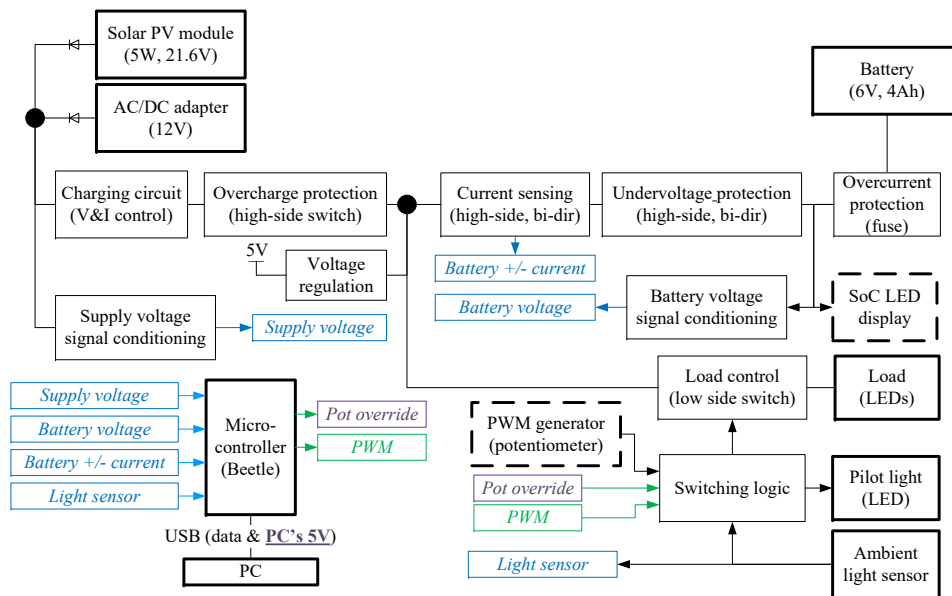




E-design 344 Project Overview

2021

You will develop, test and report on a solar-powered light source. The power sources are a 5 W solar PV module and a 12 V (2 A) AC-DC power adapter. The design makes provision for battery backup using a 6 V lead acid battery, which recharges from the two power sources. The design prevents charging too fast (charging V & I control) and must prevent overcharging of the battery (overcharge protection). The design ensures that the battery is not discharged beyond its recommended levels (undervoltage protection) and prevents high-current discharging (overcurrent protection). The circuit uses a sensor to measure the ambient light level, and turns on the LED load accordingly. The circuit makes various measurements available through a serial connection to a user interface on a PC, and allows control of the light source from the user interface. The conceptual design of the system is shown in Figure 1.



MJ Booysen – 28 Jul 2021

Figure 1: Project system diagram.

The planned weekly activities are listed in Table 1; this includes the hardware development stages and the software packages that will be used. The demonstrations, tests, and report dates are also indicated. This table is indicative and is subject to change.

Table 1: Weekly tasks and report submission dates. *This table is indicative and is subject to change.*

Wk	Starting	Topic	Hardware	Software
1	10 Aug	Components, setup, power	PSU, PV module, battery	Github, Overleaf, LTspice
2	16 Aug	Voltage regulation	Charge regulation (heat sink), 5V rail regulation	Github, LTspice
3	23 Aug	Battery protection	Over-current protection, under-voltage protection	Github, LTspice
4	30 Aug	Battery protection Load control	Overcharge protection Github,LTspice	Github, LTspice
5	6 Sep	Submission of report and catchup		Github, Overleaf
Test week and holiday				
6	27 Sep	Supply voltage & battery current measurements	Supply voltage measurement, Bi-directional battery current measurement	Github , LTspice
7	4 Oct	Precision battery voltage measurement	Battery voltage measurement	Github , LTspice
8	11 Oct	Microcontroller Beetle	Arduino	LTspice
9	18 Oct	PC interface	Beetle	Python
10	25 Oct	Catchup and slack		
11	1 Nov	Submission of report		Github, Overleaf

List of components

You have each been given the hardware listed in Table 2, with which you are to complete the project. Datasheets and LTspice models will be provided at <https://learn.sun.ac.za/> for some components. For the remainder of the components, datasheets can be downloaded from <https://za.rs-online.com/> with the given part number. In addition to this list, you are allowed to get passive components (resistors, capacitors and inductors) and development PCBs from the lab manager, Mr Hilton Johnson, in the fourth floor lab.

Table 2: List of components.

Quantity	Part number (RS)	Description
1	SLP005-12 (ACDC)	Solar panel - 5W
1	Generic (RF Robotics)	Power adapter (AC to 12VDC, 2A)
1	N/A (Digikey)	Fuse holder
1	5375422	Battery - 6V
1	787411	Fuse 1A
2	0563778	Fuse 5A
2	0563744	Fuse 10A
1	0448370	12V socket
3	3729906	Speaker cable (metre)
1	0534351	Red shielded lug 6.3mm (spade female disconnect)
1	0534705	Blue shielded lug 6.3mm (spade female disconnect)
2	5410799	PMOS IRF9Z24NPBF
2	1844881	NMOS 2N7000 TO-92
1	9087661	M3 screw
1	0560338	Washer
1	0560293	M3 nut
1	7226710	Thermal conductive sheet cut into strips to fit heatsink
1	7124302	Heat sink
1	7140792	LM317 Voltage regulator
1	7968060	LM7805 Voltage regulator
1	1977239	LM2940CT-5.0 Voltage regulator
1	1742721	Current sense resistor
3	9179108	Schottkey diode 1N5819
10	1445719	Opamps (R2R) LTC2272 or MCP6242
1	2033517	TSC213ICT current sense amp and PCB
3	8971332	Connector block
5	8106705	Ultra-bright LEDs
1	0102248	Pushbutton
1	14M2059 (Mantech)	LDR 20-30K
1	14M2024 (Mantech)	LDR 100K
1	15M8510 (Mantech)	Yellow 5mm LED
1	15M8492 (Mantech)	Green 5mm LED
3	15M5154 (Mantech)	Red 5mm LED
1	DFR0282 (DF Robot)	DF Robot Beetle
1	N/A	Micro USB Cable
8	N/A	8-pin sockets.
1	N/A	Single row headers (for surface to DIP) 8x1
1	N/A	Development PCB with sticker