

robotistan



Arduino Solar Tracking System



A List Of Materials

P.No	Name of the Product	Pcs
12819	Tower Pro SG90 RC Mini(9gr)Servo Motor	2
19698	6V 250mA Solar Panel - Solar Cell	1
19667	KY -018 LDR Light Sensor Board	4
13956	UNO R3 Board For Arduino	1
11645	Expansion Shield For Arduino V5.0	1
12898	Yellow Mini Breadboard	1
12636	10 mm M3 Metal Female - Male Spacer	4
12638	20 mm M3 Metal Female - Male Spacer	4
12632	6 mm M3 Metal Female - Male Spacer	4
12669	M3 6mm Head Metric Screw	6
12675	M3 10mm Head Metric Screw	4
16055	M3 15mm Head Metric Screw	1
12670	M3 8mm Head Metric Screw	4
12668	M3 Nut	15
12267	Buzzer	1
12379	5 mm Transparent Green LED	2
12244	1/4 W 220 R Resistor	2
11957	30 cm Separable F-F Jumper Cable	20
18660	10 cm Separable M-M Jumper Cable	20
15702	4 Pin Push Button - Black (6*6*5 mm)	2
20540	Double-Sided Tape	1
H1092	M2.2 9.5mm Screw	4
	Wooden Parts	1
	A'dan B'ye USB Kablo	1
	Spare Screw Set	1

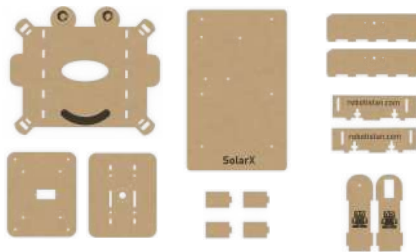
Why Solar Panel?

Solar panel is an easily accessible system that converts solar energy into electrical energy. In the solar cells on the solar panel, a direct current is formed by the sun rays. However, it is important in terms of being environmentally friendly while saving energy. You can easily learn and apply examples with the content on youtube and DIY sites without the need for advanced electrical knowledge in solar panel system construction. You have probably seen solar panels on the roofs, balconies and terraces of some houses. Solar panels, which were not widely used in the past, started to increase in popularity thanks to government incentives. Solar panels are preferred to be installed in houses, workplaces or buildings because they require very little maintenance and repair. The project is based on the principle that the sun's rays move according to the angle of incidence. For this purpose, it is aimed to benefit from the sun's rays with maximum efficiency throughout the day. Thanks to the 2 Servo Motors in your project, the axes will be able to move according to the sun angles. If you've installed solar panels to supplement your electricity needs, power your camping trip or caravan, you can make sure the panels are aligned correctly with this project. Project There are also a number of different mechanisms that work on a set of principles to align your panel directly to the sun. There are two basic types of viewers: single and dual axis viewers. Single axis trackers are adjusted each month so seasonal changes in sun position are taken into account, the single axis is used to track the daily movement of the sun across the sky. Dual axis trackers use one axis to track the daily movement of the sun and a different axis to track seasonal movement, eliminating the need for monthly adjustments. Single-axis solar tracker increases solar energy efficiency by approximately 25%, and dual-axis tracker increases approximately 40%. This project has been prepared assuming that you know the basics of Arduino programming. Knowing the basics of programming will support you in the construction of the project. All of the materials you need to complete the project are included in the set. You can implement the project without the need to supply additional materials.

Let's Get to Know the Content of the Set



Solar panel is an energy source that contains many solar cells that absorb solar energy. When a 6-30 panel system is required, a 3000-watt system of an average building can meet all the electricity needs of a house.



Wooden Parts



Uno R3 Board you can do hobby, educational or professional projects without having detailed programming and electronic knowledge. Uno R3 Board is the most widely used and best known model. With the Uno R3 Board, which was introduced in 2010, you can get physical information from various sensors and conduct various experiments with the information. You can also get an output from stimuli such as motor, LED, buzzer.



