# Enhancing Home Health Care System Using Body Area Network & Group Key

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**ABSTRACT:** Body Area Networks are the networks of wireless medical sensors, deployed on a person for enabling pervasive, individualized real time health management. As BAN deals with personal health data, securing them especially their communication over the wireless link is very crucial if there is adequate security feature for the patient in the body area sensor network then the adversaries can change the actual data which will lead to wrong diagnostics and treatment of the patient in order to provide a personalized health care system. The Body Area Network along with the group key is established for the security concern where they will provide a separate key to each of the sensors that are of deployed in the patient body when this key matches with that of the health care server system the key establishment of the network.

**Keywords:** *Sensors, group key, body area network, physiological signals*.

## 1. INTRODUCTION

The Body Area Network in the home health care system is used to monitor the elderly ,patients, who suffer from the chronic diseases where the sensor will send the physiological signals to the physician and in return they will send the feedback to the patient through the personal device which will provide a real time monitoring in the home health care system [3] .The security and the information access plays a vital role in home health care [8], where these can be achieved through the group key establishment among the body sensor networks these can be shared through the devices, once the data is sensed then the sensor nodes are made available [6] the main goal of the group key is to reduce the logistic constraints between the doctor and the patient

### *2. Prior studies of body area network & group key*

The body area network (BAN) is a wireless network of health monitoring sensors designed to deliver the personalized health care enabling the secure inter sensor communication within the BAN in a usable manner where the Body area network is deployed in the sensors to make the communication securable [1],[4] is to ensure the confidentiality and integrity by providing the key agreement where they will exchange the secrecy among the BAN by building the channel hidden from the outsiders where by creating the artificial electrical signal[11]below the action potential by this it has no effect on the body. Securing the broadcasted data and the commands within the BAN is essential for ensuring the safety of the patient and also for preserving the privacy of the data which is established between the different sensors within the BAN another mechanism[15]to secure the communication is to place the small electrical charge around the body and use that communication medium[12]where they are in need off the minimal memory and the bandwidth resources are of needed this can be achieved by using the protocol known as the (SEV) secure environmental vault [13].By using the symmetric keys between the sensor nodes are of employed in the wireless sensor networks by using three categories such as pair wise scheme, pre distribution scheme , random key method [10], the pair wise and the random schemes are of mainly used in the individual sensors[14]that are of employed in the open environment and the pre distribution method is used for the pair of the sensors that are of deployed where they will create the trusted intermediary [7] employs the group device pairing (GDP) which is used for the secure communication in the key management protocol for the authenticated group key management in the wireless communication .

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### *3. Architecture of Home Health Care System Using BAN & Group Key*

The body area network in the home health care system is a predominant in the medical application where the intelligent nodes are of deployed in the patient body which has the ability to sense, process, communicate with the different physiological signals are of also known as the (PS) that are mainly used to measure the physiological signals in the patient such as the heart beat , blood oxygen level, blood pressure where the sampling rate of these physiological signals are of recorded these sample rates are of stored in the health care server then there is unusual level of the patient is continuously monitored using the sensor nodes that are of attached where these nodes are of in minimal size and weight which will provide a integrity and calibration to the user . The actuators also plays a vital role in the body area network as they inform the changes that occur in the body where the sensor will just detect the difference in the sample rate but the actuator only will be able to detect the difference that occur in which part of the body then this will be sent to the personal device .and then the physician will gives the feedback to the patient.

