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E-Health Monitoring System using Wireless Sensor Network

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ABSTRACT

This paper describes about the E-Health monitoring system by using a wireless sensor network. It has wide range of application both in industrial based and as well as commercial based sectors. It mainly deals to monitor the health status of a human body from the harmful sickness and illness like systolic Blood pressure (BP), Heart Rate (HR), Respiratory rate (RR) and temperature of the human body. The necessary equipment and protocols used to monitor the healthy status of the human body are Sensors, communication protocol (TCP/IP), sensor nodes, UML studio and programming in visual basics. The type of platform and the communication based services are used is as follows:

Temperature with Publish-Subscribe based service. The compiler used to adjust the range of values for the patient is VISUAL BASICS. The platform used as a sensor node is CorTemp (Core Body Temperature monitoring system)

Keywords—TCP/IP, Temperature, sensor, UML studio, Visual Basics, Publish-Subscribe based service.

1 Introduction

The general meaning of a Publish is displaying the sender's message rather than addressing the necessary requirements, for the Subscriber it sends the message to all the eligible systems who is asking for the message to receive. In short Publish is message givers (or senders) and Subscribe is message receivers. It is a loosely coupled model in which the senders do not know who their subscribers actually are. The advantages of Publish and subscribe based services are It is a loosely coupled system which does not know who subscribers are, and who are the publishers. Publish and subscribe can continue their work regardless to one another. It is like a client-server based topology. Pub/Sub systems can decouple not only the location of publisher but also the subscribers (and also temporarily). It uses a strategy called a middleware analyst where pub/sub technology can let down the publisher so that subscribers can work; these systems also provide a better scalability than any other based services. The disadvantage of Pub-Sub based services are if one publisher sends any message the subscriber can't detect or make any necessary changes to it. If subscriber does any mistake the publishers will unable to specify or detect that error so more complexity arises when this case occurs [2].

The installation in pub-sub services is quite difficult and both can't handle at the same time, there is no joint for each to them to make any sort of communications in severe conditions.

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2 Block Diagram

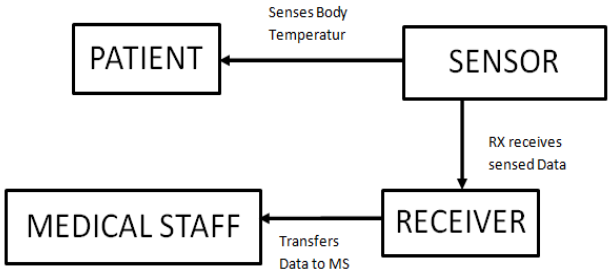

Figure 1: shows the block diagram of E-Health Monitoring System.

This sensor is made up of silicon which contains a micro-battery. When monitoring the system it can be administered into another sensor after the pill has passed. The core temperature sensor is accurate to 0.1 degree centigrade which is also cleared in FDA. Once the pill is swallowed or ingested the crystal sensor vibrates at a frequency relative to the body internal temperature and hence produces a magnetic flux in it and also allows the sensor to transmit a low frequency signal through the patient body. This sensor will be there in human body in between 20-40 hours duration and it will start working in a normal rate without harming the patient body. It can also consist of quartz crystal, communication protocol, insulated coils and circuit board. In wireless sensor network to transmit the data for the core body temperature in a E-Health monitoring system passes through the digestive tract. In this sensor the signal can locate through body of the core temperature and the data recorded by the sensor immediately sends signal to display screen through computer or laptop or any other digital signal. It is specifically designed for human use only 262 kHz. The sensor wirelessly chooses a signal for the conversion of analogue signal to digital signal by using processor technique system. The display of temperature in a real time bases and storage of data for the analysis of the system is done by using monitoring devices. This type of monitoring system is reliable, flexible, easy to use, quick response and data storage [4].

The occupation safety of sensor node mainly concern the hot environment around it with the heat stress is very important issue for workers and it should contributes to higher safety incidents, lower worker productivity, negative economic impact and morale. The frequency for the hot accidents in hot surrounding can cause more moderate environmental conditions. The core body temperature is the most objective measure of heat stress where the system delivers the data to the monitor with the highest degree of accuracy, comfort and ease of use. The absorption of this thermometer pill has a silicon coated exterior with a small battery which is made up of a quartz crystal temperature sensor which can be spaced in a system being used and with the help of circuitry the thermometer pill can react or measure the body temperature in 3 seconds and sends the signal to the system in a short particular of time [4]. This thermometer pill is harmless to human body as like once the pill is swallowed the sensor vibrates at a frequency relative to the body temperature sensor and transmitting low frequency signal through the body within 24 hours of time the pill passes safely from the digestive system without harming the human body.