IO Expanding Shield for Arduino Arduino IO Expansion Shield with Arduino boards You can use many input and output units on the card. It is a very useful product designed for you to wear. On the board, all the input and output pins of the Arduino are stretched into 3-pins, respectively, DATA, VCC and GND, and distributed on the board. In this way, all kinds of sensors, servos, relays, etc. easily attached to the card you can be used.

Let's Get to Know the Content of the Set



Servo Motor Servo, angular-linear position, velocity and acceleration in mechanisms as a drive system that performs the control of is defined. Servo motors are a mechanism that can be controlled in the same motion. Servo motors, a type of motor frequently used in robot technologies However, it can also be used in RC (Radio Control) applications.



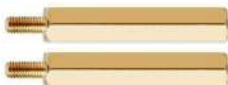
Mini Breadboard The mini breadboard has 170 holes and has a bottom adhesive so you can stick it on a variety of surfaces. You can perform rapid prototyping in your small circuit works and by sticking them on the circuit boards.



Jumper Cable It is very useful to connect the Jumper Cable, which is a kind of connection cable, between the breadboard and the arduino. 3 types of jumper cables according to the presence of male and female inputs at the ends are available.



LDR Module Photo resistor (LDR-Light Dependet Resistance) LDR light sensor board, circuit whose resistance can change depending on the intensity of light falling on it element. Like calcium sulfate in photoresistors, They contain components that change the number of free electrons as the light falls.



Metal Spacers Metal spacers, various circuit boards and mechanical materials materials that can be used to upgrade. Servo on SolarX It will be used to upgrade the engine.



Nuts – Bolts The body, which is used to connect the parts to each other in a detachable way part of which is threaded, the head is algal, rectangular or different. Fasteners shaped in different shapes are called bolts. Bolts are generally used with nut.



LED LEDs appear on our phones, in our cars, in our homes, in our daily lives. Diode LEDs are like small light bulbs. Low energy consumption, small size, fast connect and long lifetime make it ideal for mobile devices and other low power applications.



Push Button Push buttons are only on when pressed, off when released are circuit elements. A push button alone does the job of two switches can see. It's just that the faces with the pins are short-circuited. Depends on pressing the button. 1 and 3 when the button is pressed The pins are connected to each other and the circuit is completed in this way. Similarly, pins 2 and 4 are connected to each other and the circuit is completed.



Resistor Resistors limit the current in electrical circuits to a certain value. provides retention. Apart from this, they prevent high current from passing on sensitive circuit elements, and they are also used to divide the supply voltage and current. Some resistors of different types (such as LDR, NTC, PTC) can control physical changes in the external environment by acting as passive sensors. In addition, the heating of the resistors as the current value falling on them increases.



Buzzer The buzzer is a small vibrator that can operate with voltages between 2 and 4 volts. Sudden current changes occur in a coil, resulting in weak vibrations.

Servo Motor Position Adjustment

Before starting the assembly, you have to manually adjust the angles of the servo motors. Otherwise, Solar X will not work properly.



Attach the servo arm to the servo, then slowly turn the servo arm clockwise until it stops. It is not a problem if the servo arm is not the same as the angle shown in the image above. The important thing here is that you have found the last note of the servo.



Remove the servo arm from the servo and reposition it perpendicular to the servo body as shown.

