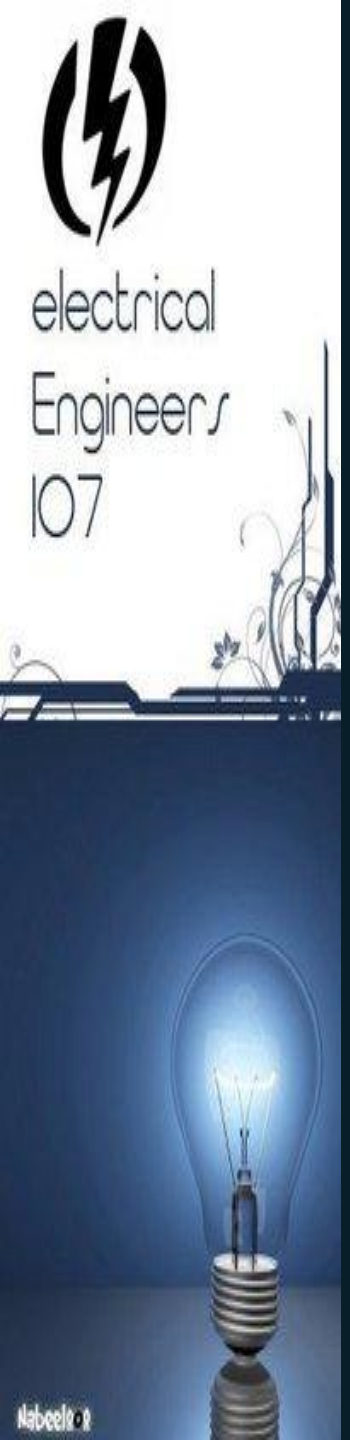


BATTERY CHARGE REGULATOR FOR A PHOTOVOLTAIC POWER SYSTEM USING MICROCONTROLLER

By:

Khaled N. Daher

Shareef Mahameed

Mohammad Samaneh

Supervised by :

Prof.Dr. Marwan Mahmoud

Introduction

Since the beginning of the oil crises, which remarkably influenced power development programs all over the world, massive technological and research efforts are being concentrated in the field of renewable energy resources. In the solar sector for electricity generation, greater attention is being given to photovoltaic conversion.

Advantages and Disadvantages:

The advantages are:

1- Renewable resource.

2- Silent.

3- Non-polluting.

4- Little maintenance.

5- easy to install.

6- Reliability.

And the disadvantages are:

1- Very expensive.

2- No work at night.

Features

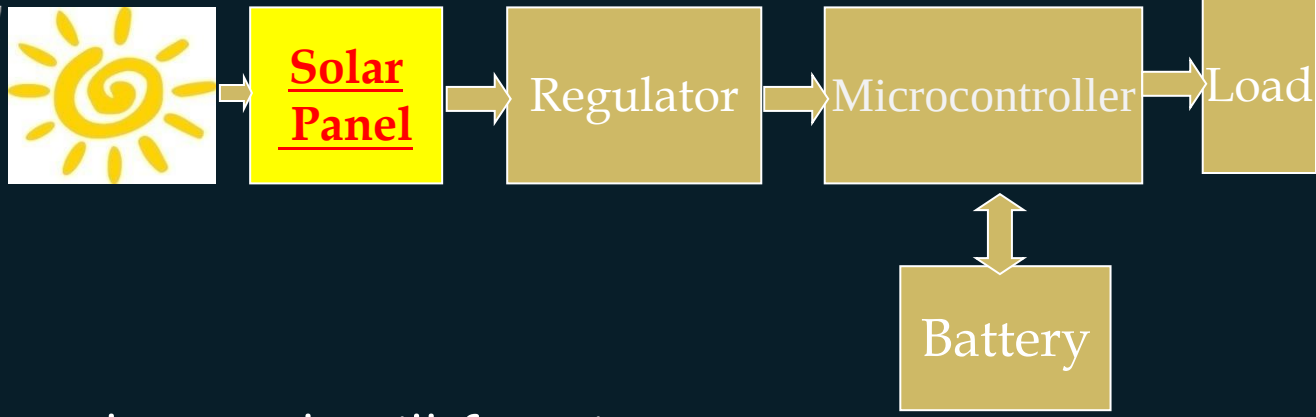
- Charge any rechargeable battery 12V,24 V by using such PV generator .
- Supply any low dc load using the PV generator.
- ***To use the solar energy widely.***
- Use the charge regulator to limit the current and to avoid the battery overcharge and deep discharge

