Health monitoring using Internet of Things (IoT)

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Health Monitoring using Internet of Things (IoT)

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Abstract—**Health is the level of useful and metabolic potency of a living organism. In humans, it is the power of people or communities to adapt and self-manage once facing physical, mental, psychological and social changes. Keeping track of the health standing of the patient reception may be a troublesome task. Specially maturity patients ought to be sporadically monitored and their adored ones got to learn concerning their health standing from time to time whereas at work. During this paper, our objective is to trace patient's health with the assistance of sensors and internet. Internet is employed to tell their beloved if there is a drag. The health observation system can keep track of patient's pulse rate, eco rate of heart, pressure level rate, temperature etc. If system detects any abrupt changes in patient heartbeat or temperature, the system mechanically alerts the user concerning the patients standing over IOT and additionally shows details of heartbeat and temperature of patient live over the internet.**

Keywords—Health Monitoring; Heartbeat; blood pressure; pulse rate; illness; doctor

I. INTRODUCTION

Late years have seen a rising enthusiasm for wearable sensors and today a few gadgets are industrially accessible [1]–[3] for individual human services, fitness, and movement mindfulness. Notwithstanding the specialty recreational fitness field taken into account by ebb and flow gadgets, analysts have additionally considered uses of such advancements in clinical applications in remote wellbeing checking frameworks for long haul recording, administration and clinical access to patient's physiological data [4]–[8]. In light of current innovative patterns, one can promptly envision a period sooner rather than later when your routine physical examination is gone before by a two–three day time of constant physiological observing utilizing reasonable wearable sensors. Over this interim, the sensors would persistently record signals related with your key physiological parameters and transfer the subsequent information to a database connected with your wellbeing records. When you appear for your physical examination, the specialist has accessible regular center/lab-test based static measurements of your physiological and metabolic state, as well as the considerably wealthier longitudinal record given by the sensors. Utilizing the accessible information, and helped by decision support frameworks that likewise approach an expansive corpus of perception information for different people, the specialist can improve a much guess for your wellbeing and prescribe treatment, early intercession, and way of life decisions that are especially viable in enhancing the nature of your wellbeing. Such a troublesome innovation could transformative affect worldwide medicinal services frameworks and definitely diminish human services costs and enhance speed and precision for analyze. Innovatively, the vision exhibited in the former section has been doable for a couple of years now. However, wearable sensors have, up to this point, had little influence on the current clinical routine with regards to medication. In this paper, we concentrate especially on the clinical field and look at the open doors managed by accessible and up and coming advances and the difficulties that must be tended to with a specific end goal to permit incorporation ofthese into the act of solution**.** Rest of the paper is organized as follows, Section II describesRelated Works, Section III describes Health Monitoring System, Section IV describes the conclusion.

II. RELATED WORKS

Among the array of applications enabled by the Internet of Things (IoT), good and connected health care could be a notably necessary one. Networked sensors, either worn on the body or embedded in our living environments, change the gathering of wealthy data indicative of our physical and mental state. Captured on a continuing basis, aggregated, and effectively mined , such data will originate a positive transformative amendment within the health care landscape. Specifically, the supply of knowledge at thus far incredible scales and temporal longitudes not to mention a replacement generation of intelligent process algorithms can: (a) facilitate an evolution within the observe of medication, from this post facto diagnose-and-treat reactive paradigm, to a proactive framework for prognosis of diseases at an early stage, not to mention hindrance, Cure, and overall management of health rather than unwellness, (b) alter personalization of treatment and management choices targeted notably to the precise

circumstances and desires of the individual, and (c) facilitate scale back the value of health care whereas at the same time rising outcomes.[1]

The promising potential of the rising Internet of Things (IoT) technologies for interconnected medical devices and sensors has contend a vital role within the next-generation attention trade for quality patient care. Owing to the increasing variety of old and disabled folks, there's associate pressing would like for a period health observation infrastructure for analyzing patients' attention information to avoid preventable deaths. Industrial IoT(healthiiot) has vital potential for the belief of such observation. Healthiiot, a combination of communication technologies, interconnected apps, Things (devices and sensors), and other people that may operate along collectively sensible system to watch, track, and store patients' attention info for in progress care. This paper presents a healthiiot-enabled observation framework, wherever graphical record and different attention information are collected by mobile devices and sensors and firmly sent to the cloud for seamless access by attention professionals. Signal improvement, watermarking, and different connected analytics are going to be wont to avoid fraud or clinical error by attention professionals. The suitableness of this approach has been valid through each experimental analysis, associated simulation by deploying an iot-driven ECG-based health observation service within the cloud.[2]

