones or tablets. That data can likewise be imparted to their doctors. The associated inhalers additionally remind patients when to take their drugs.

5.9 Smart Wearable's to Fight Depression

Apple has planned an application for its Apple Watch that helps hyper burdensome patients adapt to their downturn. The application tracks a patient's scenes outside of their planned arrangements and assists with observing intellectual and mindset capacities.

5.10 Smart Contact Lenses

Presently, associated contact focal points are perusing glucose levels of diabetes patients. In any case, soon enough, they'll have the option to help reestablish the eye's concentration and improve vision.

5.11 Specific Spot Customized Services

Things like wheelchairs, scales, defibrillators, nebulizers, siphons, or observing hardware, can be labeled with IoT sensors and found effectively by medical care staff. A lot of times actual gear can be lost or is difficult to find, however with IoT, staff will realize where everything is.

5.12 Disabled Persons Far off Monitoring

With IoT gadgets, medical services experts can screen their patients who just went through a medical procedure or who return home for outpatient care. They'll be alarmed if a patient arrives at a basic state or needs prompt consideration.

6 Conclusion

The IoT in the medical domain is commenced in full fledge and in wake of the pandemic world, non-contact and smart systems play a vital role in everyday life and hence the IoT escalate its enormous growth up to the mark. At the same time, the vulnerability factor in IoT healthcare applications has to be meticulously handled. Consider, if suppose the sensor for supplying the insulin level for diabetes patient is hacked and modified, will eventually lead to patient mortality. In another case, if an artificial sensor for pumping is placed in the heart if hacked then it will also lead to life-threatening. Since the size and capacity of the sensors are very tiny, it's hard to incorporate high-capacity security aspects. But the rise of IoT technology is inevitable and hence high power algorithms which work with lower storage and computing abilities are necessary for IoT healthcare applications.

7 Availability of Data and Material

All information is included in this work.

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