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Smart Health Care Proctoring : Software-as-a-Service for medical centers to mointor patient health status and prescribe drugs from smart devices at any time & location

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Abstract: In the modern epoch wireless sensor network forms a discernible part. A wearable device for proctoring health may ordinarily include multifarious wires, and all those wires will be incorporated into a centralized network. This network coordinates all the activities occurred with the device. Huge outlay of equipments, encroaching, and practical hassle caused for the patient, unavailability of on-time updates, lacking the continuity etc are matters arising within these, wireless sensor network can form a promising part over here. It is beneficial such that apart from high cost wires intelligent sensors are available in low cost, less weight, and can provide on-time updates. We intent to present the architecture of wireless sensor network for a person to have a continuous proctoring of his/her health status. The system consists of multiple sensor node placed in the body which forms a body area network. It is capable of monitoring body motion, heart activity, environmental conditions etc. Advanced Bluetooth technology transfers data from those sensors. It also discusses deployment of the result to the medical server and further treatments. In this paper, we present only the application developed to handle the data generated by the sensor which helps the doctors and patient to understand the health condition and prescribe drugs on emergency need.

Keywords: Wireless sensor network, Wearable sensors, Patient monitoring, Drugs therapy, Bluetooth.

I. INTRODUCTION

In this advanced cosmos requirement for best health condition, fright of cost, increased no of oldsters and hazards of various diseases leads to the exploitation of wireless sensor networks. This wireless manner of tiny sensors put up multitudinous innovations in the medical field. It can be regarded as an avaricious manner to detect the symptoms which is better than having affected with the hazards of various diseases. [1]Wireless sensor network is an assemblage of versatile nodes which are capable of detecting and delivering relevant data to any beholder who are concerned within. Currently these are used in numerous fields like military, air force etc [2]. The invention of tiny sensor nodes has been an enceinte role in medical field. The nodes can be integrated to have a remote monitoring of beholders wellness.

Wearable sensor equipments are of high use in the present era. Vibration sensing, emergency health monitoring, human recording system (HRS) of Japan, smart shirt of Italy etc are prominent among them.[3,4] Many of these technologies exhibit the necessity of the field to provide the person with health status substantially and expeditiously even in their seizure. The desire of such a system provides a quiet and unruffled life for the patient. Wireless body area network incorporates various nodes to analyze health status in a pervasive manner. It senses various biosignal like blood pressure, temperature of skin, respiration rate, oxygen saturation, perspiration, heart sounds, glucose level in blood, electromyogram, electrocardiogram, electroencephalogram, body movements etc. The entropy or info can be unified via a Bluetooth [5].

Here the person will be aware of his health condition without going to an infirmary. The system can give an alert to the person in case of any insecure situation. [6, 7] When the person gets affected with a disease the sensor uploads his physical health conditions and the physician can give relevant prescriptions and practices. Regular meetings with the physicians are reduced and this minimizes expenditure as well as time to an extent. Real time data enables treatment to be made at the earlier stage efficiently. [8, 9, 10]Since wireless, patient can move around freely and thus get rid of the discomfort zone. Also it maintains secure data transmissions within the servers.

Bluetooth technologies which transfers the info within small range consumes less power, faster transmission rate and also promote secure connection by making use of radio link. [11, 12]One of its most challenging and initial work in medical field is FDA (food and drug administration) by US (June 2003) [13].which made it one of the most promising aspects for transmission To have secure, reliable and faster data delivery, info is centralized via Bluetooth, thus to have

early perception of disorder, annotate the processing, and detect threatening cognizes through the collected results. [14, 15]In the upcoming era sensors and health care accessories becomes up to date and of inevitable part enabling each person to be adopted with its advancement in medical field.

II. RELATED WORKS

Authors in [1] portray wireless sensor network for health care. Primarily it points out WSN which aids out fast disease recognition, increased living standard of elders etc .In midst of these wsn faces network, memory and other technical issues along with security. The paper aims at providing better network of reliable data transmission via multiple hoping, also provided system with less bandwidth and energy utilization. It also provides various background details as well as applications in medical field.

Authors in [2] portray sensor networks in medical field. The new technology introduced in this paper is Codeblue. It coordinates multiple paths for transmission and maintains location of nodes, rate at which data send etc. Publish subscribe framework allows various sensors to be centralized and deliver data to those interested. Discover protocol is proposed to identify the particular sensor node which is activated. The experiment presents efficient utilization of power in sensors.

