POLITEKNIK

SULTAN SALAHUDDIN ABDUL AZIZ SHAH

TO DEVELOP CHARGING TOWER USING STEP GENERATOR

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JABATAN KEJURUTERAAN ELEKTRIK

TO DEVELOP CHARGING TOWER USING STEP GENERATOR

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This report submitted to the Electrical Engineering Department in fulfillment of the requirement for a Diploma in Electrical Engineering

JABATAN KEJURUTERAAN ELEKTRIK

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CONFIRMATION OF THE PROJECT

The project report titled "To Develop Charging Tower Using Step Generator" has been submitted, reviewed and verified as a fulfills the conditions and requirements of the Project Writing as stipulated

Checked by:

Supervisor's name : Ts. ILYA BINTI ISMAIL

Supervisor's signature:

Date :

Verified by:

Project Coordinator name :

Signature of Coordinator :

Date :

"I acknowledge this work is my own work except the excerpts I have already explained to our source"

1. Signature :

Name : **MUHAMMAD NAZRUL IDZHAM BIN MOHD NADZARUDDIN**

Registration Number : **08DEP20F1045**

Date : 8/12/2022

DECLARATION OF ORIGINALITY AND OWNERSHIP

TITLE : DESIGN FINGERS EXERGAME TO IMPROVE FINE MOTOR SKILL FOR AUTISTIC CHILDREN USING ARDUINO

SESSION: SESI 1 2022/2023

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   is a final year student of **Diploma in Electrical Engineering, Department of Electrical, Politeknik Sultan Salahuddin Abdul Aziz Shah**, which is located at **Persiaran Usahawan, 40150 Shah Alam, Selangor**. (Hereinafter referred to as 'the Polytechnic').

2. I acknowledge that 'The Project above' and the intellectual property therein is the result of our original creation /creations without taking or impersonating any intellectual property from the other parties.

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Made and in truth that is recognized by;

a) **Muhammad Nazrul Idzham Bin Mohd Nadzaruddin**) .
(Identification card No: - 020618101347)) ....…….
) **Muhammad Nazrul Idzham**

In front of me, Click here to enter text. (Click here to enter text.)) .....……
As a project supervisor, on the date:) **Ilya Binti Ismail**

ACKNOWLEDGEMENTS

I am over helmed in all humbleness and gratefulness to acknowledge our depth to all those who have helped me to put these ideas, well above the level of simplicity and into something concrete. We would like to express our sincere gratitude to our Guide Puan Ilya Binti Ismail for providing their invaluable guidance, comments and suggestions throughout the course of the project. I have taken efforts in this project. However, it would not have been possible without the kind support and help of many individuals and organization. Whose guidance, encouragement, Suggestion and very constructive criticism have contributed immensely to the evolution of Ideas on Project. we would like to extend our sincere thanks to all of them.

I thank and appreciations also go to other supervisor in giving ideas on developing the project and people who have willingly helped me out with their abilities. and helped me a lot in gathering different information, collecting data and guiding me from time to time in making this project, despite of their busy schedules, they gave me different ideas in making this project unique.

ABSTRACT

In day today life the utilization of power turns to be necessary for each work. The power delivered in this paper will not contaminate the surroundings and it is also will not to rely upon the climate conditions. The paper proposes a project for the creation of power utilizing piezoelectric sensors kept along the footpaths which can ready to charge the battery and ready to supply the force at whatever time of our prerequisite. The footstep power generation technique through piezoelectric sensors produces electrical force by changing mechanical energy of the development of individuals on the floor to electrical energy. The benefits of piezoelectric force generation framework are that it is sheltered and secure to utilize, it doesn't make any issue or distress for the general population strolling through footpath, and it is absolutely chance free strategy. Footstep power generation technique has mechanical part and in addition electrical part, however the electrical and mechanical losses are negligible. This framework additionally has the ability to store the electrical force away battery. The power produced by this technique can be utilized for helping up the road lights, additionally for activity reason. At long last the force which will be abandoned can be given to national grid for power reason.

KEYWORDS: Piezoelectric sensors, Battery, Electricity, Footstep power generation.

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CHAPTER 1

1 INTRODUCTION

1.1 Introduction

At present, electricity has become a lifeline for human population. Its demand is increasing day by day. Modern technology needs a huge amount of electrical power for its various operations. At one hand, rising concern about the gap between demand and supply of electricity for masses has highlighted the exploration of alternate sources of energy and its sustainable use. On the other hand, human population in Malaysia demanding energy is increasing day by day linearly. Accordingly, it is an objective of the present invention to provide a method of electrical power generation from this ever-increasing human population that does not negatively impact the environment.

This technology is based on a principle called the piezoelectric effect, in which certain materials have the ability to build up an electrical charge from having pressure and strain applied to them. Piezoelectricity refers to the ability of some materials to generate an electric potential in response to applied pressure. Harvesting of energy which means energy is already available, but is going to waste if not utilized. Embedded piezoelectric material can provide the magic of converting pressure exerted by the moving people into electric current.

Out of the many alternative energy resources, this technology described in this project report is the ultimate source of all known forms of energy. It is clear, safe, and free, does not pollute the environment and thus will be an extremely viable alternative in the days to come. As there is a tremendous increase in the crowd, the load applied on the footsteps by the people, it generates nonstop energy, which can be stored and utilized to energize. Here the concept is to convert the mechanical energy in to electric energy.

1.2 Background Research

Earlier various researchers had work on the conversion of dynamic energy to electrical by human locomotion Jeff Krupenkin and Ashley Taylor proposed a new technique called reverse electro-wetting in which motion of conductive liquid on dielectric coated conductive substrate causes to create electrical energy, so whenever there is any vibration on the upper plate due to human locomotion or by any mean could result in producing electrical energy

In Malaysia itself there have been many studies related to the use of piezoelectric. Studies have found that our country is well suited to use this technology due to its large population and having crowded areas; for example, in the city. But our country has not yet installed this technology to be a new source of energy for the country.

