IOSR Journal of Electronics and Communication Engineering (IOSR-JECE)
e-ISSN: 2278-2834,p- ISSN: 2278-8735.Volume 14, Issue 3, Ser. II (May.-June. 2019), PP 01-07
www.iosrjournals.org

Review on Critical Event Monitoring Protocol Based Epilepsy Monitoring For WSN

Payal N. Giradkar[1], Prof. Ashish Manusmare[2]
[1]*Department of Electronics and Communication, Ballarpur Institute of Technology Ballarpur, India*
[2]*Department of Electronics and Communication, Ballarpur Institute of Technology Ballarpur, India*
Corresponding Author: Payal N. Giradkar

Abstract: *Wireless sensor networks (WSN) are widely used to sense and measure physical conditions for different purposes and within different regions. However due to the limited lifetime of the sensor's energy source, many efforts are made to design energy efficient WSN. As a result, many techniques were presented in the literature such as power adaptation, sleep and wake-up, and scheduling in order to enhance WSN lifetime. These techniques where presented separately and shown to achieve some gain in terms of energy efficiency. In this paper, we present energy efficient cross layer design for WSN that we named Critical event monitoring protocol scheme. The Critical event monitoring protocol design is a task based sensing scheme that not only prevents wasting power in unnecessary signalling, but also utilizes several techniques for achieving reliable and energy efficient WSN.*

Keywords: *WSN, Epilepsy Monitoring*

Date of Submission: 25-05-2019 Date of acceptance: 10-06-2019

I. Introduction

Epilepsy is the fourth most normal neurological issue and influences individuals of any age and is "seizure issue." Many individuals with epilepsy have in excess of one kind of seizure and may have different indications of neurological issues too. A neurological issue set apart by sudden, repetitive scenes, loss of memory and irregular electrical action in the mind. Epilepsy is normally treated by pharmaceutical and now again by medical procedure. Many individuals are influenced by this neurological issue called epilepsy. At times it can have uncontrolled seizures and it can affect to body parts, for example, hands, legs and head. The main idea of Green task based sensing is that the communication happens over the network only when new data is present. Here we have utilized two accelerometers for identifying seizures. In this the microcontroller will measure different parameters, for example, fall identification, shaking of hands, body temperature and sound detection of patients. Thusly, we can screen the Epilepsy of patient within a given timeframe. Microcontroller gather the information from the sensors and after that exchanges remotely to the screen of the specialist utilizing RF modem and the information can be seen and record using Thing speak.

Existing system

Here the existing system has continuous sensing. The existing system has request and respond protocol which is similar to LEACH protocol. In this method the master will request for slave data irrespective of the sensor status. So as soon as any slaves receive a request from master containing its slave ID then it will send the data to MASTER.

Disadvantages of Existing system

Many applications in WSN have redundant data, which means that the data does not change very fast. So sending the same data again and again results in Wastage of Network energy which in turn reduces network life time. So, sending the data again and again results in more number of Communication frame, which increases the Network efficiency and reduces battery life as well as network life.

Objectives

To design a GTBS protocol
To monitor the Duration of epilepsy
To suggest Medicines on Epilepsy

II. Literature Review

[1] This model of frameworks fabricated utilizing distinctive sensors to be utilized for epilepsy sufferers, however, require additionally testing in genuine situations. More sensors can be actualized by including different sensors, for example, heart beat sensors, pressure sensors, and so on so to screen the epilepsy of the patient a suitable treatment should be possible precisely. The location of the subject can be tracked by using GPS (Global Positioning System). This system is implemented by using ARM 7 LPC2138, RF modem, accelerometer sensor, sound detection sensor, temperature sensor. The parameters are displayed on a PC using Visual Basics and send to Thingspeak. In recent days numerous individuals have experienced the ill effects of medical issues like heart related, cardiovascular, malignancy and various illnesses. Epilepsy is like a complex network disease, those who have seizures, which are controlled, and those who struggle on a daily basis. Many epilepsy patients cannot call for help during a seizure, because of the unconscious so it can lead to injuries, medical complications and loses memory during the seizure attack. The seizures happen because of electrical activity in the brain, causing a sudden change in behavior at times seizures appear to be unique and on what part of the cerebrum they influence. This paper proposes methodology for epilepsy individual which uses sensor to evaluate the parameters of the patients like temperature, fall of the patient, shaken of the hand and sound of the patient. The patient status can be seen on PC through IOT so that the specialist/attendants can occasionally screen the patient's epilepsy.

