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Footstep Piezo Generator

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Outline

- Project definition
- Project Objectives
- Project Specifications
- Project block diagram
- Background
- Previous Projects
- Planning
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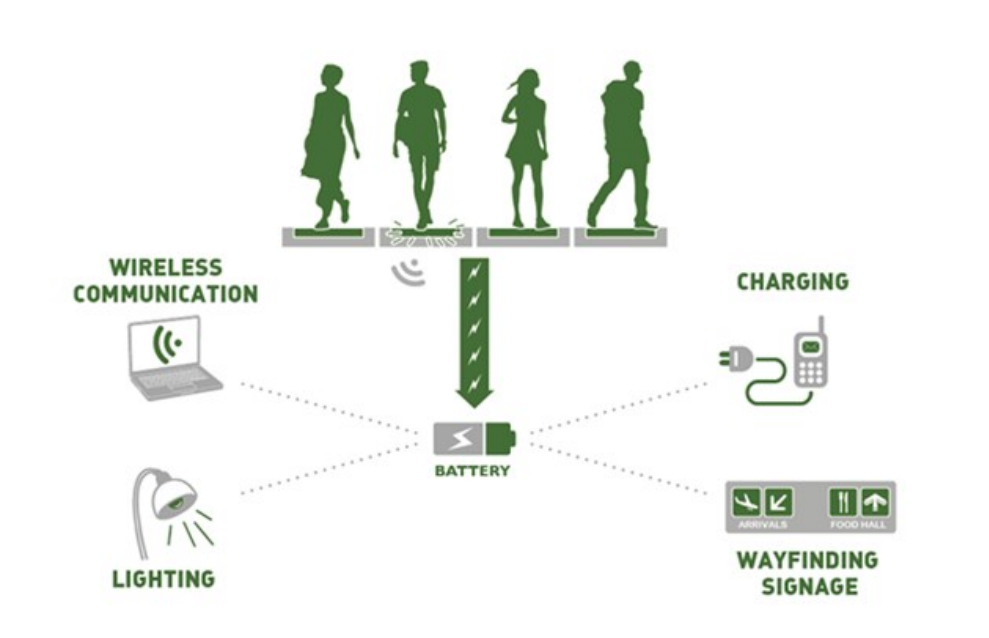
- SS2 design and testing
- References

Project definition

- To design a system that generates power by applying mechanical pressure.



Project objectives

- 1- Generating power out of free energy.
- 2- To spend less money on power generation.
- 3- To encourage people to use different ways of generating power.
- 4- To apply and experiment with our theoretical knowledge.

Project Specifications

- 1- 22x26 fiberglass plate.
- 2- 8 piezoelectric transducers.
- 3- Display the number of steps applied and voltage generated on rectifier using LCD.
- 4- 9V DC supply.

Design constraints: Environmental

- The piezoelectric sensors design were addressed with respect to the waste the generator produces. The intent is to minimize power consumption of this design. The power consumption level is an environmental concern because the more power the users. We will lower power parts by generating power from free source.

