TRUST BASED HELP TRIGGERING SYSTEM BY MONITERING HEART BEAT

J COMPONENT PROJECT REPORT
SLOT < A1 or A2 or B1>

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Under the guidance of

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Vellore Institute of Technology
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School of Computer Science and Engineering

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Required Table of Content instructions

S.No	Contents	Instructions Please note instructions for contents
1	Abstract	Note- minimum one page
2	Introduction	Minimum 3 pages
3	3.1 Literature Review 3.2 Survey Table(one or two pages) 3.3 Problem Definition	3.1 Minimum 10 pages
4	Proposed Method (should be one module MQTT based protocol there in ur work) 4.1 Flow Diagram- one page 4.2 Proposed Algorithm- one page 4.3 Circuit Diagram one page	All the diagrams should be numbered and caption properly and explained properly
5	Implementation	Upto the work
6	Results and Discussion	Upto the contents/work
7	Conclusion and Future work	One page
8	References	
	Supporting documents 9.1 complete Code 9.2 generated CSV file Vide link : Link should pase (atleast one month Online data with time log)	Separate file

Table of Content

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Abstract

Consider a situation in which there is a patient and there is no one present in his/her room and suddenly there is a drastic change behaviour of heart rate. In this case, might be patient may not be able to call or his/her noise might not reach outside room. So, as a solution to this problem, a help triggering system is proposed here. According to this system, we make a group of patients allotted to some nurse or doctors and whenever there is a drastic change in heart rate, a message is triggered to corresponding nurse or doctor as well as to a nurse/doctor nearest to that room. Using machine learning techniques, we can track heart rate pattern of each patient and try to prevent the disease. This would be further checked for the trust management of the node before the final display warning that is sent through.

Keywords: 5 key

I. Introduction

The diagnostic tool measuring heart rate is a medical device that will be used to help nurses and very useful to know the state of the patient's condition. The working principle of this diagnostic tool is to count the number of heartbeats in minutes. Then from the heart beat count will be determined whether the patient is in normal condition or not. Usually people who have echo are detected with anomalies their notification will be sent to respective doctors using SMS Gateway and connecting it with the API.

a. Significance of Heart

b. Trust based System

The heart acts as a pump that circulates oxygen and nutrient carrying blood around the body in order to keep it functioning. When the body is exerted the rate at which the heart beats will vary proportional to the amount of effort being exerted. By detecting the voltage created by the beating of the heart, its rate can be easily observed and used for a number of health purposes. Heart pounds to pump oxygen-rich blood to your muscles and to carry cell waste products away from your muscles rate gives a good indication during exercise routines of how effective that routine is improving your health. Our trust-

based health IoT protocol considers risk classification, reliability trust, and loss of health probability as three design dimensions for decision making.

A heart rate monitor is an individual monitoring gadget for measuring the heart rate progress of the particular subject. The heart rate progress detected by the sensor can be used for real time or we can also store the data and use it for further study. Early models comprised of a monitoring box with a lot of electrode drives that is joined to the chest. The heart rate of a healthy adult at rest is around 72 beats per minute (bpm) & Babies at around 120 bpm, while older children have heart rates at around 90 bpm.[1] The heart rate rises step by step during activities and returns gradually to the rest value after exercise. The rate when the beat comes back to ordinary means that the wellness of the individual. Lower than typical heart rates are generally a sign of a condition known as bradycardia, while higher is known as tachycardia. Heart rate is easily estimated by putting the thumb over the subject's blood vessel throb, and feeling, timing and measuring the beats in a 30 second time span. Heart rate (bpm) of the subject is then found by multiplying number by 2. This strategy is although basic, isn't accurate and can give blunders when the rate is high. Increasingly advanced strategies to quantify the heart rate use electronic procedures. Electro-cardiogram (ECG) is one of as often as possible utilized technique for estimating the heart rate. Be that as it may, it is a costly gadget. Ease gadgets as wrist watches are likewise accessible for the quick estimation of the heart rate. Such gadgets can give accurate estimations however their expense is more often than not more than a few hundred dollars, making them uneconomical.

Some electronics devices that are used currently for measuring heart rates are fine with daily life measuring of the heart rates of any subject. But there are many patients who suffers from sudden change in heart rates. The change may be increase in heart beats or it may be a sudden decrement. For this medical scenario, any measuring device should be there which alarms any medical professional during such a case.

