International Journal of Advanced Research in Engineering and Technology (IJARET)
Volume 11, Issue 7, July 2020, pp. 496-504, Article ID: IJARET_11_07_049
Available online athttp://www.iaeme.com/IJARET/issues.asp?JType=IJARET&VType=11&IType=7
ISSN Print: 0976-6480 and ISSN Online: 0976-6499
DOI: 10.34218/IJARET.11.7.2020.049

ANALYSIS OF MEMS AND WPAN BASED HIGH POWER FREE ARC SWITCHING

Premkumar R
Assistant Professor, Department of Electronics and Instrumentation Engineering,
Sri Sairam Engineering College, Chennai, India

G Irusapparajan
Professor, Department of Electrical and Electronics Engineering,
Mailam Engineering College, Tamil Nadu, India

Gnanasekar A K
Associate Professor, Department of Medical Electronics,
Saveetha Engineering College, Chennai, India

K Vijayan
Assistant Professor, Department of Telecommunication Engineering,
SRM Institute of Science and Technology, Chennai, India

G Ramprabu
Professor, Department of Electronics and Communication Engineering,
Bonam Venkata Chalamayya Institute of Technology and Science,
Amalapuram, Andhra Pradesh, India

ABSTRACT

Micro Electro Mechanical System (MEMS) is the fuse of automatic components, electronics, actuators and sensors. The indispensable activity in RF MEMS is to utilize little automatic gadgets as well as corporal activity to achieve the capacity of a microwave control. In this research, MEMS switch is consistent to the Peripheral Interface Controller (PIC) microcontroller by the assistance of Inter Integrated Circuit (I^2C) transport line. When exchanging happens utilizing MEMS bearing, the relating gesture is send to RF handset during I^2C with Serial Peripheral Interface (SPI). The preparing sign will broadcast to stack unit by RF system. PIC microcontroller forms the got data as well as plays out the proportionate process. PIC interfaced by the detachment path (opto-coupler) which secludes the jealous gadget. We are withdrawing to play out the above by Wireless Personal Area Network (WPAN).

Key words: Micro Electro Mechanical System, Inter Integrated Circuit, Serial Peripheral Interface and Wireless Personal Area Network.

Cite this Article: Premkumar R, G Irusapparajan, Gnanasekar A K, K Vijayan and G Ramprabu, Analysis of MEMS and WPAN Based High Power Free Arc Switching, *International Journal of Advanced Research in Engineering and Technology*, 11(7), 2020, pp. 496-504.
http://www.iaeme.com/IJARET/issues.asp?JType=IJARET&VType=11&IType=7

1. INTRODUCTION

Automatic switches have been utilized for over a century to truly unlock electrical paths as well as discontinue the progression of flow. Each occasion an electrical force gadget kills on or its control, changes moreover from a shut to an open condition or from unlock to a shut condition happens among the two contact purposes of the electromechanical force switch making a curve. This circular segment is ordinarily increasingly vivacious and along these lines progressively ruinous, reasoning the metal on the contact planes to dissolve bringing about gadget disappointment. Additionally these curves can cause fire mishaps in enterprises and family unit structures. In previous scheme mechanical as well as other strong condition switches have been utilized which has security concerns. So as to defeat these issues a RF MEMS is utilized as a microwave switch by a RF Transceiver interfacing the exchanging with burden element [1-3]. It gives lower addition misfortune, higher segregation, low influence utilization as well as decreased wiring charge.

Automatic switches are utilized where wired association is given among exchanging with burden element. Force security schemes utilize breakers or switches which harm the gadgets. It roots over the top force misfortune and ARC Interruption. Because of quality of circular segment and exchanging misfortunes the yield may lessen as well as not security for clients. To forestall this, insurance circuit is incorporated which builds the cost and size of switches.

In suggested scheme, a RF MEMS switch is utilized anywhere a wireless association is given among exchanging with burden element utilizing a RF Transceiver. A micro-scaled very quick automatic exchanging by RF strategy is utilized to lessen the curve disruption [4-6]. An opto-coupler is utilized to isolate the scheming gadget from the powerful gadget. Checking and controlling of a few burdens is likewise performed utilizing a solitary MEMS switch [7-14].

