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Title: Teaching solar energy harvesting based on an educational solar cell, information technologies and basic electronics

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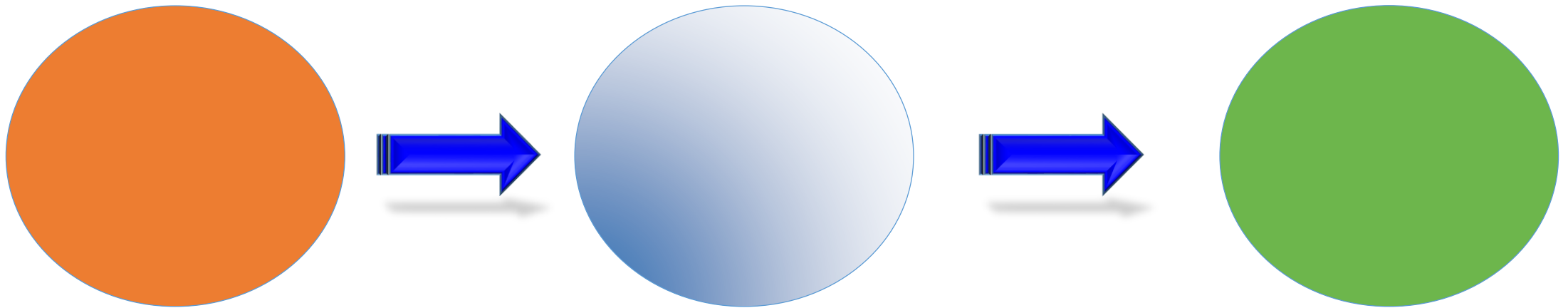
Introduction

Energy Harvesting

Collecting

Transforming

Electrical
Energy





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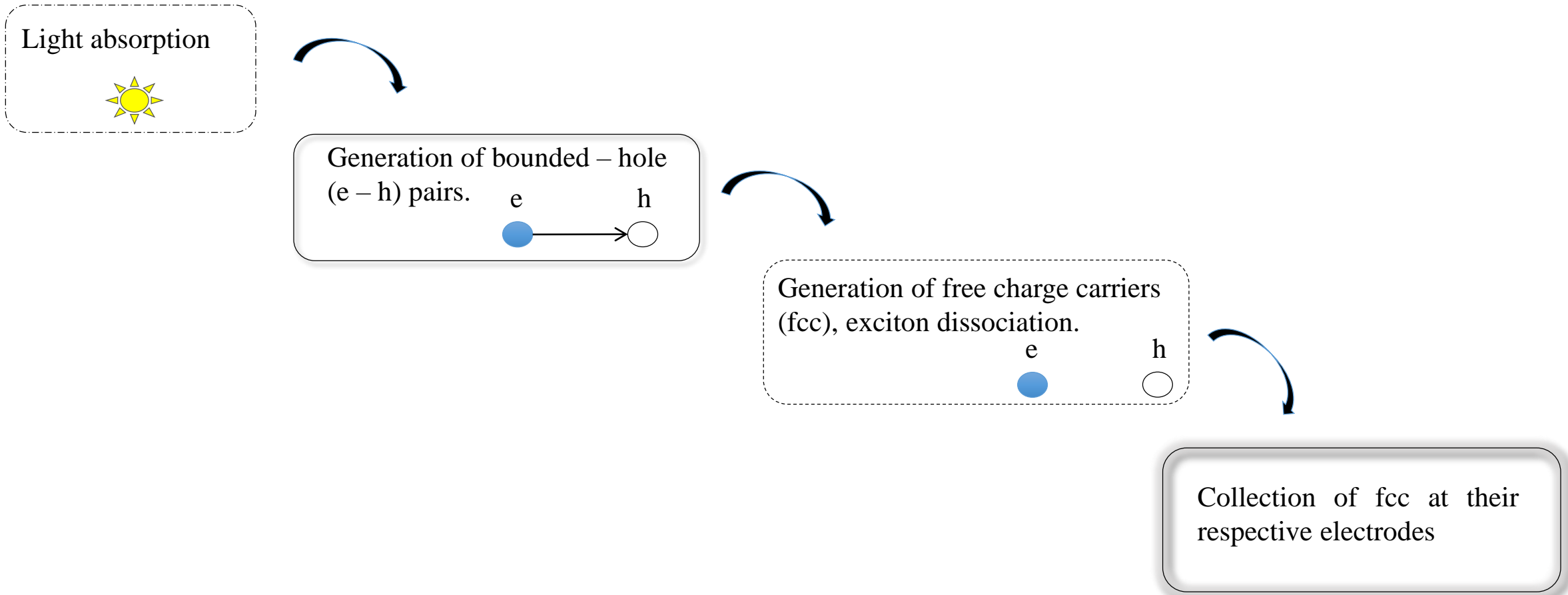
Methodology