[2] A smart sensor network for monitoring and control of society automation is designed. The developed system effectively monitors and controls the smart sensor network. The society automation is using wifi has been experimentally proven to work easily by connecting easy appliances to it and the applications were successfully controlled automatically through internet. High level of security can be achieved with the use of automation. We as humans have used technology to make almost everything faster, easier also safer to use than ever before. While there have been extensive use of technology in industry and work place in general, very little has been done towards society automation using internet. Society automation is becoming simple due to its numerous profits. Home automation related to the control of home application and domestic features by local networking or by automatic control. The wireless sensor networks are highly being used to control electric appliances. The work focuses on concept of home application where the monitoring and control operations are facilitating through smart devices installed in residential buildings.

[3] In this paper, the classification of epileptic motor manifestations during seizures is tackled with the use of triaxis accelerometers. Several feature sets are extracted from accelerometer data and compared with respect to their discriminant power. It is shown that the use of only one feature, the acceleration norm entropy, obtains the best performance on 1 s windows. The use of feature quantile normalization indicates that other features based on power spectral densities can also lead to good performance but cannot exceed the performance obtained with only HnA. Finally, a simple detector of TC seizures is proposed based on the HnA classifier showing good performances. We think that better performance could be obtained by using rules operating on the time succession of classes, or by adapting thresholds to individuals. In this paper, three triaxis accelerometers positioned on the wrists and the head of epileptic patients submitted to long-term video electroencephalographic monitoring as part of presurgical investigation are evaluated to characterize the different classes of motor manifestations observed during seizures. Quadratic discriminant classifiers are trained on features extracted from 1 or 4 s windows. It is shown that a simple rule applied to the acceleration norm entropy HnA produces the best performances compared to other classifiers trained on other feature sets. The simple rule is as follows with values given in bits: (0<HnA<1.34), no movement; (1.34<HnA<3.87), tonic manifestations; (3.87<HnA), tonic–clonic manifestations. For this classifier, features are extracted from 1 s windows and the misclassification rate is 11% evaluated on 5 607 s of epileptic motor manifestations obtained from 58 seizures in 30 patients. A quantile normalization can improve the results with features based on absolute power spectral density but performances are not as good as the ones obtained with HnA. Based on the classifier using only HnA, a simple tonic–clonic seizure detector is proposed and produces a 80% sensitivity with a 95% specificity.

[4] This study analyzes the solutions in the literature describing solutions for epilepsy tonic-clonic seizure detection and monitoring. The majority of the approaches lack several remarkable factors: developing ergonomic approaches, supporting everyday life, providing economical affordable solutions, introducing storage of the sampled data and providing intelligent CC services, introducing real time response, or considering multiple services on the MCC size. This study addresses the design of an IoT platform for the epilepsy seizure detection and monitoring considering each of these factors. The solution is based on a WD to be located on a wrist connected to a Smartphone, which in turns implements MCC services and has access to CC services as well. The global goal is detecting the seizures, storing information from the sensory system, generating alarms and notifications, performing machine learning techniques on the data to learn the best models to detect or to visualize the data, sharing data, and providing processed information to the medical staff, among others. Special attention has been paid to the MCC module, where some design decisions are discussed, leading to the experimentation stage. The experimentation stage implemented part of the MCC and CC modules, developing