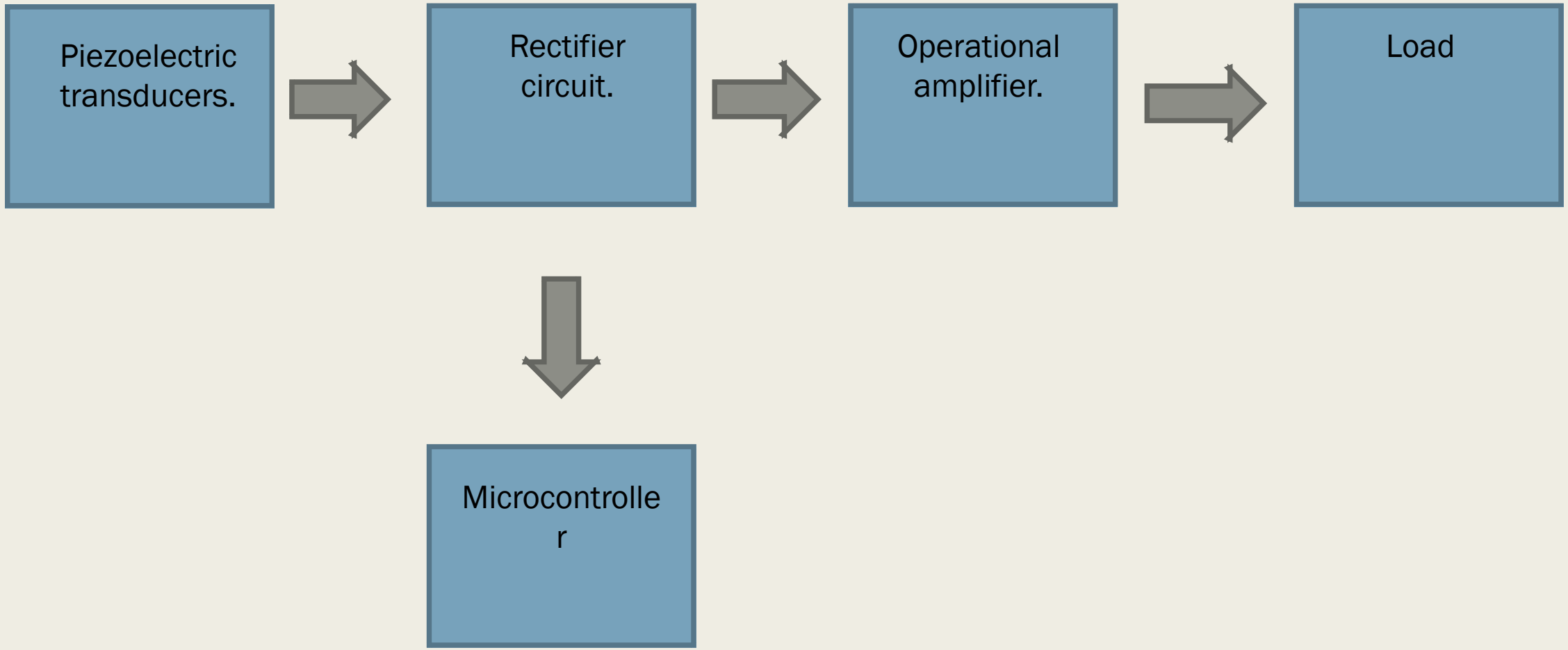
Design constraints: Ethical

- The designs were considered in relation to common morals. The project is able to perform basic tasks that reinforce important EE concepts in footpaths, hospitals, factories etc…

Design constraints: Health and safety

- Our design was considered with respect to assembly in the lab environment. There are no addition health and safety risks involved with the advance capabilities module.

Project block diagram



Background information

- Definition.
- How it works.
- Materials.

• Definition

Piezoelectric sensor is a device that uses the piezoelectric effect, to measure changes in :

- Pressure
- Acceleration
- Temperature
- Strain
- Force

By converting them to an electrical charge.

How it works

- A piezoelectric transducer has very high DC output impedance and can be modeled as a proportional voltage source and filter network.
- The voltage V at the source is directly proportional to the applied force, pressure, or strain.
- The output signal is then related to this mechanical force as if it had passed through the equivalent circuit.

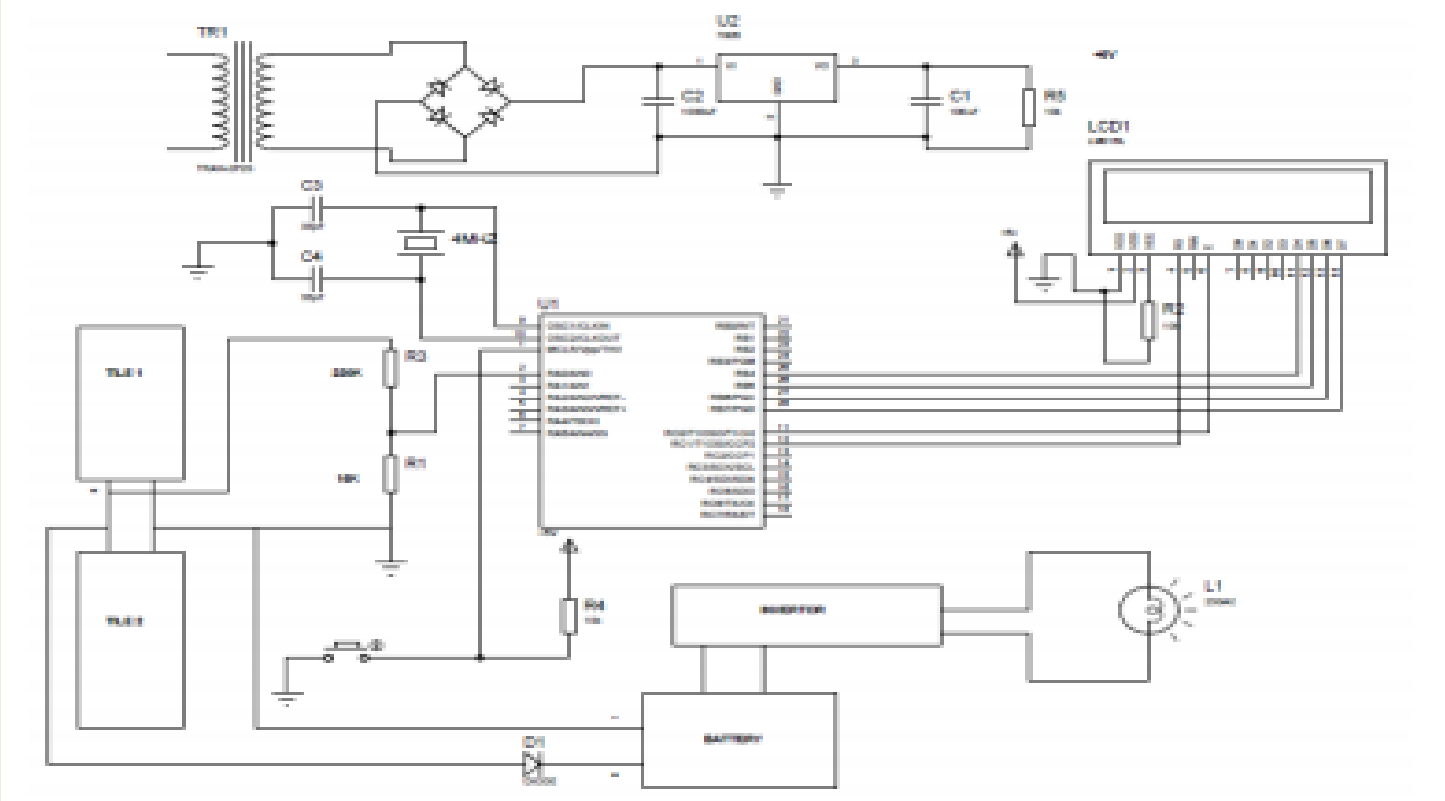
- Materials

PZT is a crystalline material that contains:

- Lead
- zirconium
- Titanium

Previous Projects (1)

International Journal of Scientific & Engineering Research, Volume 8, Issue 3, March-2017, Footstep Voltage Generator using Piezo-Electric Transducers

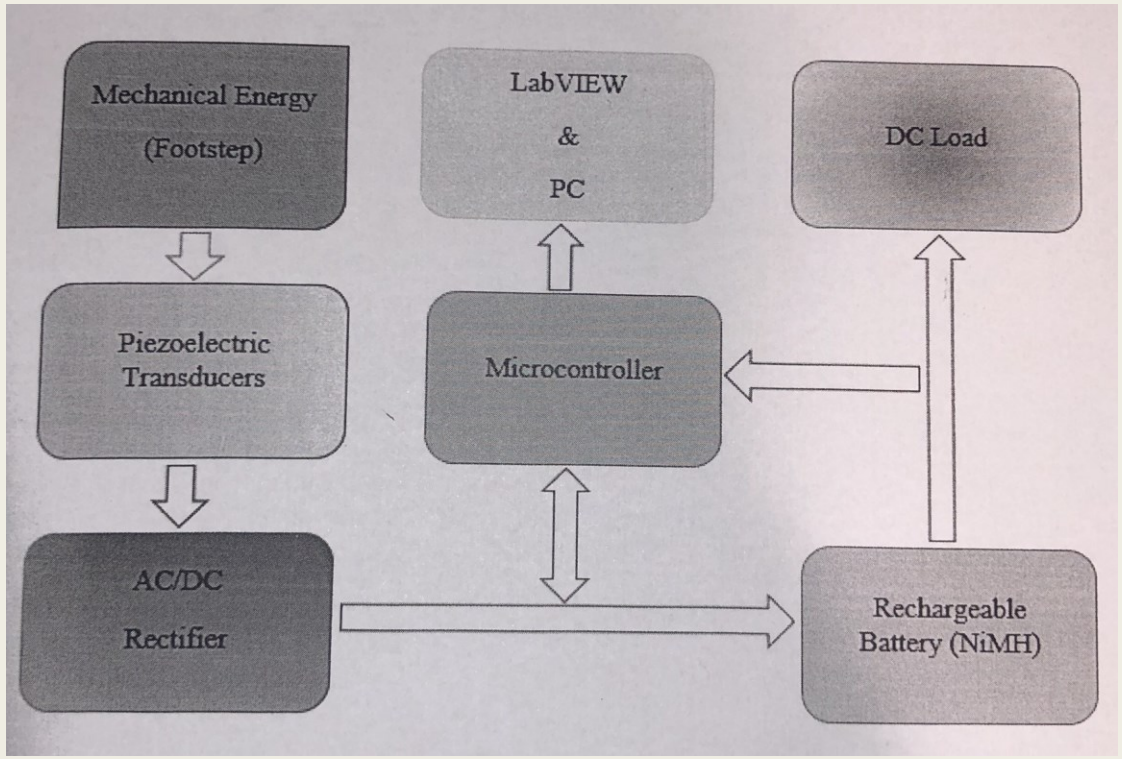


Previous Projects (1)

Previous project 1	Our project
Not using a micro controller	Using Arduino UNO
Connection of the piezo sensor is in series	Connection of the piezo sensor is in parallel

Previous Projects (2)