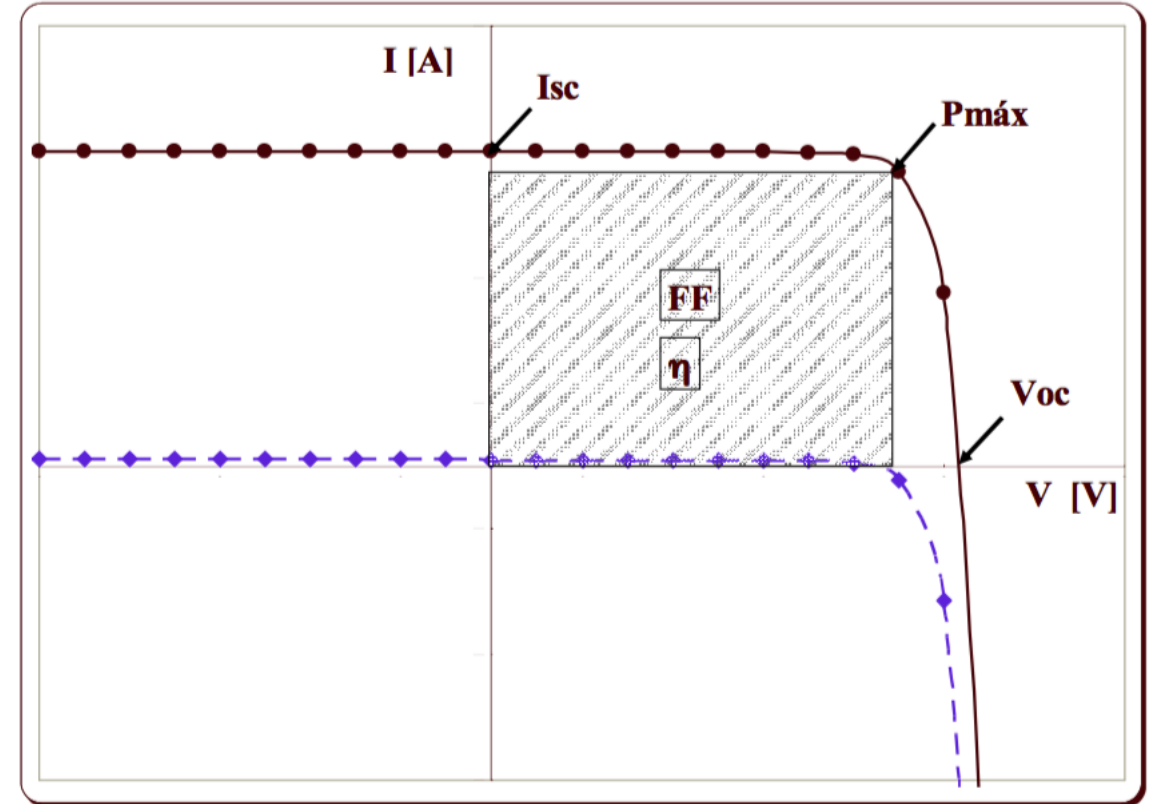
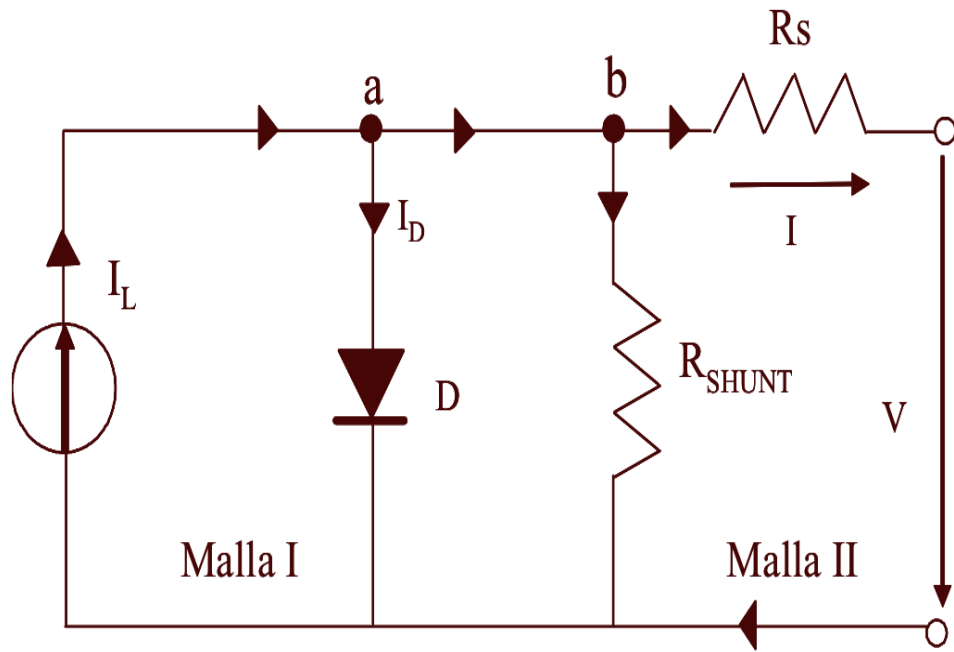


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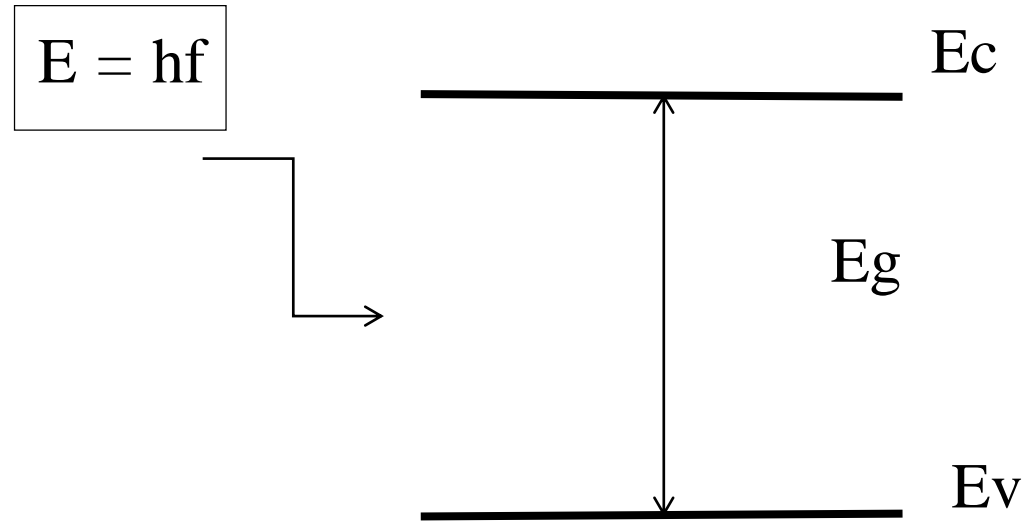
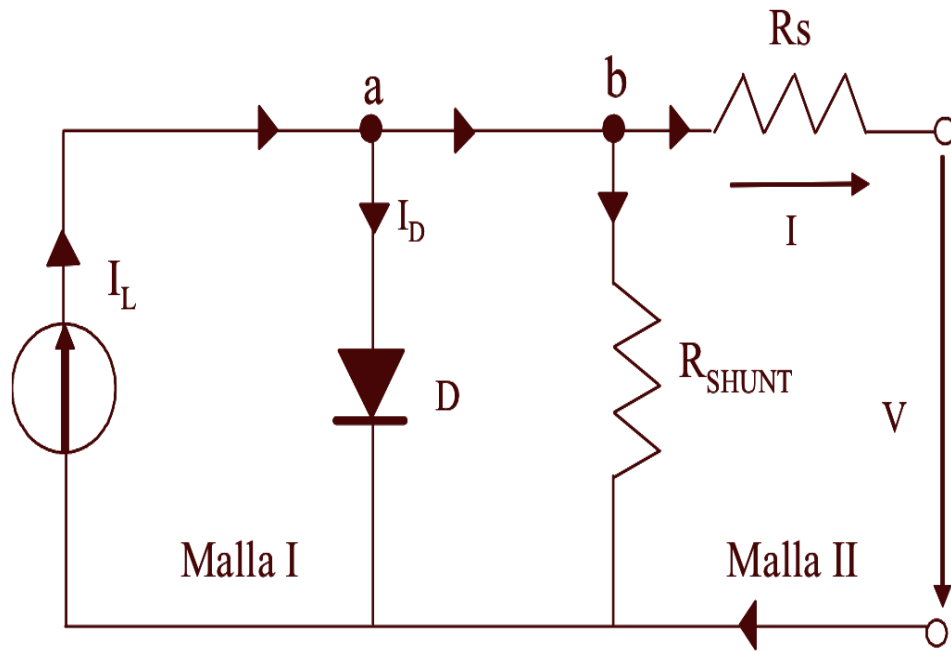
Methodology