1.3 Problem Statement

The shortage of electricity in Malaysia, with a daily increase in demand of electricity is leading all of us to prefer non-conventional resources, such as solar and wind powered mechanism, but they are still an expensive affair for many, furthermore availability of sunlight is poor especially in rainy & winter seasons, as a result it is not reliable. Consequently, an opportunity for a cheap approach needs to be implemented for the generation of electricity.

Electricity is one of the daily requirements of life. It is required to increase as much as sources of renewable energy. This system can be used for utilization of waste energy of foot step to provide electricity during the cut-off of electricity in some crowded places.

1.4 Research Objectives

The main objectives of the project work are:

- To build a 1 meter path way that can generate dc voltage using an array of piezo electric sensor.
- To develop a system that can display status of percentage charging, the number of used people.

1.5 Scope of Research

The scope of the project to develop 4 USB and 2 DC ports for charging electricity. The project should generate 0.04 V to 8.29 V per pressure on a 1-meter track using this foot step generator.

1.6 Project Significance

This project is to develop a new source of renewable energy with low-cost budget with the help of PIC16F877A as the microcontroller. The footstep power generation system is to capture the typically wasted energy surrounding a system and transforming it into electrical energy. The technique used in gaining the energy is via piezoelectric materials. This method employs piezoelectric components where deformations created by dissimilar means are directly transformed into electrical charge through piezoelectric effect. Afterwards, the electrical energy can be regulated or stored for further use. In this project, we are generating electrical power as a non-conventional method by simply walking or running as the input source. The piezoelectric sensor will then send the signal into the PIC16F877A and transform it into electrical energy. The LCD will then display the amount of voltage generated by the circuit. The highest voltage generated in this project is 8.29 V. Then, the voltage stored in the battery can be used to charge the mobile phone. The results shown that this footstep generation system is very important for utilization in todays.

1.7 Chapter Summary

CHAPTER 2

2 LITERATURE REVIEW

2.1 Introduction

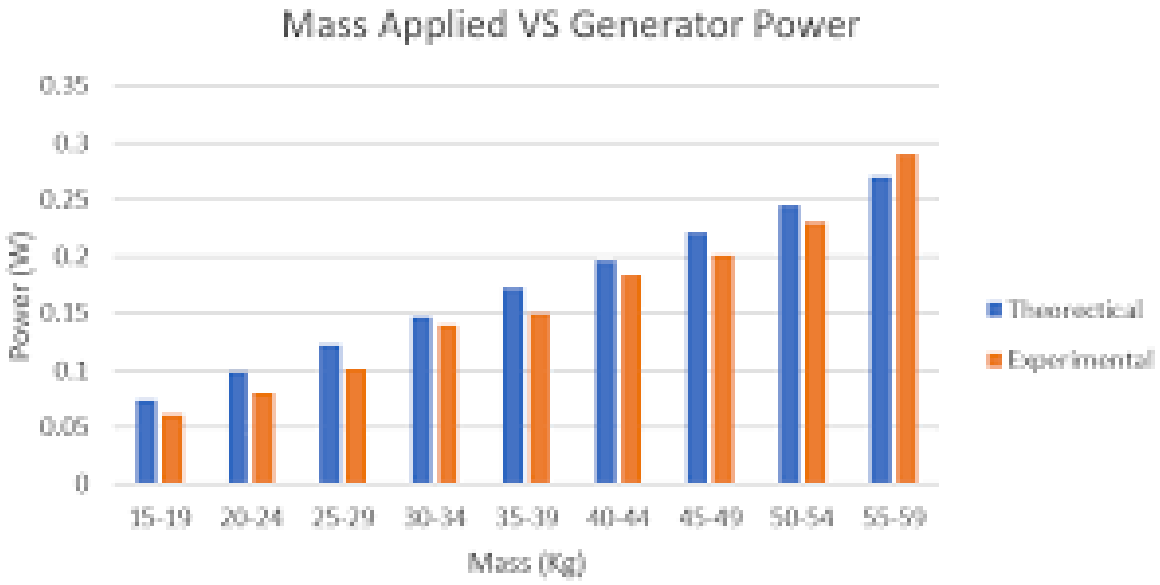
The Literature Review describes the existing tools and their related work from which the current project is carried out in the further. It also gives the detailed study on the previous work so that it provides the depth of understanding of the existing work. Lots of research has been carried out on the available tools. This gives an idea on this project work to overcome limitations of existing tools.