Authors in [3] portrays wearable and implantable sensor network for health care proctoring. It says mainly about WBAN protocol which deals with a centralized collection of tiny nodes in medical field. It services the people in such a way to maintain their health within homes. It also deals with various wireless sensor network which is implanted on jackets, shirts etc.This continuously monitor health of the patient. Artificial retina for those who is blind or with low sight have given an improved vision with the aid of retina chips.EEG variations are made out with an external circuit connected to eeg electrodes'. A smart shirt which can make out ECG and its variations are measured and transmitted via ad hoc network. This advancement in sensors is even deployed in military, air force etc. The experiment was reliable and data was secure.

Authors in [4] portray ICT in healthcare. It denotes the advancement of sensors in the medical field. It made a drastic change in health care sector. This deals with monitoring of glucose and vital signs in a person. Shocks open the port which gives out fluids to monitor glucose level. Air borne bacteria's are determined through various photo sensors and its subsequent diodes. It also deals with smart technologies that provide patient with subsequent treatment.

Authors in [5] portray security issues in medical field. The patient suffering from such serious disease also can be provided with privacy and security issues using WSMN.It identifies security faults in various health care project and put forward ideas and models to make them more secure. They also discuss about the rules imposed by the government on health care. regulations on health, future of the field.

Authors in [6] portrays body area network for ubiquitous health monitoring .SAN (sensor area network) that coordinate sensors into an exclusive ace platform, BAN (body area network) for coordinating various sensors into a central node and WAN (wide area network) that coordinate various monitoring systems are used in this paper. Follows 3 tier architecture, in which top tier forms collection of sensors which reads health continuously. Tier 2 forms personal server which maintains personal records and provide services by connecting to medical server which forms tier 3.It provide various services like collecting health status, storing it for future reference and providing subsequent remedy. The paper aims at providing better healthy life for each patient.

Authors in [7] portray wsn for computer assisted physical rehabillilation.The system gives out a real time sensor survey which provide user with data as well as warnings at the same time transferring it to corresponding medical database. Moreover it is inexpensive, unobtrusive, and challenging. Modern Zigbbee technique is used for transmittance.

Authors in [8] portray mhealth which is mobile computing, medical sensor, and communication in medical field. It depicts the effect of pervasive, wireless communications in health care. It discusses about emerging trends, challenges faced as well as future of mhealth.

The site in [9] portrays tiny os which is used in low power equipment such as sensors. It supports updated msp, ucmini platform etc.it is used to fix numerous bugs. We can retrieve various queries as well as download the same from the given site.

Authors in [10] portray the evaluated effect of elders having homely healthcare .Challenges are evaluated during its development. Devices are implanted to acquire and collaborate information. A joint form of various sensing devices such as video,rfid,pervasive etc maintained.

Authors in [11] portray a gateway for health care system.The sensor activities are carried out on low power system. Protocols are designed both for hardware and software design. Experiments are carried out and derived as the system to be reliable. Methods have been carried out to provide gprs communication between both the gateway and the sensors. Use of hidden markow model and voice call in gateway was also a proposed concept.

Authors in [12] portray system architecture of health care sector. A Mac scheme is proposed for the same. It meets requirement by dealing with quality of service. Emergency situations are dealt with by the system. The channel can be accessed via preemptive method. The solutions indented at improved performance in the medical field. The future works proposed includes simulation of mach protocol, influence of contention parameters on traffic, and errors in various predicted models.

Authors in [13] portray integration of sensor network with internet. This integration is done through gateways. A collection of nodes is required to provide a sender node with an id.The characteristics of sensor networks as data flow patterns, energy constraints, evaluated .Gateway integration is given out for both homogeneous and heterogeneous sensor network.

Authors in [14] portray health care of elderly people. It coordinates various resources via telemedicine. A mixed toolbox strategy is used for the same. It makes use of internet, mail, phone etc to connect health sector with that of telecommunication. In order to maintain secure data

transmission identification methodologies are adopted which makes sure that the person receiving service is same always. E-medicine benefits patient to have an accurate data frequently, and can make fine decisions reducing local area treatments. It allows users to have their own innovations within the sector. Paper discusses legal issues concerning the license of physician who will be providing online services in the health sector. It keeps the engineering simple and local.

Authors in [15] HMM based recognition of elderly at home. It utilize benefits of two technologies of sensor network namely shimmer and tmote sky. One of them is implanted on the body of the patient and the other act as a central node. The central node communicates with the implanted node in case of emergency. The experiment result reduces medical cost, efficient communication between patient-doctor and efficient utilization of medical equipments. Methodologies are adopted to maintain privacy and security for wsn and thereby to make it trustworthy. The competency and adaptivity of WSN is evaluated based on various sensing equipments of physiological, behavioral, and motion monitoring systems.