As shown in figure 1 the necessary steps are useful:

- *The temperature sensor is placed on the body of patient.*
- *The sensor gets waked up and senses the data.*

- *The receiver end receives the data being sensed and transfers the data to Medical staff.*
- *The system is monitored each time and the emergency condition is immediately sent by alarm to Medical staff.*
- *The medical staffs immediate assess the patient.*
- *We use TCP/IP protocol for communication.*
- *The advantages of this health monitoring are the patient is benefited cost wise, light weight and small in size.*
- *This can be practically implemented by Wireless Embedded Technology and Graphical User Interface.*

3 Hardware Used

Features of CorTemp Ingestible Thermometer Pill are described below:

Size: L 0.88" (22.352mm) approximately. Diameter: 0.42" (10.9mm) approximately. Sensor Element is made up of Crystal. Transmission Method: Near field magnetic link Frequency: 262 kHz. Temperature Range: 30 degrees C to 45 degrees C (86 degrees F to 113 degrees F). Accuracy: ± 0.1 degree C. Effective Range: 24" minimum. Power Source: Silver oxide battery. Capsule Material: Dimethyl Polysilicoxane (silicone) Complies w/21CFR177.260 & 175.300 USFDA Regulations. Battery Life: Approx. 7-10 days. Usage: One-time use only: Factory calibrated. Warranty: 90 days [1] and [3].

4 Query Based Information

Query based information contains a specific information injected through a mobile sink the communication between the networks is done in the form of packets. The collection of data through Query based services makes the system more efficient for reducing the problems in a wireless sensor network. The results obtained by these services are in the form of packets. Query information extraction contains limited queries in a system where the computation in the network requires an aggregate range of values in a system. It has spatio-temporal characteristics in the design aspects where the data generation can be possible in a wireless sensor network. The network communication is done by using a TCP/IP based protocol systems which represent higher request for the information based extraction systems. This system should complete the request and response task in a specified duration such that it distributes its information in the query language. The system based information can develop a wide range of access to distribute its values in a sensor node. Where as in the case of publish-subscribe it sends a messages to the system in a messaging pattern and does not functionally programmed to retrieve the signal back to it. In the subscribers messaging it does not program the message and directly sends to the specific receivers directly. The subscribers can express more classes in the receivers messaging systems. This service is like a sibling to each other in a message queue paradigm and it takes a larger part of the message oriented middleware system. This messaging system can elaborate the work done by pub-sub in a message queue system. It is reliable and cost effective method as compare to query based services and also provides a better network scalability with a more enthusiastic networking system. In a query based service the node will be measured by keeping the device on the patient body and publish-subscribe based service the node is measured by putting the device on the patient body. Query based service takes the approach from quality of service based methods with communicate with peripheral devices and hence makes the system simpler than any other services for more information and features refer [6] and [8].

5 Software Design

It stands for Unified Modeling Language. It is an object oriented programing language that can be easy understood by an Engineer/non-Engineer. It involves the software design and analysis of system that deals with use case, class diagram i.e. object interaction, sequence diagram i.e. the flow of data between objects. The people who use this UML are requirement analysis, architect to build such as platform for any kind of work, database professionals, testers and project managers

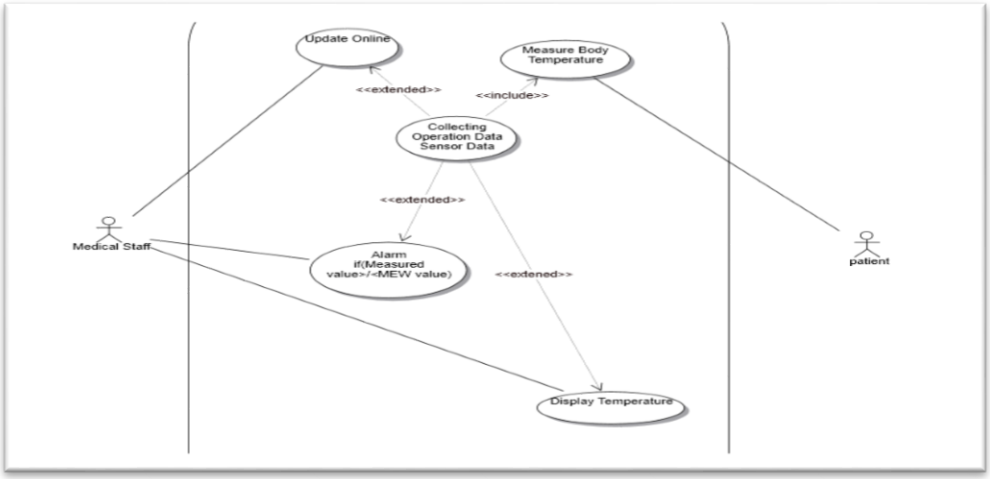

Figure 2: Use Case Diagram.