2. PROCESS AND STRUCTURES

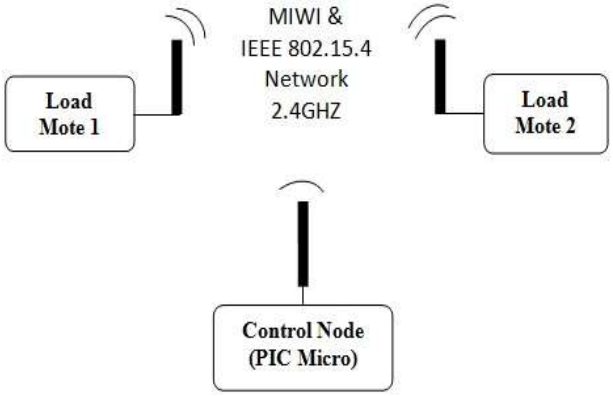

Figure 1 General Block Diagram of Structures and Process

From the figure 1, the control node is broadcasting segment where the exchanging happens as well as load bit 1, 2 are getting area where the machine is associated.

2.1. Switching Unit

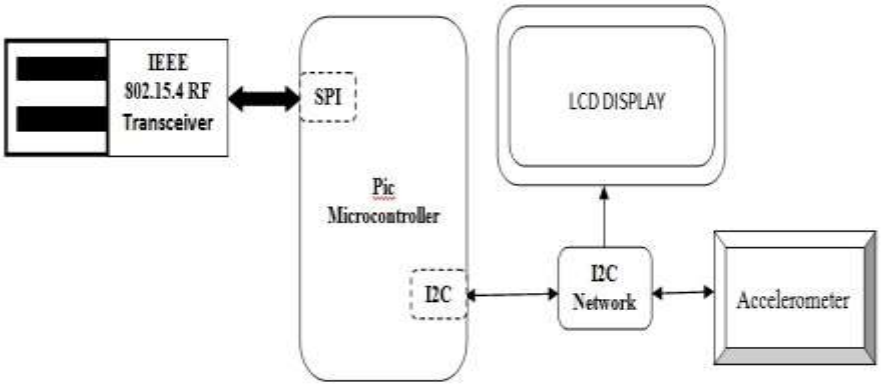

Figure 2 Switching Unit

From the above figure, the exchanging element comprises of PIC, LCD, MEMS accelerometer and RF handset. The MEMS utilized as switch here. By the direction of MEMS specifically course, wanted advanced data will took care of to PIC as well as activity is shown in LCD. The PIC processes the information then send to the accepting segment via RF handset.

2.2. Load Unit

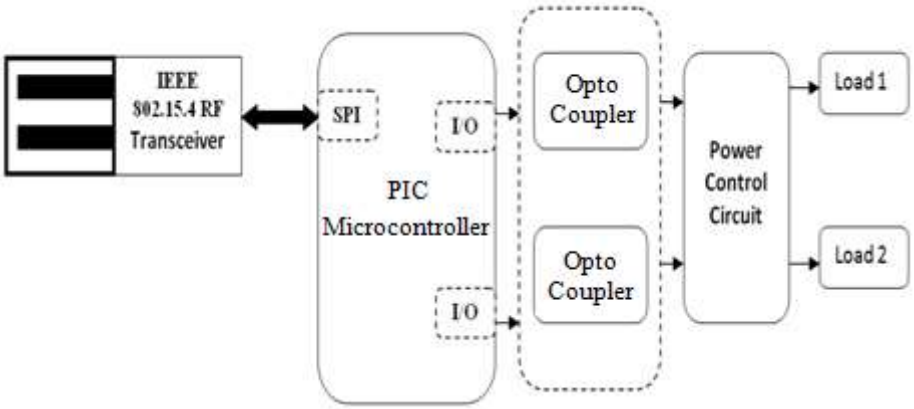

Figure 3 Load Unit

Burden bit comprise of RF handset, PIC, opto-coupler as well as higher force apparatus. The RF handset gets the sign with preparing happens in PIC. Subsequently the sign will send to the opto-coupler. As of the different apparatuses solitary machine will be chosen by opto-coupler. Opto-coupler is accommodated the delicate exchanging of apparatus with henceforth expands wellbeing.

3. PIC MICROCONTROLLER

It has a blend of various ON-chip marginal's similar to comparators, A/D convertors, frail force ups as well as PWM elements, UARTs, clocks, SPI; I2C.It likewise encloses the integral oscillator for giving the necessary recurrence.

A solitary pin may play out numerous activities. The PGD as well as PGC are the two pins which are utilized to associate with burden the sequence into PIC to play out the specific activity. The 4 pins SCL1, SCL2, SDA1 and SDA2 are the clock lines and serial data which are utilized to interface through peripherals similar to MEMS and LCD through methods for I^2C convention.