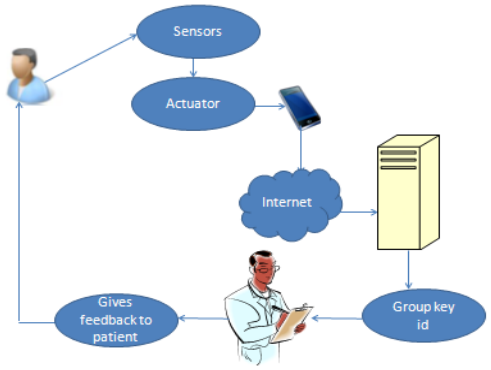


**Figure.1** *Architecture of home health care system using the BAN & Group key*

The body sensor networks are of deployed in home health care system it will reduce the financial burden of the user as well as the cost is minimum, where it will reduce the interaction with the humans in the hospital and also provides the quick treatment to the patient .The sensor nodes in the body area network are of stationary where the patient can move anywhere this will lead the nodes to be in same direction even though many of the nodes are of deployed in the patient , if there is a small change in the movement of the patient body than the prescribed level then the sensor nodes will inform to the actuator where the Ban requires the energy for the data processing, transmitting, collecting and for the development for this the energy becomes a paramount in the nodes, the battery that are of placed in the sensor nodes are of replaceable where the energy transmission in the sensor nodes are of short range as the patient may be walking, running, or may be twisting so at that time the sensor nodes to be a static. Thus the sensor attached in the body will transmit the data for 1 to 40 times per hour where the BAN will provide a real time feedback to the users this can be made possible with the help of the specific applications in the personal device**.** The sensor nodes that are of deployed in the human body will have a contact with the neighbor nodes where the nodes will establish a key generation process to provide a group key identity to the health care server, these group key is classified based on the identity that is provided by the sensor nodes when they are of installed in the patient body ,the server will also have separate identity based on the type of the diseases they are of divided when these sensor node identity matches with that of the identity in the server then the group key identity is valid or else the key is mismatched .The nodes will inform the emergency to the other nodes in case of the critical situation where these notification is taken to the personal device which will in turn inform to the health care server

## 4. IMPLEMENTATION OF NEW ARCHITECTURE

The core concept behind the wireless body area network is to remove all wires that are of connected to the patient and to develop the wireless network between the sensors where these will reduce the connection with the wires and also will not reduce the comforts of the patient. The Body Area Network in the wireless technology will interconnects the tiny sensor nodes and the actuators that are implanted in the human body where these sensor nodes are of mainly deployed in the cloth or in the shoe of the patient used to monitor the patient continuously where the curvature of the body is to be considered at the time of installing the sensors in the home health care system whose function is to detect the chronic diseases that occur mainly in the aging population , the sensor nodes will senses the nodes for every 10 seconds if there is any change in the physiological signals such as heart beat, blood temperature, blood oxygen level then the sensor nodes will inform to the actuator which will in turn will send the message to the personal device about the difference in the physiological signals of the patient, then this will be sent to the wireless medium communication such as internet after that the information will pass to the health care server which is under the control of the hospital where it just shows the mobile number of the certain patient in the sever , then it will check for the group key identity that is provided for the patient at the time of the node

installation, this key will be matched only when the group key identity of the server and the sensor node identity of the patient is matched or else the key is invalid. Then history of the patient details is sent to the physician who will in turn send the feedback to the patient, the BAN is designed to satisfy the wide range of the applications such as the health monitoring and the emergency response using the BAN the patient will experience the greater mobility and no longer to stay in the hospital where this process is considered to be the next step of the enhancement in the home health care system where it will also cope with cost of the health care system, securing of the sensor nodes will not only provide the privacy of the data but also the safety of the patient details, the communication of the home health care system is more flexible as the sensor nodes in the body area network will communicate with the personal device which is easy for the user of the system where there is no need of any other devices for the communication where the physician or the specialist can also contact the patient through the wireless technology as this system supports the alternative way for the communication the patients and as well as the physicians which leads to the flexible way of the communication

### *4.1 Networking in the Body Area Network:*

The application scenario of the body area network is different from the traditional sensor nodes where the sensor calibration is revisited well before the usage as the nodes can join /leave the network at any time

### *4.2 Temperature Routing In Body Area Network*

Considering the wireless sensor nodes it will cause some heat in the tissues of the patient body this can be reduced by balancing the communication over the sensor node

### *4.3 Security Concern in Body Area Network*

The data of the home health care system should be confidential, authenticated, as the transmission of the data is privately concerned one as it can be accessed only by the authenticated persons, as the data are encrypted this will make easy for the group key to share with the user .Furthermore the patients are in surveillance to carry the sensor nodes along with them so it will be difficult for the outside attackers to detect where the nodes are being attached in the body

### 4.4 *Home Health Care System – Users and the Sample*

To find the patient's effectiveness of health in the body area network which is based on before and after the home health care system during the November 2013- December 2013, the author collected the samples of 104 from health care sector were they used the home health care system architecture, the details of the patient using the home health care system is given below where the number of users