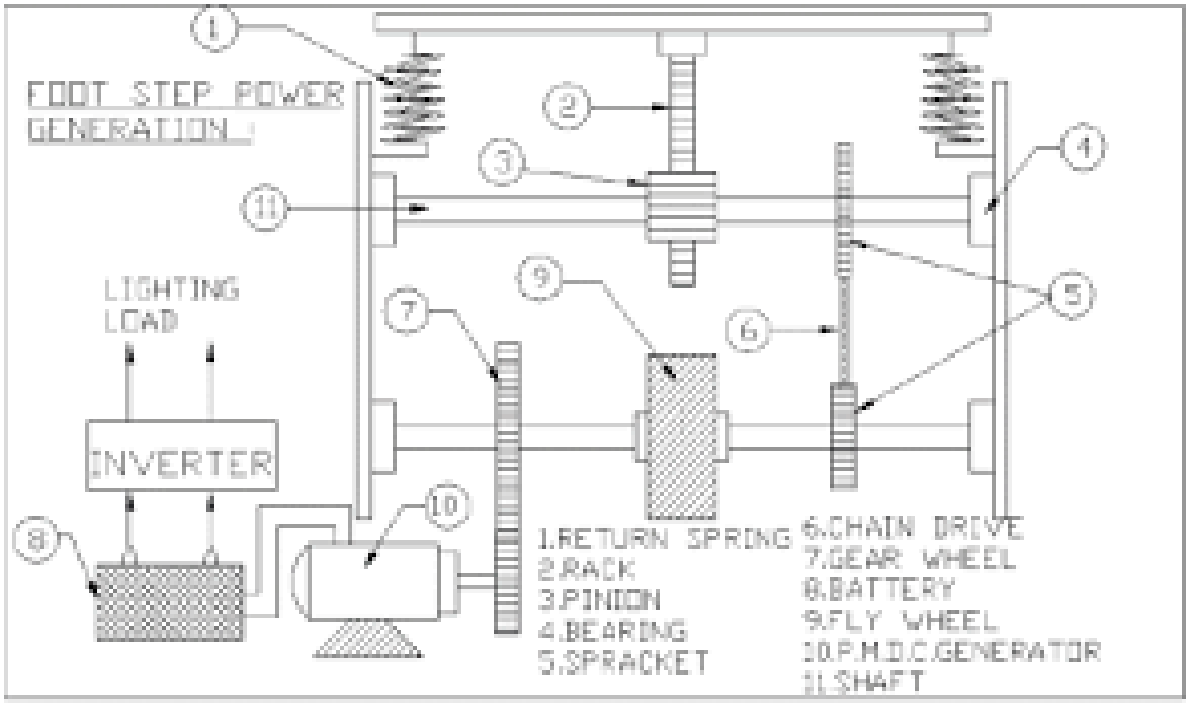
2.2 Literature Review

A journal and research by Tengku Azita Tengku Azizland Muhammad Syamir Subri1 have developed a new source of renewable energy having low-cost aspects with the help of Arduino Uno as the microcontroller. The piezoelectric sensor of the circuit will send the pressure signal into the Arduino Uno and transformation of these signals into electrical energy is done with appropriate peripherals. An LCD is used to display the level of voltage generated by the circuit and the highest voltage generated in this project was 8.29 V. Then, the voltage stored in the battery could be used to charge the mobile phones. The output showed 0V when force was not applied to the piezo-electric sensor. When low pressure was applied, the amount of voltage generated was 0.04V. For low pressure, the level of voltage generated increased to 1.53V whereas, for medium pressure, the voltage generated was 2.89V. And for high pressure, the voltage generated was 5.81V and for very high pressure, the voltage generated is 6.90V. For successive increases of pressure, the highest generated voltage was up to 8.29V. The conclusion of an increase in voltage with applied pressure was helpful.

A research paper on Electrical Power generation by footstep using a Piezo-electric transducer by Madhu and Dr. Pardeep provided an alternative way to generate electricity that was efficient, clean and pollution-free. The electricity-generating tiles (EGT) were used in this

work which are cheap and easy to install. Piezoelectric Transducers (PZT) were connected in a series-parallel manner and to increase the efficiency Prieto battery, were used (rechargeable battery made of nanotechnology), and voltage could be effectively increased using a boost converter. They made use of 72 piezoelectric sensors, which were arranged in 8*9 matrixes. The output voltage from the model has a voltage of 10-15v and a current of 50-400 microampere. A study on series and a parallel connection was done. The output from series-parallel in AC condition was 20 microamperes and in DC condition was 181 microamperes.


Mass Applied VS Generator Power
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Power (W)
15-19
20-24
25-29
30-34
35-39
40-44
45-49
50-54
55-59
Mass (Kg)
Theoretical
Experimental


FOOT STEP POWER GENERATION
LIGHTING LOAD
INVERTER
1.RETURN SPRING
2.RACK
3.PINION
4.BEARING
5.SPRACKET
6.CHAIN DRIVE
7.GEAR WHEEL
8.BATTERY
9.FLY WHEEL
10.P.M.D.C.GENERATOR
11.SHAFT

2.3 Obtained Informations

In other related study, Sensor enabled Internet of Things for smart cities [1,2] reflects the fact that the world's population is increasingly increasing, putting pressure on cities. As a result, many government and private sector organizations are working to identify long-term solutions to these complex issues. In the last few years, IoT has drawn never-before-seen interest. In this paper, we look at the concepts of sensor-enabled Internet of Things, which links billions of sensors, and discuss their potential in the construction of smart cities. The main goal of this paper is to correct the flaw and review the current system's latest trends in order to recognize some of the major issues with sensor-enabled IoT. The author of [3] provided an overview of China's IoT growth, including policies, R&D plans, applications, and Standardization. This paper is written from China's Points of view, To address the architecture challenge, the report portrays certain challenges in terms of technology, applications, and Standardization, as well as proposing an open and general IoT architecture comprised of three platforms [3]. The main goal of [4] is to create a renewable electric energy source that can be used to charge a cell phone. This paper was generated in order to generate renewable electricity and reduce energy waste. A greater number of pedestrians use the subway, stairs, and highways, causing vibrations under the floors. Io connected to piezoelectric material monitors energy generation and is linked to a multi-control device for wireless network communication with a computer or cell phone. The system proposed by [5] describes the electrical energy is generated by walking in tread-mill which is rotating in the circular motion the electricity is produced and that energy is stored in the battery and used for future purpose. This system by [6] described the mechanical energy is converted into electrical energy by using the piezo electric sensor and then it is stored in the battery. RFID is the sensor used for phone charging purpose. RFID card is used to charge the mobile phones. The prototype design and testing of a hybrid power management system for a wireless sensor mote is designed by [7]. The sensor mote, which is installed on the outside of ahigh voltage transformer, generates electricity from the transformer tank vibration using a piezoelectric cantilever. The authors of [8] proposed a decision-making procedure to assist a city energy manager in evaluating the most cost-effective energy retrofit plan for an existing public street lighting system across a large metropolitan area. The proposed decision model aims to maximize energy consumption reduction while also achieving an optimal allocation of retrofit actions among street lighting subsystems, all while making efficient use of the available budget. A quadratic knapsack problem is used to express the resulting optimization problem.