Prince Mohamed Bin Fahad University, 2015

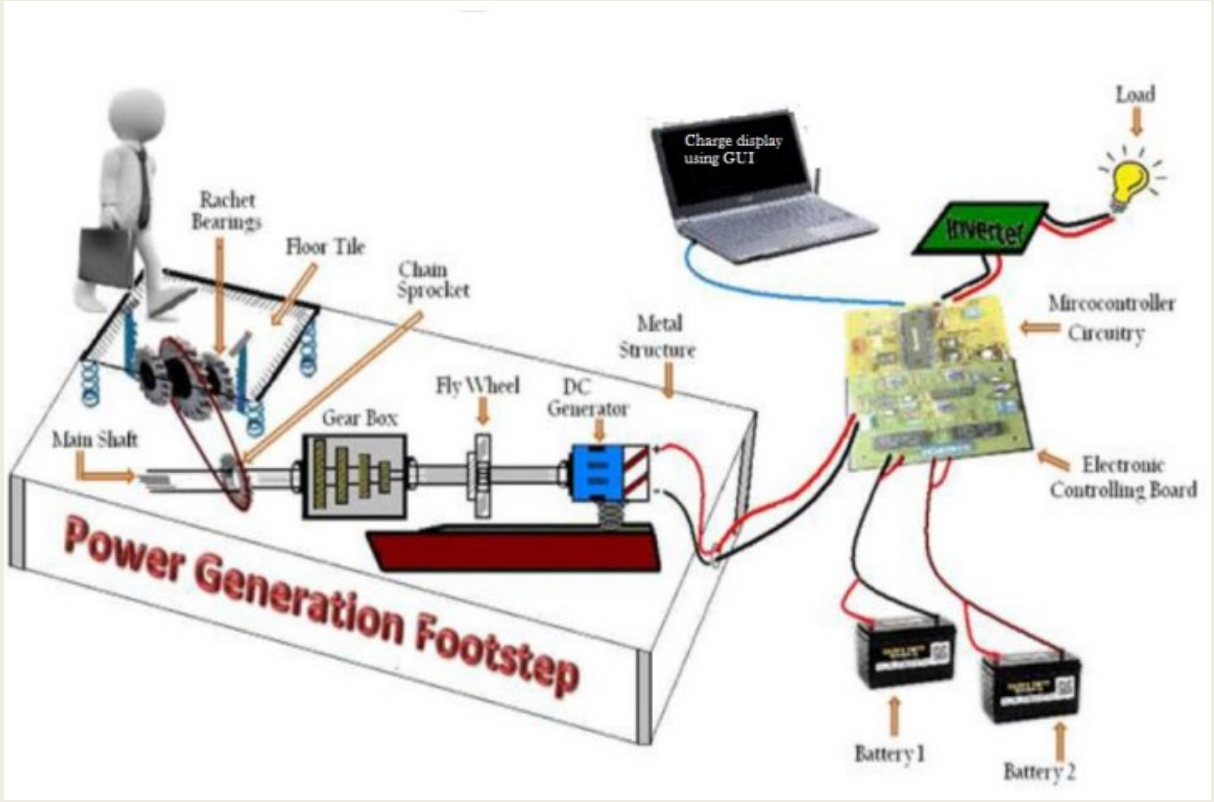


Previous Projects (2)

Previous project 2	Our project
Used a wood plate	We used a fiber glass
Microcontroller MyRio	Microcontroller Arduino UNO
Multiple plates& sensors connected in series	One plate and sensors connected in parallel

Previous Projects (3)

Al-Akhawayn university, spring 2017, footstep renewed tiles.



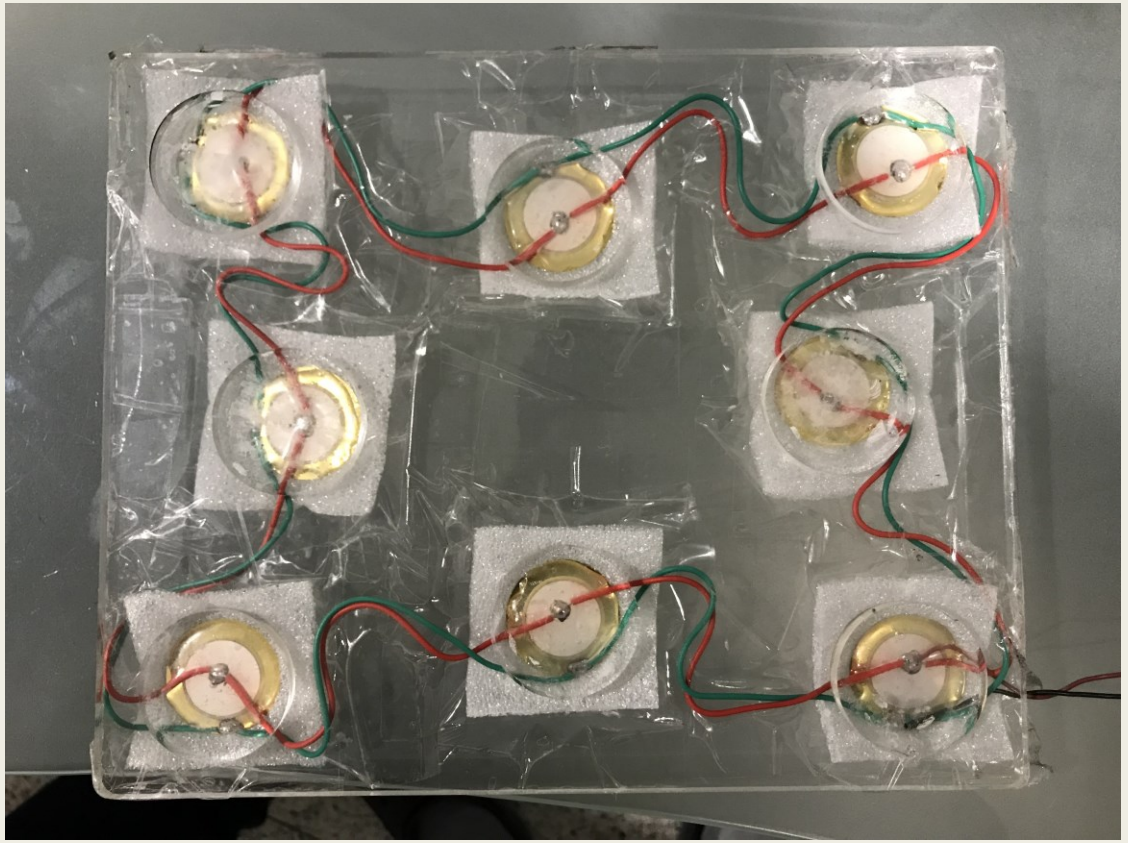
Previous Projects (3)

Previous project 3	Our project
Galvanized steel to protect the system from the floor	No protection from the floor
Piezoelectric sensor connected in a triangular shape	Singular piezoelectric transducers connected in a rectangular shape
using java code and designed with NetBean	Using Arduino UNO designed with C language

Budget estimate

Name	Quantity	Price
Various capacitors	7	48
Ultra capacitors	14	450
Various resistors	20	40
Arduio UNO	1	120
Voltage regulator	2	20
Transistor BC547	2	20
1N4007 diode	5	10
12V Battery lead acid	1	50
LCD screen	1	30
Piezoelectric material	8	150
Weighing machine	1	100
Power transistors	4	20
Other materials		150
Total		1208 SAR