Monitoring of patients' heart rate in the hospitals often needs to be done remotely. This provides higher level of control and enables more rational work. Detecting heart rate is one of the main tasks that has been addressed historically as well as recently. While the algorithms and analog electronics solutions have been provided and are well developed, the new technologies from the field of Internet of Things (IoT) provides new possibilities to ensure the
connectivity to the web and the cloud.[2]

II. Literature Review/ Related Work

Ufoaroh S.U , Oranugo C.O, Uchechukwu M.E(2015) have shown the importance of the Cardiovascular related devices and their monitoring. The Cardiovascular disease plays a vital role in the heart beat and the risk of getting the Heart Attack. Diseases such as- Congestive heart failure, congenital heart attack disease, coronary heart disease, heart attack etc related to the heart disease. So there work gives a system that provide real time monitoring of the heartbeat and it gives the proper timing of the risk associated alarms and SMS alerts.[3]

WIJAYA, N. H., RAHARJA, N., & ISWANTO, I. (2017) have stated the diagnostic tools in the form of the photopletysmograph. They are using a phenomenon known as Photoelectric which is a system capable of providing the activity of the human heart. It will detect the current temperature of the body. It will collect the pulse rate using the heart rate sensor (finger tip sensor). They are using the LM35 temperature sensor. The mechanism they are using that they are converting the heat sensing Into the electricity, which is being translated into digital form by ADC 10 bits processed by the microcontroller ATMega 16 and displayed to the LCD.[4]

Sowmya J.S, Ali M.H (2019) mainly focused in the continually monitoring of the patient so they try to present three things simultaneously like heart rate, temperature and produce ECG signal with the assistance of the sensor. Then the work of the sensor begins and they sense it and then they will send it to the phone through the message or telephone a relative nearby if there is an emergency of crisis occur. If any traffic jam is there it will detect that using the Google maps. It is also used for self-monitoring the patients anywhere at any time. In this way by using the Smart health observing framework will highly reduce the effort of experts and paramedical staff to screen the patient for 24 hours and moreover decreases the time and cost and will save the lofe of the patient at maximum extent.[5]

Gowrishankar, S., Prachita, M. Y., & Prakash, A. (2017) proposing a remote detecting parameter of the human body which comprises of heartbeat and temperature. The parameters that are utilized for detecting and observing will send the information through remote sensors. Including an electronic watching monitors, the ordinary wellbeing status of a patient. The detecting information will be persistently gathered in a database and will be utilized to educate patient to any inconspicuous issues to experience conceivable finding. Trial results demonstrate the proposed framework is easy to use, dependable and affordable.[6]

Ajitha, U., Aswathi, P. A., Sasidharan, A., Salman, V. A., Anand, V., & Arvind, A. (2017) have exhibited a constant remote checking of pulse. This system uses an alert and LCD display that are capable of monitoring the heart rate. A minimal effort, proficient and adaptable pulse recognition and ready framework utilizing remote module has been executed in this paper. The sensors sense and measure the pulse and recognized sign are sent to control unit for further handling. The processor

shows the pulse on LCD which is then continued to caution framework. In the event that there is an enormous distinction between the ordinary and estimated pulses, at that point an alarm will be given by the framework. This framework is ceaseless, constant, protected and exact in checking the pulses.[7]

Ashrafuzzaman, Md & Huq, Md Mazaharul & Chakraborty, Chandan & Rafi, Md & Khan, Monjur & Tabassum, Taslima & Hasan, Rashedul. (2013) is a step towards the preventative healthcare for patients who are suffering from heart problems. It tries to build up a brilliant versatile ECG checking framework that consistently screens what's going on around the subject when an arrhythmia occasion happens. The issue we are confronting now is the unforeseen passing of our friends and family on account of the abrupt heart assault. On account of the changing way of life the heart assault rate is expanding step by step. The current heart attack death rate is about 25% of the total deaths in India. The only reason behind heart attack death is the lack of medical care at instant. [8]

R. Ani, S. Krishna, N. Anju, M. S. Aslam and O. S. Deepa (2017) states that a patient monitoring system is proposed which is used to keep in track the patient who have previously suffered from stroke and are under treatment. Data analytics and real time decision making was used for the implementation of the technique. Growth in the field of internet of things has increased the scope of medical facilities using smart phones and other smart gadgets. Advanced healthcare monitoring systems enable doctors to review patients' health information virtually anywhere in real-time, using smart medical applications on their laptop or tablet or smart phones. Thus a final general system was implemented using input from wearable sensors and cloud storage for IoT and whenever critical situation would arise the doctor would be able to treat the patient.[9]

P. S. Pandey (2017) give a machine learning based prediction system which gives an way to predict the age and other body activites which’ll help in many other predictions. Stress is also a major factor for heart disease thus it can be also a part that can be used for the heart attack prediction. This paper concluded that resting heart rate cannot give accurate stress level due to the relationship is not accurately defined.[10]

C. Thirumalai, A. Duba and R. Reddy (2017) states about the difficulties faced by 12 attributes used by the prediction system in decision making of an event of a heart attack. Thus, it reduced the attribute with the help of pearson model which helps us to discover how intently a trait is related with different qualities. The ‘r’ factor makes a healthy relationship with the attributed and are now use by the decision-making system in calculating the chances of an event of heart attack. Thus in today’s world with Internet of Things it has become very easy to keep in reach with all the body problems without undergoing frequent body scan.[11]

S. B. Baker, W. Xiang and I. Atkinson (2017) presented the state-of-the-art research about each field in the health care sector evaluating strengths, weakness and other sustainability for the wearable IoT healthcare systems. Challenges faced mostly include security, privacy, wearability and many more. Internet of Things (IoT) technology has attracted much attention in recent years for its potential to alleviate the strain on healthcare systems caused by an aging population and a rise in chronic illness.[12]