Use Case gives out the basic idea that how a system can be used. They provide a high level view of a system that can be easily understood by both domain expert and system developer. The use case above shows the interaction between two actors. They are Medical staff and the Patient. The scenarios that take place are as follows:

- The sensor detection: the sensor senses the actual and critical body temperature of the patient and sends the data to the receiver (Medical staff).
- If the sensed data exceeds the threshold value or below the threshold value then there is an alarm sent to the Medical staff stating the emergency of patient.
- Medical staff detects the data received and even the online update can be done by Medical staff.
- The sensed data is displayed on LCD.

The class diagram shows the set of properties and behaviors that are shared by set of objects.
It has three parts the class name, the attribute and its method.
They are shown below.

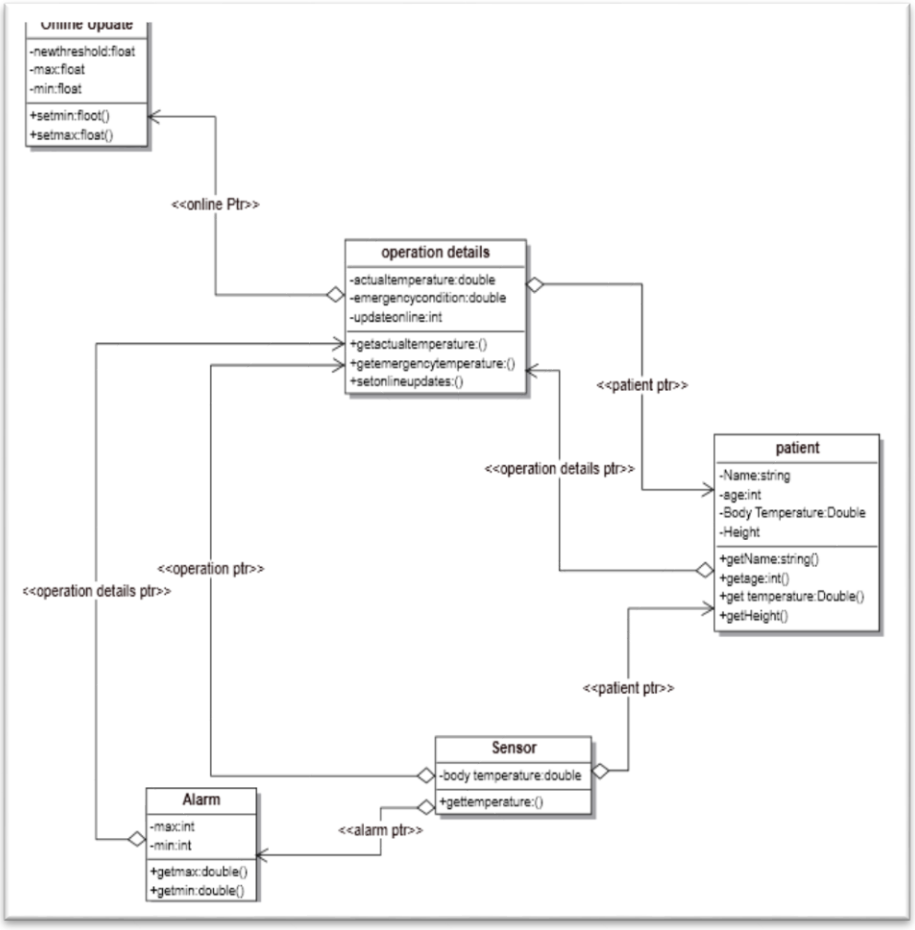

Figure 3: Class Diagram of the system

It is graphical representation of the system basically the scenarios from use case that shows interaction of objects with respect to time.

- Objects that take part are with indicated by vertical line.
- Messages or the data that is passed between two objects are shown in horizontal line.

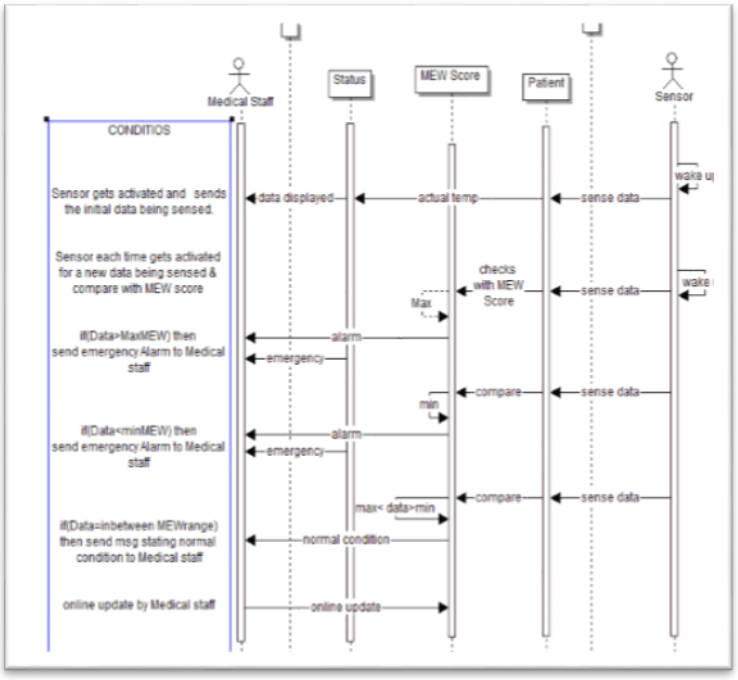

Figure 4: Sequence Diagram

The above sequence explains the action or the condition that takes places between two actors.