4. MEMS ACCELEROMETER

An accelerometer is a gadget for estimating speeding up with magnitude initiated response powers. The LIS302DL is especially conservative lower energy three tomahawks straight accelerometer. It incorporates a detecting component as well as an IC interface ready to give the deliberate increasing speed to the outer planet by I^2C/SPI serial communication.

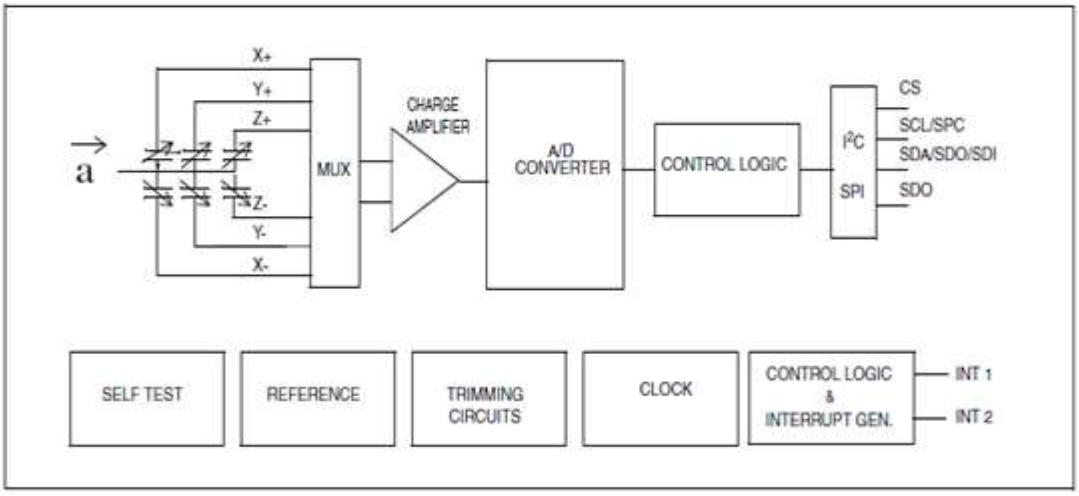

Figure 4 Block Diagram of MEMS

The speeding up is provided by the MEMS. Because of the direction vary, the discrepancy capacitance would shift. The differential worth would be contrasted and the suggestion esteem. They looked at yield which is in simple structure is chosen through MUX as well as enhanced by methods for allege speaker. As the PIC needs to obtain advanced contribution for preparing, an A/D convertor is utilized. The changed over advanced information alongside its timer beat is send for handling in PIC.

4.1. Interfacing MEMS and PIC

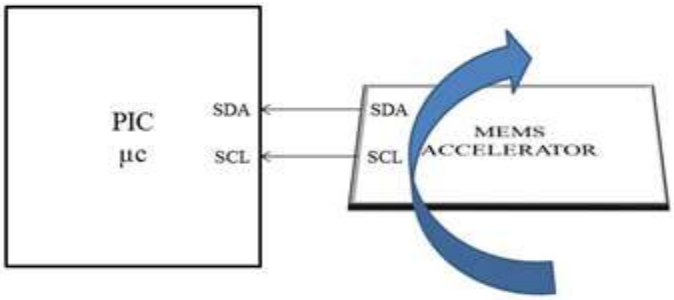

Figure 5 MEMS and PIC interfacing

The pins appear in the MEMS are SCL as well as SDA which is utilized for interfacing through the PIC. The SCL conveys timer beat and the SDA conveys data. The computerized yield because of the direction is brought through these pins by methods for I2C convention. An I^2C MEMS driver is utilized to associate the PIC by MEMS. The driver is a lot of guidance which is necessary to scuttle the predefined equipment gadgets.

5. LCD INTERFACE

LCD is a presentation part which is utilized to show the progressions finished in the MEMS. The 2*16 LCD comprises of 16 ports. Alongside the 8 data lines; it includes EN, RW and RS ports. The PIC just has 2 ports which are SCL and SDA for the I^2C. The 2 ports from I^2C may be extended through methods for IC expands to interface by LCD. Two IC expands have been utilized to remunerate by the LCD ports. An I^2C LCD driver is utilized to associate the PIC through LCD. The driver is a lot of guidance which is requisite to sprint the predefined equipment gadgets.