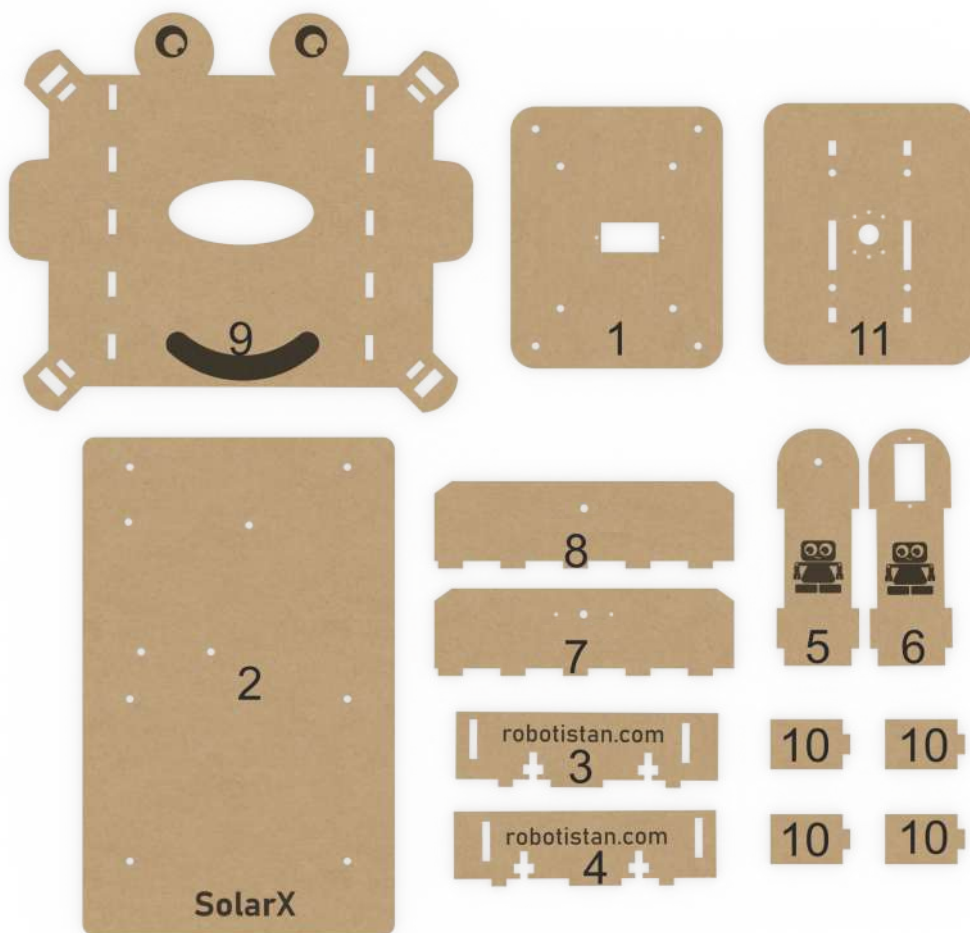


Slowly turn the servo arm counterclockwise until it is parallel with the servo body, as in the image. When this operation is done, it means that the servo motor is in the center position. It is important that you apply this process to the 2 servo motors in the set. After processing the two motors, remove the servo arm and set aside for assembly.

SolarX v2.0 Installation

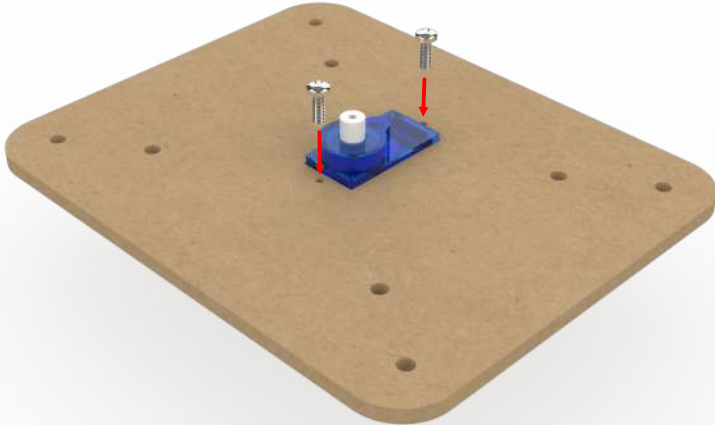
Part Number List

Each piece has a unique number. Numbers will be used to identify parts during assembly. During installation, you can refer to the part numbers from the image below.