Design subsystem 1



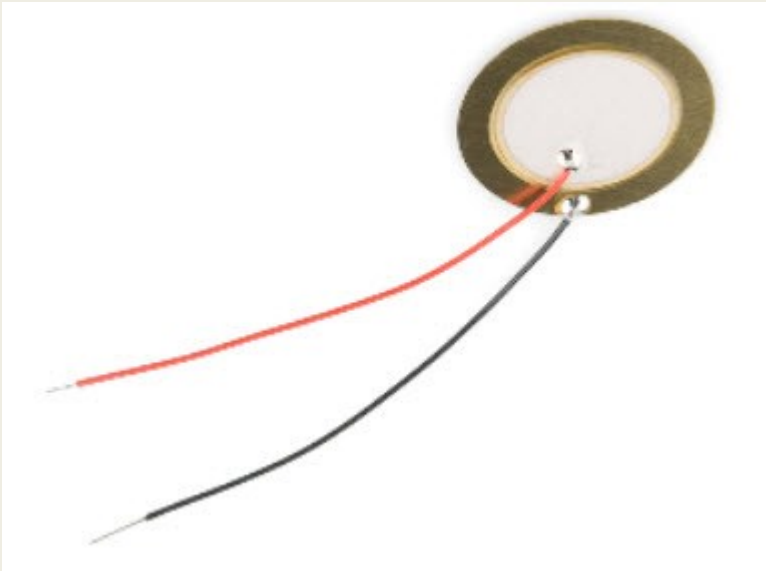
Plates options

Fiberglass

Glass

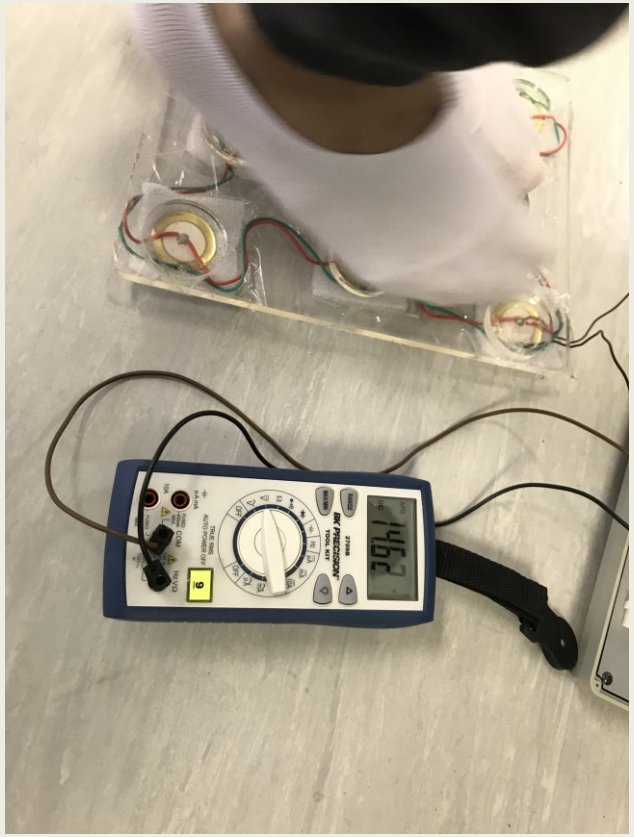
Piezo sensor options

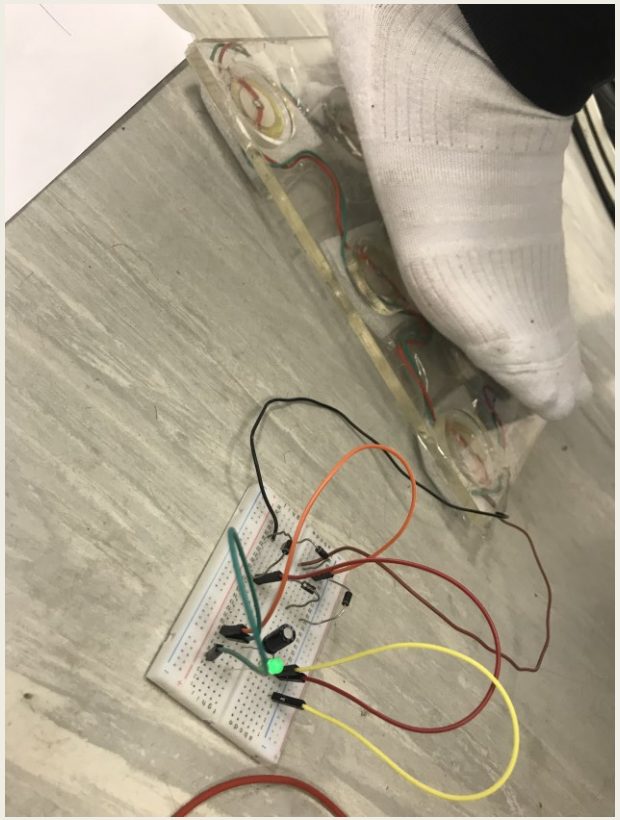
Large sized PZT



Small sized PZT

Testing SS1

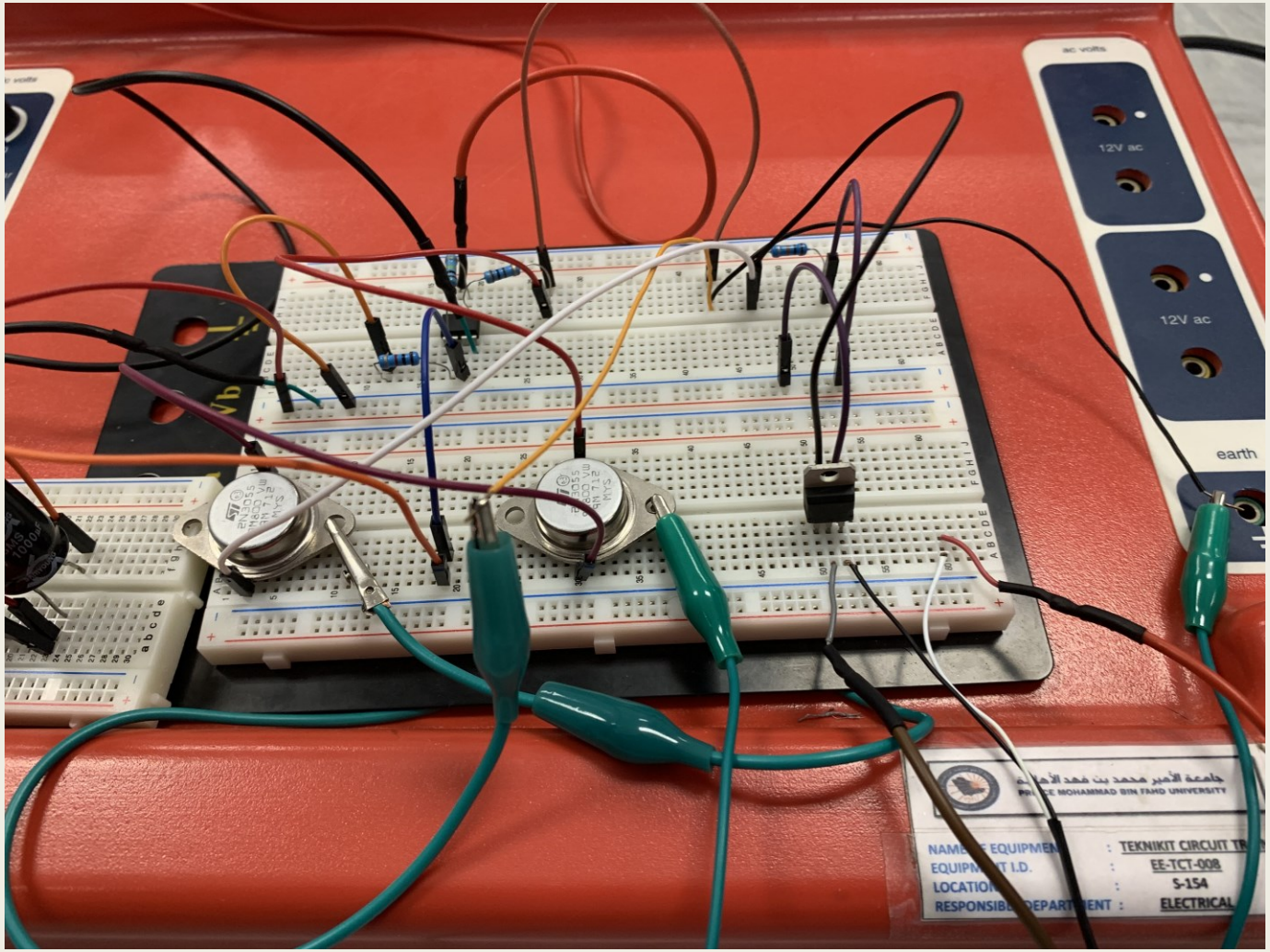