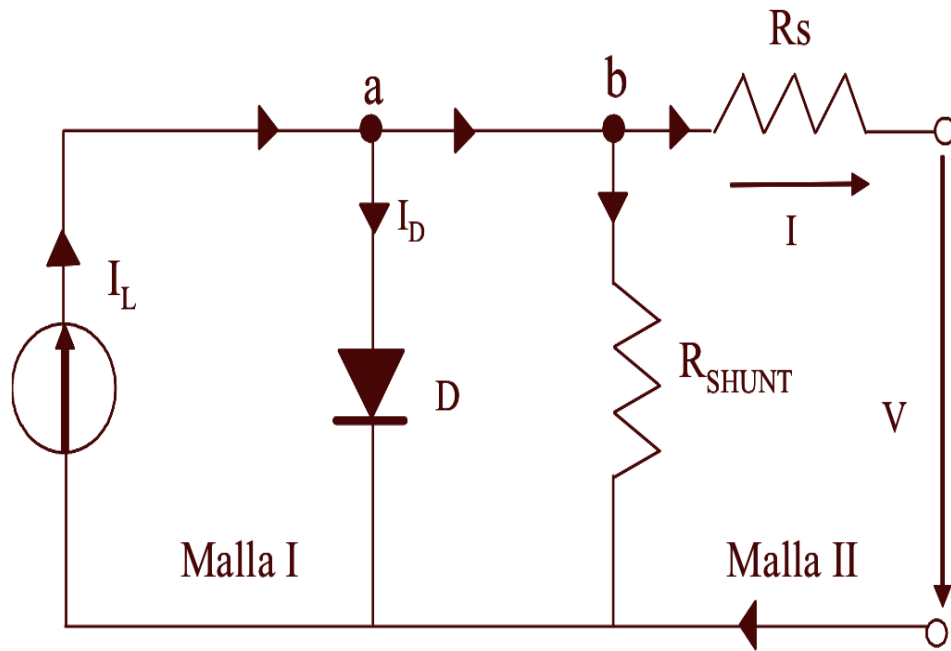
Methodology



Methodology



Methodology



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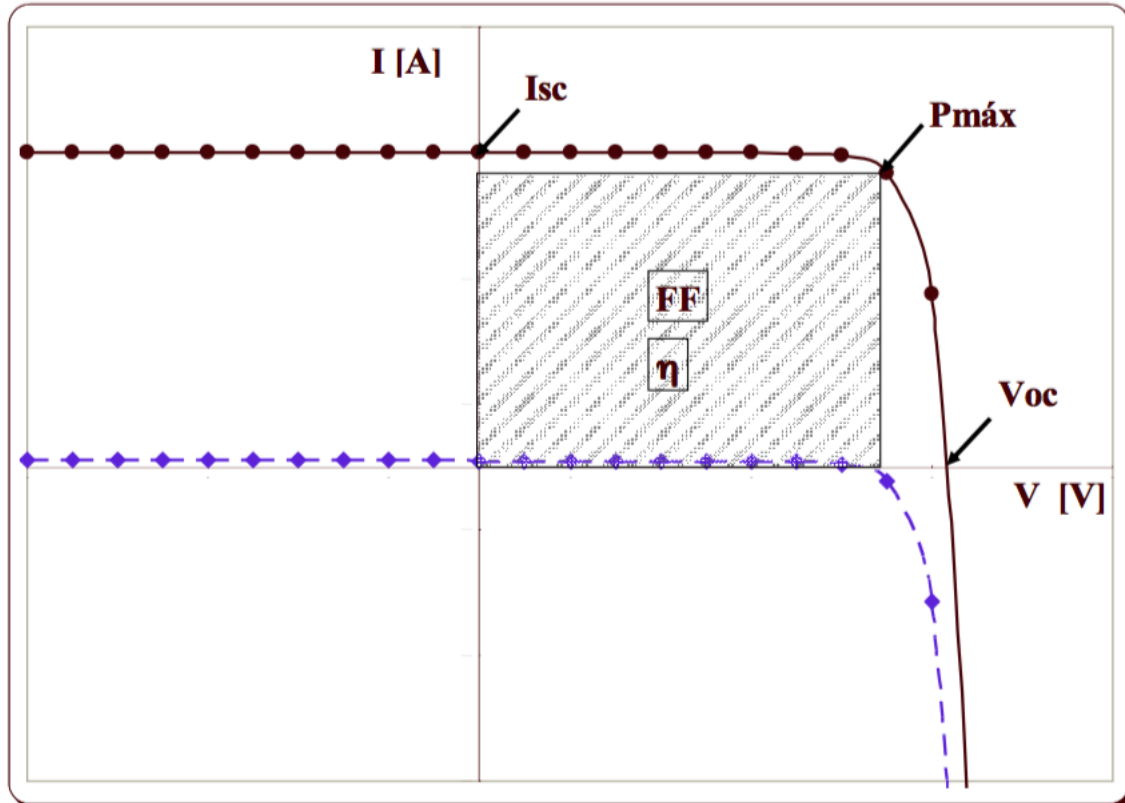
Voc

Jsc



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Methodology



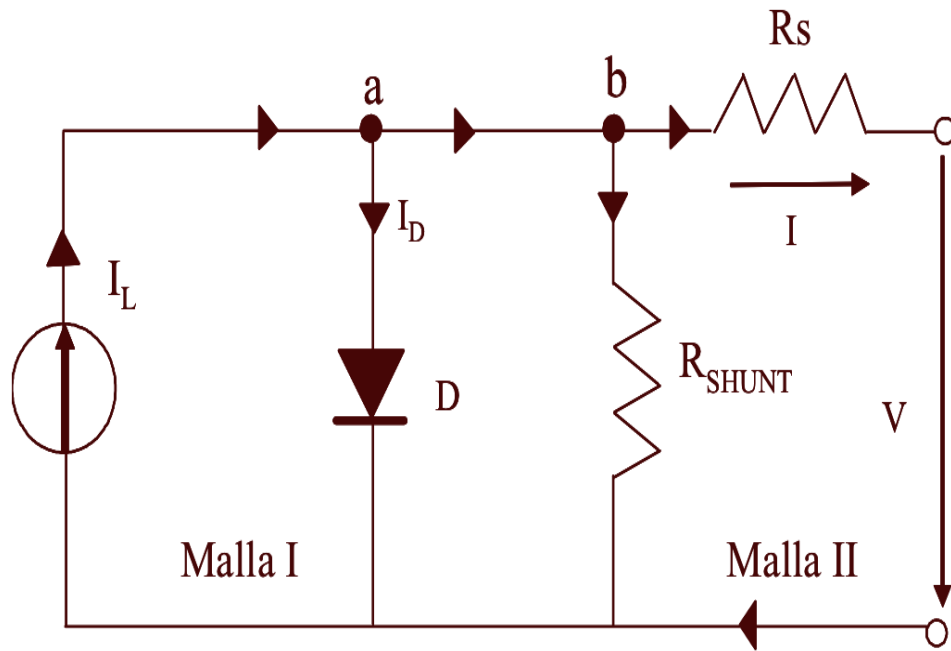
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Methodology