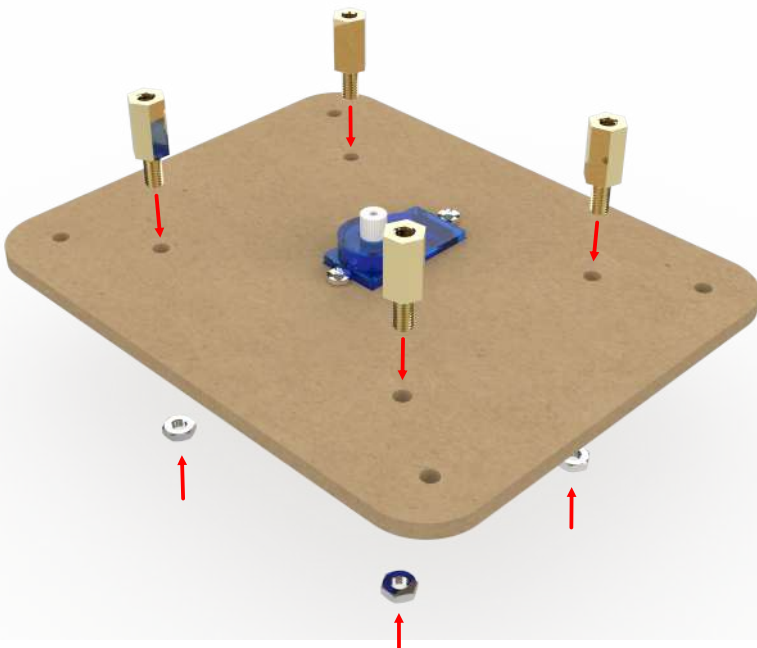


Lower Body Assembly

First, the servo motor will be mounted on the part number 1. Mount using the two long screws that come out of the servo motor package.

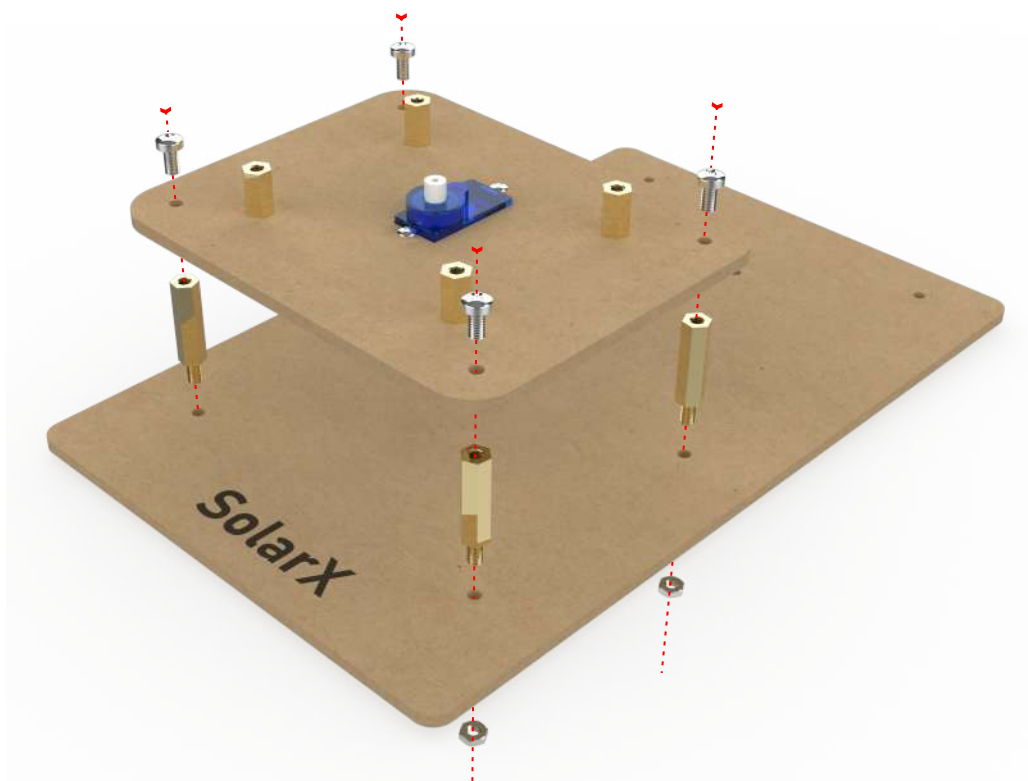


Mount 4 pieces of 10 MM spacers and 4 pieces of nuts on the part number 1 where you mounted the servo motor. These spacers will provide more stable rotation of the upper body.