III. MATERIALS AND METHODS

a. Software requirement:

a) Frontend: ASP.net, Backend: oracle

b. Hardware requirement:

a) Sensor: it can be of multifarious types. ACtis sensor node working on telos is one among them.

b) Personal db & Physician db: A PDA (personal digital assistant) can function as a personal database and physician database

c) Medical server: A personal computer or any other digital assistant which is concerned with the medical sector.

The process can be performed through various phases namely:

A. Data Acquirement and Transmittance:

This phase measures various body rates with the aid of tiny sensors implanted on patient's body. It is having battery life and its energy is maintained by recharging. We intend to implant various sensors which collectively forms body area network.

a. ECG sensor: Situated on the chest of a person to have an incessant monitoring of heart activity.

b. Motion sensor: Laid on various parts of human body which cause movement of elbow, knee etc

c. Temperature sensor: Located on the quad where the person is present to monitor the environmental conditions of the quad.

d. Bed sensor: Fixed on person's bed for monitoring breathing rate, uneasiness, quivering, agitation etc

e. Pulse oxiometer sensor: Monitors oxygen saturation in blood.

These data are transmitted to the patients PDA or PC via Bluetooth. It is a wireless technology that can transfer data received from these sensors to a pda or to a fixed computer up to an extend of 10-100 m. it is based in IEEE 802.11 standard and is communicated via networking. It enables faster delivery with a speed of 720 kb/s and its frequency ranges 2.4 to 2.48 GHz.

The data's sensed are incorporated on to a central network via internet. This network which is the medical server is the axial part where all the functionalities of the proposed system are performed. The process accomplished in medical server is given out in the other two phases.

Actuators provide alert messages on extraneous entities based on data collected form sensors. This can be indicated to the patient via an alarm which mentions the intake of medicine on time, intake of water on increase of temperature etc.

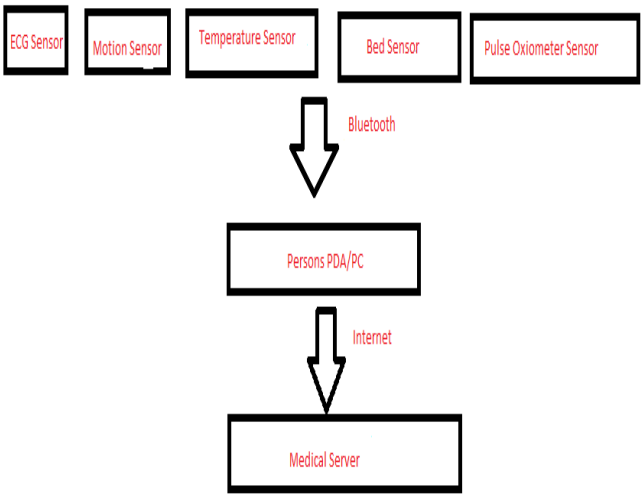

Figure 1: Data acquired from various sensors are collected on to a PDA via Bluetooth and is transmitted to Medical server Via internet

B. Data Monitoring:

This is done by the medical server which consists of person who has to obtain the service and physician who has to provide the service. The processing of this phase is as follows

a. Medical server:

This comprises the server which coordinates all the activities of the application. Each registered patient will have a record in the server. The server retrieves the results of each patient medical status via sensors and stores it for future reference. It has the purpose of holding patients book from the personal database and giving the respond accordingly. It includes various queries, reports, recommendations, health conditions and feedback from the user. Also the physical status of the patient is obtained. The physician can obtain the record from the server which will be analyzed and solutions will be identified.

b. Personal DB:

It provides a port to sensors as well as medical servers. It retrieves query results as well as health status from medical server via internet. The database is implemented on a phone, PDA, computer etc. It creates a path with the medical server maintaining each person's record up to date. If the path is not present for a particular period of time data is kept locally within personal server. Person can retrieve sensor information

and can control health only specific to him maintaining secure data within the database.

c. Physician DB:

The database consists of various physicians assigned to maintain the registered users. Each patient has the opportunity to select the physician based on availability. The duty of physician is to analyze the patient with an eye on person's regular vital signs this can be done via internet.