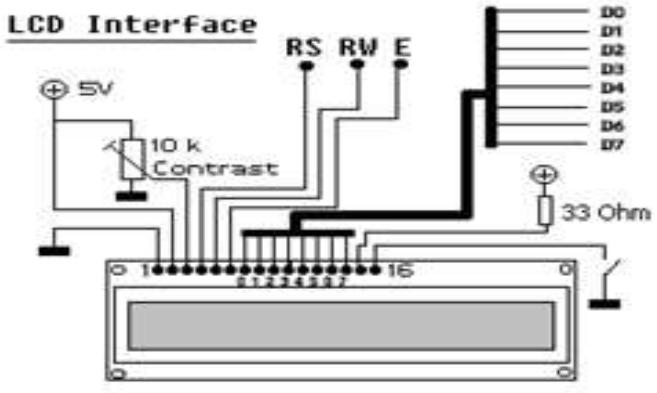

Figure 6 LCD interface

The clock and data sources are taken care of to the IC expand from PIC. From the IC expand the port lines P0 to P7 as well as 3 pins are associated with the data lines of LCD. The complexity of the presentation may be balanced from the 3rd pin VEE of LCD utilizing an uneven opposition. Some adjustments in MEMS would be broadcasted by IC expand with methods for I^2C convention as well as showed in the LCD.

6. I^2C INTERFACE

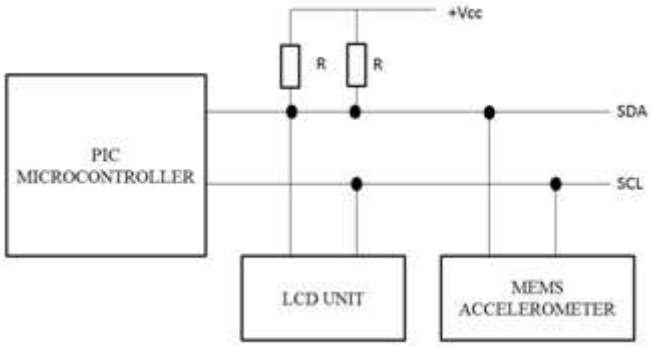

Figure 7 Interfacing LCD and MEMS through I2C

From the figure 7, it is to be noticed that PIC's have been interfaced by equally LCD as well as MEMS accelerometer by SCL as well as SDA pins. I2C is a multi-ace, multi-slave convention; subsequently PIC obtains the computerized contribution of direction from the

MEMS by SCL as well as SDA line. In this procedure MEMS go about as the ace with PIC goes about as the slave. As it is a serial correspondence, to caution different gadgets from quit transmitting data, a draw up resistor is utilized. It exits higher when correspondence happens with along these lines creates the lines occupied for different hubs. Also, after the fruitful finishing of procedure, haul up resistor then turn out to be low and permits different gadgets to begin impart. Presently the PIC gets the computerized information broadcasted from the MEMS by I^2C. At that point it cautions the LCD through transmitting information by I^2C interface as well as presentations the progressions completed through MEMS. Now PIC will go about as ace with LCD goes about as slave. Other preparing is comparative as in the past.

7. TRANSCEIVER

The MRF24J40MA go about as the RF handset which broadcasts as well as get the information. SPI convention is utilized to interrelate PIC as well as MRF24J40MA.

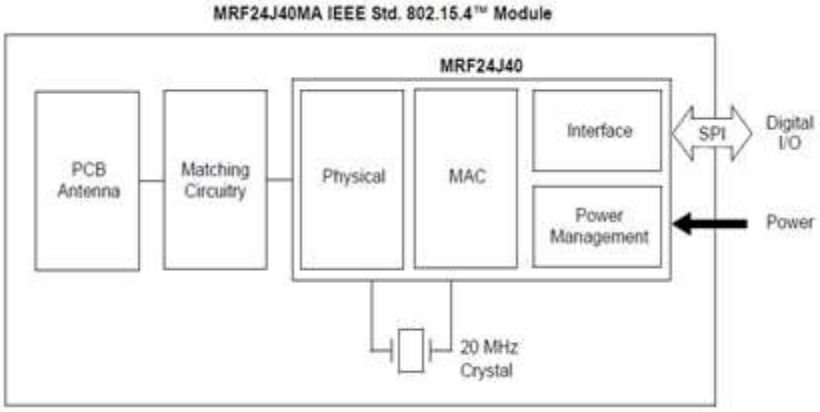

Figure 8 Transceiver block diagram

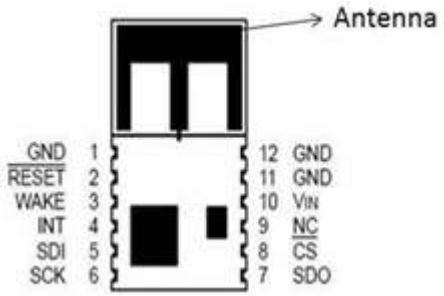

Figure 9 Transceiver pin diagram

The MRF24J40MA comprise of segments for interfacing, coordinating the impedance with receiving wire to get. At the aerial segment, they got information from the PIC by SPI would be changed over to RF recurrence with broadcasted inside the transmission capacity of 2.4 to 2.48GHz ISM band.

