International Journal of Aquatic Science
ISSN: 2008-8019
Vol 12, Issue 03, 2021

Thermoelectric Power Generation Using Waste -Heat Energy From Peltier And Seebeck Module.

Tamil Pavai G[1],D S Manivannan[2] ,R Hemanth raj[3]

[1]Assistant Professor, Electrical and Electronics Engineering, AMET Deemed to be University,
[2, 3]Student, Electrical and Electronics Engineering Marine, AMET Deemed to be University, Kanathur,
Tamil Nadu 603112,

E-mail: tamizh1205@gmail.com[1], manivannansd31@gmail.com[2] , hemanth22raj@gmail.com[3]

ABSTRACT : In today's environment, we are more focused and interested in deploying sustainable and renewable energy that produce less carbon emission and eco-friendly energy. Energy users are continuously asking for instruments that can gives us required amount of energy for their domestic and other uses, at the time when power is unavailable as well as addition to their normal usage. In this TEG, there are not any moving parts and it cannot be producing any waste during power production hence it is considered as green technology. TEG power generator converts direct waste heat in to generate electricity by this it-eliminated emission so we can believe this green technology. TEG power generation offer a possible application within the direct exchange of waste-heat energy into electric power where it is unnecessary to believe the value of the thermal energy input. This method will have a maximum outcome. The application of this feature green technology in converting waste-heat energy directly into electric power can too improve the general efficiencies of energy conversion systems. Heat source, which is, need for this conversion is a smaller amount when contrast to standard methods. By using this energy, we will charge the electronics like mobiles.

Keywords: Direct power generation; TEG effect; TEG; low temperature, TEG GENERATOR, ECOFRIENDLY ENERGY, TEG MODULE, VOLTAGE REGULATOR.

1. INTRODUCTION

The project is to design a less cost, easy to use TEG generator that will provide usable electrical energy to the home and efficient electricity if there is power loss. The system that we are designing will utilizes the waste heat produce in mechanical machine operation like motor cycle combustors as input energy source. The TEGs answer the need for a sustainable, small, simple home energy source. The design of the TEGs went through following main stages. Each stage was defined by the breakthroughs or changes

within the method of warmth transport. The main aim of this project is to develop much cleaner noise less cost-effective different way of power generation method for charging the battery also on utilization proper only the need of usage, which helps to reduces the worldwide warming also as reduce the power shortages, load shedding and we will transfer the portable generating unit. Waste may refrigerator heat, vehicle radiator heat, laptop heat, even body heat are often used as a input source as a waste heat to get electricity and it can be charged directly mobile battery and also stored during a rechargeable lead acid battery for further usage. Waste energy physical body locomotion produce electricity weight locomotion of the energy in to electricity by using electromagnetic induction principle. The control mechanism carries regulator circuit and therefore the power saving mechanism carries. Microcontroller relays etc. Maintain the warmth transfer from hot side to cold side because of uniform charging mobile battery.

2. PROBLEM DEFINITION

It have average of three to 10 hours of daily power-cuts because the rise in demand of consumer utilization electricity exceeds in order that the assembly of electricity is lesser then the consumer demand. In addition, shortage of fuel and coal i.e. about 60% of electricity is generated from fossil fuels. Therefore, that pollution also may occur thanks to the combustion of this fuel. In addition, the generating the facility from these conventional sources may cause harmful environment and pollute the character. In the new generation, they are depending upon the rechargeable batteries or diesel /petrol engine etc. when there is no power and at the time of load shedding. The use of electrical and mechanical generator is common in industrial and commercial sector. This ultimately increases the shortage of electricity and more cost. The people are not utilizing the facility properly they were unnecessarily wasting the facility and that they are not designing the facility consumption properly hence a coffee power production.

3. METHODOLOGY

In the stage one, heat is collected directly by teg module, which converts heat into electrical energy by the principle of Seebeck effect fig (i). This approach is simple and little effort of the part of the user. The second stage is voltage regulation with the assistance of transformer named LM78XX series transformer to regulate the output voltage given by TEG module fig (ii). The third stage is microcontroller and liquid display part that is for automatic control and digital interface that helps to know the working conditions of the TEG.