Testing SS1

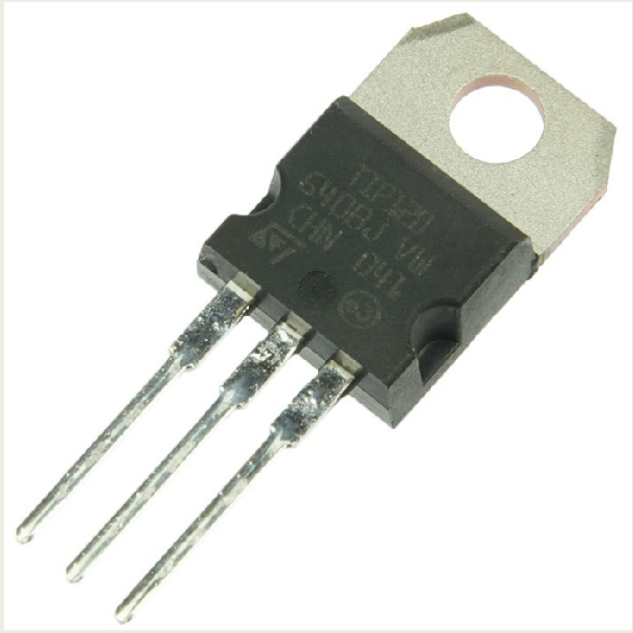
Time	Force	Load	Voltage measured	Current measured	Power
30 Seconds	70-80KG	1Mohms	10V	8.5uA	8.5X10 -5W
30 Seconds	70-80KG	1Kohms	0.09V	100uA	9X10^ -6W
30 Seconds	70-80KG	680hms	0.06V	115uA	6.9X10^-6W
30 Seconds	70-80KG	100ohms	0.02V	140uA	2.8X10^-6W