Block Diagram For Our Project :

Solar Panel → Regulator → Microcontroller → Load

Microcontroller ↕ (Battery) Lead Acid battery

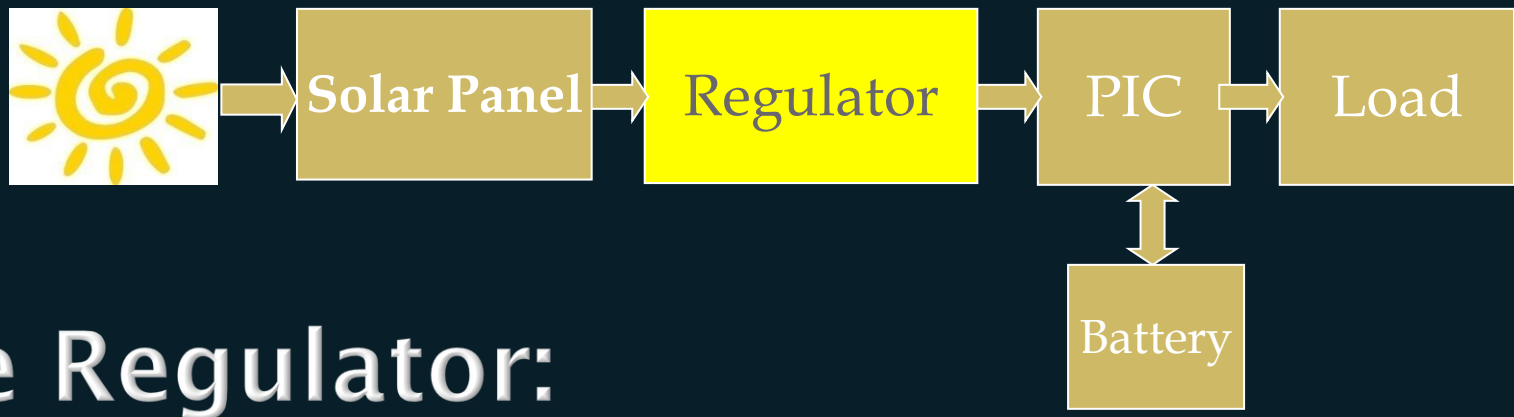
Solar Panel & Photovoltaic cells:



In our design, the solar panels will function as a power supply to our circuit. It will convert the sun radiation to voltage and current.

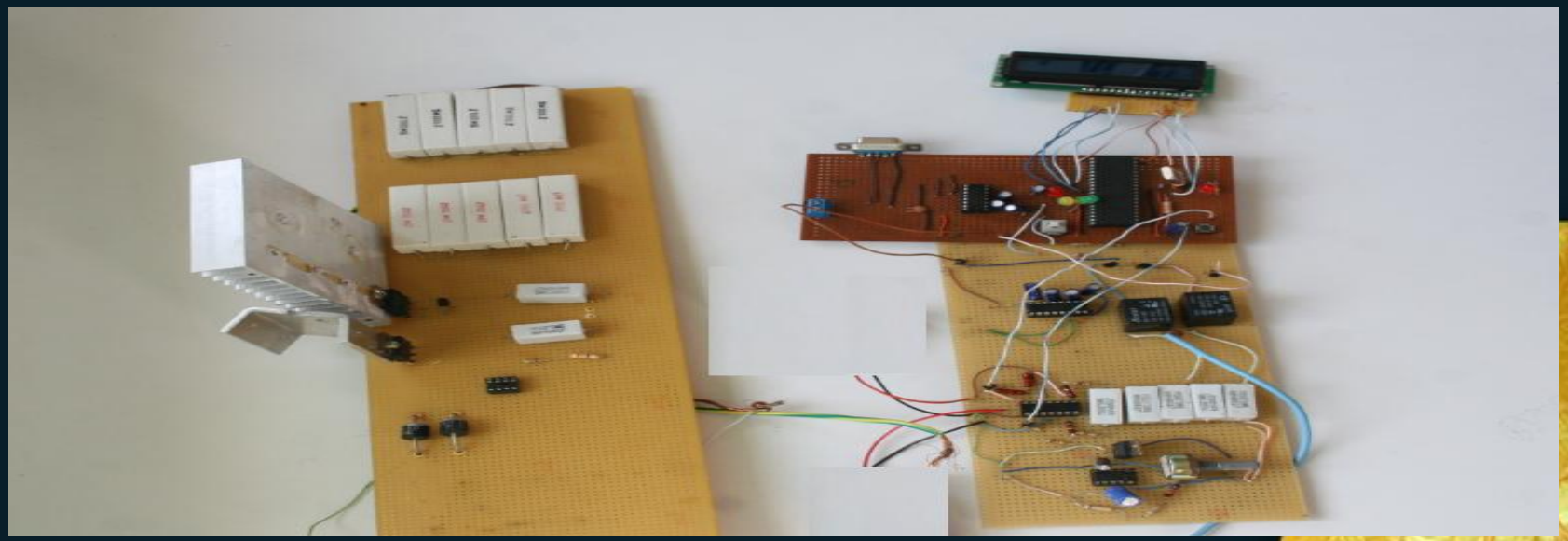
types of photovoltaic cells :