III. Survey Table

Platforms	Protocol	Hardware Support	Mobile Services	REST API	Virtual Device	Storage At the Platform	Analytics	Push Notifications	Fog Computing
Xively [78, 79]	MQTT, HTTP	Present	Readymade Template applications	Present	MQTT	Absent	Present	Minimal Push Notification for Alert	Absent
Bosch IoT Suite [78]	HTTP, MQTT, LWM2M, mPRM	IoT Remote Manager	Absent	Java client or HTTP API Manager	Present	Absent	IoT Developer Console	Remote Event Push	Absent
Google Cloud IoT Platform [78]	MQTT, HTTP	Present	Present	Google Cloud IoT API	Cloud Pub/ Sub (7 days)	Cloud Storage	Google Data Studio	Cloud Pub/ Sub	Absent
SAP IoT Platform [78]	Absent	Present	Cloud Platform, iOS	Present	Thing Registry	Present	Absent	Apple Push Notification Service	Absent
Artayent IoT Cloud Services [78]	HTTPS, Web sockets	Absent	Android, iOS	EcoAdaptor framework	Absent	Absent	Present	Realtime Alerts	Absent
General Electrics Predix [78]	HTTPS, Web Sockets	Predix Machine	Predix SDK for Hybrid device	Asset Services	Mobile gateway	Blobstore (S3)	Absent	Absent	Absent
IBM Watson IoT [78]	MQTT, HTTP	Edge Analytics SDK	Android	Present	MQTT	Bluemix Storage	MQTT Watson IoT	Bluemix Push Notifications	Absent
thinger.io [78]	HTTPs	Arduino, Sigfox Or Linux	Android application	Server API	Present	Data Bucket	Cloud Console	Absent	Absent
Microsoft Azure IoT [78]	MQTT, HTTPS, AMQP	Device Provisioning	Android, iOS	Present	IoT Edge	Azure Storage	Present	Notification Hubs	Absent
Oracle IoT Cloud Service [78]	MQTT, HTTPs	Endpoint Management	Java, iOS	Present	Present	Present	Present	Present	Absent
Amazon or AWS IoT core [78]	HTTP, MQTT, Web Socket	AWS Greengrass	Android, iOS	Present	Present	S3	AWS Console	Amazon SNS	Absent
Cisco [80-84]	Present	Independent Hardware Vendors	iOS	Open and Programmable APIs	Gateway	Present	Present	Event Response	Present

IVProblem definition

Trust based systems that identify untrustworthy nodes solve various problems associated with

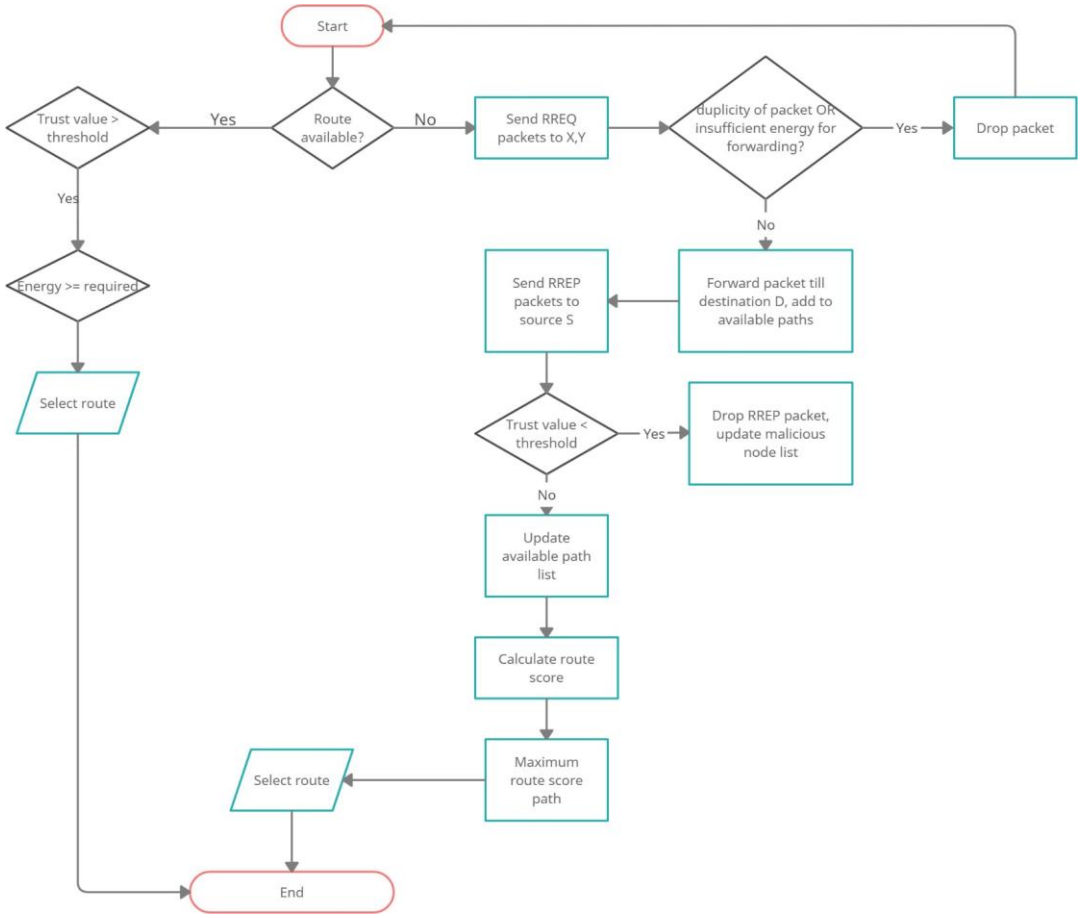
mobile ad hoc networks, including energy constrains and security. The first step to create a trust-based system is to calculate trust values at various nodes and to arrange them in descending order[22]. The second step is the consideration of limited availability of power and selecting nodes with both high trust value and enough power. Third step is to find the number of hops and the last step is to combine these values and generate a total score for each node.