an adhoc solution for the WD. The experimentation has been focused on determining the best data bunch size and on drawing conclusions concerning the criteria to choose when performing computation on the MCC versus requesting services on raw data to the CC layer. The experimentation results show two possible data bunch sizes (20.39 and 40.78 KB) as the most suitable ones. Furthermore, the second stage of the experimentation suggests that plenty of computation can be delivered on the Smartphones, reducing the amount of networking. Furthermore, special care should be taken to reduce the power consumption due to some mobile components, such as touchscreens. This research is only in its early stages, and in the near future we expect to complete the design, considering the integration of this framework into publicly available open software health platforms, such as GNU Health.

[5] This paper introduced a green Task-Based sensing (gTBS) protocol. This design allows the WSN to sense data in the form of tasks directed to a cluster of nodes. The gTBS adopts gradient-forwarding, power adaptation, and sleep and wakeup techniques to increase the energy efficiency of WSN. We evaluated our gTBS protocol on TelosB motes network. We showed that gTBS reduces the energy consumption by 20% −55%. Moreover, we also obtained a reduction of the delay by 54% − 145%, and an enhancement of 24% − 73% of the event delivery ratio. In future work, although we performed as a starting point a representative pilot-test for a proof of concept, we however plan to expand our scalability impact analysis to include a variation of the higher number of nodes in order to claim an overall superiority of our proposed gTBS scheme. Wireless sensor networks (WSN) are widely used to sense and measure physical conditions for different purposes and within different regions. However due to the limited lifetime of the sensor's energy source, many efforts are made to design energy efficient WSN. As a result, many techniques were presented in the literature such as power adaptation, sleep and wakeup, and scheduling in order to enhance WSN lifetime. These techniques where presented separately and shown to achieve some gain in terms of energy efficiency. In this paper, we present an energy efficient cross layer design for WSN that we named "green Task-Based Sensing" (gTBS) scheme. The gTBS design is a task based sensing scheme that not only prevents wasting power in unnecessary signaling, but also utilizes several techniques for achieving reliable and energy efficient WSN. The proposed gTBS combines the power adaptation with a sleep and wake-up technique that allows inactive nodes to sleep. Also, it adopts a gradient-oriented unicast approach to overcome the synchronization problem, minimize network traffic hurdles, and significantly reduce the overall power consumption of the network. We implement the gTBS on a testbed and we show that it reduces the power consumption by a factor of 20%−55% compared to traditional TBS. It also reduces the delay by 54% − 145% and improves the delivery ratio by 24% − 73%.

[6] Falls are an important adverse event in an epilepsy monitoring unit (EMU). We identified patterns of falls in an EMU and compared them with risk factors for inpatient falls. Twenty-six patients with 26 falls (2.3% of admissions) in the EMU were compared with 50 general neurology inpatients with 56 falls over a 4-year period. In the EMU, the majority (62%) of falls happened during the first 3 days of admission, mostly in the bathroom (74%), in patients with a normal mental status (77%). Most general inpatients fell after the third day (64%), inside their rooms (68%), and had an altered mental status before the fall (68%). All 26 EMU patients were identified as high risk at admission, in spite of which falls were not prevented. We outline these differences between EMU patients and general inpatients and highlight the practice gap in preventing falls in an EMU.

[7] This paper summarizes recent researches on Event Detection and Transmission Protocols in event driven WSNs. Each of these protocols performs the event detection and transmission based on various approaches in wireless sensor network. Wireless Sensor Networks (WSNs) can be typically used to achieve Continuous Monitoring or Event-Detection inside the supervised area. Event detection is a central component in numerous wireless sensor network (WSN) applications. Accurate event detection as well as reliable and real time transmission is basic needs of a good WSNs. This paper describes a survey on event detection and event transmission protocols in Wireless Sensor Networks. Classification of protocols are based on mainly two types i.e. sink centric event detection and transmission protocols and node centric event detection and transmission protocols. Paper also consists of the advantages and disadvantages of each protocol .Finally the paper concludes with the comparison of each protocol with different parameters.