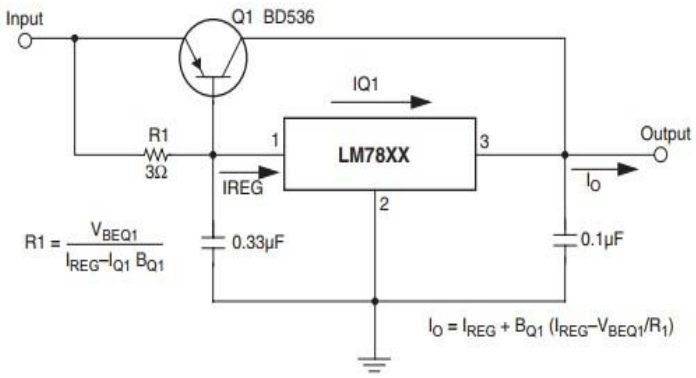


Fig (i) TEG MODULE

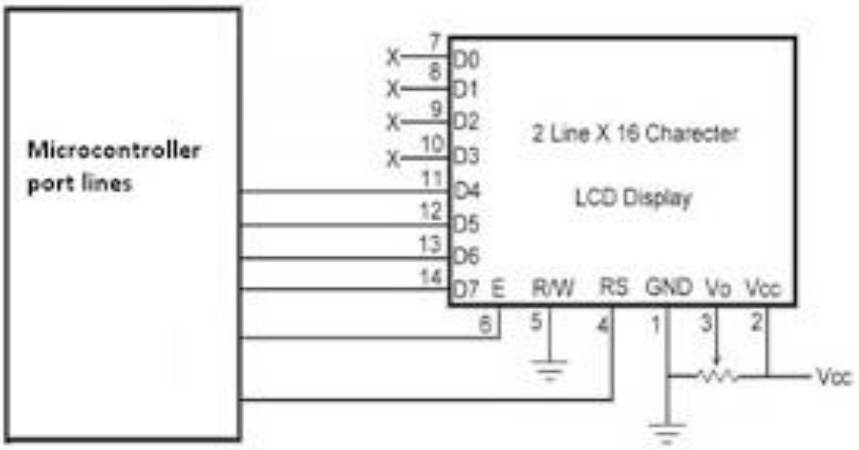


Fig (ii) LM78XX VOLTAGE REGULATOR

Fig (iii) Microcontroller connected LCD

4. WORKING

A TEM consists of the many thermoelements like bismuth telluride serial electrical link for increasing operating voltage and in parallel thermal connection to enhance the thermal conductivity. TEG module converts heat energy to electrical energy based on

Seebeck effect when there is temperature difference occurs. The electrical equivalent circuit of TEG generator is a voltage V and an internal resistance R, which is similar to a battery. TEG modules are placed directly on the highest of surface and mounted uniformly over the available surface of the warmth exchanger. The cold-side temperature of the modules are maintained by the cooling system.