In order to calculate the trust value, it is assumed that each node can obtain the packet forwarding behaviour by sniffing neighbouring nodes [25][27]. The selected nodes must have three extra criteria for selection in addition to the ADOV protocol and the efficient, distributed and localized algorithm on connected dominating set (CDS) by Yamin Li, Shietung Peng and Wanming Chu [31]. Those extra criteria are: abundant energy in the node, node should not be present in the list of corrupt nodes (inclusion of trust value) and number of h

V Algorithm or Pseudocode

1. Start
2. if (route exists between source S to destination D)
3. if (trust value > threshold t)
4. if (energy requirements >= required energy)
5. select the path
6. else
7. send RREQ (route request message packets) to the neighbour nodes say X and Y
8. if (X,Y's energy is enough for packet forwarding OR packet is not duplicate)
9. forward packet till it reaches destination D
10. add path in the available path list
11. else
12. drop packet
13. Destination D sends RREP route reply packets to source S
14. if (trust value of neighbour node < threshold t)
15. add in malicious node list
16. drop RREP generated from malicious node M
17. Update the available path list after step 14
18. Calculate route score:
19. route score = c * combined trust value + c * (total energy – energy exhausted)+ c * number of hops
20. Arrange route scores in descending order
21. Select route with maximum score
22. End

Flow diagram



Caption:

Flow Diagram Explanation

As per the given Flow diagram ……

Implementation and Results (if its Circuit) based ow Results and Discussion (example next page)