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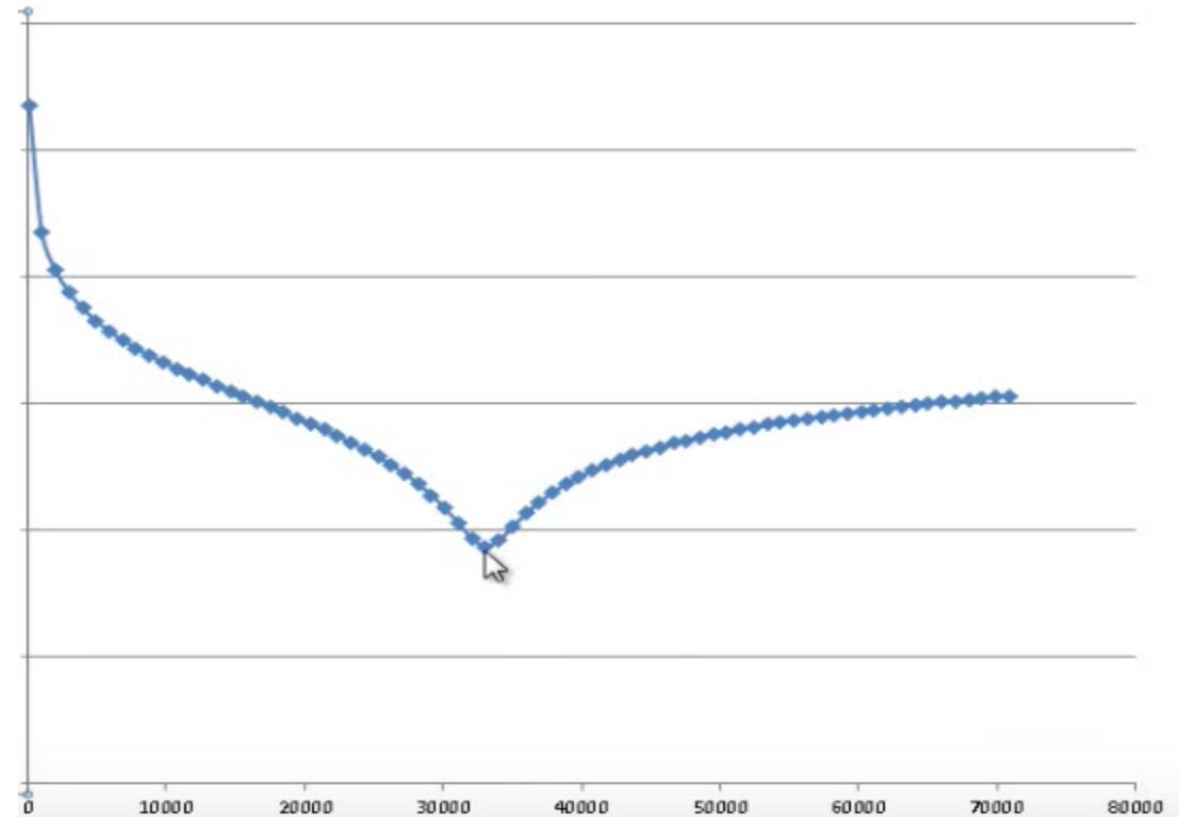
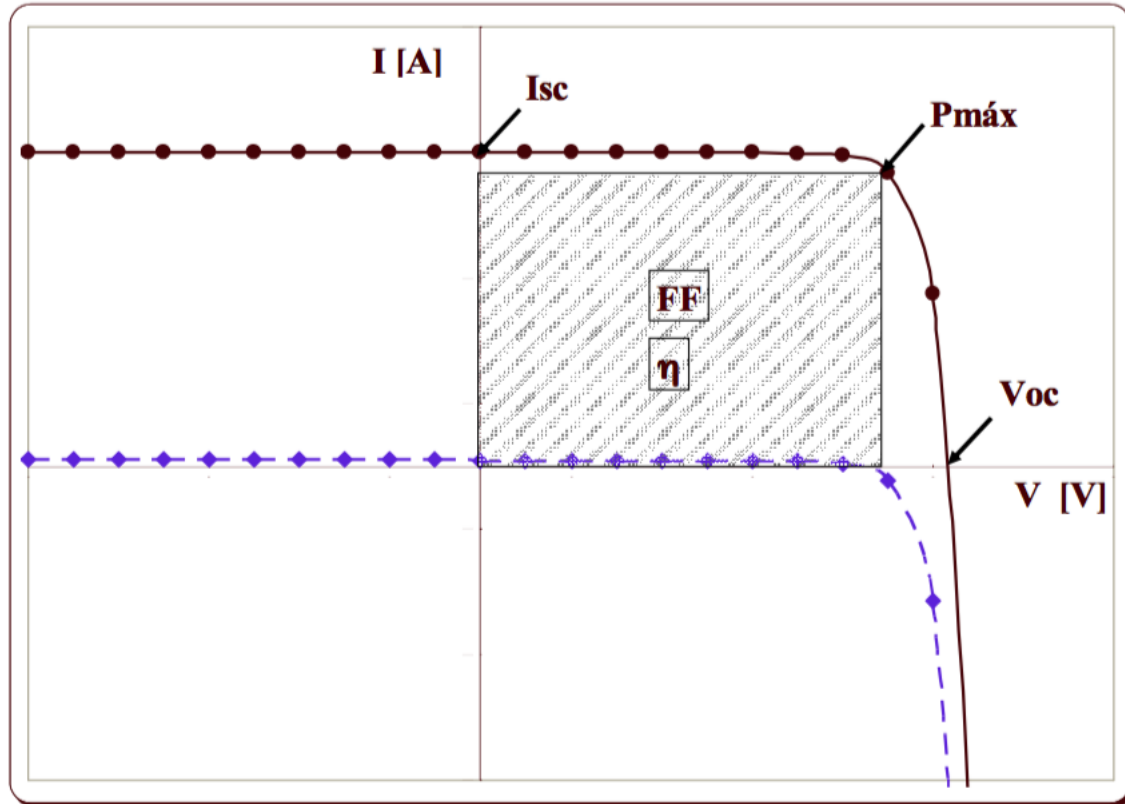
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LKI