8. SERIAL PERIPHERAL INTERFACE

SPI bus now and again said 4 wire interfaces might be utilized to interface such chips or else gadgets similar to: sensors, LCD, recollections, RTC, ADC as well as handsets. Here MRF24J40MA is associated by the SPI.

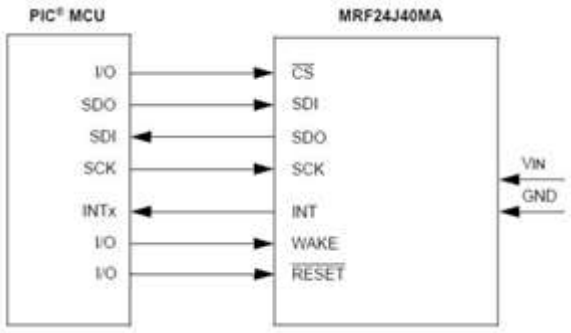

Figure 10 Interfacing PIC with MRF24J40MA

9. OPTO COUPLER

Opto couplers are utilized to keep higher voltage from influencing the scheme getting the sign. It may likewise go about as delicate exchanging where no curve is created.

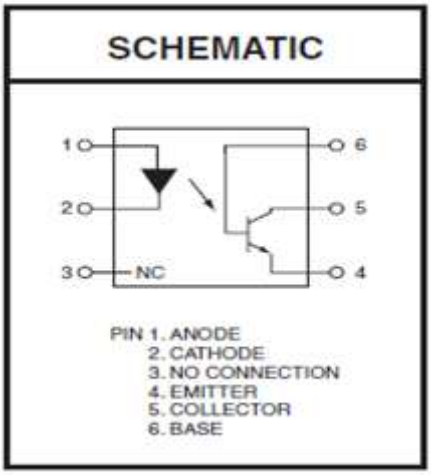

Figure 11 MCT2E OPTO COUPLER

9.1. Interfacing PIC and Opto coupler

The I/O pins in the PIC microcontroller is utilized to associate by opto coupler. It goes about as a scaffold among the lower force as well as higher force machines. The delicate exchanging is conceivable through methods for opto coupler. Subsequently it ignores the bend in the scheme.

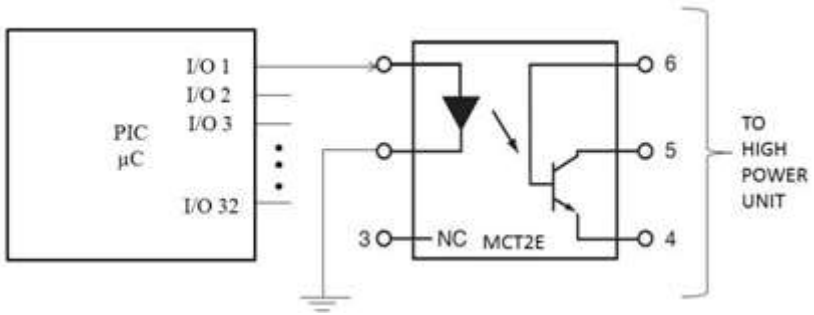

Figure 12 PIC and Opto-coupler interface

Various machines associated by the force flexibly are exchanged through methods for discrete opto couplers. On the off chance that if there should be an occurrence of any higher

voltage, opto coupler forestalls the lower force comprising of PIC as well as other handset segment. As the expense of opto coupler is lesser, it very well may be supplanted without any problem. It helps in maintaining a strategic distance from the human interaction with the high force. Because of this delicate exchanging, no circular segment will be created and thus it guarantees wellbeing for the both human and the pre-owned segments.

10. SOFTWARE DESCRIPTION

10.1. MPLAB IDE

MPLAB IDE is a product device which assists with programing the PIC by methods for significant stage language as well as provide for the program by assembling. At first a calculation is composed for the procedure and consequently the calculation assists with developing flowcharts. Subsequent to these improvements has completed, Embedded C coding will be written.