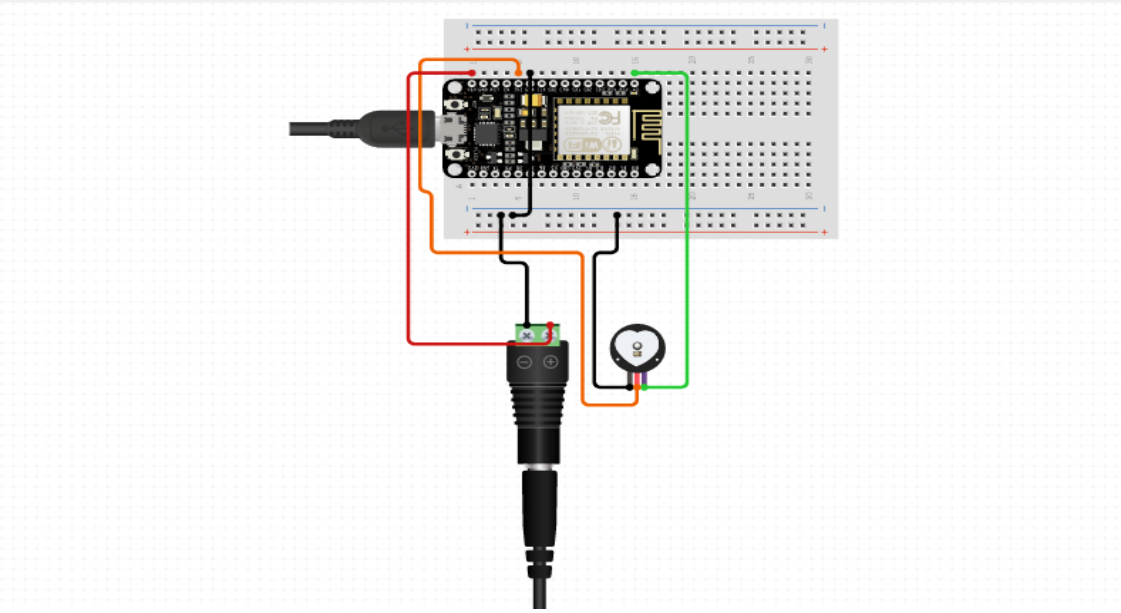


Fig no: Caption

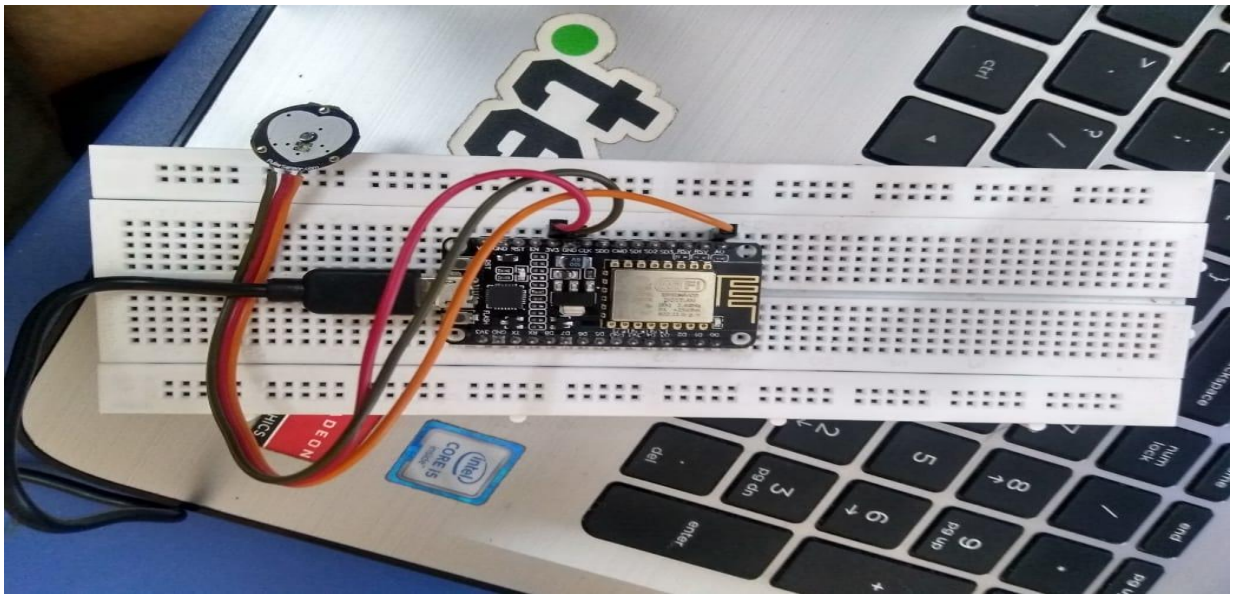
Fig No:X, Explaination

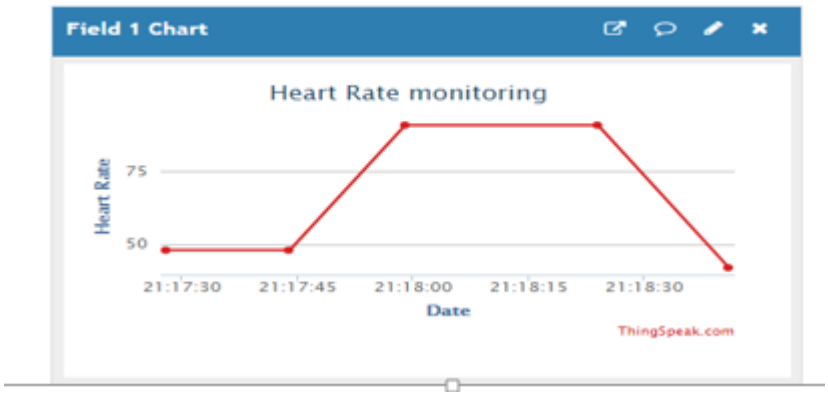
As per the given Fig No :X circuit and with help of the NodeMCU code uploaded onto the memory of it helps us to store the information about the pulse of the patient directly on to the ThingSpeak platform with the help of the API key feeded into the code and also the data is saved locally onto the Excel sheet. This excel sheet stored every measurement taking even if the network connection is weak due to which if the data is not been reflected instantenously on to the ThingSpeak channel data.

The data stored is further used by the training set and the decision making for the changes in the heart sensor data and is then further notified about the status of the current patient. The data is also used from the local database incase of the network issue due to which the the patient will get the surveillance all the time. This is further checked for the trust management system that'll ensure the data transmitted is given by the trusted node from the local server that is handling the data and the id of the trusted node will also be displayed.

Thus the proposed system is implemented by using a simple NodeMCU with the pulse rate sensor and all the other process is done with the help of local server coding in the machine which will in return complete the whole connection of the system.

Screenshots-





LOCAL ENTRIES Fig Number : caption, x and y axis shoulsd label

Explainations

VI Results and Discussions

The performance of PrEE-MAC protocol is compared with Baseline MAC and ZigBee-MAC by using the Castalia Simulator. The simulation used the specification of IEEE 802.15.4, the WSBN star topology with N-1 devices and one Coordinator is used. A priority Queue is incorporated in Coordinator to improve the better performance of PrEE MAC protocol. We used the default BO and standard slots for both CAP and GTS. The simulation parameter used for the application is tabulated in Table-4.1.The Simulation is executed for 100 sec 500sec and

1000 sec. The default simulation time for the Simulator is 100 sec. More than 100 times it executed, and results is taken based on maximum similar occurance.

The following performance metrics have considered to compare the protocols.

- Energy Consumed by the individual Nodes.
- Total Number of Frames Transmitted.
- Total number of Frames Received
- Frame delivery delay
- Calculated the performance of life time of the network.

