Health Care Monitoring System in Internet of Things by Using RFID

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Abstract – Advances in information and communication technologies have led to the emergence of Internet of Things. In the healthcare environment, the use of IoT technologies brings convenience to physicians and patients as they can be applied to various medical areas such as constant real-time monitoring, patient information management, medical emergency management, blood information management, and health management. The Radio-Frequency Identification technology is one of the core technologies of IOT deployments in the healthcare environment. To satisfy the various security requirements of RFID technology in IOT, many RFID authentication schemes have been proposed in the past decade. Recently, elliptic curve cryptography based RFID authentication schemes have attracted a lot of attention and have been used in the healthcare environment. In this paper, we discuss the security requirements of RFID authentication schemes, and in particular, we present a review of ECC-based RFID authentication schemes in terms of performance and security. Although most of them cannot satisfy all security requirements and have satisfactory performance, we found that there are three recently proposed system.

Index Terms – Internet of Things, Health care, Smart Hospital, Home Care, RFID, Sensor Network.

1. INTRODUCTION

In hospitals, generally the E-healthcare system is used for getting the information of patient .Exceptionally, living e-healthcare approach has been accomplished within cabled conversation among distinguished fields for instance network protocol and database in hospice atmosphere. There has been an increase in healthcare system's use of the mobility characteristics and wireless communication and emergence in technologies has enabled smart appliances and gadgets with mean appraising energy to exploit wireless sensor nodes .In the new epoch of technology and wireless communication, the tremendous rise in electronic devices made smart phones and tablets has become the most popular and fundamental tool of day to day life.

The main favour of loT is to swell the profit of Internet with remote control talent,data sharing, eternal connectivity and many more. The healthcare servers keep electronic medical records of registered users and provide different services to patients, medical consultants and informal caregivers. The patient's consultant can access the data from office via internet and examine the patients' history, current symptoms and patient's response to a given 3treatment. Once WBAN network is con figured, the health care server manages the network, taking care of channel sharing .In rural area most of the peoples does not gets appropriate approach to health monitoring and clinics.

So it is necessary to design the effective health monitoring system. A tiny wireless device is a resolution bound with loT can form a conceivable way to regulate patients distantly rather than dating the actual clinic. The unusual tiny transducers are transplant into the human to aggregate the details through which system get human fitness data security and for analysis for treatment. The collected data is then send to remote station via divergent communication technologies (like as 3G/4G enabled base station or Wi-Fi network with Internet. From data came from internet the medical professionals can seize conclusion and consequently furnish

services centrally. Main advantage of this electronic healthcare is it provides a superb leisure to sufferers and healthcare contributors, and also enhances the first-class showing existence. In this electronic healthcare the privacy of the patient is not taken into consideration but it is essential in case of patient and this is the major disadvantage of this system. To avoid this disadvantage the RFID technology is used. It manages the patients documents with its mobility and usability. Also the main advantage of RFID is that it resist all kinds of attacks and threats so less noise are presents in signal. Most of the design the different security systems with privacy protocol and low cost for development of applicability. Therefore, it is necessary to design productive ultra-lightweight cryptographic protocol for costless RFID system . The lOT is the best solution for this purpose in recent years. Therefore in this paper the effective healthcare monitoring system is designed by using the lOT and RFID tags.

2. RELATED WORK

A literature review of the Internet of things is used in different vehicles, mobile phones, physical devices etc. The devices that uses the loT also called as smart devices or connected devices. The loT can be communicate with different devices like as sensors, electronics software, embedded systems, actuators, etc. Apart from these devices the RFID, barcodes, QR codes, Ambient Intelligence and mobile Computing, uses the loT.

2.1 Recent Advances And Medical Application Of Internet Of things

The Mir et al. proposes effective lOT which provides the healthcare information of a patient with the help of Internet and RFID tags. These RFID tags creates communication for the healthcare information system for automating administrative daily tasks like permission care, remove and release details. In Mukho padhyay S.C. proposes the effective human monitoring system architecture. The main advantage of this system is that this system continuous monitor the physiological parameters particularly of the mature or chronic patient.

2.2 A Survey on RFID

An intelligent home-based healthcare lOT system is presented by Niranjana . For the home-based healthcare system he uses a Medical Box(I Med Box) which is health loT system and iGATE way which acts as a home healthcare gateway. Wearable sensors and intelligent medicine packaging (I Med Pack) are successfully coupled to the I Med Box via a diverse network, which is well-matched with several presented wireless principles. The I Med Pack is joined with the I Med Box via an RFID link to support the users with their arranged prescription. Kiholee presented effective U-healthcare system by using lOT. The lOT presents in this paper uses the mobile gateway for the communication purpose. It provides the sensed information to a doctor or home medical station. Yvette and E Galogo proposed the U-healthcare system which uses the mobile devices gateways and mobile devices gateway for the communication devices.

