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Article

Smart Health Monitoring System for Patients using Internet of things

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I N F O

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A B S T R A C T

IOT is the serious organization framework of availability, transportation and innovation. IOT shrewd gadgets can execute the offices of far off wellbeing observing and crisis notice framework. IOT has considerable utilization of shrewd medical services framework. In the medical services framework the featured arrangements and methodologies that help to the specialists and researchers and specialists who create savvy gadget which is the up degree to the current innovation.

This paper will help specialists to think about the condition of patient wellbeing and screen anyplace on the planet.. Medical services framework has the observation that proposed the need of savvy gadgets and shrewd items to diminish the shortcoming of accessible medical care framework. The IOT based medical services has improved innovation which is selective from the conventional medical care and entire clinical framework.

Keywords: Internet of Things (IOT), Raspberry Pi, Sensors, Health Monitoring, Pi Camera

Introduction

The world population is increasing tremendously. The cities accommodating more population face astounding pressure of urban living. Even though the medical resources and facilities in cities are expanded daily, still the suffice level is not attained. The massive pressure towards the management of healthcare in cities has triggered the advancement in technologies to come out with the proper solutions to the booming problems. With the increased rate of medically challenged people, remote healthcare has become a part of our life.

The Internet of Things is a rising topic of social, economic and technical significance. Internet of Thing using sensors, Processors and microcontrollers with accessories used for communication through the internet and becoming the constitutive part of the Internet, it is built with a suitable protocol which helps the interacting and communicating with each other and with the users respectivelyThis correspondence through web assists with finding numerous applications which are created dependent on IoT innovation in which each physical item like sensor gadgets are associated with the internet.[1] Healthcare assumes a significant part in the Internet of things which lessens the trouble confronted patients and specialists. The homecare is given rather than the costly clinical consideration and anticipation is given by the proficient medical care administration. This administration will help each person by following the essential medical care, which prompts more beneficial outcomes.

[2]IOT technology is increasing to support the cost and quality of patient life and ensures life span of patients with proper medication. In conventional health care undetected health problems can be solved through this IoT Technology thereby ensures healthcare services by maintaining digital identity for each patient complication can be greatly reduced. The communication between the health sensors device with

the computer or smartphone which has the default ability to communicate with the server which makes the whole system cost reduce and the complexity of the system is also reduced. Hence the system can also be made IoT enabled and Machine TO Machine compatible.[3] Here the proposed paper show a reliable continuous monitoring by the doctor, solution of patients anywhere in the world based on a healthcare monitoring system can be checked. The patients carry a set of body sensors to collect their body parameters.

Literature Survey

[1]In Ravi Kishore Kodali et al. proposed the medical services observing which is actualized to check the temperature of the patient. The Zig Bee work convention is utilized where the patient 24-hour care records is being checked. In-emergency clinic records are kept up in the cloud. IoT enabled gadgets simultaneously advance the nature of care with ordinary observing and assortment of information effectively and moderate the expense of care and investigation of the equivalent.

[2]In Jasmeet Chhabra et al. proposes the plan and implementation for emergency medical services based on IoT health monitoring system. In this project the patient health related problems and healthcare cost is reduced. The collection, recording, analyzing and sharing data streams though the internet which reduce the patient problem of visiting the doctor every time to check the health parameter like heart beat rate, temperature and blood pressure.

[3]In Thirumalasetty Sivakanth et al. presents a reconfigurable sensor network for essential health checking. The chance of patients breakdowns, and the hazardous outcomes is decreased in substance and ongoing wellbeing observing framework. The 566 International Conference on Signal, Image Processing Communication and Automation-complete data of patient is be precisely gotten by the specialist by NFC innovation. Biosensors interfaced with the microcontroller will screen patient's basic wellbeing. In the event that any of the sensor's preset limit esteem is exaggerated over, a sensor's worth will be shipped off specialists and the patient's overseer through message.

[4]In Y. T. Zhan et al. presents the usage of telehealth frameworks for older populace and conversation on different ongoing infections and its significance. They examined in insight regarding wearable innovation for far off medical services system.[5] In A. Murray et al. presents the arranging of current medication, viable and safe utilization of medical services innovation as basic for any medical services framework. Worries about clinical hardware care have been raised up. There is have to examine the advancement of medical services framework, In this paper noteworthy advancement in the execution of the medical care framework is proposed. Likewise the absence of clinical hardware wellbeing measures and the defensive advances that should be taken consideration to improve the nature of medical services is discussed.[6] In Saed Tarapiah et al. presents the paper which certifications to diminish the expense of the framework and by and large improvement in the nature of medical care administrations. It is a framework that can gauge pulse and internal heat level and speak with them if there should arise an occurrence of unplanned conduct to oversee clinical staff utilizing GSM, GPS and web advancements to accomplish quick activity to spare the patient's life.