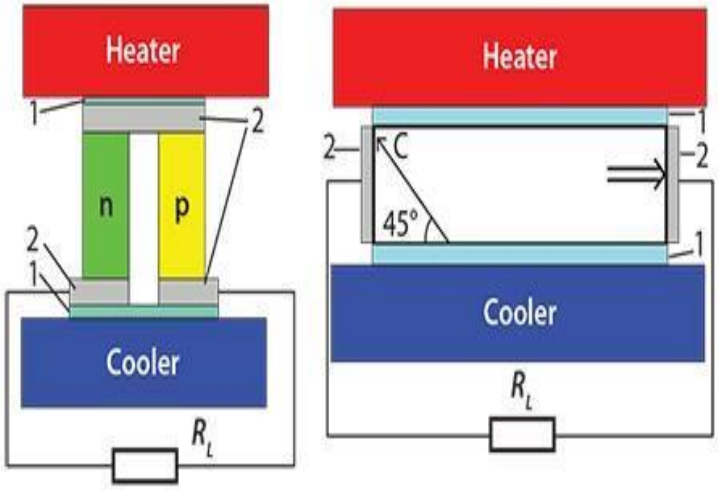


Fig (v) TEG Materials

5. TEGMODULE

A TEG module will be used for both heat and cool purposes. A TEM also used for power generation purpose where we need to apply a temperature difference across the module to generate a current. It mainly contains n and p-type doped semiconductor materials which are connected thermally in parallel and electrically in series. They are mounted between two ceramic layers that keep the overall structure together mechanically. It insulates the individual elements from one another electrically and from external mounting surfaces. These types that is N-type and P-type Bismuth Telluride TEG materials are used in a TEG. N-type material is highly doped so that it will have an excess of electrons and P type material is doped so that it will have a deficiency of electrons. By varying temperature, we can control the output current generate across the module. The Seebeck effect is a phenomenon in which a temperature difference between two dissimilar electrical conductors or semiconductors produces a voltage difference between the two substances Renewable energies . There are some disadvantages Solar cells are the foremost commonly utilized in applications like household industrial and spacecraft electrical systems. However, if there is no sun light there will no production of electricity alternative sources are necessary for generating electricity or a way of storing energy for future use. Satellites are settled at the planets that is so for from the earth. For example, TEG devices can be used in vehicles to producing electricity using the waste heat 'TEG is used to convert thermal energy (heat) into Electricity based on "Seebeck effect" directly.

Advantages of TEG power generators are.
1. Small size and less weight. - 2. Increase the general efficiency (5% to 8%).

2. Alternative power sources of energy. - It requires less space and cost compare to other source
3.Waste heat to generate the power is to decrease the cost-per-unit of the devices.

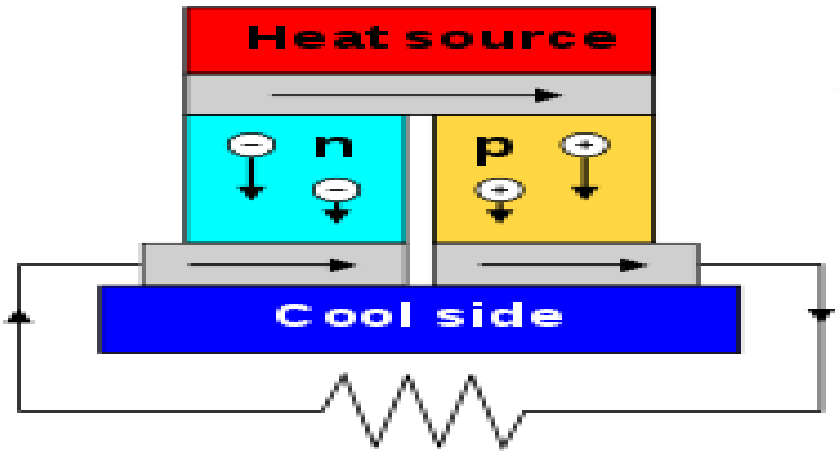


Fig (vi) TEG

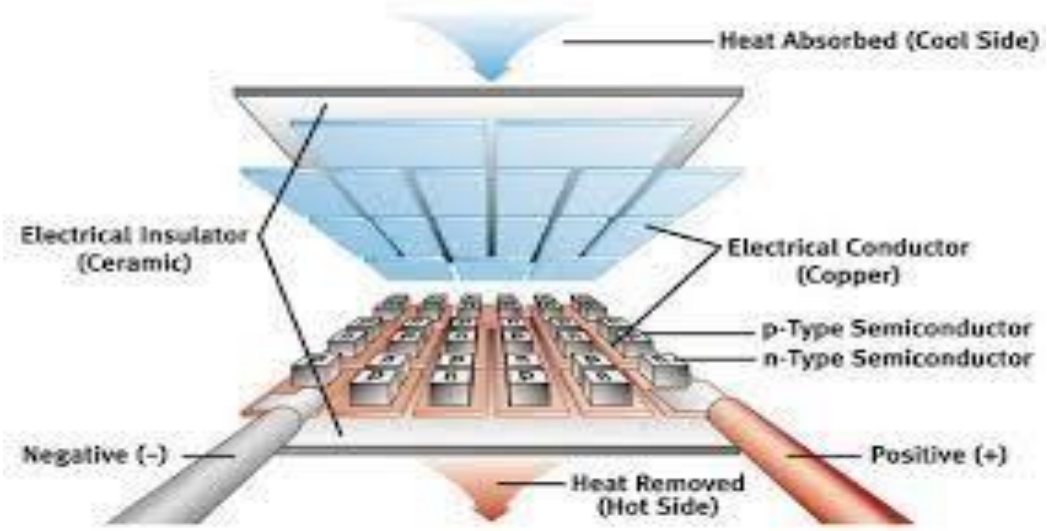


Fig (vii) TEG Module

LM78XX SERIES VOLTAGE REGULATOR

A transformer is use to get a hard and fast output voltage that is still constant no matter changes to its input voltage or load conditions . It compared the output voltage with precise set voltage and adjusts the pass device to take care of a continuing output voltage. A switching regulator is use for converting the dc voltage into a switched voltage applied to an influence MOSFET or BJT switch. The output voltage is then feedback to the circuit for controlling the power switch on and off times so that the output voltage remains constant regardless of input voltage or load current changes. The power dissipation of a voltage regulator is directly proportional to its output current for a

given input and output voltage, which efficiencies can be 50% or even lower. Using the optimum components, a switching regulator can achieve efficiencies up to 90%. The linear regulator has much lower noise than a switching regulator with the same output voltage and current requirements.