1-mono-crystal silicon.
2-Polycrystal silicon .
3-Amorphous silicon (thin film silicon).



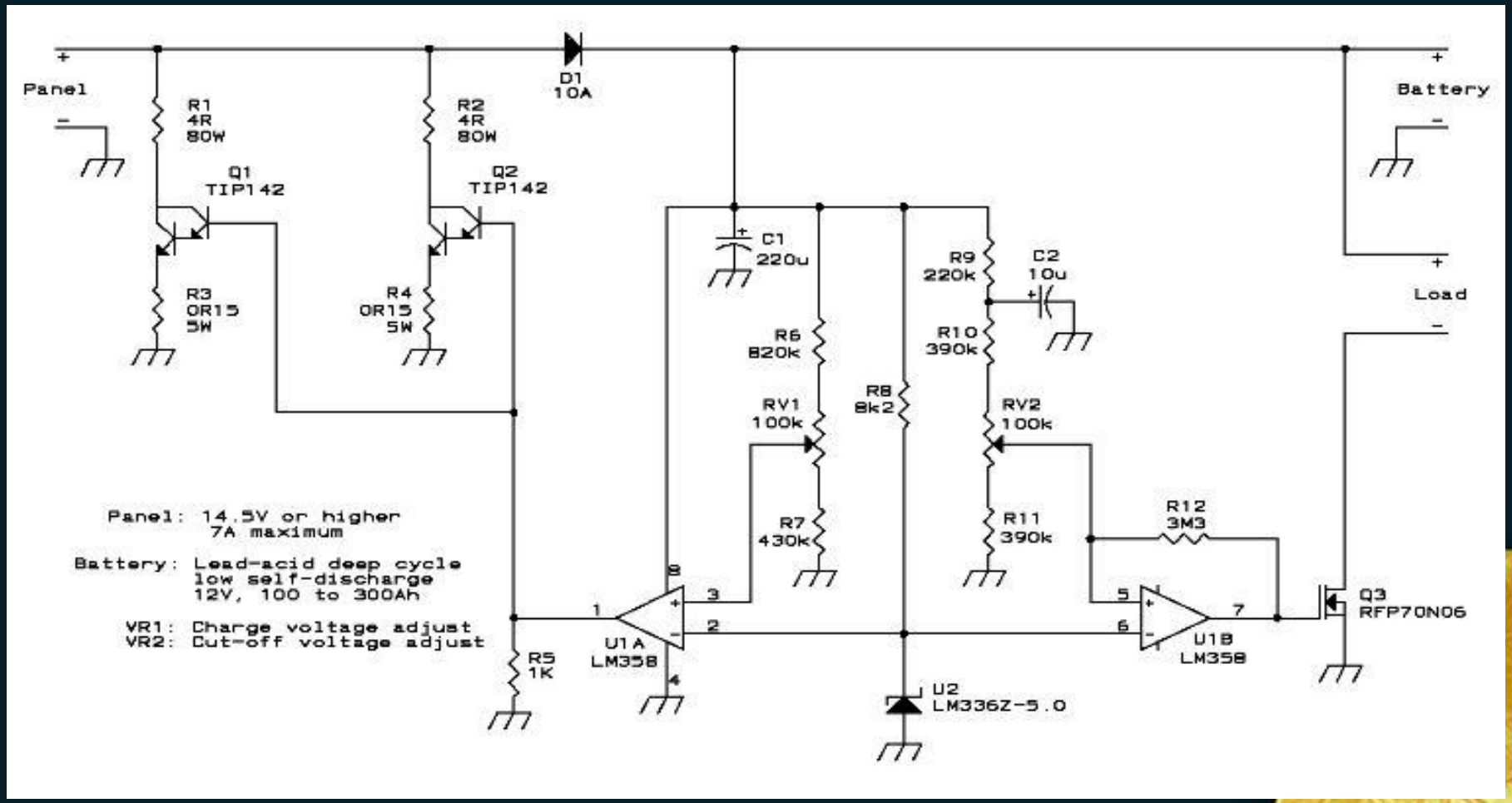
Charge Regulator:

The solar charge regulator main task is to charge the battery and **to protect it** from **overcharging and deep discharging**. Deep discharging could also damage the battery.



Circuits For Our regulater :

1- Regulator circuit:



Component notes:

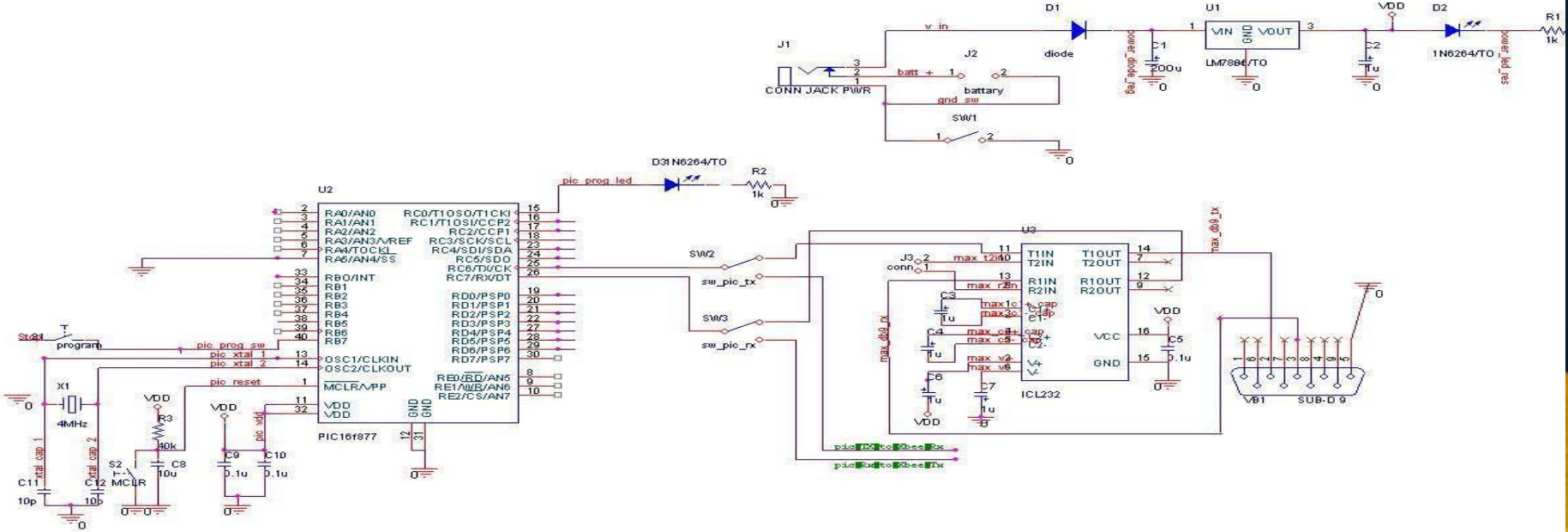
- D1 can be any diode that can safely survive the panel's current.
- Q1 and Q2 are common power Darlington transistors. They need to be heatsinked for safe long-term operation at the 12 Watt dissipation level.
- R1 and R2 will have to be made by combining a number of power resistors in parallel. Yes, you need to make two resistor arrays of 4 Ohm, 80W each! This 80W
- R3 and R4 may to have be built from parallel combinations too, because of the low value of only 0.15 Ohm.
- U2 is a voltage reference IC is a 7805 regulator

- U1A is a comparator used to compares an adjustable sample of the present battery voltage to a 5V reference
- U1B is a Schmitt trigger that compares the battery voltage to the same stable reference of the other section, but for another purpose: It controls the load switch Q3.
- RV1 and RV2 we used them to control the voltage to work as voltage divider.