The smart phone will estimate admitted sensing observation to develope keywords and ships to the central system. In Xu et al., the effective construction of different applications of lOT and Smart Community are presents. The architecture presents in this paper has three main domains viz. Service Domain, Community Domain and Home Domain. These three domains can handles the critical situation , disaster circumstances and normal circumstances. Contemplated method presents in this paper uses different IEEE standards, Ethernet Technology, different cordless transmission standards like as 3G mobile system, body sensors, piconet and Wi-Fi technology, Ethernet and Home PNA. The proposed system provides the veracity demands while entire transmission method and security.

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Jara et al , in this paper has presented a separate formation to central supervised founded on lOT. The lOT presents in this paper integrates with different systems like Environment Integration Platform, Knowledge Base Systems,Context Management Framework, services provider system and hospital information system. This structural design uses a new protocol called YOAPY, HOP, wireless personal devices, WPAN,embedded systems , Marital hardware and RFID. But the protocol YOAPY manifestshopeful, though, this system not give details treatment of extremity conditions.

3` PORPOSED MODELLING

3.1 Block Diagram

In this project, the RFID tag is used to initialize the bed system as an key. The sensors are used to monitor the patient's condition periodically. The data report are transmitted to the website through IOT system so that the doctor or any other relatives of the patients can know about the condition of the patient. The movable bed mechanism is used to adjust the bed according to the patient's condition. The buzzer is to indicate the nearby persons that the patient is in critical situations.

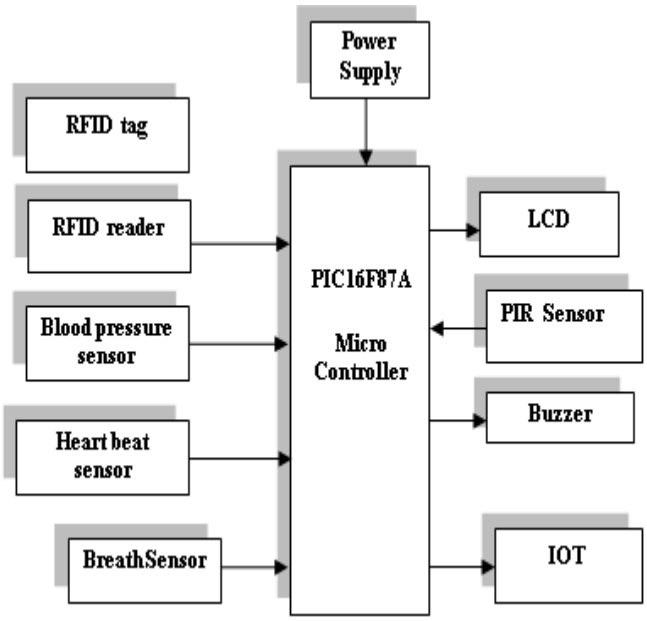

Figure 3.1 Block Diagram

3.2 Proposed System Technique

The movable bed mechanism is used to adjust the bed according to the patient's condition. The buzzer is to indicate the nearby persons that the patient is in critical situations. We can control each port by using an assigned address of specific port, but there is much easier way to control the port. We are allowed to use the names of the ports without considering their addresses. The smart phone will estimate admitted sensing observation to develop keywords and ships to the central system.

3.3 Operation Of Proposed System

In this paper the RFID Tags are used to establish the wireless communication. The RFID tags are simple chips which are used for the identification of objects. The RFID reader sends a question signal to the tag and receives mirrored signal from the tag, which is then passed to the database for storage purpose [5].

Figure 1 shows the RFID Network using Sensor. In this figure the RFID tags send the signals to the static node receiver, the static node receiver sends the signal to the mobile base station, directly to the mobile phone. Then by using the GPRS and through the internet it is pass to the server for display purpose.In the Smart healthcare system the loT and RFID plays an important role.

In this system the different sensors are embedded in the patient body and according to the signals from the sensors, RFID and lOT the patient can be monitor. The RFID tags commits entity recognition involuntarily through evaluation the tag, that joined to objects. There are two types of RFID tags are presents viz. active RFID and Passive RFID.Usually passive RFID tag utilized for negligible power consumption, RFID tag reader yield the power though which it energetic for transmission with reader. Essential goal of sensor network to prominently acquiring data from context and ships it to the domestic cache ware house .

lOT allows to users to use to surf the Internet cordlessly with various equipment, e.g., tablets, smart phones and handheld electronic appliances. 2G/3G/4G are the GSM standards for communication exploited by Internet. LTE 4G or 3G networks are required in RFID based network. Practicing such competences, solitary get statistics linked to cases health and drive up to distant base station furthermore reckoning and repository.