2.4 Chapter Summary

CHAPTER 3

3 RESEARCH METHODOLOGY

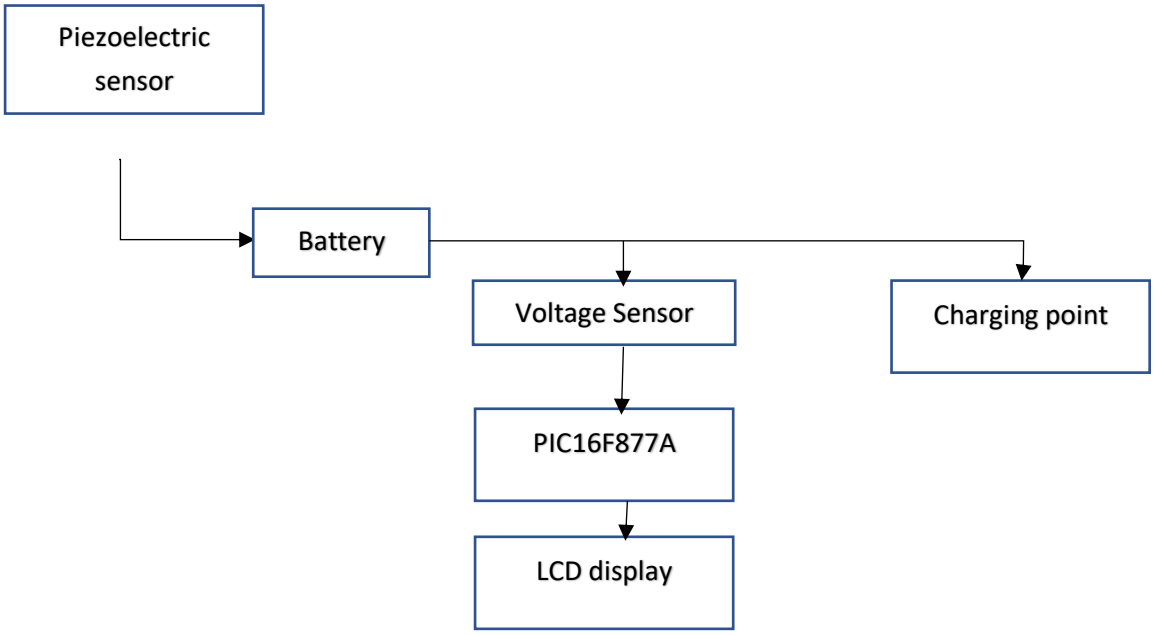
3.1 Introduction

In this paper use of piezoelectric crystal is to generate electric output from surrounding vibration. Piezoelectric materials have crystalline structure. They can convert mechanical energy into electrical energy and vice versa. The produced electrical energy from piezoelectric crystal is very low in the order of 2-3 volts and is stored in battery to charge controller, since it is not possible to charge 12v battery through crystal output. To increase the voltage, the boost converter circuit is used. The level of voltage ranges 12v and it is stored in 12v battery.

