

Solar PV Greenhouse Components and Justification

Component	Description	Quantity	Unit Cost	Shipping	Purchased Materials	Justification
Solar Panel	20W 12V 240mm by 520mm	3	76	13	241	60W total provides more than enough power even during cloudy days. This dimension fits our streamline house design well.
Charge Controller	10A 12V/24V Controller with display EPRC10-ST	1	26	0	26	Charge controller fits well with solar panels and battery used.
Battery	Lead acid 12V 8AH	1	50	0	50	12V allows flexibility as many types of sensors, controllers, and actuators can use 12V. Also, solar panels are usually made to charge 12V. 8Ah suits the load to power the greenhouse at night. Can add additional batteries if needed.
Arduino	Arduino Nano, leads pre- soldered	1	10.49	8	18.49	Two Arduinos to split the load. Uno is easier to use shields; Nano is cheaper when shields are not needed. Each control different systems. Provides redundancy.
Arduino 2	Arduino Uno R3 with programming wires	1	23.9	0	23.9	
Arduino Expansion	Arduino Nano Uno Expansion Card	1	6.9	0	6.9	To make hooking up sensors easier.
Transistor	MJE3055TG NPN 60V 75W	6	0.55	0	3.3	Switching mechanism, NPN acts like a switch for the LEDs. This transistor is more than enough to drive the LEDs and is readily available. See data sheet.
Relay	HK4100F- DC5V-SHG	1	5.45	0	5.45	Relays are easier to hook up for larger loads such as heaters and are safe for the controller. This relay is enough to drive the heater.

PCB	150x100mm	2	2.19	0	2.19	Small PCB to hold all the components.
Wires	10m	1	1.7	0	1.7	Wires just for signal, so no specific requirements. Wires for motors and heaters included on device already.
Temperature/Humidity Sensor	DHT11 for Arduino with wires	2	4.78	0	8.16	Combination sensor reduces cost and saves space. Sensor is accurate enough for our purposes. See data sheet.
Light Sensor	S1227-16BQ for Arduino	4	2.2	0	8.8	Photo-resistor is cheap and effective.
O2/CO2 Sensor	MQ-135 Air quality sensor	1	6.9	0	6.9	Cheap air quality sensor that can sense O2 and CO2 relatively well. See data sheet.
Heater	12V Car heater 200W	1	39	0	39	200W heater allows fast heating. Heater doesn't have to turn on for long to reach desired temperature. Fan is included for ease of assembly.
Watering System	Pump	1	14.3	3.5	14.3	Easy to use and reliable.
LED	SMD5050 LED strip 12V (5m) RGB	2	15	0	30	RGB LEDs can change color to provide the best conditions for the plants.
LED 2	SMD5050 LED strip 12V (5m) Warm white	1	15	0	15	Warm white LEDs to provide for general lighting and ambient lighting for operators.
Fan	Fan 120mm for computer	3	6	0	18	Fans are an easy way to provide fresh air for the greenhouse.
Solar Panel Motor	NEMA 42 SK4234-1518 27:1 12V 0.6A	3	3.89	5	8.89	42 size motors have enough torque (0.8Nm torque) to rotate solar panels (require 0.6Nm). They are also small and light enough for the support structure and provide high accuracy.

Solar Panel Motor Controller	L293D Motor controller (for 4 motors)	1	10	0	10	Easy to use motor controller shield for Arduino Uno.
Watering System	Piping	2	2	3.5	4	Flexible pipe makes assembly easy and makes watering system durable. They are light and easy to mount too. Comes in rolls and can be cut to size accordingly.
Frame and Solar Panel Mounts	Aluminum 25mm square profiles	1	95	13	108	Aluminum frame is strong and lightweight. Also corrosion resistant. Can be bent into shape easily to form the smooth flowing shape of the greenhouse.
Window Film	1mm Plastic (by meter)	16	1.78	0.01	28.49	Thin transparent window film is easy to apply, cheap, and keeps heat in relatively well. 16 square meter material allows for single application, reducing assembly times. Also can be used for pond material and controller box material.
Screws	M4x10, M5x10, M6x20	40	8.35	0	8.35	Various screw pack for mounting. Readily available.
Nuts	M4, M5, M6	40	2.7	10	2.7	Various screw pack for mounting. Readily available.