3.4 Developing System

This venture configuration comprises of association between micro controller and actuator to procure faithful estimation, and watching and evaluating the cases condition eventually grows the strength of lOT in healthcare. Types of sensors used are ECG sensor, Blood Pressure sensor, Temperature sensor, Motion sensor, EEG sensor and Blood ,Glucose sensor. The combination of micro controller with the smarts sensors offers advantages like as incorporated precision analog capabilities, small power consumption and easy for designing GUI's. The Figure I shows patients healthcare model by using lOT. It consists of the sensors which are attached to human body, Microcontroller, Analog to digital converter (ADC), wireless devices like as Bluetooth, RFID, Mobile Phones, Wi-Fi system, Internet devices and doctors/nurses, hospitals, emergency team, Ambulance Government Agencies, etc. which provides the facility to the patients for their healthy fare. The sensors continuously collect the information from the patient's body to get the patient details. In case of any emergency, these wireless devices can distantly report the physical condition of the patient to his doctors and/or relatives.

In such condition the doctors and hospitals can respond with emergency medical services such as ambulance or provide the necessary actions to the relatives for aiding them to help the patients. In Figure I different sensors are attaches to the patient's body to measure the different parameters like as EEG, blood pressure, Body temperature, Blood Glucose, ECG and Motion.

The signals generated from these sensors are in analog form making it necessary to be converted into digital form for which ADC is used. These digitalized signal form the ADC are forwarded to RFID/Bluetooth device through microcontrollers. RFID/B1uetooth devices wirelessly transmits these signal to the mobile phone for the

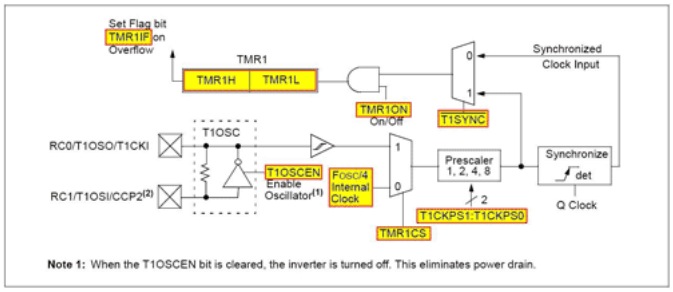

Fig.3.4 Block Diagram of PIC timer1

transmission of data through internet to the specific destination. The internet either uses the base station or

internet for the transmission purpose.

3.5 Advantages Of Proposed Technique

- It provides the monitoring of health parameter of the patient health
- Data security
- Efficiency and assurance for privacy

4. RESULTS AND DISCUSSIONS

4.1 Simulation Results

Initially C was developed by Kernighan and Ritchie to fit into the space of 8K and to write (portable) operating systems. Originally it was implemented on UNIX operating systems. As it was intended for operating systems development, it can manipulate memory addresses. Also, it allowed programmers to write very compact codes. This has given it the reputation as the language of choice for hackers too.

As assembly language programs are specific to a processor, assembly language didn't offer portability across systems. Toovercome this disadvantage, several high level languages, including C, came up. Some other languages like PLM, Modula-2, Pascal, etc. also came but couldn't find wide acceptance.

4.2 Building The Model

Amongst those, C got wide acceptance for not only embedded systems, but also for desktop applications. Even though C might have lost its sheen as mainstream language for general purpose applications, it still is having a strong-hold in embedded programming. Due to the wide acceptance of C in the embedded systems, various kinds of support tools like compilers & cross-compilers, ICE, etc. came up and all this facilitated development of embedded systems using C.

5. CONCLUSION

Though, the present electronics health systems do not use mobile phones, tablets or PC to transmit essential data related to the patients' health. In this proposed system we propose the information of a patient's health to the medical professionals via smart phones using loT. This approach will virtuously supervise the anatomical arguments of the cases and any variations in the pre-set parameters will trigger alerts been send to the medical professional. The association of the WEAN with an Android Smartphone advances a enormous practicality. Therefore this electronics healthcare has the capability of worldwide acceptance. Also the proposed approach may accumulate facts of patient and it can reclaimed by more interested partyin coming year.

REFERENCES

[1] J. Chavarría, D. Biel, F. Guinjoan, C. Meza, and J. J. Negroni,"Energy-balance control of PV cascaded multilevel grid-connectedinverters under level-shifted and phase-shifted PWMs," IEEE Trans. Ind.Electron., vol. 60, no. 1, pp. 98–111, Jan. 2013.

[2] M. Coppola, F. D. Napoli, P. Guerriero, D. Iannuzzi, S. Daliento, and A.D. Pizzo, "An FPGA-based advanced control strategy of a grid-tied PVCHB inverter," IEEE Trans. Power Electron, vol. 31, no. 1, pp. 806–816,Jan. 2016.

[3] G. Farivar, C. D. Townsend, B. Hredzak, J. Pou, and V. G. Agelidis,"Low-capacitance cascaded H-bridge multilevel StatCom," IEEE Trans.Power Electron, vol. 32, no. 3, pp. 1744–1754, Mar. 2016.