Table 1 Comparison Table

100 meter range				
Connection Type	**Number of Loads**	**Requirements**	**Cost**	**Total cost**
Wired	N	150m wire*n	1m wire=Rs10	150*10*n=Rs 1500*n
Wireless	N	Pic-2 MIWI-2	PIC =Rs 150 MIWI=Rs 250	(150*2)+(250*2)=Rs800

11. CONCLUSION

This research work features effective technique for staying away from curve free exchanging in the powerful machines. It maintains a strategic distance from the odds of hazard as well as focuses on the force utilization. The use of segments was all around tried for their effectiveness and life span. It lessens the unpredictability and builds portability of assets. Subsequently this research effectively brought about playing out a curve free exchanging for high force modern apparatuses. This outcome in safe exchanging of high force machines and furthermore lessens the expense of assurance component. It additionally deducts the force misfortune experienced in automatic switch. The utilization of WPAN lessens the portability with 100m to 300m. It very well may be actualized in modern meadow for lessening multifaceted nature in wiring as well as disposing of the aspect of hazard. In future, the utilization of intensity may be decreased as well as the scope of versatility of switch may be expanded.

REFERENCES

[1] Chirag D. Patel, and Gabriel M. Rebeiz, (2012) Fellow, “RF MEMS Metal-contact Switches With mN-Contact and Restoring Forces and Low Process Sensitivity”, IEEE

[2] Harvey S.Newman, John L. Ebel, Daniel Judy, John Maciel, (2011) “Lifetime Measurements on a High-reliability RF-MEMS Contact Switch’’, IEEE

[3] Jaehong Park, Eun Sub Shim, Wooyeol choi, Youngmin Kim, Youngwoo Kwon, Dong-il Cho, (2010) “A Non-Contact Type RF MEMS Switch for 24-Ghz Radar Applications”, IEEE

[4] Feixiang Ke, Jianmin Miao and Joachim Oberhammer, (2008) “A Ruthenium-Based Multimetal-Contact RF MEMS Switch With a Corrugated Diaphragm”, IEEE

[5] J.Costa, T.Ivanov, J.Hammaond, J. Gering, E. Glass, J.Jorgenson, D.Dening, D.Kerr, J.Reed, S.Crist, T.Mercier, S.Kim, and P.Gorisse, (2008) “Integrated MEMS switch technology on SOI_CMOS”, IEEE

[6] D. Mardivirin, A. Pothier, M.EI Khatib, A. Crunteanu, O.Vendier, and P. Blondy, (2008) "Reliability of dielectric actuators in rf-mems ohmic switches", IEEE

[7] D.A. Goins, R.D. Nelson, and J.S. McKillop, (2007) "Design of a 20 GHz low loss ohmic contact RF MEMS switch", IEEE

[8] J.J. Maciel, J.F. Slocum, J.K. Smith, and J Turtle, (2007) "MEMS electronically steerable antennas for fire control radars", IEEE

[9] F. Torres, (2007) "Nanometer scale gaps for capacitive transduction improvement on RF-MEMS resonators", IEEE

[10] T. Seki, Y. Uno, K. Narise, T. Masuda, K. Inoue, S. Sato, F. Sato, K. Imanaka, and S. Sugiyama, (2006) "Development of a large-force low-loss metal-contact RF MEMS switch", IEEE

[11] D. Periyaazhagar, G.Irusapparajan, (2016) "Asymmetrical cascaded multi level inverter using control freedom pulse width modulation techniques", International Journal of Power Electronics and Drive System.Vol.7, Issue 3, pp 848–856.

[12] D. Periyaazhagar, G.Irusapparajan, (2016) Comparative study on three phase cascaded inverter for various bipolar PWM techniques", International Journal of Modelling, Identification and Control. Vol. 25, Issue 4, pp 261–272.

[13] G. Irusapparajan, D. Periyaazhagar, N. Prabaharan and A. Rini ann Jerin, (2019) Experimental verification of trinary DC source cascaded H-bridge multilevel inverter using unipolar pulse width modulation", Automatika, Journal for Control, Measurement, Electronics, Computing and Communications, Vol. 6, Issue 1, pp.19–27.

[14] G. Ramprabu, T. Saravanan, G. Saritha, (2018) "Wireless Audio Signal Communication using Li-Fi Technology", International Journal of Engineering and Advanced Technology, Volume 8, Issue 2, December, pp.208-210.