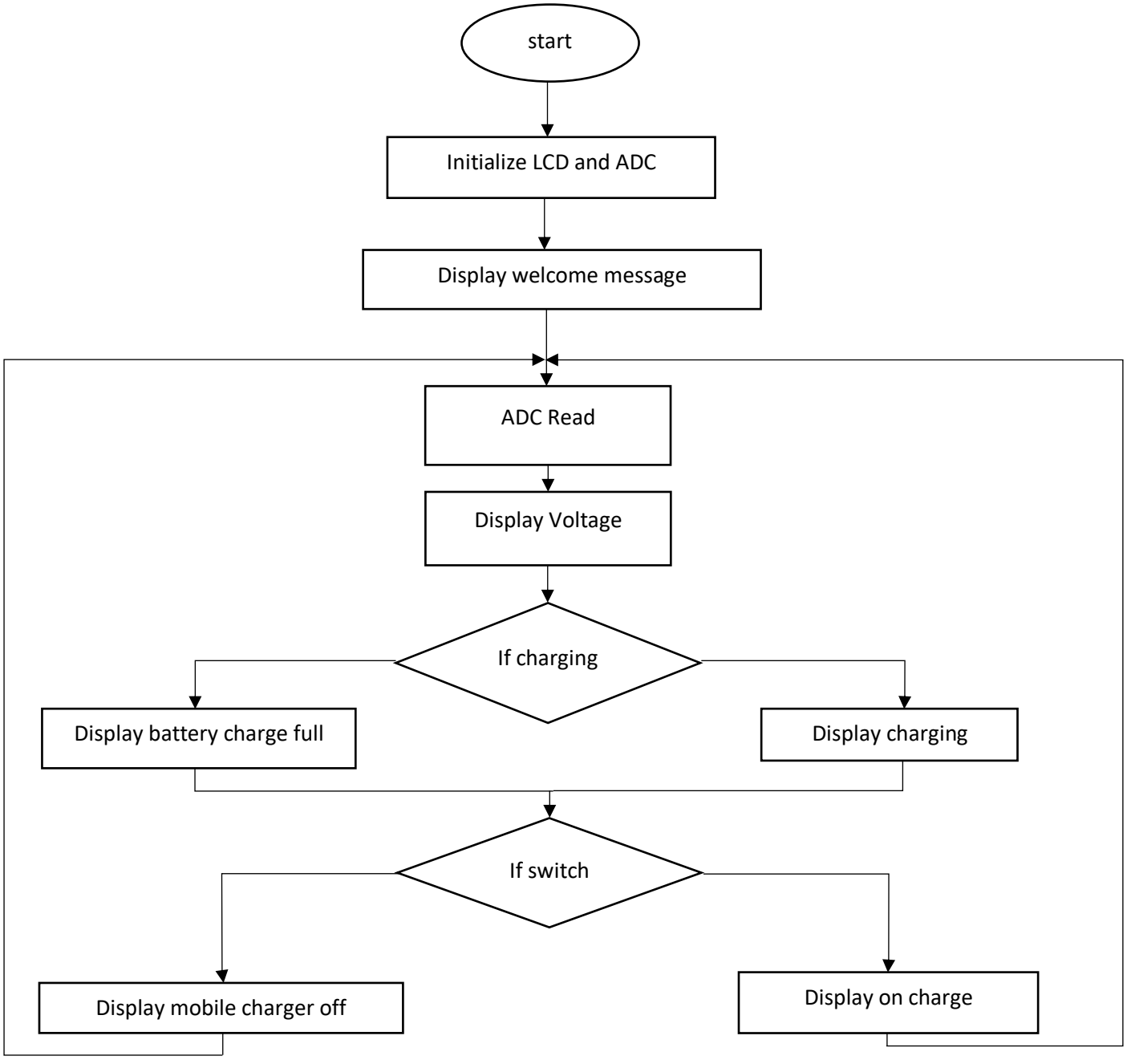
3.2 Methodology

In simple thoughts it can defined as the power is generated by human motion while walking on the piezoelectric sensor, which is pressed and produces kinetic energy, which is then converted into electrical energy. The generated energy is stored in the battery. The energy in the battery is used for charge the mobile phones using the charging port which is installed in the park and to be used for other purposes in the park. All the data is get tracked and stored in the IOT for continuously monitoring and for future purpose.

3.2.1 Block Diagram

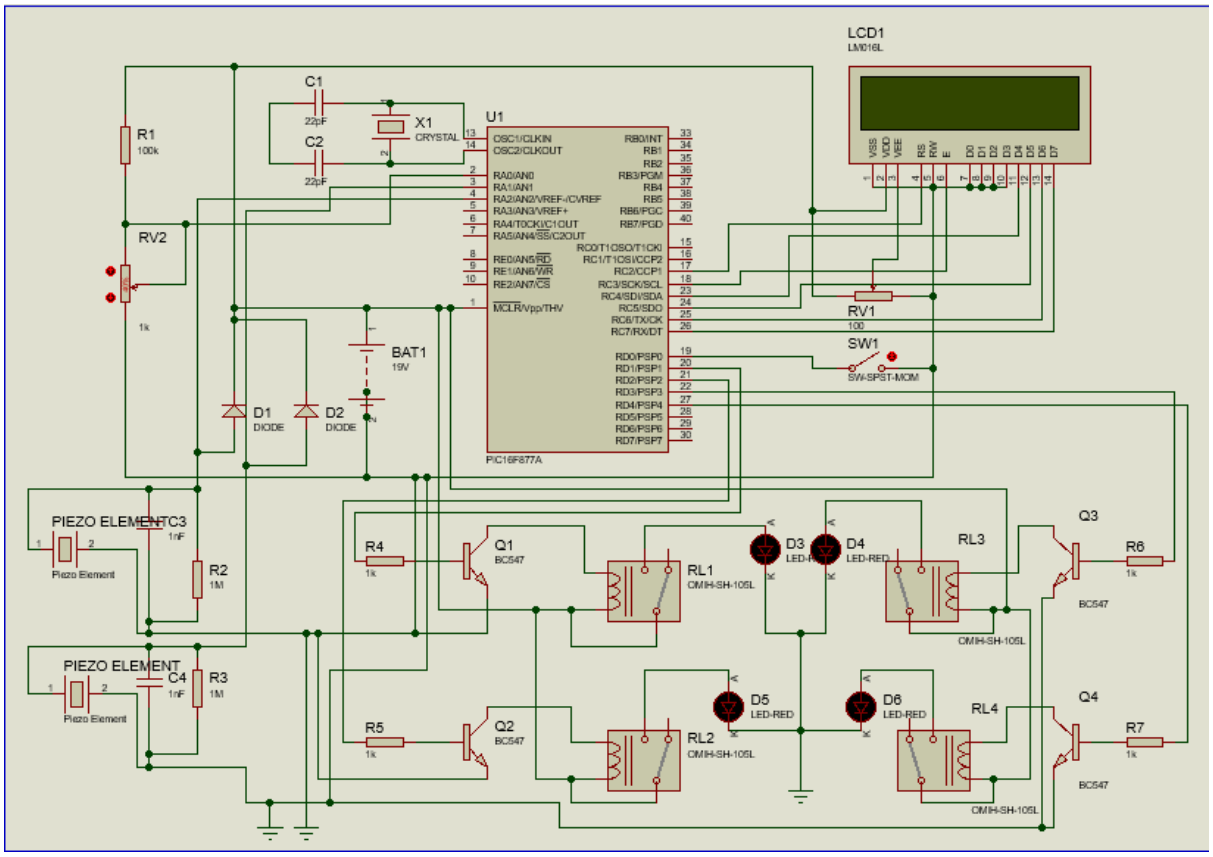


3.2.2 Flow Chart



3.3 Project Hardware

3.3.1 Schematic Circuit



3.3.2 Description of Main Component

The main components of the system include piezoelectric sensors, voltage boosters, voltage regulator, PIC microcontroller, battery, LCD display, LDR and a socket for mobile charging. Here in this this system, at first, the output from an array of piezoelectric sensors is fed into voltage booster. In the system, two voltage boosters are used to boost the voltage to get the desired output. The output from piezoelectric sensor is in the range of 3 V to 4 V. It has to be boosted to a range of 9 V to 12V with the help of voltage boosters.