[4] G. Farivar, B. Hredzak, and V. G. Agelidis, "A DC-side sensorlesscascaded H-bridge multilevel converter-based photovoltaic system,"IEEE Trans. Ind. Electron., vol. 63, no. 7, pp. 4233–4241, July 2016.

[5] F. Khoucha, S. M. Lagoun, K. Marouani, A. Kheloui, and M. E. H.Benbouzid, "Hybrid cascaded H-bridge multilevel-inverterinduction-motor-drive direct torque control for automotive applications,"IEEE Trans. Ind. Electron., vol. 57, no. 3, pp. 892– 899, Mar. 2010.

[6] S. Kouro, M. Malinowski, K. Gopakumar, J. Pou, L. G. Franquelo, B.Wu, J. Rodriguez, M. A. Pérez, and J. I. Leon, "Recent advances andindustrial applications of multilevel converters," IEEE Trans. Ind.Electron., vol. 57, no. 8, pp. 2553– 2580, Aug. 2010.

[7] M. Malinowski, K. Gopakumar, J. Rodriguez, and M. A. Pérez, "A surveyon cascaded multilevel inverters," IEEE Trans. Ind. Electron., vol. 57, no.7, pp. 2197– 2206, July 2010.

[8] J. Napoles, A. J. Watson, J. J. Padilla, J. I. Leon, L. G. Franquelo, P. W.Wheeler, and M. A. Aguirre, "Selective harmonic mitigation techniquefor cascaded H-bridge converters with nonequal DC link voltages," IEEETrans. Ind. Electron., vol. 60, no. 5, pp. 1963–1971, May 2013.

[9] E. Villanueva, P. Correa, J. Rodríguez, and M. Pacas, "Control of asingle-phase cascaded H-bridge multilevel inverter for grid-connectedphotovoltaic systems," IEEE Trans. Ind. Electron., vol. 56, no. 11, pp.4399–4406, Nov. 2009.

[10] S. Vazquez, J. I. Leon, J. M. Carrasco, L. G. Franquelo, E. Galvan, M.Reyes, J. A. Sanchez, and E. Dominguez, "Analysis of the power balancein the cells of a multilevel cascaded H-bridge converter," IEEE Trans.Ind. Electron., vol. 57, no. 7, pp. 2287–2296, Jul. 2010.

[11] M.ValanRajkumar, P.S.Manoharan, Modeling and Simulation of Three-phase DCMLI using SVPWM for Photovoltaic System, Springer Lecture Notes in Electrical Engineering, under the volume titled "Power Electronics & Renewable Energy Systems", Volume 326, Chapter No 5, January 2015, Pages 39-45.

[12] M.ValanRajkumar, P.S.Manoharan, Harmonic Reduction of Fuzzy PI Controller based Three-Phase Seven-level DCMLI with SVPWM for Grid Connected Photovoltaic System, Journal International Review on Modeling and Simulations, Volume 6, No 3, June 2013, Pages 684-692.

[13] A.Ravi, P.S.Manoharan, M.ValanRajkumar, "Harmonic Reduction of Three-Phase Multilevel Inverter for Grid connected Photovoltaic System using Closed Loop Switching Control", Journal-IREMOS, Volume 5, No 5, October 2012, Pages 1934-1942. ISSN: 1974-9821 (Print), 1974-982X (Online)

[14] P.Thirumurugan, P.S.Manoharan, M.ValanRajkumar, "VLSI Based Inverter Switching Control" in the proceedings of International Conference on Mathematical Modeling and Applied Soft Computing MMASC'12 – Coimbatore Institute of Technology on July 2012, Vol-2 (Page):965-973.

[15] C.Hemalatha, M.Valan Rajkumar, G.Vidhya Krishnan, "Simulation and Analysis for MPPT Control with Modified firefly algorithm for photovoltaic system", International Journal of Innovative Studies in Sciences and Engineering Technology, Volume 2, No 11, Nov.2016, Pages 48-52.

[16] G.Vidhya Krishnan, M.Valan Rajkumar, C.Hemalatha, "Modeling and Simulation of 13-level Cascaded Hybrid Multilevel Inverter with less number of Switches", International Journal of Innovative Studies in Sciences and Engineering Technology, Volume 2, No 11, Nov.2016, Pages 43-47.

[17] M.ValanRajkumar, P.S.Manoharan, FPGA Based Multilevel Cascaded Inverters with SVPWM Algorithm for Photovoltaic system, Elsevier Journal Solar Energy, Volume 87, Issue 1, January 2013, Pages 229-245.

[18] M.ValanRajkumar, P.S.Manoharan, Space Vector Pulse Width Modulation of Three-Phase DCMLI with Neuro-Fuzzy MPPT for Photovoltaic System, World Journal of Modelling and Simulation, Volume 10, No 3, August 2014, Pages 193-205.