A new approach is bestowed for health observation of structures exploitation terrestrial optical maser scanning (TLS). Three-dimensional (3D) coordinates of a target structure noninheritable exploitation TLS will have most errors of concerning ten millimeter that is lean for the aim of health observation of structures. A displacement measuring model is bestowed to boost the accuracy of the measuring. The model is tested by experimentation on a merely supported steel beam. Measurements were created exploitation 3 completely different techniques: (1) linear variable displacement transducers (lvdts), (2) electrical strain gages, and (3) an extended gage fiber optic device. The most deflections calculable by the TLS model area unit not up to one millimeter and inside one.6% of these measured directly by LVDT. Though GPS enables measuring of displacements solely at the GPS receiver antenna location, the projected TLS methodology permits measuring of the whole building's or bridge's malformed form, and therefore a practical answer for observation structures at each structure and member level. What is more, it are often wont to produce a 3D finite part model of a support or the whole structure at any instance of your time mechanically. Through periodic measurements of deformations of a structure or a support and playing inverse structural analyses with the measured 3D displacements, the health of the structure are often monitored ceaselessly.[3]

This paper proposes the internet of Things communication framework because the main enabler for distributed worldwide health care applications. Ranging from the recent convenience of wireless medical detector prototypes and the growing diffusion of electronic health care record databases, we tend to analyze the wants of a unified communication framework. Our investigation takes the move by moldering the plot line of every day in Robert's life, our unlucky character within the not

to date future, into easy processes and their interactions. Afterwards, we tend to devise the most communication needs for those processes and for his or her integration within the net as net services. Finally, we tend to gift the internet of Things protocol stack and also the benefits it brings to health care situations in terms of the known needs.[4]

Traditional wearable devices have numerous shortcomings, admire uncomfortableness for long-run carrying, and insufficient accuracy, etc. Thus, health observation through ancient wearable devices is tough to be property. So as to get attention huge information by property health observation, we have a tendency to style "Smart Clothing", facilitating unassertive assortment of varied physiological indicators of soma. To produce pervasive intelligence for sensible consumer goods system, mobile attention cloud platform is made by the utilization of mobile net, cloud computing and large information analytics. This paper introduces style details, key technologies and sensible implementation ways of sensible consumer goods system. Typical applications hopped-up by sensible consumer goods and large information clouds are given, admire medical emergency response, feeling care, illness identification, and period of time tactile interaction. Especially, cardiograph signals collected by sensible consumer goods are used for mood observation and feeling detection. Finally, we have a tendency to highlight a number of the planning challenges and open problems that also have to be compelled to be addressed to create sensible consumer goods omnipresent for a large vary of applications.[5]

The Internet of Things (IoT), additionally referred to as the internet of Everything or the commercial net, could be a new technology paradigm unreal as a world network of machines and devices capable of interacting with one another. The IoTis recognized in concert of the foremost vital areas of future technology and is gaining huge attention from a large vary of industries. This text presents 5 IoT technologies that are essential within the readying of productive IoT-based merchandise and services and discusses 3 IoT classes for enterprise applications accustomed enhance client price. Additionally, it examines internet gift price technique and also the real possibility approach wide employed in the justification of technology comes and illustrates however the important possibility approach may be applied for IoT investment. Finally, this text discusses 5 technical and social control challenges.[6]

Internet of things (IoT)has provided a promising alternative for structural health observance (SHM) recently. In vibration-based structural health observance, structural options that area unit extracted from sporadically spaced activity exploitation sensors area unit subject to variable environmental conditions. This paper proposes Associate in Nursing IoT result removal based mostly structural health observance theme in Associate in Nursing IoT environment. Principal element analysis (PCA) is utilized to eliminate setting effects from sensing element knowledge that contain each real vibration feature of branch of knowledge structure and environmental interferences. Once environmental effects removal, Hilbert-Huang transformation (HHT) that may be a classical technique for signal analysis is employed for structural health analysis and observance. Simulation results show that the projected theme achieves high

accuracy in structural health observance and strong performance against environmental interferences.[7]