[8] In this paper, a framework using wireless sensor network for equipment monitoring was discussed. This framework is designed in order to meet the objectives of balancing throughput and timeliness. A multi-channel algorithm that is used to relay sensor information from the field nodes to designated base station nodes was designed. The algorithm has the features of load balancing by distributing the traffic to multiple channels in the network at a particular time slot, thereby maximizing throughput. From the results it could be inferred that the delay incurred for various data rates by using eight channel networks is less compared to the delay for four channel network. Therefore it shows with the increase of the number of channels, the proposed algorithm produces increased throughput and good timeliness. Industries have lots of benefit by integrating sensors in industrial plants for continuous sensing and monitoring the status of the system. This paper discusses the efficient process monitoring of pipelines that carry oil, gas, water, and other important resources for an

essential infrastructures. A Wireless Sensor Networks (WSN) should be designed to obtain maximum throughput of data to efficiently monitor the health condition of the system and obtain timeliness for handling critical events in case of emergency. A real-time Multichannel Process Control Monitoring System is designed to monitor and control large network. For any real time system timeliness and throughput are equally important but are obtained on the compromise of each other. This paper proposes a Multichannel Process Monitoring Algorithm (MPMA) which brings a balance between timeliness and throughput by increasing in number of operating channels. The protocol has been implemented and experimentally evaluated on a testbed using nodes with standard IEEE 802.15.4. It has been observed that the proposed algorithm has shown an increase in timeliness and throughput compared with the standard algorithm.

[9] All three scenarios represent a cost-effective use of resources and would avert 800,000–1 million DALYs per year in India relative to the current scenario. However, especially in poor regions and populations, scenario 1 (which publicly finances only first-line therapy) does not decrease the OOP expenditure or provide financial risk protection if we include care-seeking costs. The OOP expenditure averted increases from scenarios 1 through 3, and the money-metric value of insurance follows a similar trend between scenarios and typically decreases with wealth. In the first 10 years of scenarios 2 and 3, households avert on average over US$80 million per year in medical expenditure. Significance: Expanding and publicly financing epilepsy treatment in India averts substantial disease burden. A universal public finance policy that covers only first-line AEDs may not provide significant financial risk protection. Covering costs for both first- and second-line therapy and other medical costs alleviates the financial burden from epilepsy and is cost-effective across wealth quintiles and in all Indian states.

[10] The deep knowledge of each functional module’s current demands of a WSN mote is essential when striving to achieve energy consumption optimization. This paper presents the design and implementation of an efficient measuring setup based on a well known WSN platform, able to provide accurate measurements concerning the current demands of the mote at run-time by a current mirror circuit implementation. Furthermore, elementary functional modules are identified and a profiling methodology is presented able to capture the mote’s current demands in the context of the functionalities under investigation. A sufficient number of experiments were carried out, aiming to evaluate, but even more importantly, to extend the published TelosB datasheet, concerning the motes power consumption under specific scenarios. Valuable conclusions extracted support the discussion on the power consumption pattern of each module as well as the possible energy gains that can be expected from low power mote configurations. The choice of very low radio transmission power does not necessarily provide the expected consumption conservation judging from the low drop in current demands, as shown in most cases, and the small percentage of the actual transmission in the overall sequence of packet transmission actions. On the other hand, the idle radio mode imposes significantly lower power demands. Thus, keeping the radio in idle state must always be a crucial goal. Similar considerations can be raised for the MSP430 low power state. Furthermore, the use of LEDs is emphatically discouraged since they tend to be a main source of energy waste, which, however, can be mitigated with efficient operation scheduling. In summary, these insights can be proven valuable in future energy consumption modeling attempts aiming to maximize network lifetime and performance. Finally, an accurate and practical model is extracted by the composition of elementary module’s power consumption respective analysis.