Subsystem 2: Amplifying circuit



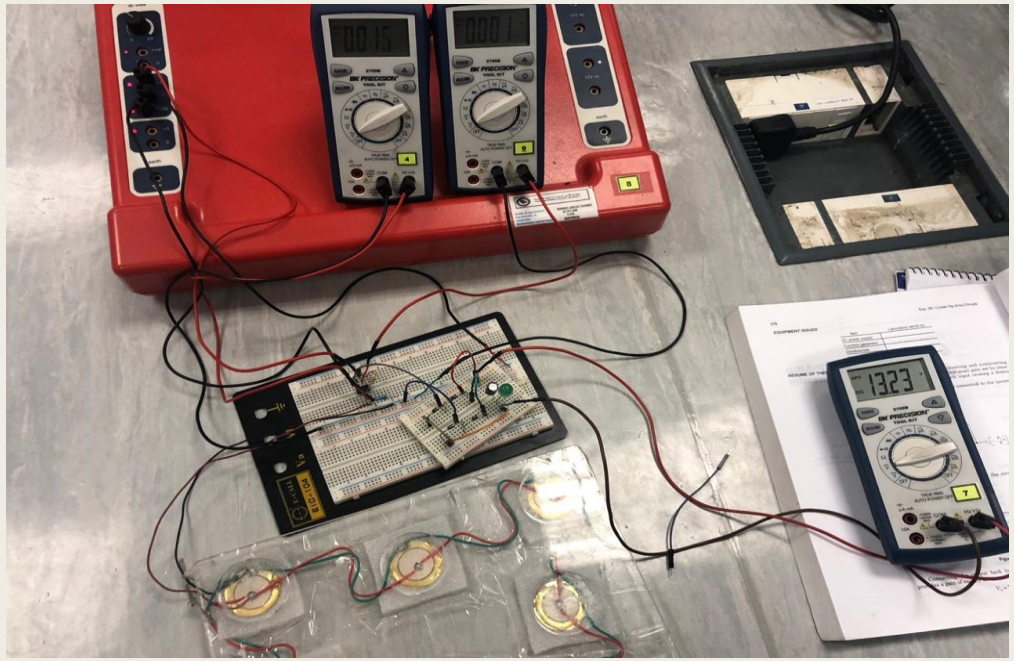
Subsystem 2: Options

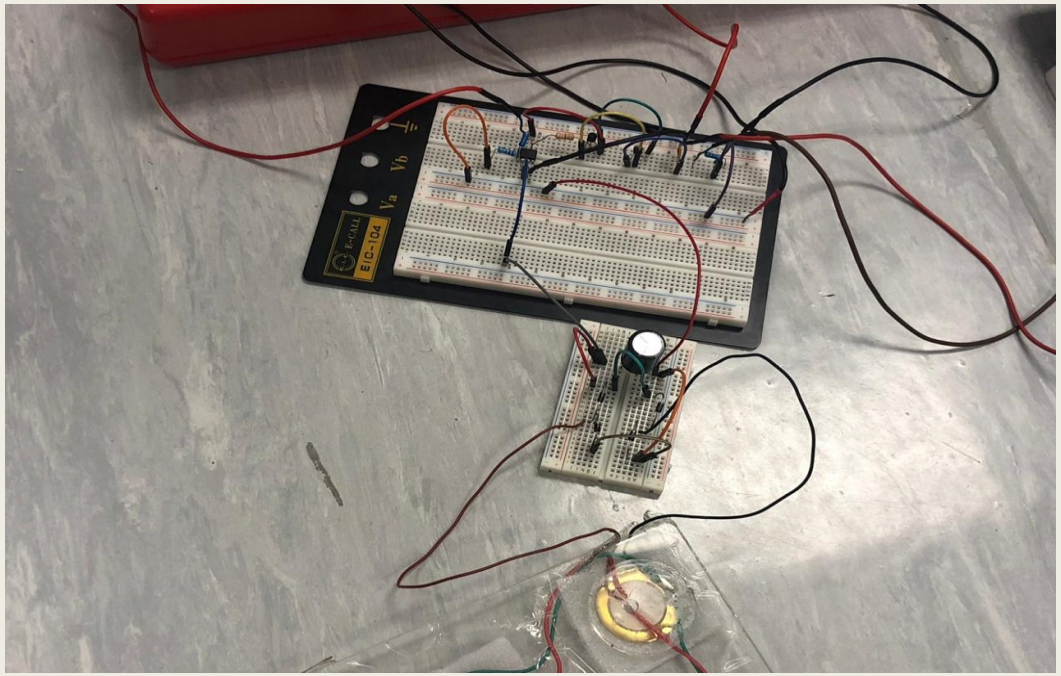
2n3055 power transistor



Tip 120 transistor

SS2: testing



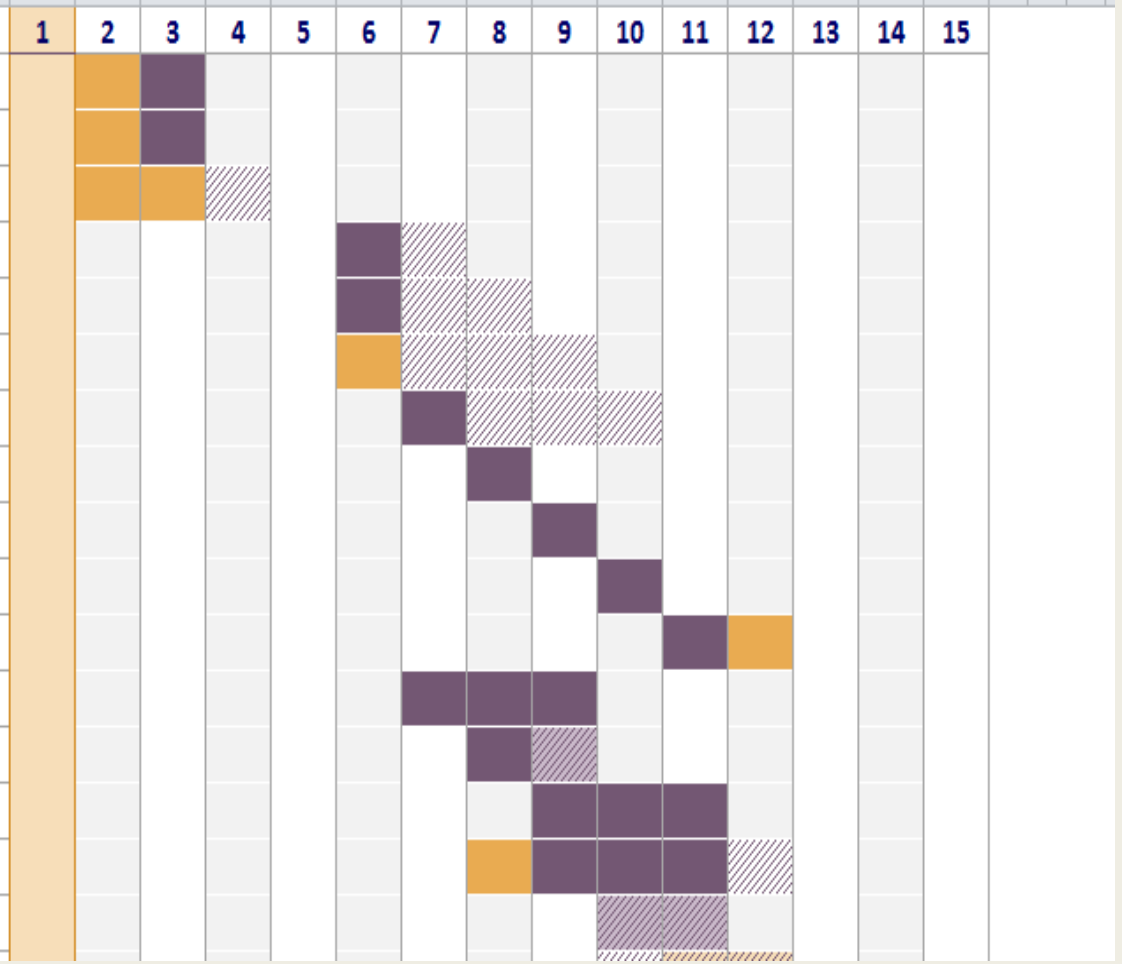


SS2: testing

Force	Load	Voltage	Current	Power
70-80Kg	2.5KOhms	5V	2mA	0.01W
70-80Kg	1KOhms	5V	5mA	0.025W
70-80Kg	100Ohms	5V	17mA	0.085W
70-80Kg	10Ohms	5V	18mA	0.09W

Plan and completed work

Write plan	3	1	All	2	2	100%		
redesign subsystem 1 (weighing ma	3	1	All	2	2	100%		
search and acquire components	4	1	All	2	2	100%		
design subsystem 2(monitoring circ	6	2	All	6	1	100%		
test subsystem2	6	3	All	6	1	100%		
integrate subsystem1&2	7	3	All	6	1	100%		
meeeting advisor for feedback	7	4	All	7	1	100%		
ordering additional components fo	8	1	All	8	1	100%		
consulting advisor for subsystem 2	9	1	All	9	1	100%		
preparing for midtem presentation	10	1	All	10	1	100%		
working on subsystem 2	11	1	All	11	2	100%		
Test inegrated SS1 &SS2 and tweak	7	3	JA,KH	7	3	100%		
Prepapre final report	8	2	All	8	2	50%		
Prepapre final presentation	9	3	All	9	3	100%		
Prepare Project Demo	9	4	All	8	4	100%		
Submit Rpt/PPT/Brochure	10	2	All	10	2	0%		



Teamwork and project management

Task	Ahmed	Khalid	Jubarah	Azeb
Search & acquire components	30%	25%	20%	25%
Design & Implement Subsystem 1	25%	35%	20%	20%