The focus on this paper is to make Associate in Nursing humanoid platform based mostly mobile application for the aid domain, that uses the thought of internet of Things (IoT)and cloud computing. We've got engineered Associate in Nursing application known as 'ECG humanoid App' that provides the top user with visualization of their Electro graphical record (ECG) waves and knowledge work practicality within the background. The logged knowledge will be uploaded to the user's personal centralized cloud or a selected medical cloud that keeps a record of all the monitored knowledge and might be retrieved for analysis by the medical personnel. Although the thought of building a medical application victimization IoT and cloud techniques is not completely new, there's a scarcity of empirical studies in building such a system. This paper reviews the elemental ideas of iot. Further, the paper presents Associate in Nursing infrastructure for the aid domain, that consists of varied technologies: IOIO microcontroller, signal process, communication protocols, secure and economical mechanisms for giant file transfer, knowledge base management system, and also the centralized cloud. The paper emphasizes on the system and computer code design and style that is crucial to overall IoT and cloud based mostly medical applications. The infrastructure conferred within the paper may be applied to different aid domains. It concludes with recommendations and extensibilities found for the answer within the aid domain.[8]

The world population is growing at a fast pace. Cities and cities area unit accommodating 1/2 the world's population thereby making tremendous pressure on each facet of urban living. Cities area unit glorious to possess giant concentration of resources and facilities. Such environments attract folks from rural areas. However, unprecedented attraction has currently become an awesome issue for town governance and politics. The big pressure towards economical town management has triggered varied good town initiatives by each government and personal sector businesses to speculate in info and communication technologies to search out property solutions to the growing problems. The internet of Things (IoT)has conjointly gained vital attention over the past decade. Iotenvisions attaching billions of sensors to the internet and expects to use them for economical and effective resource management in good Cities. Today, infrastructure, platforms and package applications area unit offered as services victimization cloud technologies. During this paper, we have a tendency to explore the idea of sensing as a service and the way it fits with the iot. Our objective is to analyze the idea of sensing as a service model in technological, economic and social views and determine the main open challenges and problems.[9]

III.   HEALTH MONITORING SYSTEM

A.   Innovations:

This system includes four-protocol layers start from device layer, followed by network layer, middleware layer and application layer.
Disease such as obesity, hypertension, arrhythmia, fever and diabetes can be detected through the developed IoT system.
However, diabetes is done through blood glucose test, which requires physical pain of the patient.
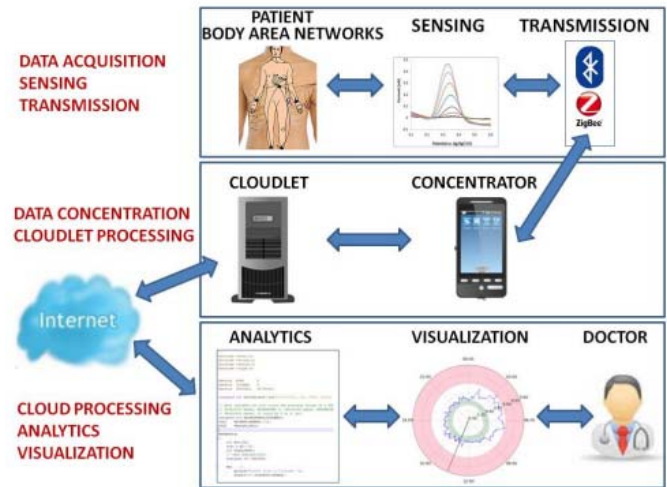

Fig 1- Components of Patient Monitoring system

This paper proposed non-intrusive method using the parameters included in the system to detect type-II diabetes, leading the trend of non-intrusive healthcare monitoring.
Features and Demonstrations: The system consists of three healthcare sensors which are- temperature sensor, pulse sensor, blood sensor. The user wears all the sensors to collect data. All the collected data are now ready for transmission. The data are transmitted to cloud for data processing. The result will be uploaded to the connected display. BMI will be calculated using the data. If the health status shows unhealthy, the system will tell the user what are the disease he may face and what preventions he should take.