[7]In Dr. K.N. Muralidhara and Bhoomika B.K., presents the plan for IoT keen medical services framework utilizing the microcontrollers.In this, the pulse oximeter, the temperature sensor and the heart rate are designed for the patient and the microcontroller to send data through the wireless network protocol and the data also shows the patient displayed on the LCD screen who knows his health status. The experts can see the information that logs the log to the HTML site of the page using IP address and page recovery methods that are so persisted by the information collection. So, the continuous patients check framework is composed.[8] In D. Mahesh Kumar, presents health systems based on wireless sensor networks. The wide range of benefits of wireless technology for the medical staff, patients and the continuous monitoring of the community, early detection of abnormal situations and potential knowledge found in the past data inserted all the information collected. The framework enables the wellbeing to mind staff to control the total condition of the patient in a different, continuous and extraordinary way. Through the organization can arrive at each hub of the patient whenever if the organization terminal is accessible. The patient sends a lot of sensors to gather their body boundaries. The clinical staff assesses the general state of every patient and checks the gathered estimations of the hubs.[9] Luciano Tarricone et al., paper recommends, IoT-mindful, design for following of patients, programmed checking, and biomedical gadgets inside nursing foundations and medical clinics. Sampada Sathe and Alok Kulkarni, 10 paper endeavors to assess and comprehend the application of IoT in personalized care for the realization of excellence in health care costs within reasonable limits. Here it describes how IoT's functions and how to use it in the use of remote sensing technology and wireless technology to achieve health care requirements.

[10]Jayeeta Saha et al. has proposed Advanced IOT Based Combined Remote Health Monitoring, Home Automation and Alarm System which can ascertain the size of saline levels, blood pressure, respiration rate, body temperature, body movement and heart rate of a patient. This model use Raspberry Pi to collect data from sensors and stores

that to cloud. SMS & Email alert, role-based authentication and one home appliance controlling feature have been added on that paper.

IoT and Smart Health

[11]IoT term was first coined by Kevin Ashton in 1999. The concept of Internet of Things entails the use of electronics devices that capture or monitor data and are connected to the private or public cloud, enabling them to automatically trigger certain events. It enables with humans, allows object to sense and control often is referred to as the Internet of Things (IoT). IoT basically connects different objects(sensors) to each other. Through connecting medium which can be wireless or wired. When object can be sensed then we can be performed action according to that. And that is known as smart objects. Basically, IoT made day to day life easy and we can do things automatically with using IoT technology. It includes many fields like home automation, health care, smart environment.

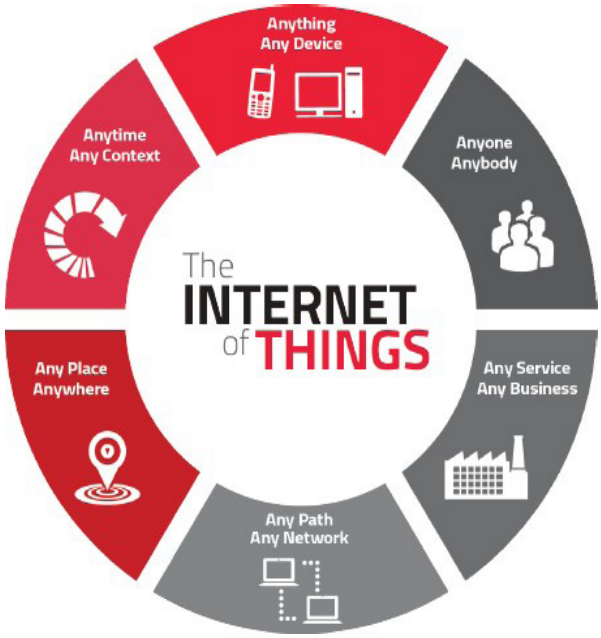


Figure 1.Concept of internet of Things

Healthcare Surveillance

The smart health care system encounters the smart health disease surveillance. Categorized of this surveillance are mainly smart IOT devices and smart backbone devices. This conclusively serves the mechanisms of cloud computing and main servers at the hospitals. Personal Survey and an international response followed by overall public health by World Health Organization (WHO) that has announced plans to establish the Disease Intelligence Unit that will function independently. The trends and analysis have reached the backbone network that is the prevalent need of today.