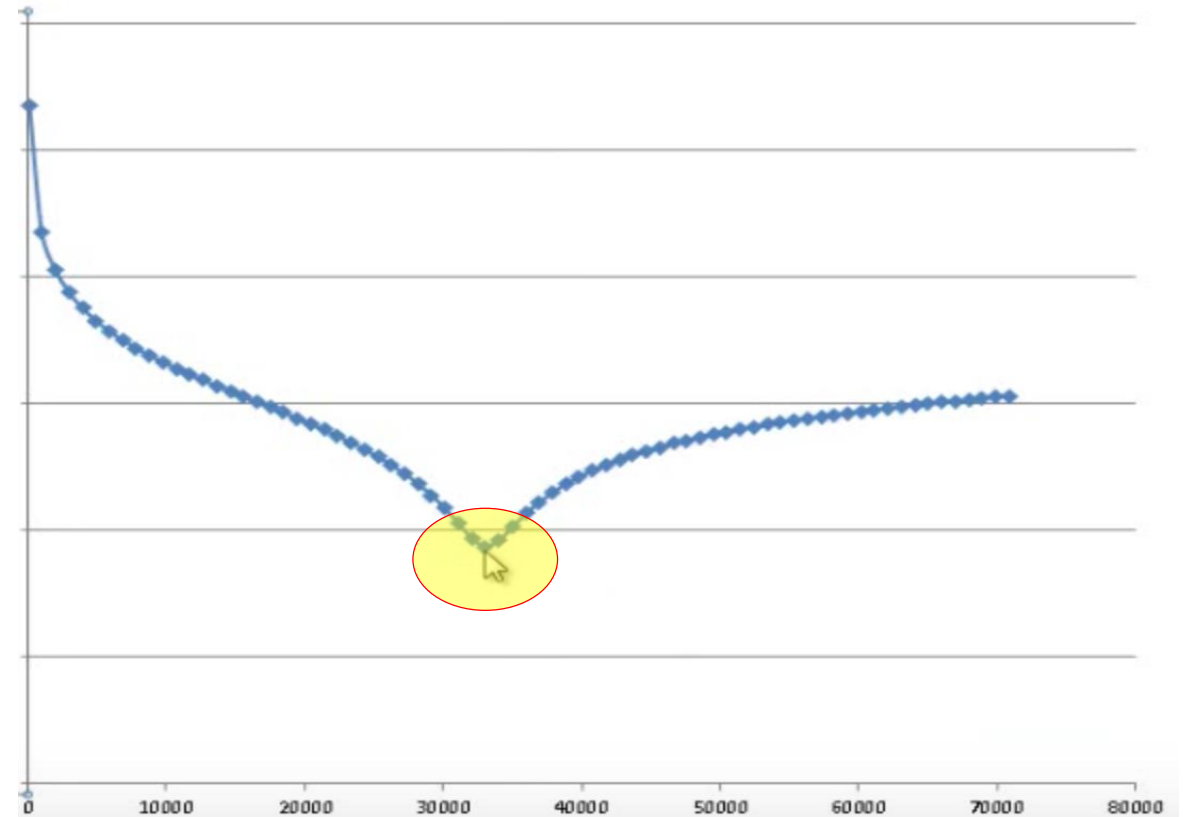
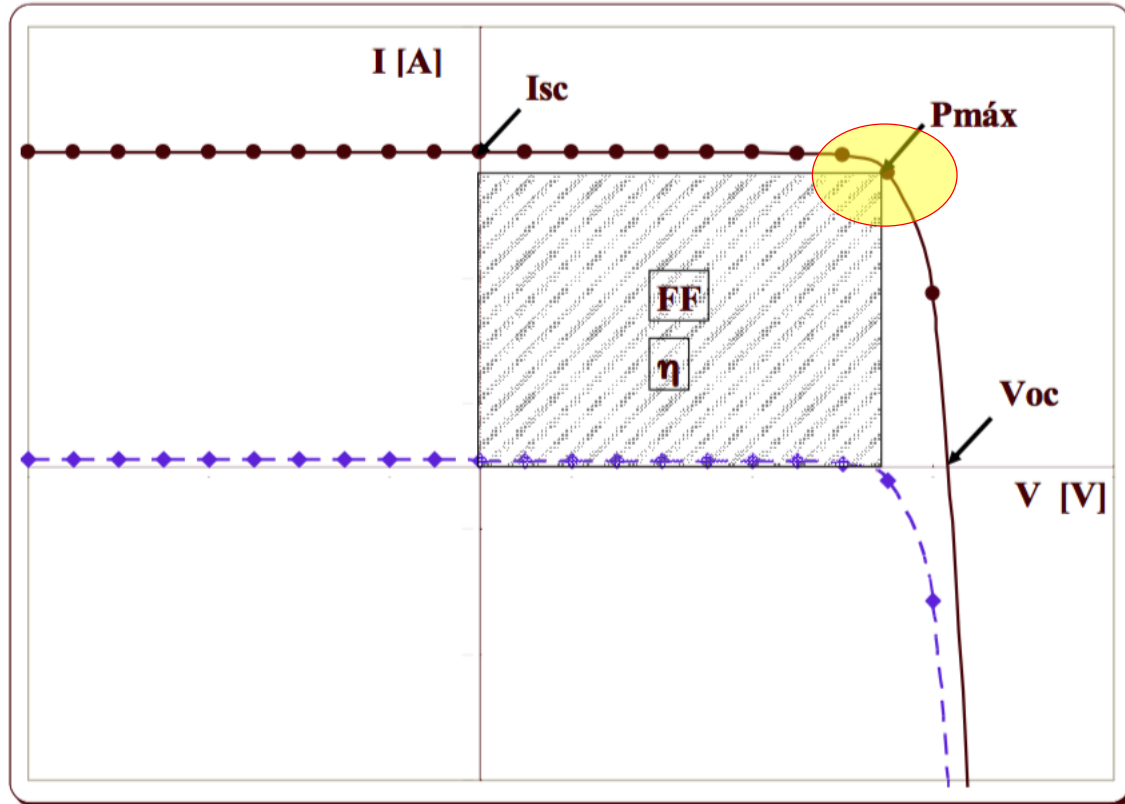