Solar Panel → Regulator → **Microcontroller** → Load

Battery

2- Microcontroller



Flow chart:

Problems faced us

1- The output voltage was about 15 volts, and the PIC accept only 5 V maximum.

2- How to read the current on LCD .

3- How to connect the relays to the PIC to connect or disconnect the load and the battery.

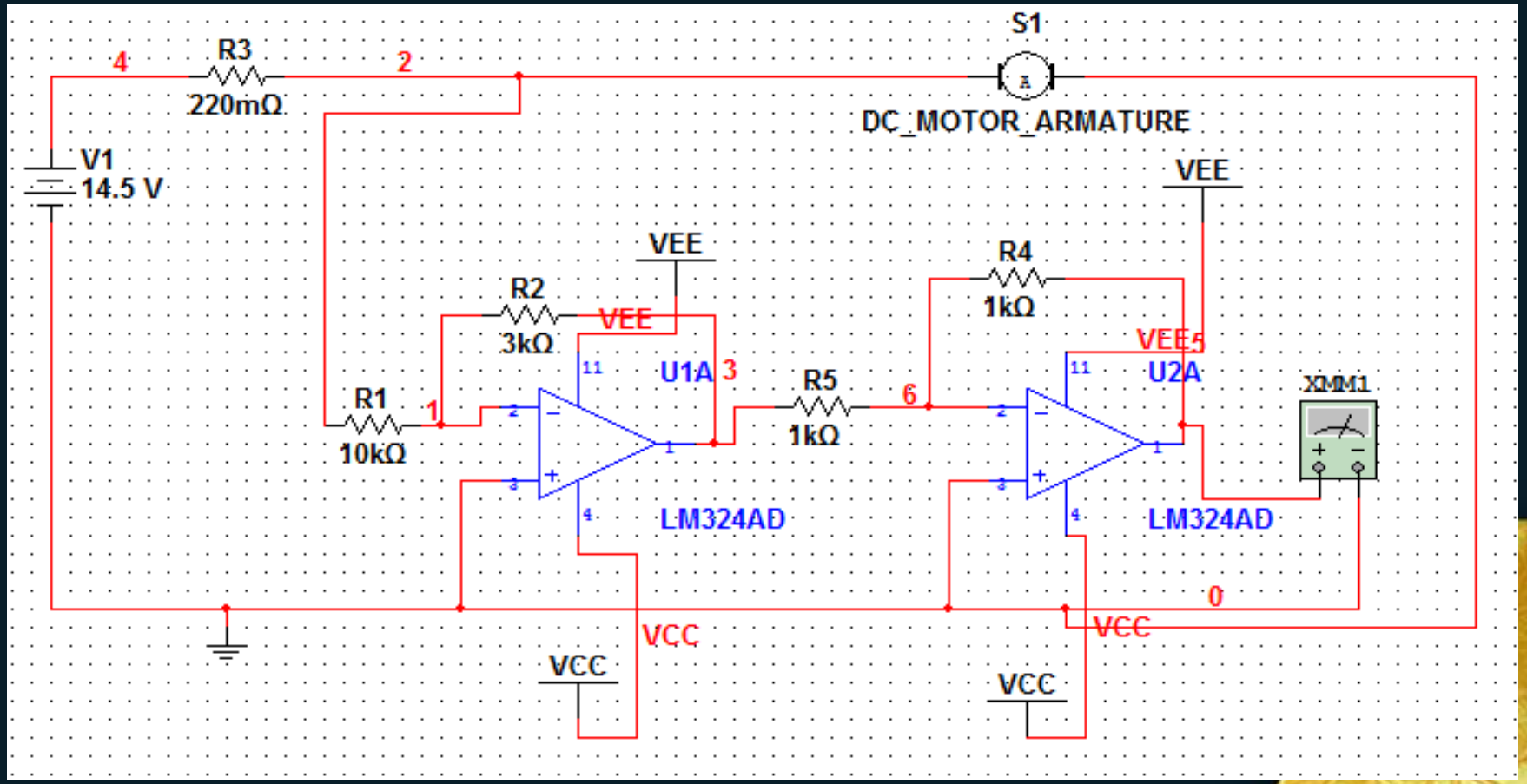
Solving the above problems:

1. The voltage we read it by using the LM324

2. The current we read it by using the same comparator but by reading the voltages at the terminal of very small resistor.