Table 1 Simulation Parameter for PrEE MAC

S.No	Parameters	Value
	Rx mode	
1	data Rate (kbps) High, low, ideal	(1024, 512, 1024)
2	Bits Per Symbol	2
3	bandwidth(MHz)	20
4	Power Consumed(mW)	3.1
	DELAY TRANSITION in ms	
5	Tx to Rx and Rx to Tx	0.02
6	Sleep to Rx and TX	0.194
7	Tx, RX to sleep	1.5
	POWER TRANSITION	
8	Tx to Rx and Sleep vice versa	3.0 mW
9	Tx and RX to sleep	1.5 mW

Energy Consumed by the individual Nodes

The Figure 4.8, shows the consumed energy for individual nodes. In that the PrEE protocol performance better when compare to other protocol, because the proposed protocol used minimum energy consumption, the energy consumption for Node 0 is slightly high in PrEE MAC compared to other nodes means it act as like a Coordinator. The overall energy consumed by protocol per cycle that is 100s is Baseline MAC=0.948mW, ZigBee=0.511 mW and PrEE

MAC is 0.27 mW. And also the simulation is tested with 100 sec , 500 sec ,1000 sec maximum. Sometimes result is multiples of execution of 100sec, some test case it random value. Out of Six nodes three are consumed more power in PrEE mac, that is the node placed in Chest is act as like a Coordinator and also the sensors, other two nodes event driven nodes which is placed in wrist, transmitted the critical data to the coordinator