[11] This limited-focus preliminary investigation of adults admitted to 1 EMU during 1 year sought to determine if admission to an inpatient adult EMU resulted in definitive diagnosis, change in diagnosis or treatment, and whether referral patterns were consistent with guidelines. Findings are limited because this was a nonrandomized, retrospective review conducted at 1 EMU. The care provided in an AHC EMU is technologically advanced and requires an interdisciplinary team. This review’s findings support the NAEC guidelines and demonstrate the utility of video-EEG monitoring in an AHC Comprehensive Epilepsy Center EMU to establish a definitive diagnosis in adults with refractory epilepsy or seizure-like events. Since 1989, the NAEC guidelines have recommended referral to a specialized epilepsy center when the patient’s seizures are not controlled after 1 year of treatment by a general neurologist. Earlier referral is indicated if the diagnosis of epilepsy is questioned. Time to referral documented in this review was inconsistent with guidelines. Adherence to these guidelines is important as early diagnosis is associated with improved outcomes. Approximately 80% of the $12.5 billion annual cost of epilepsy is due to 25% of patients whose seizures are not controlled with AED therapy. The literature has not yet addressed reasons for delayed EMU referral. Reasons for delayed referral to a neurologist or epilepsy specialist discussed in the literature include lack of patient recognition of ongoing seizures resulting in inadequate treatment, inadequate education of generalist physicians regarding implementation of treatment guidelines, skeptical view of epilepsy surgery among patients and physicians, and a shortage of epilepsy specialty centers. This model of care warrants further examination. Future prospective studies should include cost analysis of the EMU admission, comparison of AHC-EMU care with non-AHC care, comparison of outcomes among AHC comprehensive epilepsy care center EMUs, utilization of EMUs according to established referral guidelines, and reasons for delay in EMU referral.

III. Proposed Work

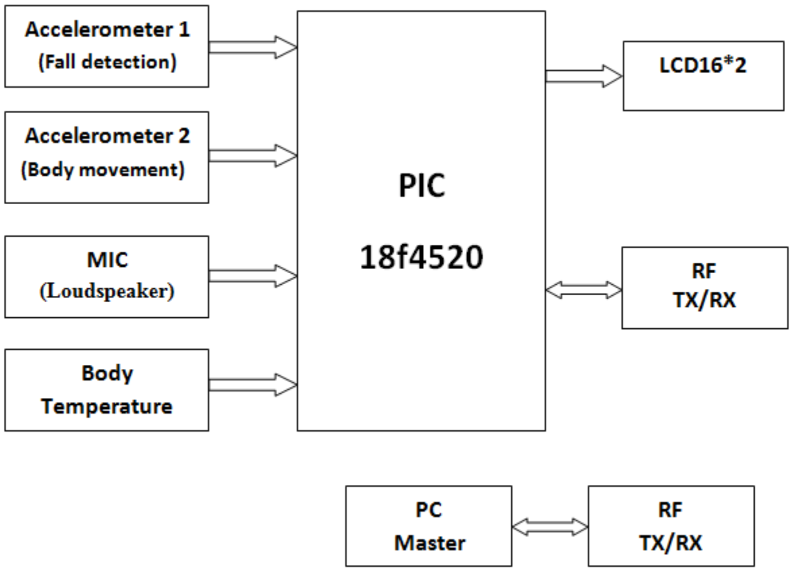


Fig. Block Diagram of Epilepsy Monitoring

Application

Here we are developing a Patient monitoring system using Android Platform. There are many locations where we cannot track the patient. So we are developing a Visual basic based PC server for doctors / Parents for monitoring and analysis of epilepsy patients. Epilepsy patients are susceptible to fits. These fits can be as frequent as 10-15 times a day and the main problem is that the patient has no memory that he has had a Fit Attack. There is a great need to monitor the epilepsy patients and to inform the concerned doctor for analysis which is not possible in now a day's hectic Work schedule where in both the parents are either working or 24 Hours Nurse is very expensive. To solve these problems we have designed a Embedded hardware which can continuously keep a track of all the patients activity using a PIC18f4520. Also we are differentiating between the types of Epilepsy. The user has to choose the epilepsy type and then the software will monitor various activities such as fall detection, Haphazard body movement, Urination, Loud noises. .Depending upon the type of activity the Android Software will keep a track of Fits. We are sending an SMS to doctor and parents as soon as the fits start as well as an SMS when the FIT ends. In this way we can monitor and analyze the Epilepsy attack and also track the progress of patient with in a given period of time.