3.3.2.1 Microcontroller Unit

The main controlling unit of the entire system is a microcontroller. The input of the microcontroller is the output from the voltage generator. For the project PIC16F877A is used.

3.3.2.2 Voltage Booster

It is a DC to DC converter and output voltage greater than the input voltage. The device has at least to semiconductors and one energy storage element. It is a class of switched mode power supply.

3.3.2.3 Simulation Result

The simulation part of the project is carried out with the help of soft wares such as Mikro C and Proteus. LCD Display With the help of the block diagram the circuit design has been started. As the entire project has been controlled by the microcontroller; the design has been started from the controller IC PIC. The basic design now completed is the interfacing of PIC with the LCD display. Here, we are using a 16*2 LCD display. After the completion of this first step in circuit design, the working is verified using the Proteus Software and coding has been written using Mikro e program for PIC.

3.3.2.4 Mobile Charging

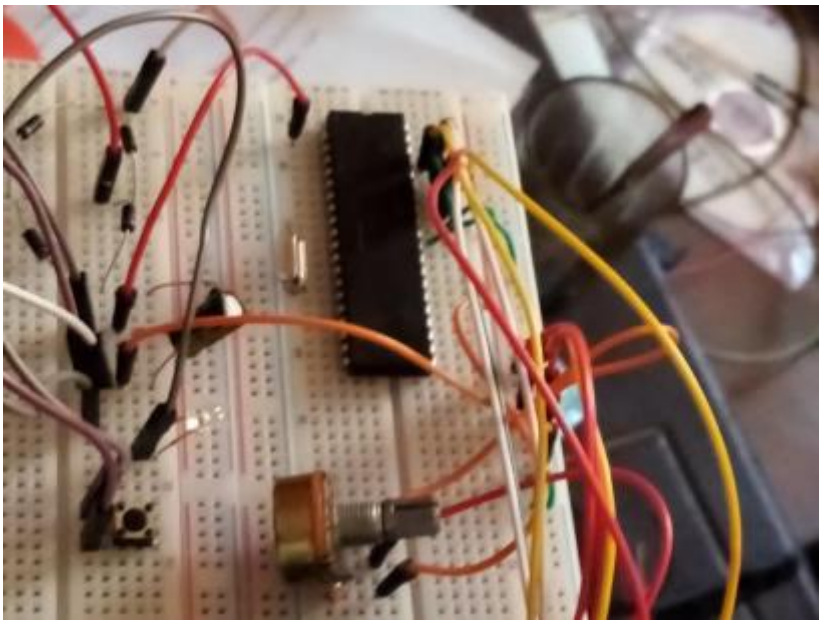
Designed the external circuit connection the as per the block diagram by using PIC16F877A.The input of the PIC is given from the piezo electric crystal. The output from the socket is 5v which can be used for a mobile charging.

3.4 Project Software

In this paper a piezoelectric generator is designed which will generate electrical energy by using applied vibrations and pressure of footsteps during the walking. The renewable energy sources such as piezoelectric material, this non-electrical energy sources are converted into electrical energy. Programming is done using the Mikro C and Proteus software. The Hardware is usually the PCB part. It comprises of PIC microcontroller which is the heart of the system PIC16F877A Microcontroller. The system designed is easy to implement and cost effective.

3.5 Prototype Development

Energy harvesting from mechanical vibration is a potential power source which can be used for conversion to electrical energy through Micro electromechanical systems technology ,In a piezoelectric crystal, the positive and negative charges are separated from each other, but they are symmetrically distributed in order to keep the crystal electrically neutral. When a stress is applied, this symmetrical position is disturbed, and the asymmetrical charge generates a voltage.



3.6 Chapter Summary

CHAPTER 4

4 RESULT AND DISCUSSION

4.1 Introduction

Human race requires energy at very rapid rate for their living and wellbeing from the time, because of this reason power resources have been worn out and enervated. Proposal for the employment and application of extravagant energy in foots of human is very much to the purpose for extremely populated nations like China and India. Where the streets, rail and bus station are over peopled and packed like sardines moving around the clock. So, using such concept the power can be availed and deployed by converting mechanical energy to electrical energy.

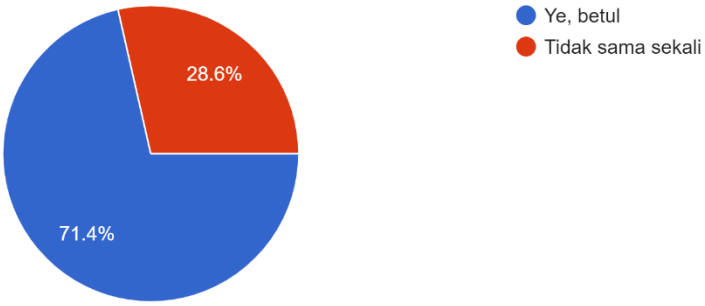
4.2 Result and Analysis

The amount of voltage produced is depend on magnitude and power of press in piezo electric sensor, It has been observed that after press 50 steps, the storage capacitor charges to approximately 3.75 V, In a single step the storage capacitor charges to 0.075 V with eight piezo electric sensor together. when press the push button the charge of capacitor go to led and it turn on.