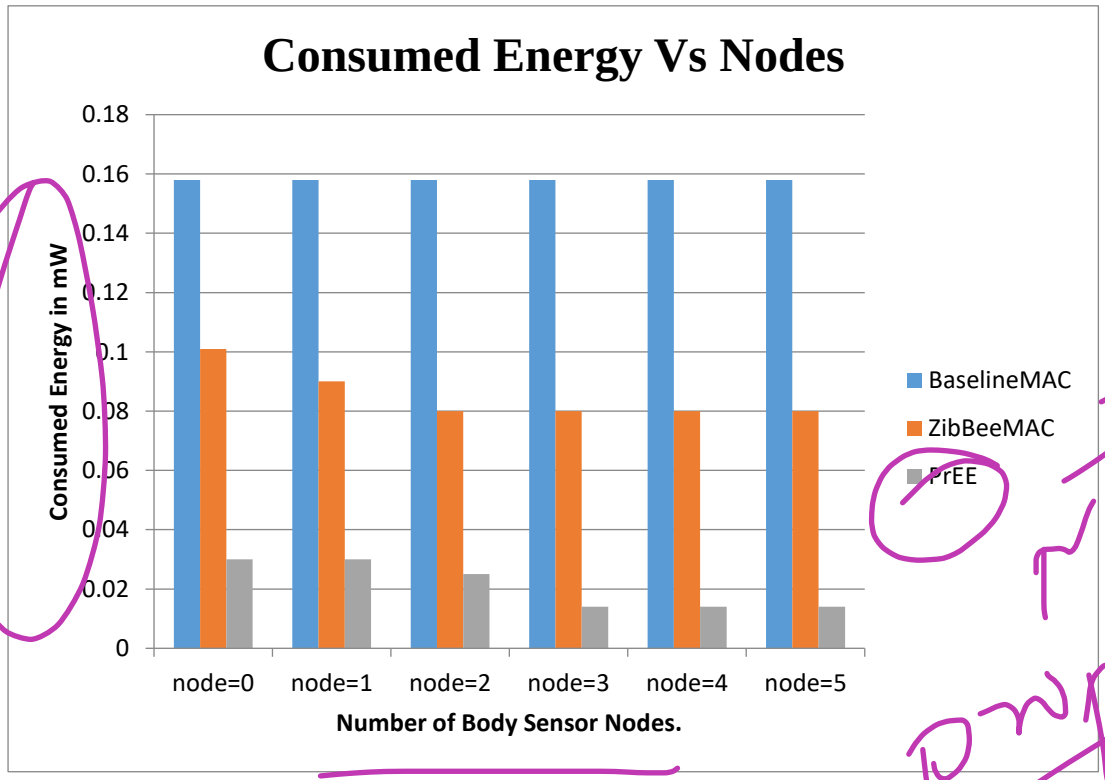


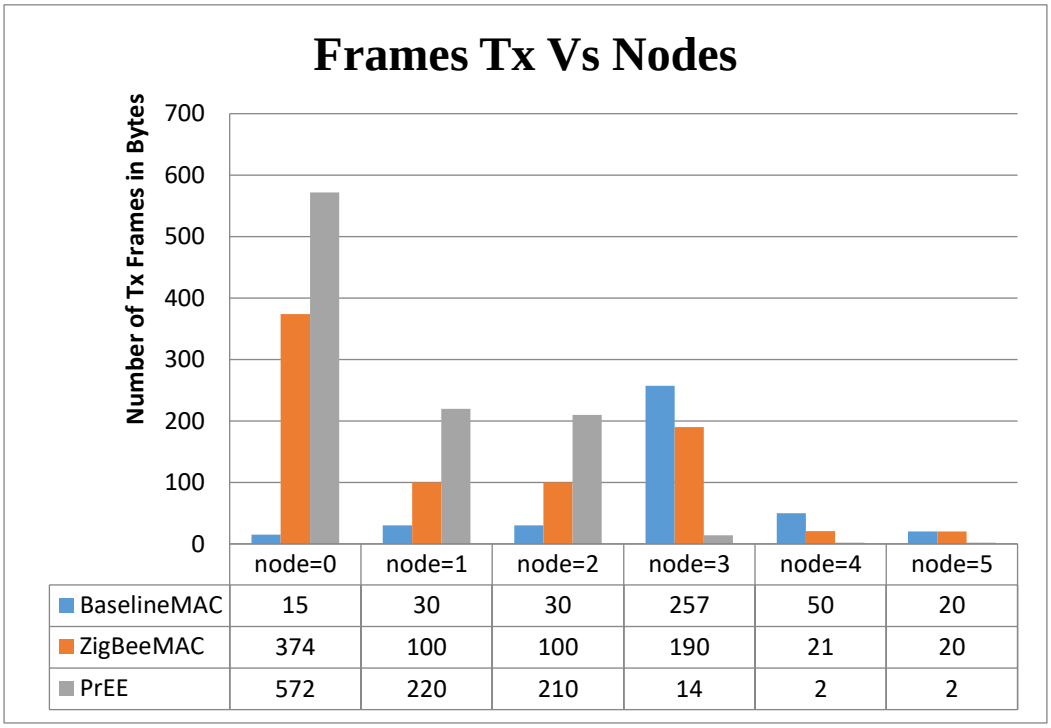
Figure 4.8 Consumed Energy vs Body sensor Nodes

Total number of Frames transmitted.

Figure 4.9, shows the total number of Frames transmitted by individual nodes, if we compare the sum of Frames transmitted by individual protocols PrEE shows the maximum value of priority of nodes is incorporate the protocol total 840 Frames is transmitted in one

time simulation execution, other protocol such as ZigBee AMC is 687 and Baseline MAC is 402 Frames, PrEE is ≈ 20.47% is better than ZigBee MAC.

Another reason is, the node 0 act as coordinator so deals more number of frames, and other node 1 and node 2 participated in even driven application, which transmits more number frames compare to other nodes. If the simulation executes by increasing the seconds from 100 to 1000 seconds and also more than 100 times simulated. Sometimes it will execute the random values. So the simulation results what we considered is optimal and attain maximum number of times out of 100 trials.



	node=0	node=1	node=2	node=3	node=4	node=5
BaselineMAC	15	30	30	257	50	20
ZigBeeMAC	374	100	100	190	21	20
PrEE	572	220	210	14	2	2

Figure 4.9 Number of Frames transmitted by Nodes.

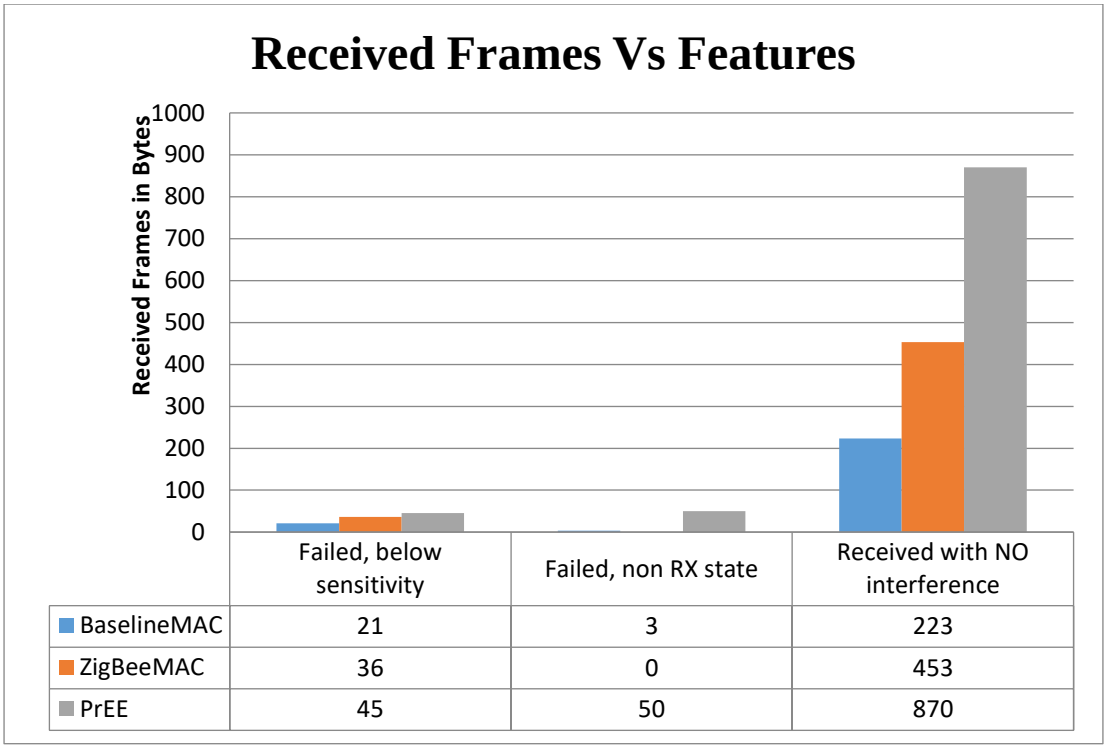


Figure 4.10 Number of Frames Received by Nodes

Total number of Frames Received.