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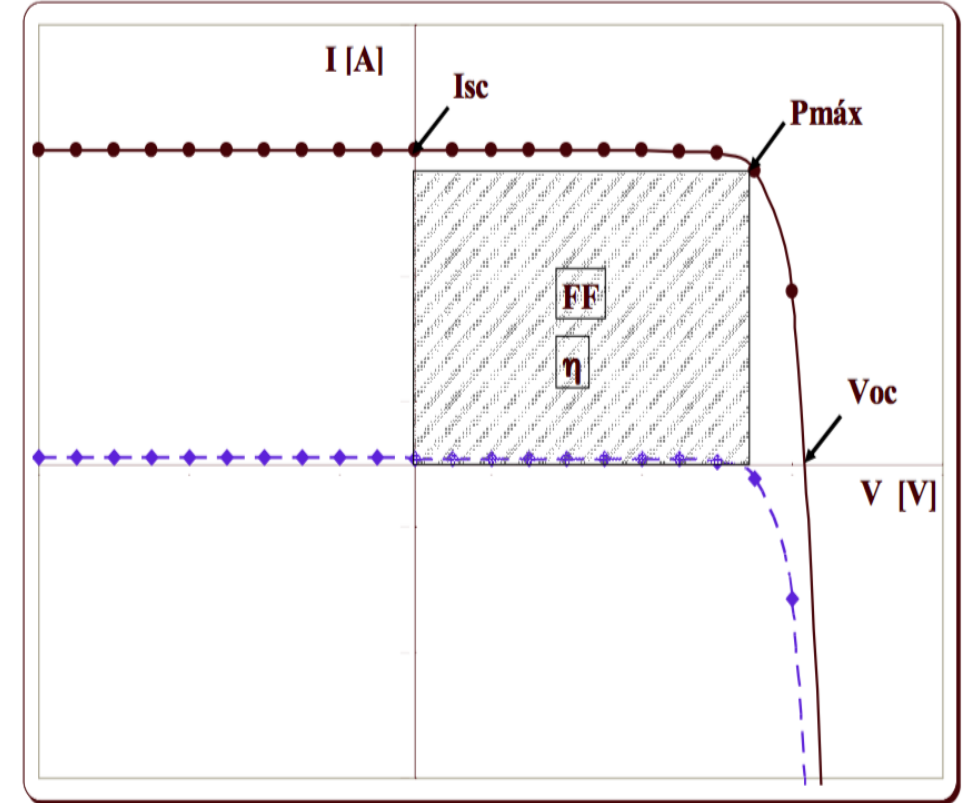
Methodology



Methodology



Methodology

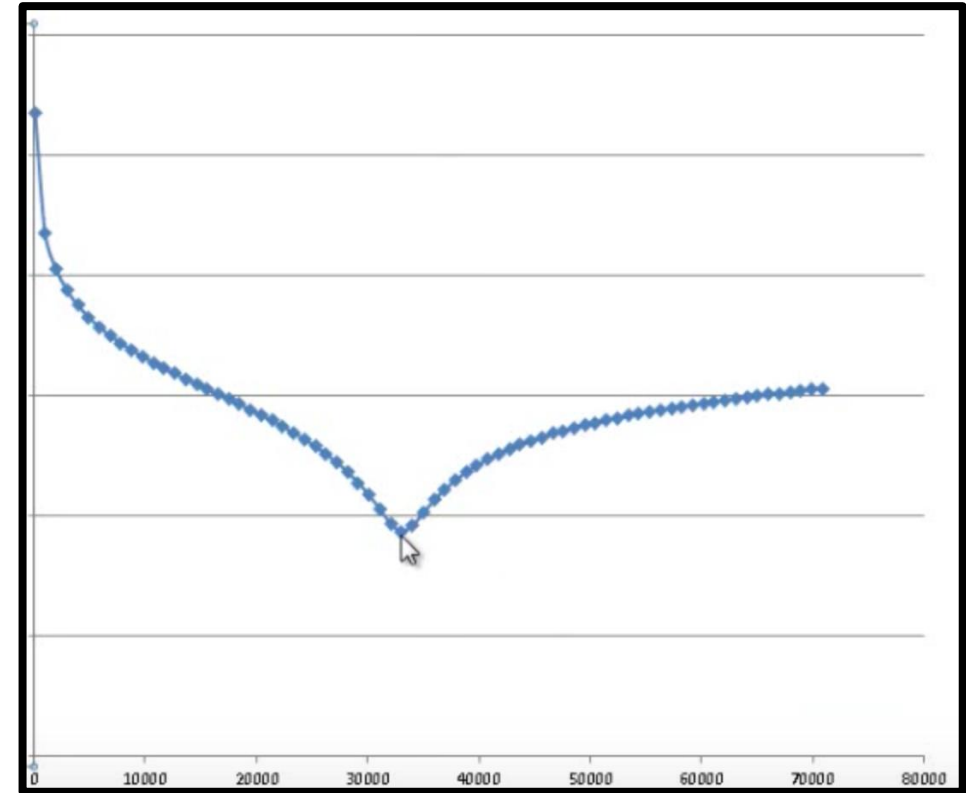




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Results

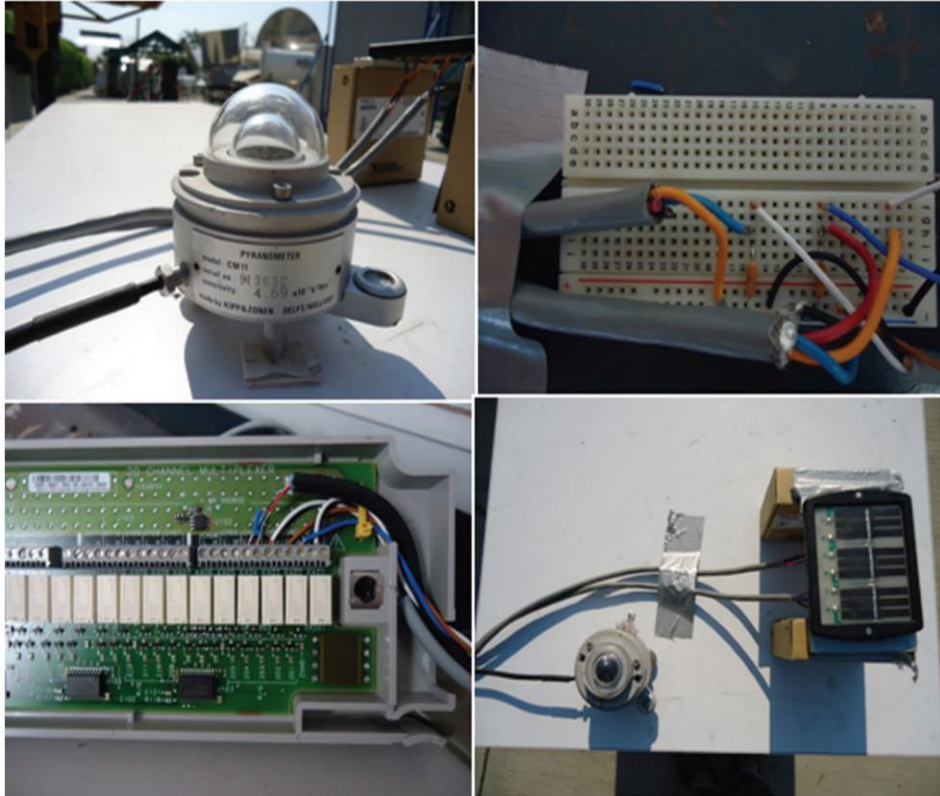
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7	1000	2.07E+01	2.27E+04	-2.27E+04	22715.80974297050000000000
8	2000	4.15E+01	1.14E+04	-1.13E+04	11326.98950129490000000000
9	3000	6.22E+01	7.58E+03	-7.52E+03	7516.97744171592000000000
10	3950	8.19E+01	5.76E+03	-5.67E+03	5674.65013446108000000000
11	4920	1.02E+02	4.62E+03	-4.52E+03	4519.83217082246000000000
12	5890	1.22E+02	3.86E+03	-3.74E+03	3738.79929959082000000000
13	6860	1.42E+02	3.31E+03	-3.17E+03	3172.99476460836000000000
14	7830	1.62E+02	2.90E+03	-2.74E+03	2742.48191625299000000000
15	8800	1.82E+02	2.58E+03	-2.40E+03	2402.39143363970000000000
16	9770	2.03E+02	2.33E+03	-2.12E+03	2125.91407720972000000000
17	10740	2.23E+02	2.12E+03	-1.89E+03	1895.78062855673000000000
18	11710	2.43E+02	1.94E+03	-1.70E+03	1700.47791259648000000000
19	12680	2.63E+02	1.79E+03	-1.53E+03	1532.01640587823000000000
20	13650	2.83E+02	1.67E+03	-1.38E+03	1384.67839455843000000000
21	14620	3.03E+02	1.56E+03	-1.25E+03	1254.26451658795000000000
22	15590	3.23E+02	1.46E+03	-1.14E+03	1137.62163999561000000000
23	16560	3.43E+02	1.37E+03	-1.03E+03	1032.39674429871000000000
24	17530	3.63E+02	1.30E+03	-9.34E+02	936.53253828061400000000
25	18500	3.84E+02	1.23E+03	-8.45E+02	848.72751552411000000000
26	19470	4.04E+02	1.17E+03	-7.64E+02	767.73804520774800000000
27	20440	4.24E+02	1.11E+03	-6.89E+02	692.60863044840900000000
28	21410	4.44E+02	1.06E+03	-6.18E+02	627.56155865464600000000