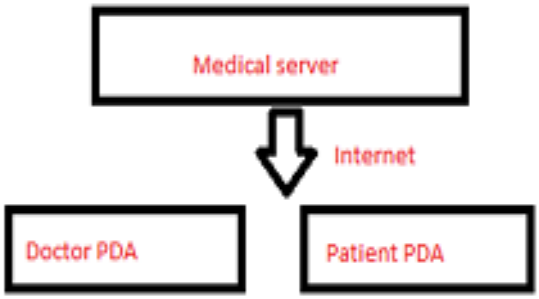

Figure 2: Analysis of data obtained in physicians personal digital assistant via internet

C. Drug Therapy:

This phase is also processed via the medical server. It is mainly concerned with providing treatment based on sensor info. It maintains personal database as well as physician database. The precautions and query results of patients will be sending back to the medical server

a. Personal DB:

Person retrieves relevant and efficient treatment based on his health condition in a timely manner. The patient can contact emergency in case of crisis, and can clarify any ambiguity with concerned physician .This reduces cost, and time of both patient and physician. Moreover the procedure is simple and efficient without any adversity.

b. Physician DB:

Each physician proctors patient's biophysical condition providing appropriate prescriptions, diet, and physical activity for the same. Also assisted with various queries and its results posted by the patient. It reduces time of both physician and patient. Enables to perform profession effortlessly and comfortably.

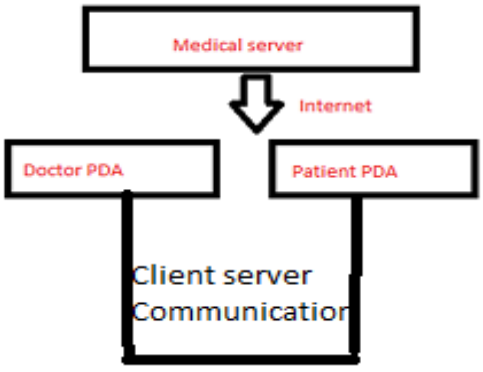

Figure 3: Providing patient with subsequent treatment via analyzing health status

An **algorithm** proposed to illustrate flow of data in the system is as follows:

Step 1:

Input: set of sensed data from multifarious nodes located in Patient's body

Parameters: rate of variation in human body, Time of occurrence, Date of occurrence

Let there be n wireless sensors as WS (n)

The time at which it is measured are n (t1, t2, t3, tm)

The rate at which it is measured is n (r1, r2, r3, rm)

Step 2:

Assemble the sensed data on to the centralized part. Let medical server be MS

Go to data transmittance Integrate WS (n) ->MS

Step 3:

Let physician database be PD

Go to monitor. Transmit records from MS to PD. MS->PD.

Step 4:

Perform check on the collected data. If the variations are normal physician port remains idle

Else supported with subsequent health care.

Step 5:

Let treatment proposed for each patient be T (p)

If variation patient retrieves T (p) from physicians port.

IV. RESULTS AND DISCUSSION

At this level, we had developed an application that can help the patient and doctors integrated. Various screen shots are

Figure 4 : Login process performed by the patient and the physician

Demonstrates the home page of smart health care. Here patient,or the physician can login using their own username and password.Provisions are given for a new patient to get service and for a new physician to provide service.Proper username and password allows user to get into smart health care. otherwise an error will be generated.

Figure 5: Physicians providing services are registered.

A physician who supposed to promote his job in an easier and efficient manner can register themselves with the application.

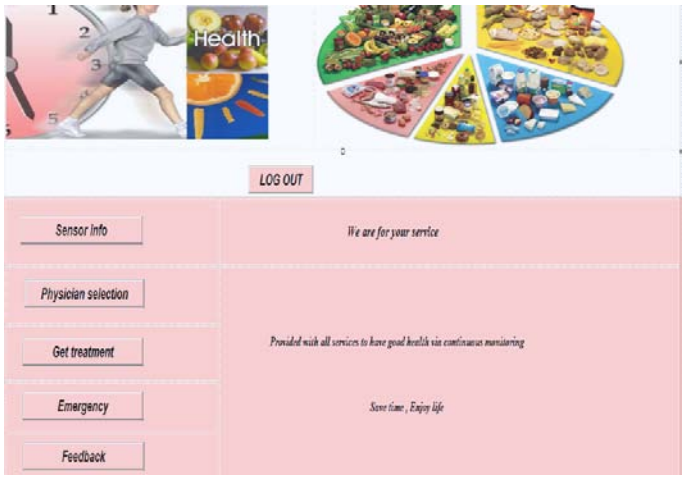

Figure 6: Various activities done by the beholder in the system

A patient who login to the application can obtain various services like viewing his health status, selecting particular physician, obtaining treatment, requesting emergency and providing relevant suggestions for improvement.