[19] M.Valan Rajkumar, Prakasam, P. and Manoharan, P.S. (2016) Investigational Validation of PV Based DCDMLI Using Simplified SVM Algorithm Utilizing FPGA Tied with Independent Sources. Circuits and Systems, Volume 7, No 11, 3831-3848. http://dx.doi.org/10.4236/cs.2016.711320

[20] P.Thirumurugan, P.S.Manoharan, M.ValanRajkumar, VLSI Based Space Vector Pulse Width Modulation Switching Control in the proceedings of IEEE International Conference on Advanced Communication Control and Computing Technologies ICACCCT 2012 on August 2012, ISBN No. 978-1-4673-2045-0 (Print) (Page):366-370.

[21] M.ValanRajkumar, P.S.Manoharan, "Modeling, Simulation and Harmonic Reduction of Three-Phase Multilevel Cascaded Inverters with SVPWM for Photovoltaic System", Journal International Review on Modeling and Simulations, Volume 6, No. 2, April 2013, Pages 342-350. ISSN: 1974-9821 (Print), 1974-982X (Online)

[22] M.Valan Rajkumar, G.Ranjhitha, M.Pradeep, Mohammad Fasil PK, R.Sathishkumar, "Fuzzy based Speed Control of Brushless DC Motor fed Electric Vehicle", International Journal of Innovative Studies in Sciences and Engineering Technology (IJISSET), Volume: 3, Issue: 3, March 2017, Pages 12-17. ISSN: 2455-4863 (Online).

[23] M.Valan Rajkumar, J.Chandramohan, D.Aravind, M.Basker, "Performances Analysis of Power Factor Correction for PWM Control based Bridgeless Cuk Rectifier with Positive Output Voltage", International Journal of Emerging Technologies in Engineering Research (IJETER), Volume: 5, Issue: 4, April 2017, Pages 116-121. ISSN: 2454-6410 (Online).

[24] K.Aswini, K.Nandhini, SR.Nandhini, G.Akalya, B.Rajeshkumar, M.Valan Rajkumar, "Simulation and Analysis of ASCAD Multilevel Inverter with SPWM for Photovoltaic System", International Journal of Innovative Studies in Sciences and Engineering Technology (IJISSET), Volume: 3, Issue: 4, April 2017, Pages 1-9. ISSN: 2455-4863 (Online).

[25] M.Valan Rajkumar, M.Mahakumar, M.Manojkumar, M.Hemaraj, E.Kumaravel, "Modelling and Analysis of DC-DC Converter with Various MPPT Algorithms for PV System", International Journal of Innovative Studies in Sciences and Engineering Technology (IJISSET), Volume: 3, Issue: 4, April 2017, Pages 17-22. ISSN: 2455-4863 (Online).

[26] M.Valan Rajkumar, T.Indumathi, "Analysis of Low Power Multi-core Embedded Management for Energy Harvesting", IOSR-Journal of Electrical and Electronics Engineering, Volume 12, Issue 2, Ver. II, March-April 2017, Pages 25-33. ISSN: 2320-3331 (Print) 2278-1676 (Online).

[27] A.Ravi, M.Valan Rajkumar, P.S.Manoharan, "Harmonic Reduction of Three-Phase Eleven-level DCMLI with Fuzzy MPPT for Grid Connected Photovoltaic System", International Journal of Applied Engineering Research (IJAER), Volume 10, No 2, 2015, Pages 3251-3268. ISSN: 0973-4562 (Print).

[28] M.Valan Rajkumar, J.Karthikeyan, P.S.Manoharan, "Modeling and Simulation of Multiphase DCMLI with SVPWM for Photovoltaic System", International Journal of Applied Engineering Research (IJAER), Special Issue: Volume 9, No 24, 2014, Pages 8477-8483. ISSN: 0973-4562 (Print).

[29] M.ValanRajkumar, P.S.Manoharan, "Modeling and Simulation of Five-level Five-phase Voltage Source Inverter for Photovoltaic Systems", Journal PrzegladElektrotechniczny, Volume 10, No. 10, October 2013, Pages 237-241. ISSN: 0033-2097 (Print)

[30] M.Valan Rajkumar, P.S.Manoharan, A.Ravi, "Simulation and an Experimental Investigation of SVPWM Technique on a Multilevel Voltage Source Inverter for Photovoltaic Systems", Elsevier International Journal of Electrical Power and Energy Systems, Volume 52, Issue 9, November 2013, Pages 116-131. ISSN: 0142-0615 (Print), 1879-3517 (Online)

[31] SR.Nandhini, G.Akalya, K.Aswini, K.Nandhini, M.Valan Rajkumar, B.Rajeshkumar, "A New Topology of H-bridge based Multilevel Inverter for PV System with Reduced Switches", International Journal of Emerging Technologies in Engineering Research (IJETER), Volume: 5, Issue: 4, April 2017, Pages 60-68. ISSN: 2454-6410 (Online).