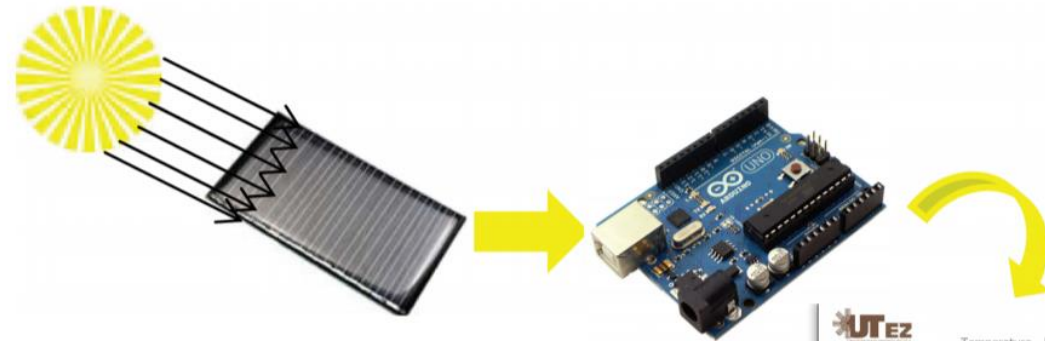
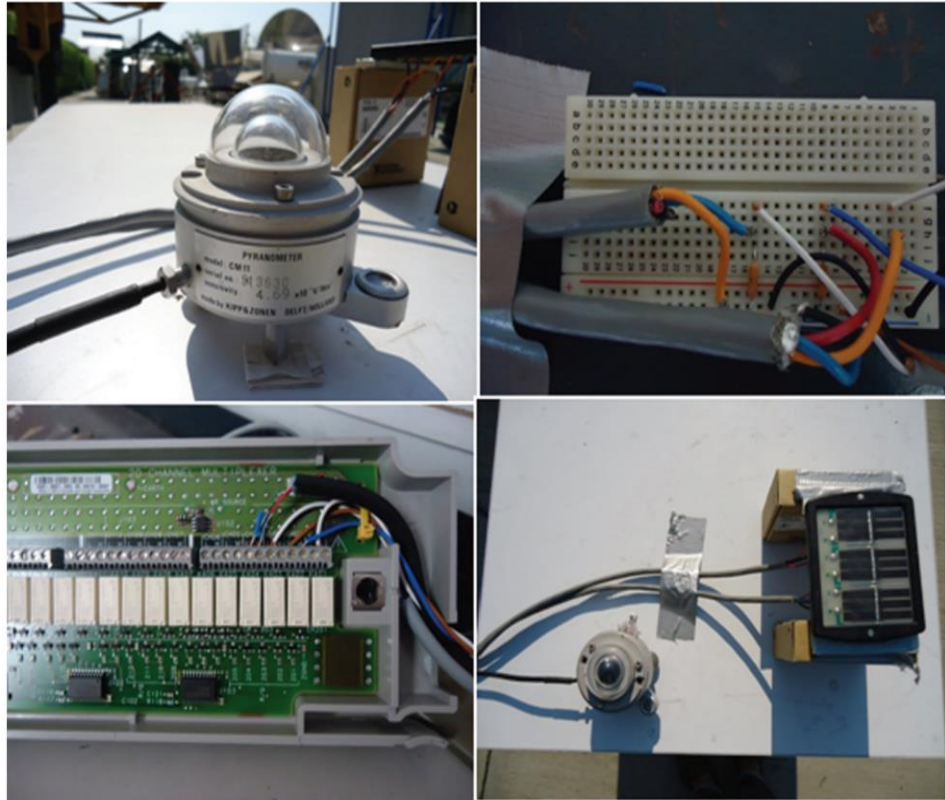


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Results



Results



A LOW COST SOLARIMETRIC STATION



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UTEZ
UNIVERSIDAD TECNOLÓGICA
EMILIANO ZAPATA DEL ESTADO DE MORELOS

ACQUISITION SYSTEM BASED ON WEB PLATFORM AND ARDUINO WiFi FOR A LOW COST SOLARIMETRIC STATION

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CENTRO DE DESARROLLO DE SOFTWARE (CDS), DIVISION ACADÉMICA DE TECNOLOGÍAS DE LA INFORMACIÓN Y COMUNICACIÓN (DATIC)
UNIVERSIDAD TECNOLÓGICA EMILIANO ZAPATA DEL ESTADO DE MORELOS (UTEZ)

INTRODUCTION

A WEB ANALYTICAL TOOL HAVE BEEN DESIGNED TO AND BUILT TO PROCESS THE DATA ACQUIRED BY A LOW COST SOLARIMETRIC STATION. ARDUINO MICROCONTROLLER WITH A WIFI SHIELD WAS USED TO ESTABLISH THE WIRELESS COMMUNICATION BETWEEN THE TRANSDUCER (SOLAR CELL FROM AN EDUCATIONAL KIT) AND THE WEB DATA BASE. MICROCONTROLLER ARDUINO IS THE DATA ACQUISITION DEVICE, HARDWARE TO BUILD A SOLARIMETRIC STATION USED TO BE EXPENSIVE. LOW COST STATION BUILT DURING THIS JOB IS A VERY GOOD OPTION TO HAVE A VERY CLOSE ESTIMATION OF IRRADIANCE AND TEMPERATURE LEVEL AS WELL AS SOLAR RESOURCE AVAILABLE IN THE REGION. MORELOS STATE HAS A VERY VARIETY OF CLIMATES EVEN IT IS A SHORT AREA STATE, WHICH MEANS IS NECESSARY TO HAVE SOLARIMETRIC STATION TO BUILD A CLIMATE MAP BY REGIONS.