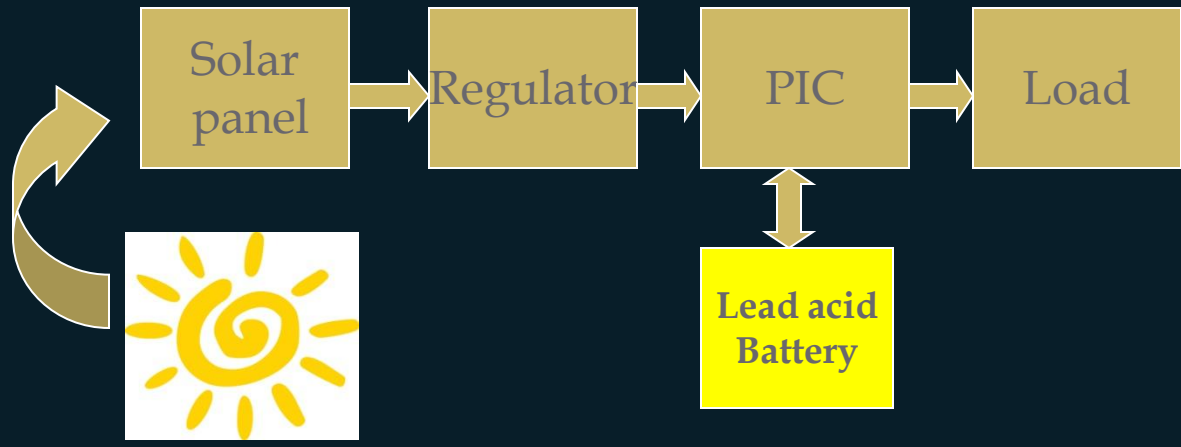
3. To control the relays we used a small transistor to seek a very small current from the PIC.

After solving the problems (1&2) we got the final circuit:



After solving the problem3 we got the final circuit:

- دارة من سماعنة تاعت الريلي



Lead Acid Battery:

1- We are going to work on six-cell lead-acid batteries.
2- Voltage/cell 1.75-2.4 V at at 25°C .

It is a lead /sulfuric acid-lead dioxide electrochemical systems, whose overall reaction is given by the following equation :

$$Pb + PbO_2 + 2H_2SO_4 \rightarrow 2PbSO_4 + 2H_2O$$

Important Calculations for battery:

Vcell = 2 volt ….and have 6 cells:

V max. = 6 * 2.4 = 14.4 volt

V min. = 6 * 1.75 = 10.5 volt

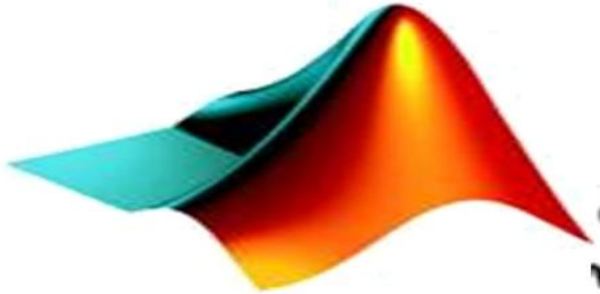
Batteries are commonly rated it terms of their ampere-hour(Ah) or watt-hour (Wh) capacity :

C = I * t …….[Ah]

C_{ah} :Ampere – Hour Capacity

C_{Wh} :Watt-hours capacity

MATLAB :



MATLAB®
SIMULINK®

The Cost:

Device	Number of needed devices	Cost(NIS)
Circuit #1 [Part One of charge regulator]	1	270
Circuit #2 [PIC Microcontroller & base circuit]	1	90
Circuit #3 [Inverting OP-Amp]	2	30
LCD	1	40
Battery	1	70
Total Cost		**500**

Conclusion:

- In this Presentation, we discussed the main goal and vision of the project, we started with a brief introduction about the project and the general idea of it, then we moved to give a background about the theoretical information and the scenario of the project.

- We discussed the components of our system and illustrate the specifications of the each component then we discussed the implementation process of the system which contains the practical part of the project in details.

- We also provide the algorithm and the cost of the project in the end of this report.