[32] M.Valan Rajkumar, M.Mahakumar, M.Manojkumar, M.Hemaraj, E.Kumaravel, "A New DC-DC Converter Topology with Grey Wolf MPPT Algorithm for Photovoltaic System", International Journal of Emerging Technologies in Engineering Research (IJETER), Volume: 5, Issue: 4, April 2017, Pages 54-59. ISSN: 2454-6410 (Online).

[33] S.Rashini, P.S.Manoharan, M.Valan Rajkumar, "Interfacing PV system to the Utility Grid using a Voltage Source Inverter", Journal of Emerging Technologies Electrical Engineering, Special Issue- ICBDM 2013, Volume 1, No 1, March 2013, Pages 124-129. ISSN: 0973-2993 (Print)

[34] S.Sathyaraj, M.Valan Rajkumar, J.Chandramohan, "Modeling and Simulation of Asymmetric Cascaded Multilevel Inverter with Reduced Switches using Multicarrier PWM Control", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering (IJAREEIE), Volume 5, Issue 10, October 2016, Pages 8064-8071. ISSN: 2320-3765 (Print), 2278-8875 (Online)

[35] G.Ranjhitha, M.Valan Rajkumar, "Implementation of Genetic Algorithm based Maximum Power Point Tracking for Photovoltaic System", International Journal of Innovative Research in Science, Engineering and Technology (IJIRSET), Volume 5, Issue 11, November 2016, Pages 18860-18868. ISSN: 2347-6710 (Print), 2319-8753 (Online)

[36] S.Sathishkumar, M.Valan Rajkumar, R.Yuvaraj, "Modeling and Analysis of Soft-Switched Interleaved Boost Converter for Photovoltaic System", International Journal for Science and Advance Research in Technology (IJSART), Volume 2, Issue 11, November 2016, Pages 43-48. ISSN: 2395-1052 (Online)

[37] M.Sundaraperumal, M.Valan Rajkumar, A.Venkatesh, "Modeling and Analysis of Current Source Multilevel Inverter using PI Controllers with Multicarrier PWM Technique", International Journal for Science and Advance Research in Technology (IJSART), Volume 2, Issue 11, November 2016, Pages 275-280. ISSN: 2395-1052 (Online)

[38] R.Yuvaraj, S.Sathishkumar, M.Valan Rajkumar, "Analysis of PV based Soft Switching Boost DC-DC Converter with Zero Current Switching Technique", International Journal of Advanced Research in Management, Architecture, Technology and Engineering

(IJARMATE), Volume 2, Issue 12, December 2016 Pages 1-5. ISSN: 2454-9762 (Print) 2454-9762 (Online)

[39] M.Valan Rajkumar, M.Mahakumar, M.Manojkumar, M.Hemaraj, E.Kumaravel, "A New MPPT design using Grey Wolf Optimization Techniques with DC-DC Converter for PV System", International Journal for Science and Advance Research in Technology (IJSART), Volume 3, Issue 3, March 2017, Pages 829-835. ISSN: 2395-1052 (Online)

[40] K.Nandhini, SR.Nandhini, G.Akalya, K.Aswini, M.Valan Rajkumar, B.Rajeshkumar, "Implementation of 21-level Asymmetrical Cascaded Multilevel Inverter with Reducing Number of Switches", International Journal for Science and Advance Research in Technology (IJSART), Volume 3, Issue 3, March 2017, Pages 809-818. ISSN: 2395-1052 (Online)

[41] S.Sathishkumar, M.Valan Rajkumar, S.Vinothkumar, M.Maruthamuthu, A.Sounder, A.Kumaresan, "A New Design for DC-DC Converter Topology with MISO for Renewable Energy Resources", International Journal of Emerging Technologies in Engineering Research (IJETER), Volume: 5, Issue: 4, April 2017, Pages 143-149. ISSN: 2454-6410 (Online)

[42] M.Valan Rajkumar, M.Mahakumar, M.Manojkumar, M.Hemaraj, E.Kumaravel, "Implementation of Various MPPT Algorithms with SEPIC Converter for PV System", International Journal of Engineering Research & Technology-Special Issue 2017, Volume 5, Issue 13, 2017, Pages 589-593. ISSN: 2278-0181 (Print)

[43] G.Akalya, K.Aswini, K.Nandhini, SR.Nandhini, M.Valan Rajkumar, B.Rajeshkumar, "Modelling and Analysis of Multilevel Inverter for Photovoltaic System", International Journal of Advanced Research Methodology in Engineering & Technology (IJARMET), Volume 1, Issue 3, May 2017, Pages 36-43. ISSN: 2456-6446 (Online)

[44] Mohammad Fasail PK, M.Pradeep, R.Sathishkumar, G.Ranjhitha, M.Valan Rajkumar, "Speed Control BLDC Motor using Fuzzy Logic and PID Controller fed Electric Vehicle", South Asian Journal of Engineering and Technology, Volume 3, Issue 3, March 2017, Pages 118-131. ISSN: 2454-9614 (Print)

[45] P.Pushparani, M.Valan Rajkumar, R.Suganya, "Simulation and Analysis of SVHM Technique for DCMLI under Transient Conditions with Non-Linear Loads", International Journal of Emerging Technologies in Engineering Research (IJETER), Volume: 5, Issue: 11, November 2017, Pages 90-96. ISSN: 2454-6410 (Online).