**Figure. 2** *Body Temperature Monitoring in Patient*

| Gender | Number of Respondents | Percentage |
|---|---|---|
| Male | 60 | 58.4 |
| Female | 44 | 41.6 |
| Total | 104 | 100.0 |

**Table.1.** *Users of Home Health Care System*

The figure (2) represents the body temperature monitoring in the patient where these reports of the patient can be sent by the physician through the personal device such as the mobile phone of the user

### *4.5 Goals of the home health care system*

The five design goals of the home health care system are the node installation, configuration of sensors , calibration of sensor nodes, automated feedback,real time data

#### *a) Node Installation*

The sensor node installation requires the method of uniquely identifying the neighbor nodes in the patient body to make up a routine activity in the network with the continuousmonitoring of the patient the sensor nodes will senses the physiological signals in the body, the sensor nodes attached in the body of the patient shoule be user friendly, it is possible to check which sensor nodes are located in the bodily movements of the patient .Whenever the sensor nodes are installd in the body they are provided with the key value where these key value will match with that of the server in the home health care system

#### *b) Configuration of sensor nodes*

Depending on the type of the sensor node process the server of the home health care system should configure with the other sensor nodes that are attached in the person body where this will help the sensor nodes if any error occur in the particular node thses neighbor nodes will act upon the position of that particular node so the configuration part of the nodes plays a vital role in the home health care system

#### *c) Calibration of sensor nodes*

The server of the home health care system should collide with that of the personal device so the group key is established with them these group key acts as key validation in the server so that the data that is acquired from health care system will be categorized according to the needs of the sensor nodes for the patient where the vital signals such as the heart beat rate, blood pressure, glucose level, blood flow in the body and the need for the sensor nodes are of categorized in the server of the home health care system

#### *d) Automated feedback*

The feedback has been sent by the physician to the patient these automated feedback is received through the personal device of the patient where the patient can also receive their report fprms such as the ECG through the wireless technology which will help the patient to know about the status of their body condition

| Date | Time | Temperature | Glucose Level | Blood pressure | Status |
|---|---|---|---|---|---|
| 2013-12-01 | 08:00:00 | 102.0 | 80 | 100.0-130.0 | Lowtemperature,normalblood pressure,normal glucose level |
| 2013-11-06 | 08:10:00 | 102.0 | 75 | 10.0-140.0 | Lowtemperature,highblood pressure,normal glucose level |

**Table .2**. ***Status of the patient in the health care***

### *4.6 Physilogical signal data characteristics*

Thse characteristics will depend on the sample rate of the vital signs such as the blood flow, bloop pressure, body temperature, ECG signs etc where there is a maximum fequency rate for each of the signs in the body when the range of this level is beyoubd then the sensor nodes are of activated in the patient body where they will alert the actuators in the network.


**Figure.3.** ***Patient Vital Signal Monitoring Screen***

**Advantages**

a) Whenever the node is deployed in the patient body it will be able to join the other nodes and also set up a route without any of the intervention
b) As the nodes are of self organizing it will able to detect the problem that occurred in the nodes
c) The entry from the outsiders is prevented by using the exclusiveness of the key where it allows only the member of the group
d) There should not be any information regarding the previous group key generation this can be solved by using the forward secrecy in the group key
e) The body area network will provide a real time feedback to the users using the personal device It uses a limited energy resources where they require low transmit power per node to cope up with the health issues with a reliable communication

## 5. CONCLUSION

The wireless body area network are of mainly used in the health application as it will offer wide range of benefits to the patients by continuous monitoring them, to the medical personal , and also to the society through this it is possible to detect the diseases at the early stage , and by using the group key generation it is possible to have a multiple devices to share the key in a authenticated manner , the another feature of the home health care is the patient don't need to go to hospital by just sitting in the home it is possible for the user to know about the diseases without visiting the doctors and also having the conversation with them will lead to the wastage of the time, by using the group key technique it is possible to have reliable communication with the sensor nodes , and also it will reduce the complexity between the nodes , the sensors will integrate with the body area network in a step by step process where by having a close proximity with the nodes in the health care system so the medical information should be of stringent one in the medical field which will be able to provide a quality of the life using the home health care system in a wireless technology.

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