OBJECTIVE

TO DEVELOP A SYSTEM IN A WEB PLATFORM WHICH VISUALIZES IN A GRAPHIC WAY THE LEVELS OF SOLAR IRRADIANCE AND TEMPERATURE THROUGH THE USE OF TOOLS WHICH ALLOW TO GENERATE DYNAMIC CHARTS BASED ON DATA OBTAINED BY THE PROCESS OF DATA ACQUISITION.

DATA PROCESSING

- 1 COLLECT SOLAR RADIATION AND METEOROLOGICAL DATA IN A CONTINUOUSLY AND RELIABLE WAY WITH EDUCATIONAL SOLAR CELL KIT
- 2 THE ARDUINO SENDS THE INFORMATION THROUGH WIRELESS NETWORK
- 3 STORE INFORMATION IN A DATABASE FOR DATA PROCESSING
- 4 GET DATA FROM THE DATABASE TO PERFORM THE PROCESS AND PROGRAMMED CALCULATIONS
 $k = 1.38E-4 \text{ V/Wm}^2$
 $k_{\text{(pyranometer)}} = 4.69 \text{ V/Wm}^2$
 $k = V/Irr$
 $Irr = V/k$
- 5 GENERATE CHARTS WITH THE OBTAINED INFORMATION TO SHOW THE LEVELS OF IRRADIANCE AND TEMPERATURE IN REAL TIME

LOOKING FORWARD

DATA WILL BE AGAIN RECOLLECTED USING THE SOLAR PANEL. MOBILE COMPATIBILITY. A SOLAR TRACKER WILL BE DEVELOPED WITH AN ENGINE SYSTEM WHICH WILL ALLOW US TO TRACK THE SUN.

RESULTS



CONCLUSION

THE CONSTANT DEVELOPMENT OF TECHNOLOGIES OFFER US THE NECESSARY TOOLS TO ACHIEVE PROJECT REQUIREMENTS. THE SET OF OPEN SOURCE TOOLS IS A COMPLETE, RELIABLE AND EFFICIENT SOLUTION THAT ALLOWS TO CREATE A COMPUTER SYSTEM OF A SOLARIMETRIC STATION AT A LOW COST



UTEZ **Ghesu** Inicio Irradiancia Temperatura Contacto
UNIVERSIDAD TECNOLÓGICA EMILIANO ZAPATA DEL ESTADO DE MORELOS
Gestión del Historial de la Estación Solarimétrica UTEZ.

Introducción
En la actualidad la energía eléctrica generada por el hombre se ha convertido en una trascendencia de ventajas y desventajas, la electricidad es una forma de energía que a pesar de su conocimiento y su dominio son relativamente recientes, se encuentra en todas las facetas y actividades de cualquier sociedad.
La utilización de la electricidad represento una importante evolución en las soluciones tecnológicas que dan respuestas a las necesidades de la humanidad.

Objetivo
Con el fin de crear una evolución en el mundo, la humanidad y disminuir la generación de gas carbónico que genera la electricidad y daña a la capa de ozono y se contempló la posibilidad de alimentar un edificio mediante energía solar. La energía solar es un tipo de energía renovable que convierte la energía del sol en otra forma de energía, como puede ser la

Rentabilidad
La utilización de energías renovables disminuye fuertemente el grado de la contaminación existente en la tierra. "Según un estudio sobre los "Impactos Ambientales de la Producción de Electricidad" el impacto ambiental en la generación de electricidad de las energías



UTEZ **UNIVERSIDAD TECNOLÓGICA EMILIANO ZAPATA DEL ESTADO DE MORELOS** Temperatura | **Irradiación Solar** | Contacto

Sábado, 13 de abril 2013 17:02:45 hrs - Emiliano Zapata, Morelos.

ESTACIÓN SOLARIMÉTRICA

Temperatura **32° c**

CDS
Centro de Computación de Morelos
Fijación nivel 3 de Microsoft

IRRADIANCIA SOLAR | 24 HORAS

Periodo:

UNIVERSIDAD TECNOLÓGICA EMILIANO ZAPATA DEL ESTADO DE MORELOS
ESTACIÓN SOLARIMÉTRICA



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Conclusions

Learning to some level of background, **physical** concepts and management of **mathematics** related to them is not an easy subject for students who do not take their training a solid academic preparation in these two basic sciences. The approach physics and mathematics with the development of a technology prototype is therefore interesting and productive for students in IT.

Students working under the stage **DIY or hands on**, they learn in an integrated environment that allows them to develop skills such as critical search for the sources of information necessary for the development of a job; autonomous behaviour on time management and progress at work; identifying opportunities for improvement in the **teaching - learning** process and the development of technological products.



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Conclusions

Another important value added obtained in this work is that IT students, become aware of the importance of **renewable energy**, the importance of photovoltaic devices such as generating energy sources. Incorporating this consciousness in them, which will lead integrated into their personal appearance and inherently in the professional, which is very important in these times when **the environmental impact** left by the activities of humans can observe and feel easily.

Acknowledgements

To the enthusiastic students, Gerardo and René Figureoa Diana Vazquez for accepting the challenge of doing different things and friendship, besides the work put into this academic and technological development.

To the engineers Jose Ortega and Jesus Quiñones Renewable Energy Institute of the UNAM, for help with infrastructure, with permission to enter its facilities, and technical assistance in the development of the project.

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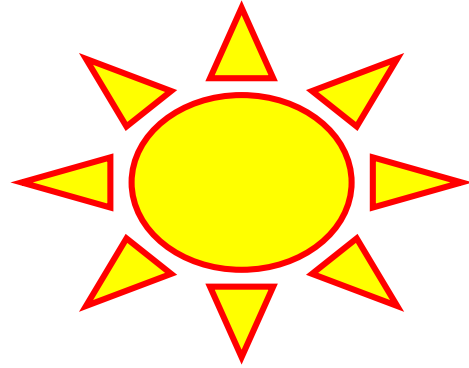
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