[46] R.Suganya, M.Valan Rajkumar, P.Pushparani, "Simulation and Analysis of Boost Converter with MPPT for PV System using Chaos PSO Algorithm", International Journal of Emerging Technologies in Engineering Research (IJETER), Volume: 5, Issue: 11, November 2017, Pages 97-105. ISSN: 2454-6410 (Online).

[47] P.Pushparani, M.Valan Rajkumar, R.Suganya, "Modeling and Analysis of Maximum Power Point Tracking for Photovoltaic System using Fuzzy Logic Controller", International Journal for Science and Advance Research in Technology (IJSART), Volume 3, Issue 11, November 2017, Pages 298-306. ISSN: 2395-1052 (Online)

[48] R.Suganya, M.Valan Rajkumar, P.Pushparani, "Modeling and Analysis of Sinusoidal PWM Technique for CHB Multilevel Inverter for Photovoltaic System", International Journal for Science and Advance Research in Technology (IJSART), Volume 3, Issue 11, November 2017, Pages 307-315. ISSN: 2395-1052 (Online)

[49] M.Sundaraperumal, M.Valan Rajkumar, D.Aravind, "Simulation and Analysis of APOD Pulse Width Modulation Technique for Z-Source Cascaded Multilevel Inverter for Photovoltaic System", International Journal for Science and Advance Research in Technology (IJSART), Volume 3, Issue 11, November 2017, Pages 816-824. ISSN: 2395-1052 (Online)

[50] J. Chavarría, D. Biel, F. Guinjoan, C. Meza, and J. J. Negroni,"Energy-balance control of PV cascaded multilevel grid-connectedinverters under level-shifted and phase-shifted PWMs," IEEE Trans. Ind.Electron., vol. 60, no. 1, pp. 98–111, Jan. 2013.

[51] M. Coppola, F. D. Napoli, P. Guerriero, D. Iannuzzi, S. Daliento, and A.D. Pizzo, "An FPGA-based advanced control strategy of a grid-tied PVCHB inverter," IEEE Trans. Power Electron, vol. 31, no. 1, pp. 806–816,Jan. 2016.

[52] G. Farivar, C. D. Townsend, B. Hredzak, J. Pou, and V. G. Agelidis,"Low-capacitance cascaded H-bridge multilevel StatCom," IEEE Trans.Power Electron, vol. 32, no. 3, pp. 1744–1754, Mar. 2016.

[53] G. Farivar, B. Hredzak, and V. G. Agelidis, "A DC-side sensorlesscascaded H-bridge multilevel converter-based photovoltaic system,"IEEE Trans. Ind. Electron., vol. 63, no. 7, pp. 4233–4241, July 2016.

[54] F. Khoucha, S. M. Lagoun, K. Marouani, A. Kheloui, and M. E. H.Benbouzid, "Hybrid cascaded H-bridge multilevel-inverterinduction-motor-drive direct torque control for automotive applications,"IEEE Trans. Ind. Electron., vol. 57, no. 3, pp. 892–899, Mar. 2010.

[55] S. Kouro, M. Malinowski, K. Gopakumar, J. Pou, L. G. Franquelo, B.Wu, J. Rodriguez, M. A. Pérez, and J. I. Leon, "Recent advances andindustrial applications of multilevel converters," IEEE Trans. Ind.Electron., vol. 57, no. 8, pp. 2553– 2580, Aug. 2010.

[56] M. Malinowski, K. Gopakumar, J. Rodriguez, and M. A. Pérez, "A surveyon cascaded multilevel inverters," IEEE Trans. Ind. Electron., vol. 57, no.7, pp. 2197– 2206, July 2010.

[57] J. Napoles, A. J. Watson, J. J. Padilla, J. I. Leon, L. G. Franquelo, P. W.Wheeler, and M. A. Aguirre, "Selective harmonic mitigation techniquefor cascaded H-bridge converters with nonequal DC link voltages," IEEETrans. Ind. Electron., vol. 60, no. 5, pp. 1963–1971, May 2013.

[58] E. Villanueva, P. Correa, J. Rodríguez, and M. Pacas, "Control of asingle-phase cascaded H-bridge multilevel inverter for grid-connectedphotovoltaic systems," IEEE Trans. Ind. Electron., vol. 56, no. 11, pp.4399–4406, Nov. 2009.