Smart diseases surveillance is extreme novel and innovation to speed up the existing process of surveillance to reach the highest goals of accuracy and real-time database. Smart disease surveillance is an epidemiological practice by which outbreak and spreading can be monitored. Main role is to predict and to observe to minimize harm to the lives. Modern communication technology includes organization like world health organization WHO and centers for disease control that now can report with enhanced and advanced application like “smart grid” and smart devices like heart monitoring, biochip, transponders, etc.[12]

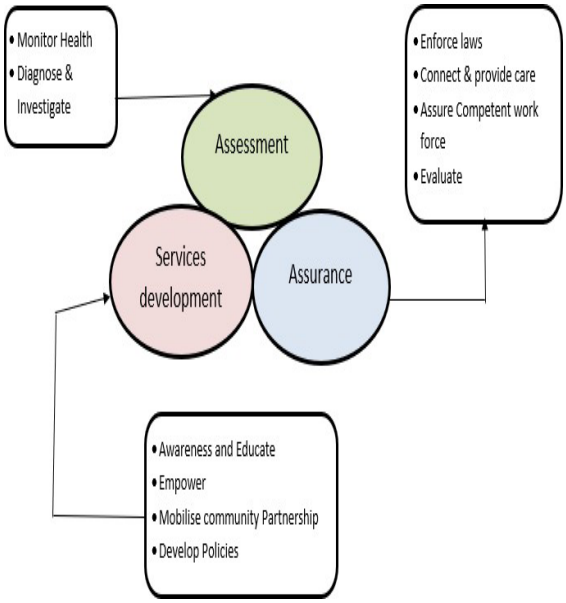


Figure 2.System management in smart healthcare

Smart Devices

IOT is increasingly being recognized by researchers and analyst as one of the most sophisticate technology that has the potential of innovation. It consists of sensors, actuators, computing device and data communication capabilities. It enhances advance treatments and diagnosis that has improved drastically. Smart devices are used to treat the issues like chronic disease management, personal health and fitness management.[3]

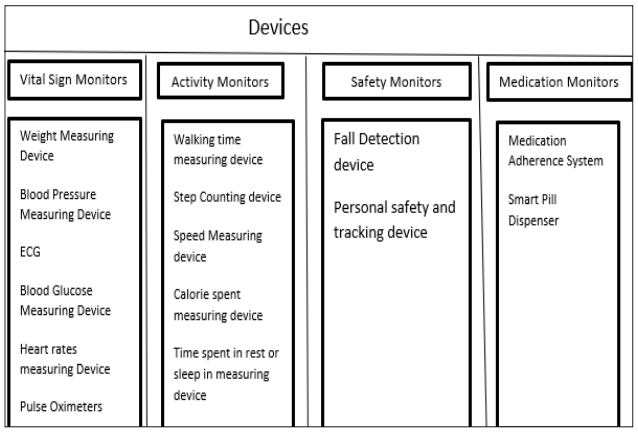


Figure 3.IOT technology- smart medical devices

Existing System

In the present social protection structure for patients who remains in home during post operational days checking is done either through regulator/clinical overseer. Incessant watching may not be refined by this framework, because anything can change in prosperity boundary within part of seconds and in the midst of that time if watchman/specialist isn't in the premises causes more essential damage. Along these lines, with this development we have given an idea to include another mechanism for wellbeing mindfulness structure where time to time steady checking of the patient is cultivated.

Proposed System

Health Monitoring framework utilizing IOT depicts the assortment and interoperation of Patient information gathered from the sensors from the clinics through IOT Technology. The gathered sensor information will uphold the specialist in the crisis for the advancement and improvement of Patient wellbeing. A wellbeing checking framework comprises of a few sensors associated with a patient and they impart the information through the handling unit. This proposed thought will help specialists to think about the condition of patient wellbeing and screen anyplace on the planet. In this proposed thought the sensors accumulate the clinical data of the patient that incorporate patient's pulse, circulatory strain and heartbeat rate.