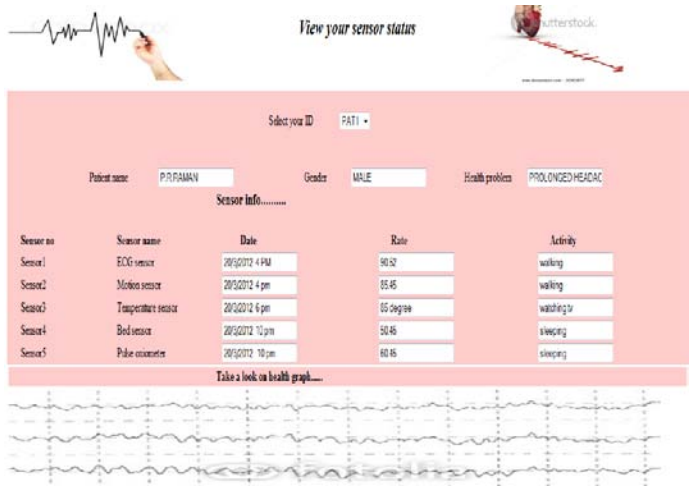

Figure 7: Sensor status of a patient during data acquirement and transmittance

Patient is given provision to view his rate of various biophysical signals, date and time at which it is measured, and the activity performed while measuring the same. Medical server displays each patient's data by filtering based on ID. Demonstrates **data acquirement and transmission phase.**

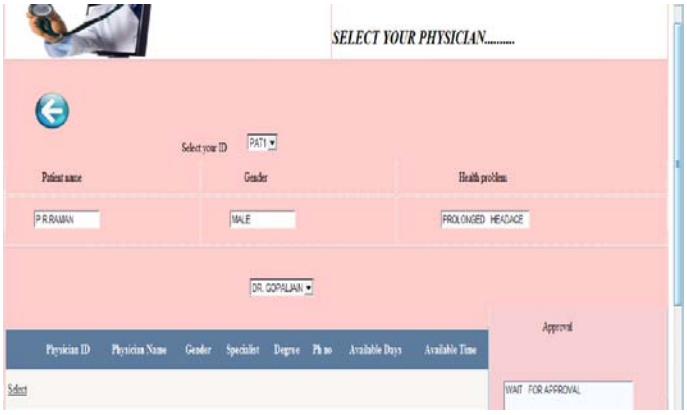

Figure 8: Selecting physicians by the patient.

The patient who needs treatment can choose diff physicians based on availability. This is done by displaying all physicians who are suitable at a particular time. Patient information's are displayed by filtering them using ID.

Figure 9: Treatment obtained by the beholder

The patient can obtain his prescription in less time efficiently, and effectively. Only process to perform is filtering his data based on ID. Clarifying doubts regarding his health status is also possible.

Figure 10: Assessment of the beholder with regard to the system

Each beholder is given provision to assess the system. This is an aid to improve the system as well as to know about its current status

Figure 11: Service provided during drug therapy

The physician should provide necessary treatment which includes medicine to be taken, its dosage, days, time etc. He can view patient health status based on information obtained from various sensors during data acquirement and transmittance phase.

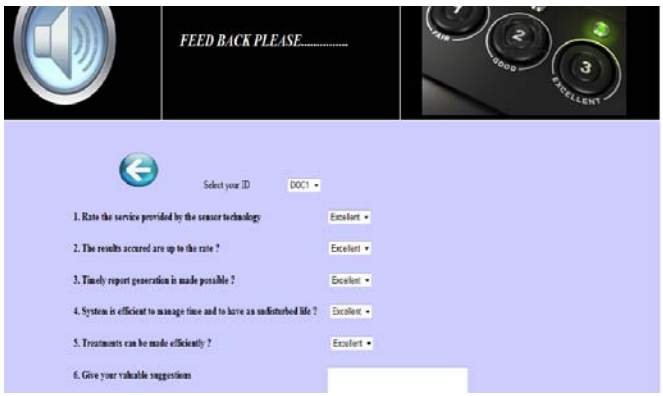

Figure 12: Assessment of physician with regard to health care system.

Physician can provide necessary details on how to improve the system, and the difficulties caused during patient analysis. This will be helpful foe future enhancement.

V. CONCLUSION

The exploitation of wireless sensor network has made a great impact on medical field. The major benefit of this is attained by person who is engaged daily in the medical sphere. It reduces their time and cost to an extent .From the above study it is concluded that smart health care can be attained by using various protocols and architectures of wireless sensor networks. This can make a spectacular change in the people to bring of their health in a constant and regulated manner. Various prototype like wearable body area network, wearable wireless body area network helps in attaining the same. This application developed to handle the up to second information will be good for the patient and medical community.

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