[59] S. Vazquez, J. I. Leon, J. M. Carrasco, L. G. Franquelo, E. Galvan, M.Reyes, J. A. Sanchez, and E. Dominguez, "Analysis of the power balancein the cells of a multilevel cascaded H-bridge converter," IEEE Trans.Ind. Electron., vol. 57, no. 7, pp. 2287–2296, Jul. 2010.

[60] H. Fang, X. Dan, and S. Shaowu, "On the Application of the Internet ofThings inthe Field of Medical and Health Care," in Green Computing anCommunication(GreenCom), 2013 IEEE and Internet of Things(iThings/CPSCom), IEEE International Conference on and IEEE Cyber,physical and Social Computing,.

[61] J. Jin, J. Gubbi, S. Marusic, and M. Palaniswami, "An information frameworkcreating a smart hrough Internet of Things," IEEE Internet of Things Journal,vo1. 1, pp. 1l2-12l, 2014.

[62] Kiho Lee, Yvette E. Gelogo and Sunguk Lee, "Mobile gateway System forUbiquitous system and Internet of Things, Application ", International Journal of Smart Home ,Vo1.8, NO.5 (2014), pp.279-286.

[63] Niranjana, Balamurugan, "Intelligent E-Health Gateway Based UbiquitousHealthcare Systems in Internet of Things", International Journal of Scientific Engineering and Applied Science (IJSEAS) Volume-I.

[64] Niranjana, Balamurugan, "Intelligent E-Health Gateway Based UbiquitousHealthcare Systems in Internet of Things", International Journal of Scientific Engineering and Applied Science (IJSEAS) Volume-I.

[65] Yvette E. Gelogo, Ha Jin Hwang and Haeng-KonKimz, "Internet of Things(IOT) Framework for u-healthcare System" , International Journal of SmartHome ,Vo1. 9, No. 11, (2015), pp. 323-330 .

[66] D.Umakirthika, P.Pushparani, M.Valan Rajkumar, "Internet of Things in Vehicle Safety – Obstacle Detection and Alert System", International Journal Of Engineering And Computer Science (IJECS), Volume 7, Issue 2, February 2018, Page No. 23540-23551, ISSN: 2319-7242 (Online)

[67] M.Devika, M.Sundaraperumal, M.Valan Rajkumar, "Simulation of Quasi Cascaded H-Bridge Five-Level Boost Inverter", International Journal Of Engineering And Computer Science (IJECS), Volume 7,

Issue 3, March 2018, Page No. 23727-23736, ISSN: 2319-7242 (Online)

[68] S.Priyanga, M.Valan Rajkumar, "Modeling and Simulation of 27-Level Hybrid H-Bridge Multilevel Inverter for PV System", International Journal Of Engineering And Computer Science (IJECS), Volume 7, Issue 3, March 2018, Page No. 23773-23780, ISSN: 2319-7242 (Online)

[69] R.Sasikala, S.Suresh, J.Chandramohan, M.Valan Rajkumar, "Driver Drowsiness Detection Based On Novel Eye Openness Recognition Method Using Image Processing", International Journal Of Engineering And Computer Science (IJECS), Volume 7, Issue 5, May 2018, Page No. 23914-23925, ISSN: 2319-7242 (Online)

[70] R.Rubasri, D.Aravind, M.Valan Rajkumar, "Simulation of Health Care Monitoring System in Internet of Things By Using RFID", International Journal Of Engineering And Computer Science (IJECS), Volume 7, Issue 6, June 2018, Page No. 23952-23970, ISSN: 2319-7242 (Online)

[71] M.Devika, M.Sundaraperumal, M.Malarvizhi, J.Chandramohan, M.Valan Rajkumar, "Reduction in Harmonic Distortion using Quasi Cascaded H-Bridge Five-Level Boost Inverter", International Journal of Emerging Technologies in Engineering Research (IJETER), Volume: 6, Issue: 5, May 2018, Pages 90-98. ISSN: 2454-6410 (Online)

[72] D.Umakirthika, P.Pushparani, J.Chandramohan, M.Valan Rajkumar, "Obstacle Detection and Alert System for Vehicles Based on Internet-of-Things", International Journal of Emerging Technologies in Engineering Research (IJETER), Volume: 6, Issue: 5, May 2018, Pages 117-123. ISSN: 2454-6410 (Online)

[73] R.Sasikala, S.Suresh, J.Chandramohan, M.Valanrajkumar, "Driver Drowsiness Detection System using Image Processing Technique by the Human Visual System", International Journal of Emerging Technologies in Engineering Research (IJETER), Volume: 6, Issue: 6, June 2018, Pages 1-11. ISSN: 2454-6410 (Online)

[74] S.Priyanga, M.Valan Rajkumar, J.Chandramohan, G.Vidhya Krishnan, "Simulation and Analysis of 27- Level Hybrid H-Bridge Multilevel Inverter for PV System", International Journal of Emerging Technologies in Engineering Research (IJETER), Volume: 6, Issue: 6, June 2018, Pages 12-17. ISSN: 2454-6410 (Online)