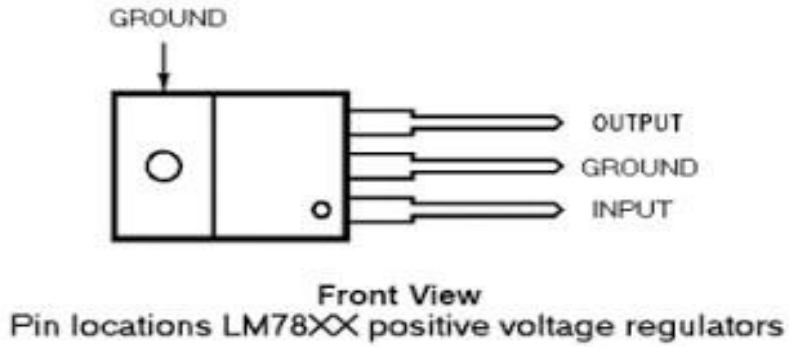
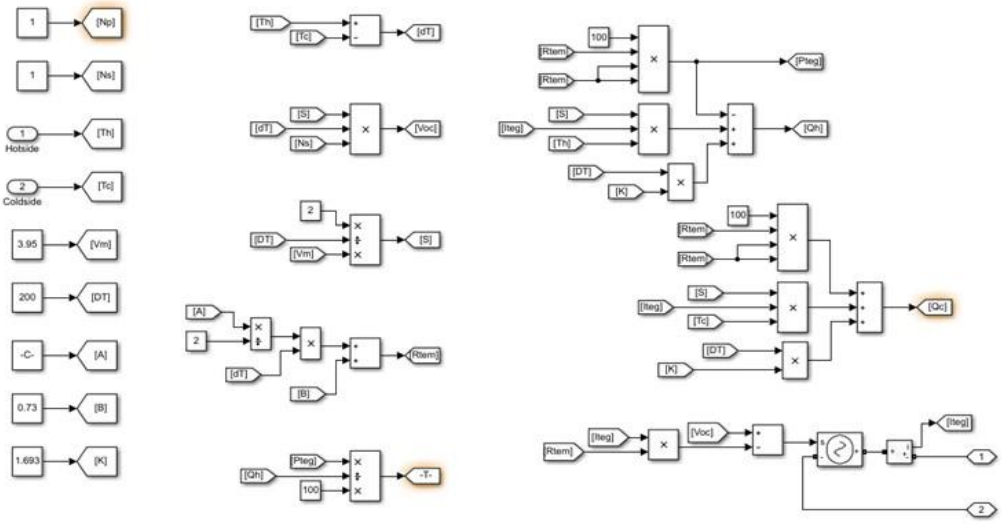


Fig (viii) LM78XX Voltage Regulator

Table 1: Observation Table

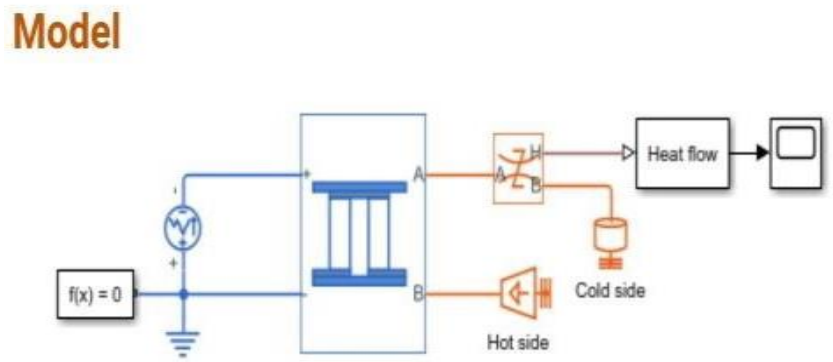
Average $\Delta_{T(^{\circ}C)}$	Maximum power generated (W) = V * I	Load resistance (Ω)	Load voltage(V)	Load current (amp)
20	0.232	1.45	0.58	0.4
26	0.436	2.47	1.04	0.42
35	1.156	3.96	2.14	0.54
44	1.996	5.19	3.22	0.62
55	2.563	5.15	3.61	0.71
68	4.057	5.75	4.83	0.84