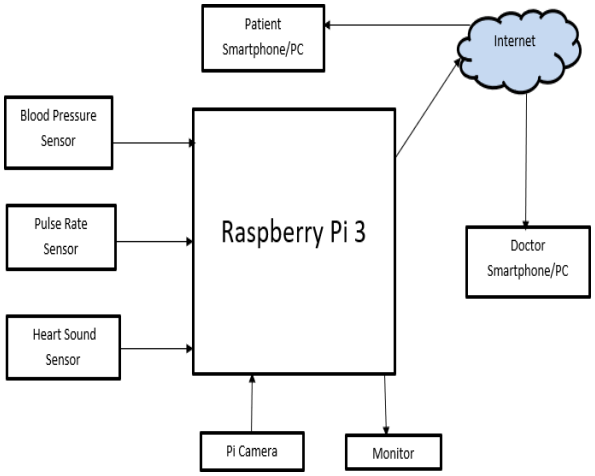
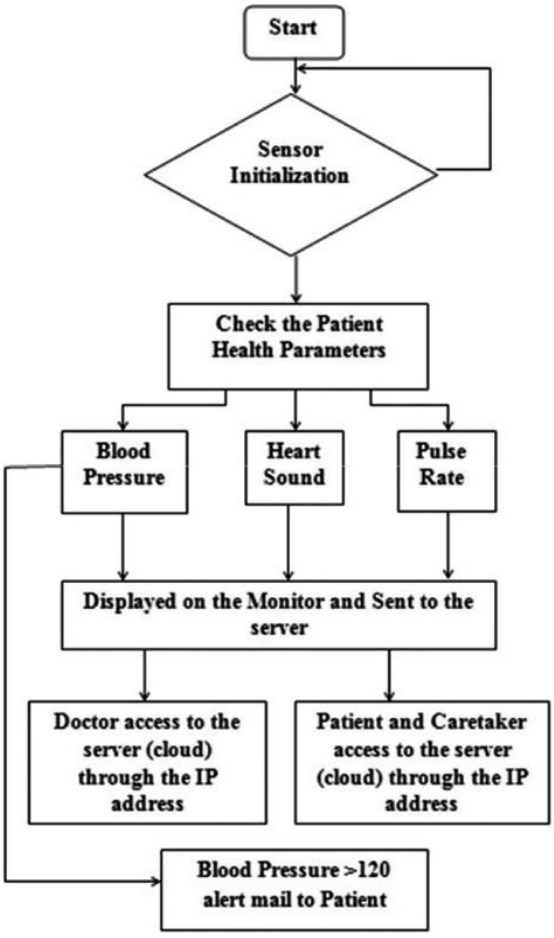


Figure 4.Proposed System

Then using camera the patient is lively monitored through the Raspberry kit and this information is sent to the Internet and stored in a medical server. The doctor and patient can monitor the patient data from any place of the world through the provided IP server address anytime. The emergency alert is sent to the patient if the sensor value is exceeded the threshold data. Thus the patients' health parameters are watched lively and regular monitoring through the medical server to a doctor will help to make effective diagnosis and almost accurate care can be given.

The data collection through the IOT will help the patient to recover easily and also enhanced medical care can be given to the patients with low cost.

The hardware platform to execute the framework comprises of a sensor and Raspberry Pi 3 Model B prepared in a manner to speak with specialist through Internet and Smart Phone. Raspberry Pi is utilized as an information aggregator just as a processor. The patient and specialist cell phone/ PC are utilized as a checking framework. As in figure 4, the sensors framework is utilized to get the data or readings from the patient and the perusing which is perused are changed over into signals. These signs are given to handling to Raspberry Pi, which is the IoT module The Pi then displays the information on a Monitor and stores the information over the cloud. This information can be accessed by the doctor on his phone/ computer and get the information. If any emergencies, the patient is sent an alert automatically through the mail for medical medication. The flow diagram of the monitoring system is shown in figure 5, the sensors value are read and displayed on the monitor and stored in the cloud for future use. If blood pressure sensor output is above 120 an alert mail is sent to the patient automatically to consult the doctor.



Implementation and Result

The unit usage for Health Monitoring System is appeared in the figure 6. The Mouse and Keyboard associated with the USB port of Pi and the Monitor associated with the HDMI video port. The sensors associated with the GPIO pin through which the information from the Pi is moved to the worker and the patient can screen the information on the screen.