6 Conclusion and Results

E-Health Monitoring System is very efficient in design, fast in processing, ease of use for user. This design analysis can also be implemented and extended to monitor the health status of a human body from the harmful sickness and illness like systolic Blood pressure (BP), Heart Rate (HR), and Respiratory rate.

The results for temperature sensing system from an human body is as shown below:

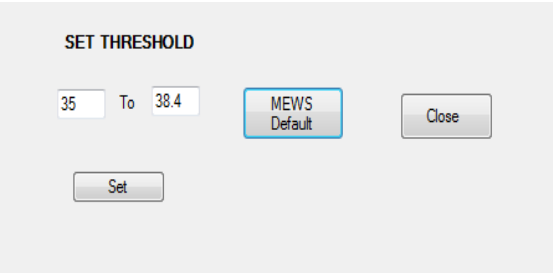

Figure 5: After debugging (Set Threshold before measuring Patient Body Temperature)

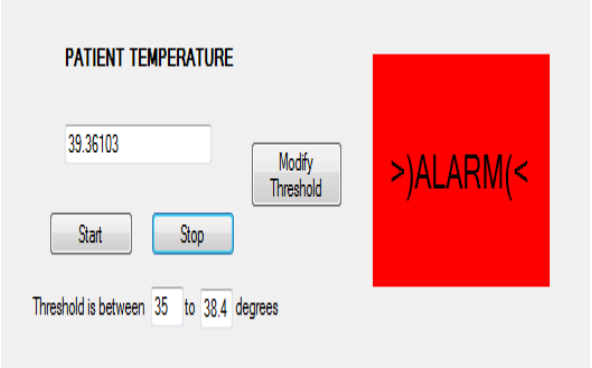

Figure 6: Shows Patient Temperature that exceeds the MEW scores Chat with Alarm

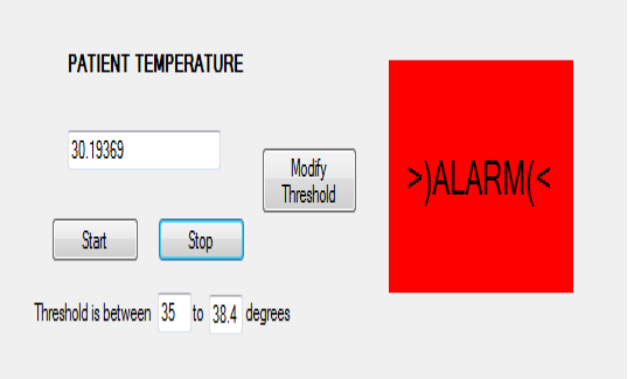

Figure 7: Shows Patient Temperature that is below the MEW scores Chat with Alarm

Figure 7 represents the abnormal temperature of the human body where the threshold value is below than the predetermined value and hence the patient should be needed an intensive care.

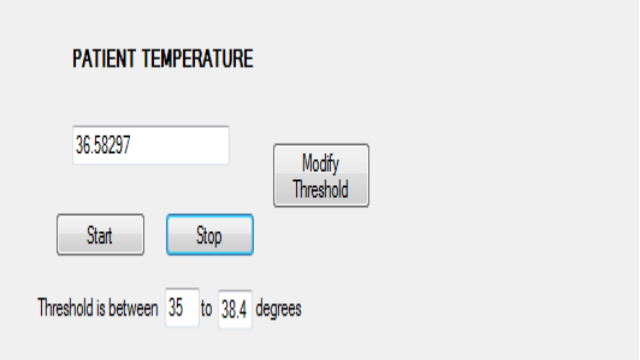

Figure 8: Shows Patient Temperature that is in the range of MEW scores Chat.

Therefore the -Health monitoring system using wireless sensor network is detecting the temperature of the patient body; figure 8 shows the normal temperature of a patient body where the signal detecting the healthy status of human body hence no alarm is generated. The temperature difference is set in a predominant fashion and then modifying the threshold values in the system by using wireless sensor networks. This method of design and hardware implementation can also be done by Python Programming along with hardware equipment known as Onyx II and WristOX_2 [13].

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