MATLAB MODEL



International Journal of Aquatic Science
ISSN: 2008-8019
Vol 12, Issue 03, 2021

STIMULATION OUTPUT



Fig(x) Performance Graph

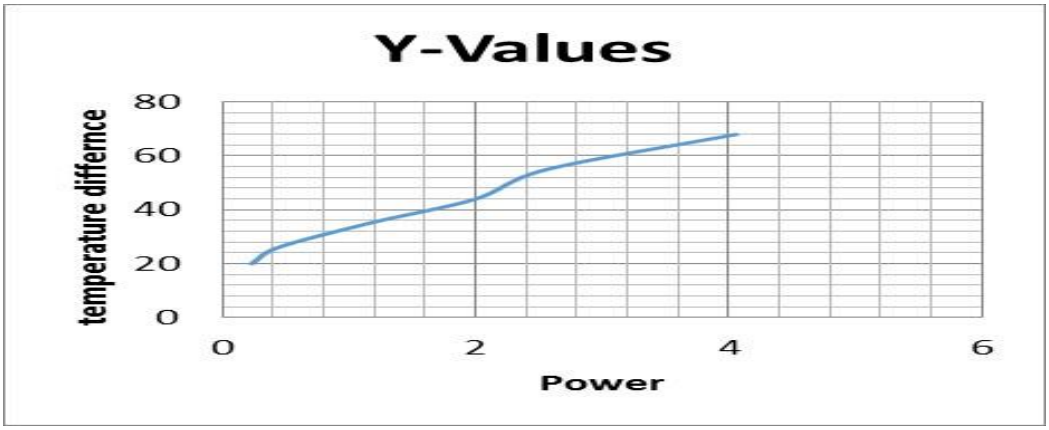
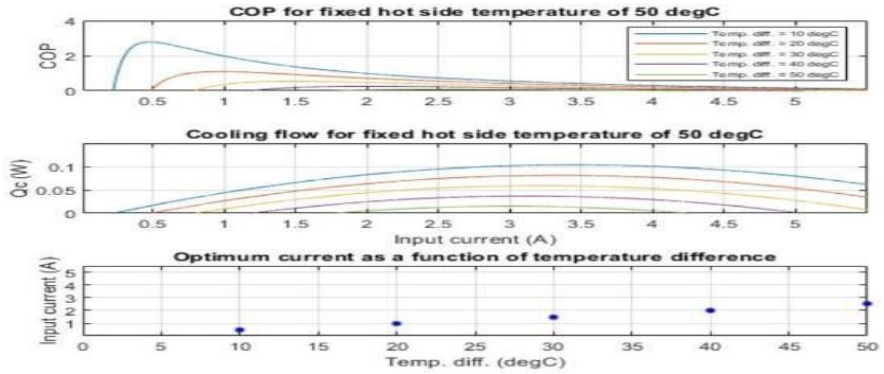


Fig (xi) Mat lab/Simulink modelling for Peltier and Seebeck module.



6. DRAWBACKS

Improper variation of gradient difference may damage the TEG, Complex design the performance of the TEG generator under mismatch conditions like the limited working temperature and therefore the inconsistent temperature distributions among the modules serial connection. It are often concluded that a correct difference in temperature applied between two sides of module improves the electrical performance.

7. RESULT

Telluride TEG device (TEC1-12706). The load resistance is variable within the experimental setup and thus the facility generation and efficiency are plotted versus the voltage produced. As we see, efficiency of the generator is somewhat low due to their relatively low conversion efficiency. As for the convenience, we take the utmost temperature difference (68°C) which may be a very modest value, higher temperature differences would end in higher efficiency. Generally, TEG devices require temperature difference approximately up to 500°C to achieve an efficiency upto10%. It is often concluded that a correct difference in temperature applied between two sides of module improves the electrical performance. The experimental results show that the facility loss of the modules serial connection is critical, 11% but the theoretical maximum power, thanks to the temperature mismatch condition. These situations are often improved from thermal insulation on the modules and therefore the power loss thanks to the inconsistent temperature distributions reduces to 2.3% at an equivalent working condition.