No. of piezo pressed	Produced voltage
8	0.07 v
4	0.032v
2	0.013v

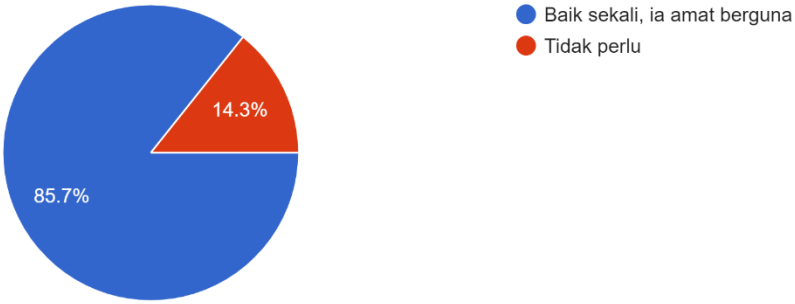
Adakah anda menghadapi masalah untuk mendapatkan sumber kuasa(elektrik) untuk; contohnya mengecas fon di mana-mana dengan mudah ataupun ianya begitu terhad?

7 responses



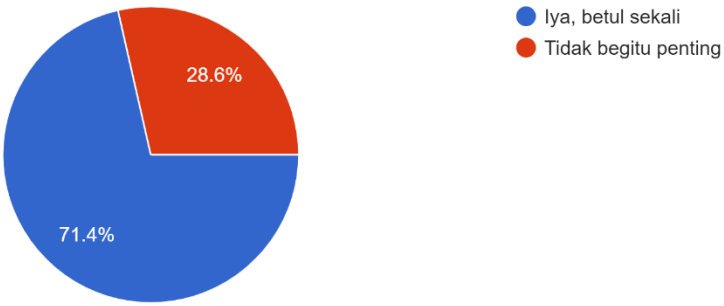
Bagaimana jika anda dapat mendapatkan sumber ini dengan cara hanya berjalan atau memijak plate yang disediakan untuk mendapat sumber elektrik?

7 responses

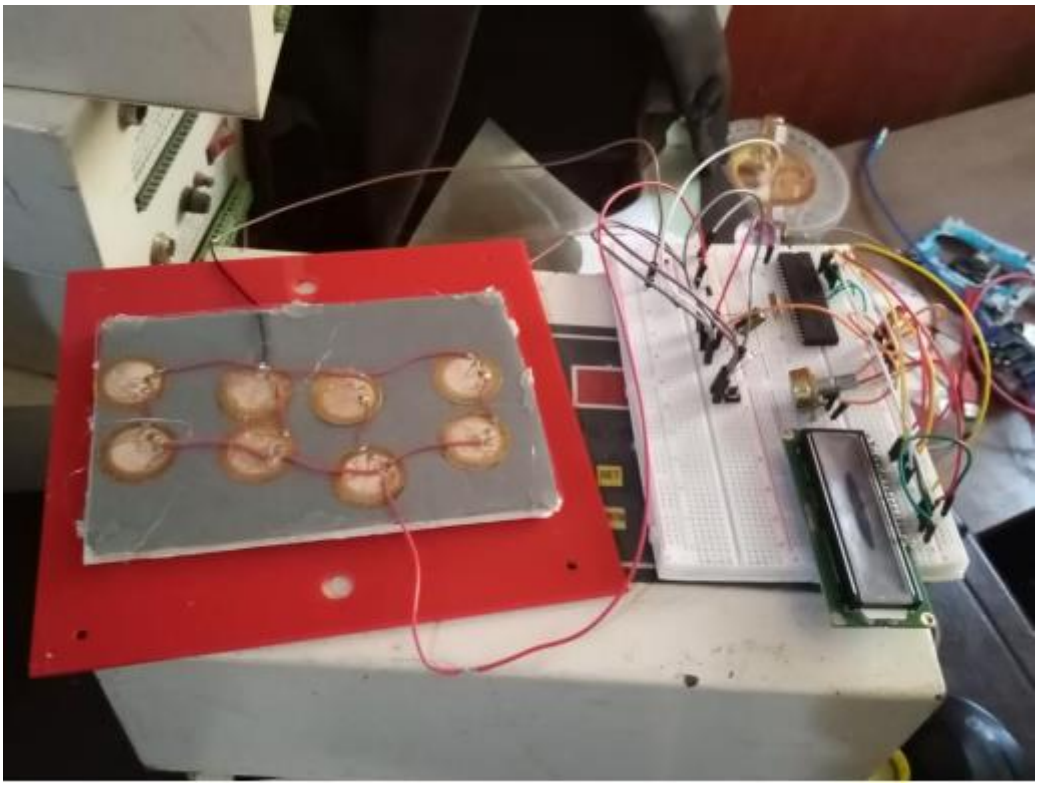


Adakah projek ini dapat memudahkan anda untuk mendapatkan sumber elekrik bagi mengecaskan barang-barang elektronik anda?

7 responses



4.3 Discussion



This chapter describes the implementation of the project in steps. Firstly, every circuit connected separately then all the circuits connected to work with each other the following steps explain that.

Secondly all the components of the project are connected in two circuits one of them representing the main circuit, it contains eight piezo electric sensors to produce energy ,also contains potentiometer all them connected with microcontroller .

4.4 Chapter Summary

CHAPTER 5

5 CONCLUSION AND RECOMMENDATION

5.1 Introduction

A prototype piezoelectric floor tile was built to study the amount of energy that could be harvested. Using this prototype, the energy harvested was recorded and discussed. After the energy had been harvested, methods to store the energy were looked into. Two experiments were conducted to investigate harvesting performance. In the first experiment, connection between each piezoelectric element was varied and in the second experiment the distance between each column of piezoelectric element was varied. Rechargeable batteries were used as storage, where the energy harvested from the piezoelectric array will charge the battery. By conducting these experiments, it was found that the prototype floor mat produced the highest current of 48.5μA, when the piezoelectric array was connected in parallel, with a distance that matches the average foot size.