Epilepsy type 1: Accelerometer 1 to detect the fall of patient + Sound.

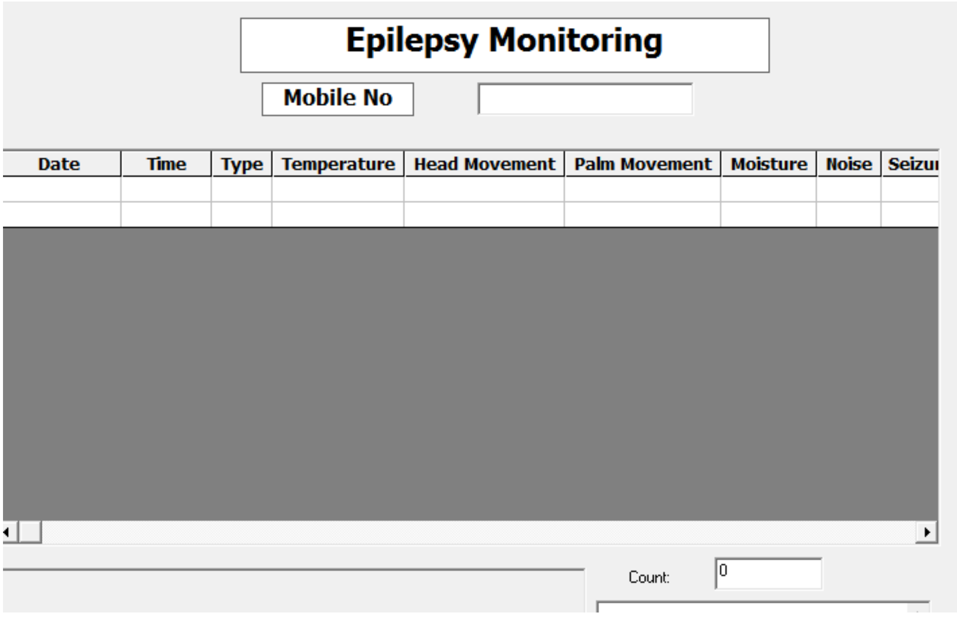
Epilepsy type 2: Accelerometer 2 to detect rapid movement of body + High temperature.

Proposed algorithm

Critical event monitoring protocol

Here we are implementing the Critical event monitoring protocol. Many applications in WSN have redundant data, which means that the data does not change very fast. A task is characterized by different parameters: type of sensing, number of sensing operations, period of sensing and the intended nodes (nodes required to sense data). So sending the same data again and again results in Wastage of Network energy which in turn reduces network life time. So, here in our project we will send the data whenever the sensor crosses a threshold /Set point. That means whenever a new data is present, then only the slave will send the data frame in response. This results in less number of Communication frames, which increases the Network efficiency.

Sample VB Server Window



Hardware Requirements
µC: PIC 18F4520
Sensors: Accelerometer (ADXL335) , MIC, LM35(Temp)
Interface: WIFI MODEM Tans-receiver (ESP8266)
Display:16*2 LCD

Software Requirements
Embedded C
MPLAB compiler.
PIC KIT 3 Programmer
Server: Visual Basic 6.0

IV. Conclusion & Future Scope

This paper introduced a Critical event monitoring protocol. This design allows the WSN to sense data in the form of tasks directed to a cluster of nodes. The Critical event monitoring protocol adopts task based sensing, power adaptation, and sleep and wake-up techniques to increase the energy efficiency of WSN. We will evaluate our Critical event monitoring protocol on visual basic software with comparison with conventional method.