8. SCOPE OF THE FUTURE WORK

1. By using proper heat sink material help to increase the output voltage.
2. Using long proper heat sink material is to avoid the heat in between the gap of fins.
3. SERIES is to increase the voltage.

9. DISADVANTAGES

1. Improper variation of gradient difference may damage the TEG, Complex design the performance of the TEG generator under mismatch conditions like the limited working temperature and therefore the inconsistent temperature distributions among the modules serial connection.2. It are often concluded that a correct difference in temperature applied between two sides of module improves the electrical performance

10. REFERENCES

[1] R. Ahiska, S. Dislitas Computer controlled test system for measuring the parameters of the real time TEG module.Yang jihui, R. Stabler Francis Automotive applications of using TEG material.Eisenhut, C. and Bitschi, A.: “TEG conversion system based on geothermal and solar heat in low cost efficiency,” 25th International Conference on TEGs, (2006), p.510-515.

[2] S Balaji and T Sasilatha, “Detection of denial-of-service attacks by domination graph application in wireless sensor networks - Cluster Computing”, Vol 22, Issue 6, Pages 15121-15126, Springer US 2019.

[3] M. Dheepak, G. Jegadeeswari, Dr. S.V. Saravanan, and R. Sundar, “Humanoid Robot for Remote Surveillance” at International Journal of Mechanical Engineering and Technology (IJMET), August 2018/ Volume 9, Issue: 8/ Page no: (653-659)/ ISSN 0976 – 6359/ Impact Factor: 9.22,

[4] G Jegadeeswari, (2019)“Performance Analysis of Power Quality Improvement using Shunt Active Power Filter” International Journal of Recent Technology and Engineering (IJRTE), 7 (5), 1-3

[5] G Jegadeeswari, M DHEEPAK, SV Saravanan, V Vanisree, (2018) “The Power Factor Correction Improvement For A Single Phase Ac/Dc Converter Using An Enabling Window Control”, International Journal of Mechanical and Production Engineering Research and Development (IJMPERD, 8, 41-48

[6] P.Sivaperumal , S.S.Dash,, K.Mohanraj and C.Balaji, “Switched Coupled Inductor Inverter based Interline Dynamic Voltage Restorer with DWT-ANN Technique”, International Journal of Electrical Engineering & Education, 1-18, 2019

[7] Thermoelectric Power Generation Using Waste-Heat Energy as an Alternative Green Technology Basel I. Ismail*, Wael H. Ahmed** *Department of Mechanical Engineering, Lakehead University, Canada, **Component Life Technology, Atomic Energy of Canada Ltd., Canada

[8] Design and Performance Analysis of Heat Exchanger for Thermoelectric Power Generation Using Exhaust Waste-Heat Energy #1D. T. Kashid, #2S. H. Barhatte, #3D. S. Ghodake 1 dtkashid@coe.sveri.ac.in 2 surendra.barhatte@mitcoe.edu.in #13Mechanical Engineering Department, SVERI‟s College of Engineering, Pandharpur #2Mechanical Engineering Department, MAEER‟s MIT College of Engineering, Kothrud, Pune.

[9] A research on thermoelectric generator's electrical performance under temperature mismatch conditions for automotive waste heat recovery system, Z.B.Tang[a]Y.D.Deng[a]C.Q.Su[a]W.W.Shuai[a]C.J.Xie[b], [a]Hubei Key Laboratory of Advanced Technology for Automotive Components, Automobile Engineering Institute, Wuhan University of Technology, China, [b]School of Automation, Wuhan University of Technology, 205 Luoshi Road, Hongshan District, Wuhan 430070, China

[10] Development of Alternative Electrical Energy Utilizing Thermo Electric Generators (TEG) for Refrigerators Anthony S. Tolentino

[11] Thermoelectric Generator: Power Generation Using Temperature Difference for Use in Home Applications, Albert Patrick David, Bulacan State University.

[12] S Vidhya, T Sasilatha, (2018) “Networks “Wireless Personal Communications 103 (4), 3055-3077

[13] M Parameswari, T Sasilatha, (2018)"Cross-layer based error control technique for WSN with modified relay node selection and corruption aware method" Wireless Personal Communications 99 (1), 479-495

[14] A Priya, T Sasilatha (2017) "Wireless network for strategic boundary supervision system" Bulletin of Electrical Engineering and Informatics 6 (4), 367-370