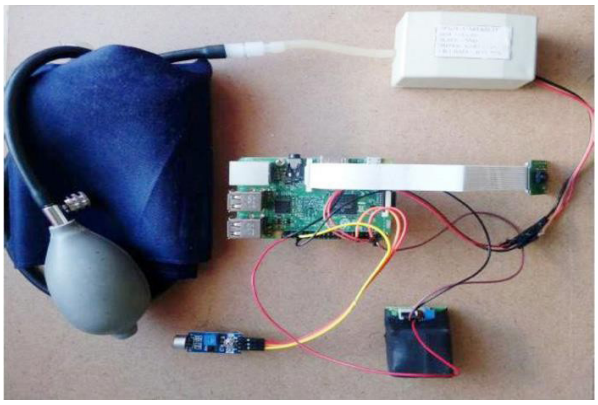


Figure 6.Kit implementation of an IOT based health monitoring system

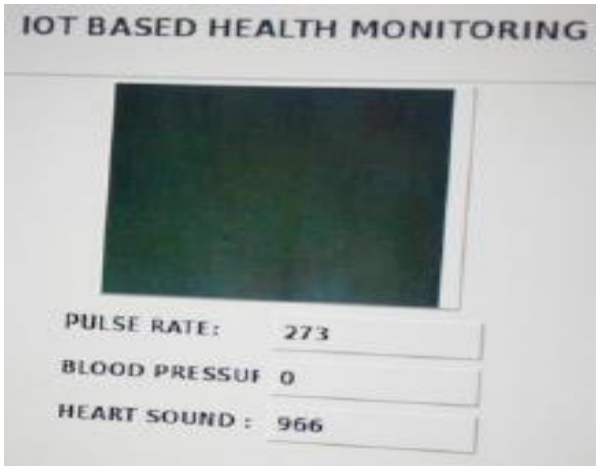


Figure 7.Display of monitor after execution

Figure 7 shows the display of the health monitoring system on the patient's monitor. After the use of the pulse rate, blood pressure and heart sound sensor, the digital output from the sensor through the Pi is displayed on the Monitor. The Pi camera output is displayed on the server, the IP address of the server is same as the IP address of the raspberry pi. The camera output is shown in Figure 8.

The Sensors output is displayed on the server, the IP address of the server is same as the IP address of the raspberry pi which is shown in figure 9. This is data base where the patient's health report is stored for future requirement by the doctor and the patient. If the patients' blood pressure >120 an alert mail is sent to the patient by the doctor for the medial medication.

Figure 8.Pi Camera Output

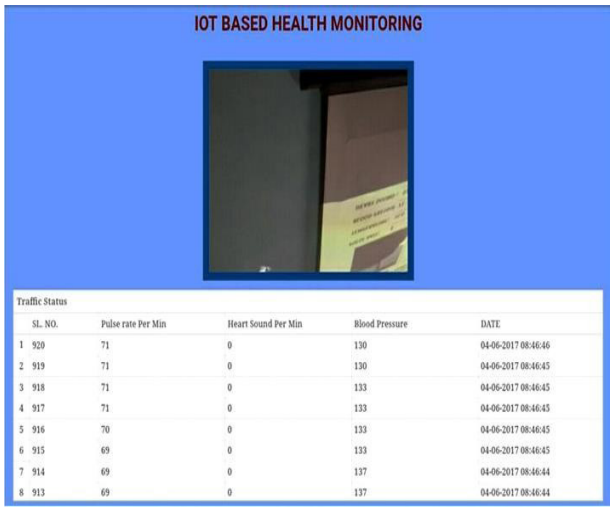


Figure 9.Server output of screen

Conclusion

By using the system, the healthcare professionals can monitor, diagnose, and advice their patients all the time. The health parameters data are stored and published online. Hence, the healthcare professional can monitor their patients from a remote location at any time. Our system is simple. This system is helpful for patients who are advised for the complete bed rest and the paralyzed patients, where the doctor can physical monitored the patient from the home with the help of the Pi camera In the designed system the enhancement would be connecting more sensors to internet which measures various other health parameters and would be beneficial for patient monitoring i.e. connecting all the objects to internet for quick and easy access.. Further enhancement of existing model can also be deployed as a mobile application in order to become easy to access the model around the world. The mobile application can be enhanced with the ambulance services, doctor's list, nearby hospitals.

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