We can increase the range of WSN by using Zigbee module of higher range than 30 meters. We do get RF modules with ranges of 200 meters to 1 Kilometer. This system can be enhanced with more features like adding more sensor nodes. Also we can add an IOT based android APP. The slave data can be viewed on internet. The user can monitor and control the WSN from anywhere in world using IOT.

References

[1]. Pranjal T. Jagtap, Dr. Nilesh P. Bhosale "IOT Based Epilepsy Monitoring using Accelerometer sensor" 2018 International Conference on Information, Communication, Engineering and Technology (ICICET)
[2]. Rucha Mehta, Dr. A. N. Gaikwad "Energy Management using GTBS Sensor Network for Society Automation" International Journal for Research in Applied Science & Engineering Technology (IJRASET)Volume 6 Issue VI, June 2018.
[3]. Guillaume Becq, Philippe Kahane, Lorella Minotti, St´ ephane Bonnet, and R´ egis Guillemaud "Classification of Epileptic Motor Manifestations and Detection of Tonic–Clonic Seizures With Acceleration Norm Entropy" IEEE TRANSACTIONS ON BIOMEDICAL ENGINEERING, VOL. 60, NO. 8, AUGUST 2013
[4]. Paula M. Vergara, Enrique de la Cal,José R. Villar,Víctor M. González, and Javier Sedano "An IoT Platform for Epilepsy Monitoring and Supervising" Hindawi Journal of Sensors Volume 2017.
[5]. Abdullah Alhalafi, Lokman Sboui, Rawan Naous, and Basem Shihada "gTBS: A Green Task-Based Sensing for Energy Efficient Wireless Sensor Networks"2016 IEEE Conference on Computer Communications Workshops (INFOCOM WKSHPS)
[6]. Sandipan Pati, Vishakhadatta M. Kumaraswamy, A. Deep, S.S. Chung, M. Pluegera, G. Kiyota, D.M. Treiman "Characteristics of falls in the epilepsy monitoring unit: A retrospective study" Dignity Health on March 15, 2016

[7]. Raghavendra D. Krushnaji, Dnyaneshwar A. Rokade "A Survey on Event Detection and Transmission Protocols in Wireless Sensor Network" International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE) Volume 3, Issue 11, November 2014.

[8]. K. Arthi, A. Vijayalakshmi, and P. Vanaja Ranjan"Critical Event Based Multichannel Process Control Monitoring using WSN for Industrial Applications" Procedia Engineering 64 (2013) 142 – 148

[9]. Itamar Megiddo, Abigail Colson, Dan Chisholm, Tarun Dua, Arindam Nandi, and Ramanan Laxminarayan "Health and economic benefits of public financing of epilepsy treatment in India: An agent-based simulation model" Epilepsia, 57(3):464–474, 2016 doi: 10.1111/epi.13294

[10]. Prayati, Ch. Antonopoulos, T. Stoyanova, C. Koulamas, G. Papadopoulos "A modeling approach on the TelosB WSN platform power consumption" The Journal of Systems and Software 83 (2010) 1355–1363

[11]. Janice L. Smolowitz, Sarah C. Hopkins, Tracey Perrine, Karen E. Eck, Lawrence J. Hirsch and Mary O'Neil Mundinger "Diagnostic Utility of an Epilepsy Monitoring Unit" © 2007 American College of Medical Quality.

IOSR Journal of Electronics and Communication Engineering (IOSR-JECE) is UGC approved Journal with Sl. No. 5016, Journal no. 49082.

Payal N. Giradkar. " Review on Critical Event Monitoring Protocol Based Epilepsy Monitoring For WSN." IOSR Journal of Electronics and Communication Engineering (IOSR-JECE) 14.3 (2019): 01-07.