Figure 4.10, shows the Frames received and breakdown, the breakdown Frames is classified into two category first one is Failed below sensitivity and Failed non Rx state, yes the breakdown of Frames for PrEE is slightly more than the other protocols. But the Frames received are drastically improved and better results than the other protocols, the PrEE is received 870, Baseline MAC is 223. And ZigBee MAC is 453. Frames. So PrEE ≈ 22% is more compare to ZigBee protocol, the comparison and difference is charted in Figure 4.11. We calculate the total Frames dropped are PrEE proposed MAC is 150 Frames and ZigBee is 352 frames. So that the proposed MAC performance better than other two protocols.

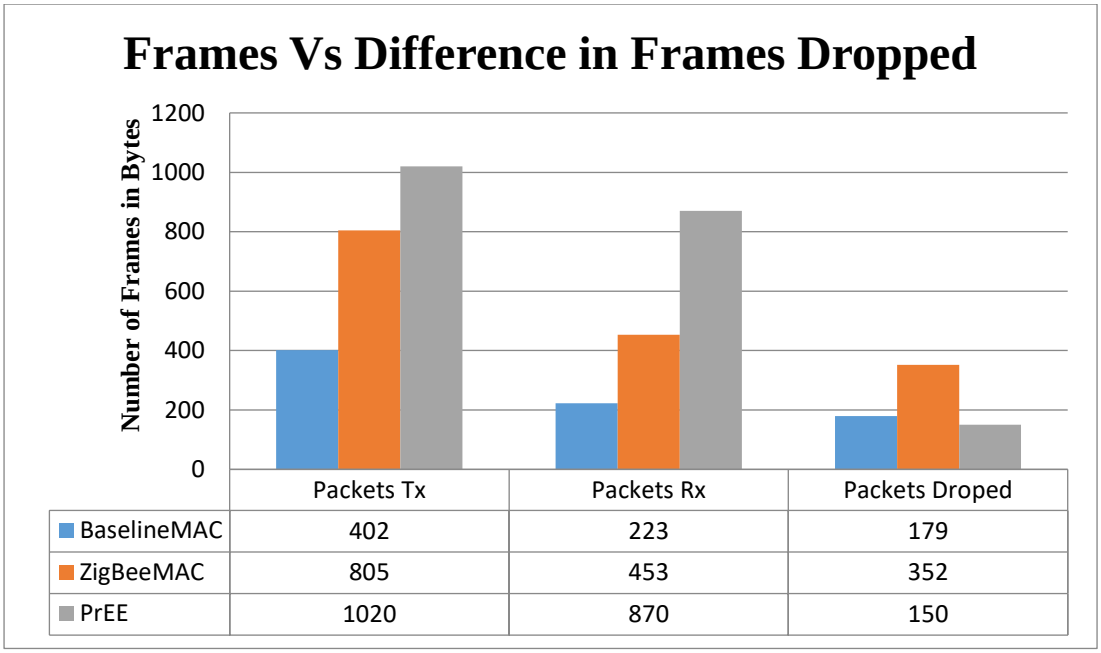


Figure 4.11 Difference in Frames received

End to End Delay

Figure 4. 12 shows the average delay which is executed in the network to deliver the frames. Here PrEE Mac protocol shows the better performance compare to other MAC protocols. The frames is delivered in minimum delay due to the priority is given to the nodes by the Coordinator. The average delay is calculated for all the three protocols, proposed protocol PrEE is 5.506ms, ZigBee is 6.741 ms and Baseline is 7.580ms. If the average value is compared PrEE is ≈ 10% is better performance than ZigBee and ≈20% than Baseline MAC

Life time of the Network.

Life time of the network in days is calculated based on the given equation (8), the initial energy is 18720 J, based on consumed energy, the total number of days where

Baseline MAC protocol is used in network will be 73.7 days , in which the life time is more compare to other MAC their life time is 69 days.

$$Life\ time = \frac{\left(\frac{Initial\ Energy}{consumed\ energy}\right)*100}{3600}\ Days$$

VII Conclusion and Future Work one page

Cardiovascular disease is one of the major causes of untimely deaths in world, heart beat readings are by far the only viable diagnostic tool that could promote early detection of cardiac events. Wireless and mobile technologies are key components that would help enable patients suffering from chronic heart diseases to live in their own homes and lead their normal life, while at the same time being monitored for any cardiac events. This will not only serve to reduce the burden on the resources of the healthcare center but would also improve the quality of healthcare sector.

Our project is totally based on the heart beat monitoring and alert system that is cable of calculating the heart beat condition of the patient. Here our system will monitor the heart rate

Or Future Work (Separate)

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