Design & Implement Subsystem 2	20%	20%	35%	25%
Testing	25%	20%	20%	35%
Write Reports & Presentations	20%	20%	35%	25%

Recommendations

- Add more plates for bigger power and bigger load.
- Change type of sensors but consider the bigger sensors require bigger force applied in order to generated power efficiently.
- Test both parallel and series connection for the sensors to make sure the output desired is met.
- Consider the very high output DC impedance from the piezoelectric sensors.
- Springs can be used below the weighting plate in order to increase the force applied.

Project demo

References

- 1- https://www.ijser.org/researchpaper/Footste-Voltage-Generator-using-Piezo-Electric-Transducers.pdf/ accessed 1/10/2018
- 2-https://ijmter.com/published_special_issues/28-04-2016/foot-step-power-generation-using-pic-microcontroller.pdf /accessed 2/10/2018
- 3-http://nevonprojects.com/advanced-footstep-power-generation-system/Accessed 1/10/2018
- 4-https://www.slideshare.net/ansarimasroof/foot-step-power-generationreport-pdf-70007526 }Accessed 1/10/2018
- 5-https://www.ijser.org/researchpaper/Footstep-Voltage-Generator-using-Piezo-Electric-Transducers.pdf Accessed 2/10/2018
- 6- https://ijmter.com/published_special_issues/28-04-2016/foot-step-power-generation-using-pic-microcontroller.pdf Accessed 30/9/2018