For instance a blood sugar monitoring system could be designed as follows. We need a blood sugar monitoring probe, a Arduino micro-controller, a phone and a computer with internet connection. The probe detects blood sugar at regular intervals and sends the data to the phone. The phone sends the data to a cloud service like Azure. We can use Azure to generate statistical reports, most importantly use machine learning of Azure to predict any major health risk or warn the user when his blood-sugar levels are way up by sending a message to his phone (or his smart watch). This kind of system would be immensely helpful to diabetic patients who have a busy schedule.

B.   Benefits and Impacts:
In terms of scalability, the system can be duplicated in terms of convenience, health analysis can be performed at home and distance problem can be solved. The system design is lightweight, Portable and wearable. The creation of this system meet the specification of iot, transforming the current

healthcare system using IoT technology. Diabetes no longer requires laboratory test, detection can be done through non-intrusive way.
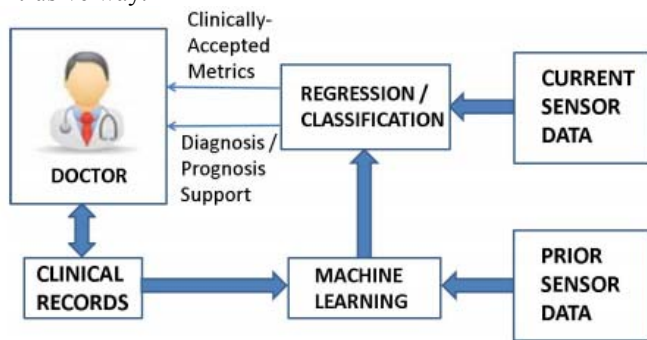

Fig 2- Analytics Workflow

The IoT devices like temperature device (LM35CAZ), Wireless force per unit area Monitor, and Heartbeat monitor are connected to the body of the patient to create the BAN. The devices sense the information from the patient's body and send them to the native system through the wireless device devices. Mobile application is intended for the good thing about doctors and patients. The health standing of the patient is updated within the application for each sixty seconds once the update within the server. Data collected from the IoT devices to the system is large and therefore the information just for last 3 days will be viewed in mobile application. All parameters for the last 3 days will be viewed through the mobile application anyplace any time. To generate the PHMS, sample knowledge is collected to observe the patient health.

The doctors, attender of the patient (authorized to read) and therefore the patients will view the small print exploitation the mobile application or through the online. The mobile application is accessed by doctors through their user name and positive identification. The doctors will read all the small print related to their patients. Data reminiscent of temperature, vital sign, vital sign etc. Is updated within the server for each sixty seconds. If the doctor desires to access any of his patient's information he will request to send the present standing of the patients and retrieve the info from the IoT devices to their mobile devices when change with the server. If patients or caregivers of patients' wish to access the small print of the patient they need to use the patient identification number/Registration number to login and think about the small print. The mobile application mechanically shows the risks in red color to warn the patient if the temperature is high, vital sign level will increase and therefore the vital sign is not within the traditional pulse.

IV. CONCLUSION

In year 2015, a report from who reveals about 44% of the member's states have less than one physician per thousand population. The situation is more critical in rural area. Recently telemedicine has achieved technology breakthrough with the emergence of iot.

However, there is still room of improvement for current IoT implementation. In scientific research perspective, no project has been done to integrate temperature, blood pressure and pulse rate sensors in a single system.

Iotbased systems only display value or graph instead of diagnosis. Two-way communication is not considered.

Iottechniques may be accustomed promote care in a very higher method. The health connected info might be interacted with doctors World Health Organization are in emergency. Even within the absence of the doctor close to the patient or within the hospital, the doctor will grasp the patients' standing so the doctor's recommendation is given in crucial cases. Brian poet commented that the human users might be alerted proactively supported their fitness and historical medical or genetic science history.