5.2 Conclusion

In this project, we showed that this footstep power generation system can be a good alternate to produce electricity. This system is really beneficial for such households that suffer frequent electricity cuts, or in the areas where electricity is still not available. Also, as the major part of electricity is generated by fossil fuels that keeps polluting our planet on a daily basis, this is an eco-friendly way of generating electricity without any pollution, any sound, any smoke that makes it a system that can be installed in any public place or household without any compromises. This mechanism can be installed in staircases, can be installed in various crowded places like stations, malls, foot over bridges, pedestrian walks, parks.

5.3 Suggestion for Future Work

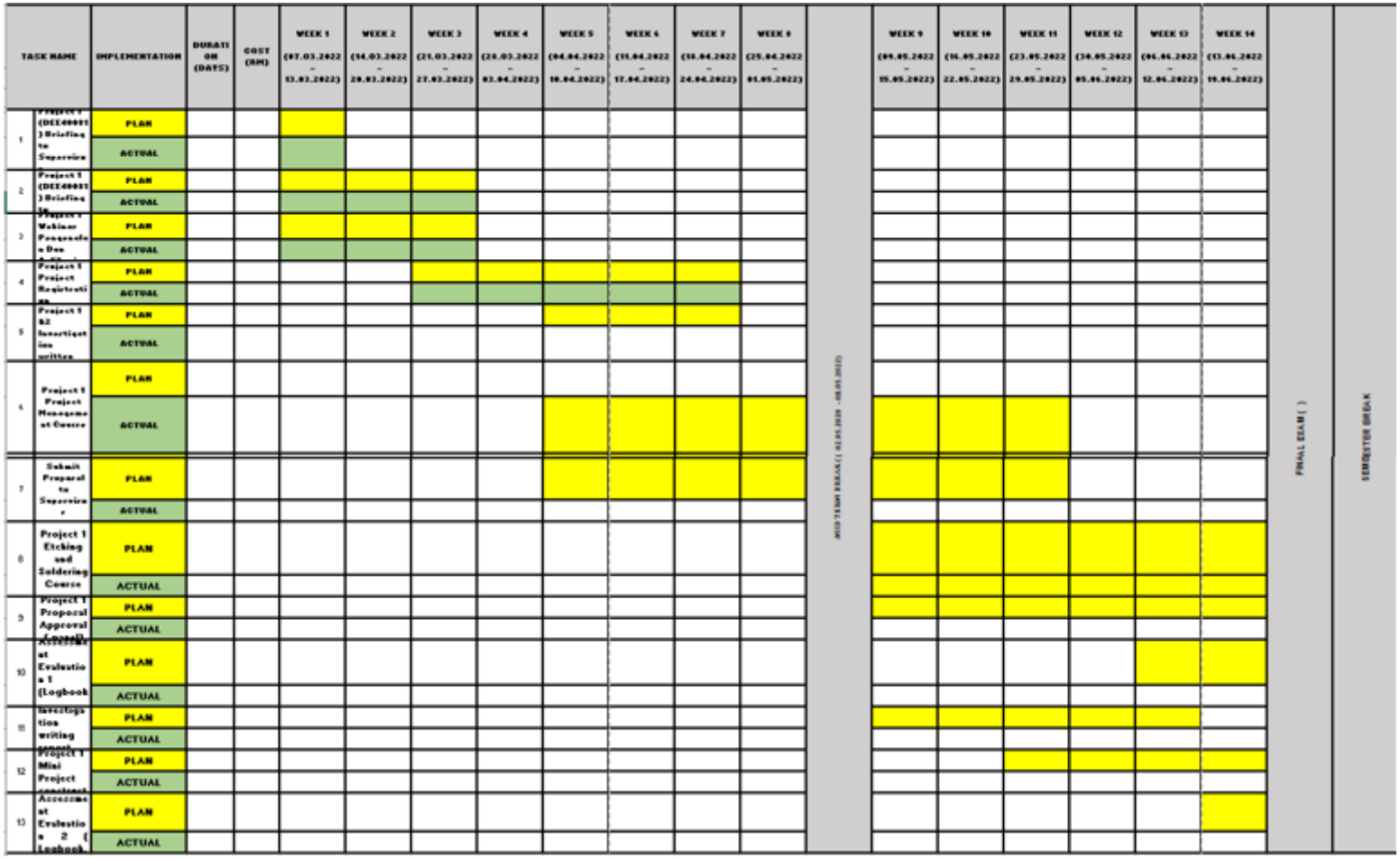
The piezoelectric crystals have been starting better use with the positive result. In China and Japan, maximum public movement is observed in railway station, airports and shopping malls. Hence this place can be used for piezoelectric crystals for generation of electric power. Apart from all the above places attempts are made to develop energy from our daily life by initialling piezoelectric in shoes thus in each step piezoelectric crystal can be compressed which can turned enough power to charge a cell phone, mp3 player etc. Through this we can generate electric power and used that for small electronic gadgets.

CHAPTER 6

6 PROJECT MANAGEMENT AND COSTING

6.1 Introduction

Gant Chart and Activities of the Project



6.2 Cost and Budgeting

No.	Component and materials	The unit price	Quantity	Total
1	Arduino UNO set	RM 23.50	1	RM 23.50
2	Piezoelectric sensor set	RM 10.00	5	RM 50.00
3	Charging tower	RM 300.00	1	RM 300.00
4	Voltage sensor	RM 5.00	5	RM 25.00
5	LCD display	RM 10.00	5	RM 50.00
6	Battery	RM 100.00	1	RM 100.00
7	Other materials	RM 50	-	RM 50.00
			Total :	**RM 598.50**
	List of other costing			
1	Transportation			
2	Postage			RM25
3	Craft Work			RM 20
4	Internet			RM 20
5	Application			RM 75
			Total :	**RM 140**
			Overall total	**RM 738.50**

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