V. REFERENCES

[1] MoeenHassanalieragh; Alex Page ; TolgaSoyata; Gaurav Sharma ; Mehmet Aktas; Gonzalo Mateos; BurakKantarci; SilvanaAndreescu ,"Health Monitoring and Management Using Internet-of-Things (IoT)Sensing with Cloud-Based Processing: Opportunities and Challenges", 2015

[2] M. Shamim, Ghulam Muhammad, "Cloud-assisted Industrial Internet of Things (iiot) – Enabled framework for health monitoring", 2016

[3] H. S. Park, H. M. Lee, HojjatAdeli, I. Lee, "2006",A New Approach for Health Monitoring of Structures: Terrestrial Laser Scanning

[4] Nicola Bui, Michele Zorzi, "Health care applications: a solution based on the internet of things", 2011

[5] Min Chen, Yujun Ma, Jeungeun Song, Chin-Feng Lai, Bin Hu, "Smart Clothing: Connecting Human with Clouds and Big Data for Sustainable Health Monitoring", 2016

[6] In Lee, Kyoochun Lee, "The Internet of Things (iot): Applications, investments, and challenges for enterprises", 2015

[7] Hongyang Zhang; JunqiGuo; Xiaobo Xie; RongfangBie; Yunchuan Sun, "Environmental Effect Removal Based Structural Health Monitoring in the Internet of Things", 2013

[8] Junaid Mohammed; Chung-Horng Lung; Adrian Ocneanu; AbhinavThakral; Colin Jones; Andy Adler, "Internet of Things: Remote Patient Monitoring Using Internet Services and Cloud Computing", 2014

[9] CharithPerera, ArkadyZaslavsky, Peter Christen, DimitriosGeorgakopoulos, "Sensing as a service model for smart cities supported by Internet of Things", 2013

[10] Himadri Nath Saha, "Comparative Performance Analysis between nrf24l01+ and XBEE ZB Module Based Wireless Ad-hoc Networks", 2017

[11] HN Saha, A Mandal, S Abhirup, "Recent trends in the Internet of Things", 2017

[12] M Narsaria, D Bhattacharya, HN Saha, "Performance Optimization and Evaluation Algorithm", 2016

[13] R Singh, HN Saha, D Bhattacharyya, PK Banerjee, "Administrator and Fidelity Based Secure Routing (AFSR) Protocol in MANET", 2016

[14] D Choudhury, D Kar, KR Biswas, HN Saha, "Energy efficient routing in mobile ad-hoc networks", 2015

[15] HN Saha, D Bhattacharyya, PK Banerjee, "Semi-Centralised Multi Authenticated RSSI Based Solution to Sybil Attack",2010

[16] A Bhattacharyya, A Banerjee, D Bose, HN Saha, D Bhattacharjee, "Different types of attacks in Mobile ADHOC Network: Prevention and mitigation techniques", 2011

[17] A Banerjee, D Bose, A Bhattacharyya, HN Saha, D Bhattacharyya, "Administrator and trust based secure routing in manet", 2012

[18] HN Saha, S Banerjee, R Nandi, R Dey, "A review on different Intrusion Detection Systems for MANET and its vulnerabilities", 2015

[19] HN Saha, A Chattopadhyay, D Sarkar, "Review on intelligent routing in MANET", 2015

[20] Debopam Ghosh Himadri Nath Saha, Debika Bhattacharyya, Bipasha Banerjee, Sulagna Mukherjee, Rohit Singh, "A Review on Attacks and Secure Routing Protocols in Manet", 2013

[21] HN Saha, PK Banerjee," Fidelity Based On Demand Secure (FBOD) Routing in Mobile Adhoc Network", 2012

[22] HN Saha, D Bhattacharyya, AK Bandhyopadhyay, PK Banerjee, " Two-level secure re-routing (tsr) in mobile ad hoc networks", 2012

[23] Dipayan Bose, Arnab Banerjee, Aniruddha Bhattacharyya, Himadri Nath Saha, Debika Bhattacharyya, Pranab Kumar Banerjee, "An efficient approach to secure routing in MANET", 2012

[24] Himadri Nath Saha, Dr Debika Bhattacharyya, Dr PK Banerjee, Aniruddha Bhattacharyya, Arnab Banerjee, Dipayan Bose, "Study Of Different Attacks In Manet With Its Detection & Mitigation Schemes", 2011