SolarX v2.0 Installation

In order to raise the number 1 piece from the bottom plate, mount the 4 pieces of 20 mm spacers using 4 nuts. Then, mount the 1st piece to the 20 mm spacers on the 2nd piece using 4 6 mm bolts. After this step, SolarX's lower body assembly will be completed.

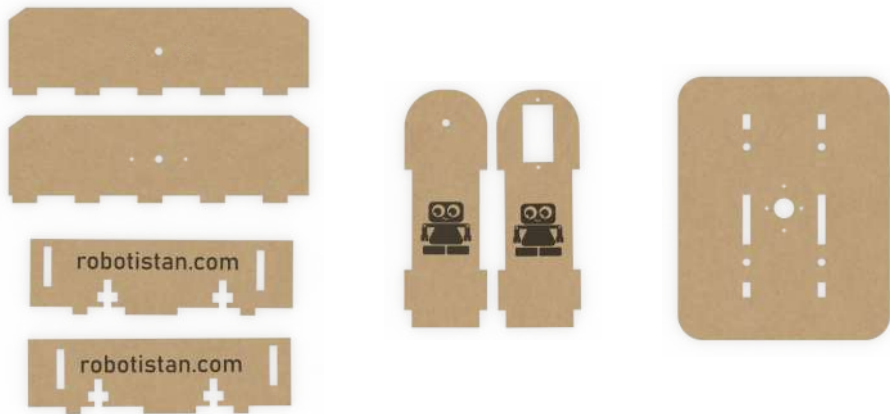


Upper Body Assembly

We can divide the upper body into two compartments. The first part allows the solar panel to move left and right. The second part is the part used to move the solar panel up and down.

This step will describe the assembly of the first part. Parts 3, 4, 5, 6 and 11 and 4 10MM bolts will be used in the assembly of the first section.

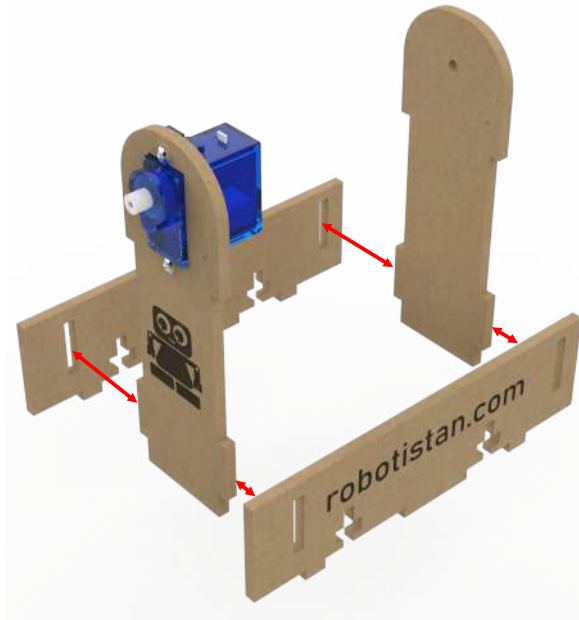
The parts to be used in this step are in the image below.



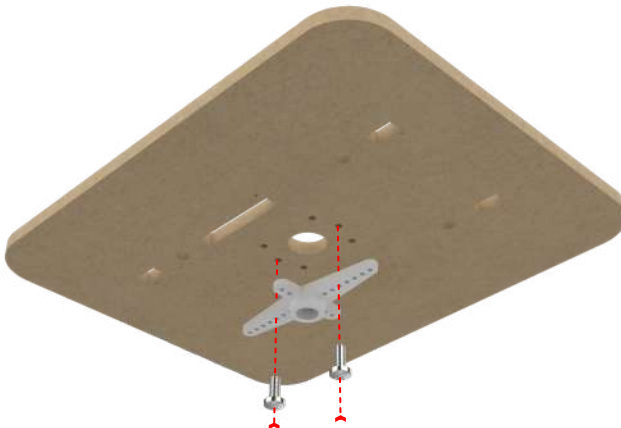
In the first step, fix part 5 with the screws included in the set with the gear mechanism of the servo motor facing upwards as in the image.



In the next step, fix the parts 3, 4, 5 and 6 by combining them as in the image. It is normal for the parts to fit together hard. In this case, you can apply some force.

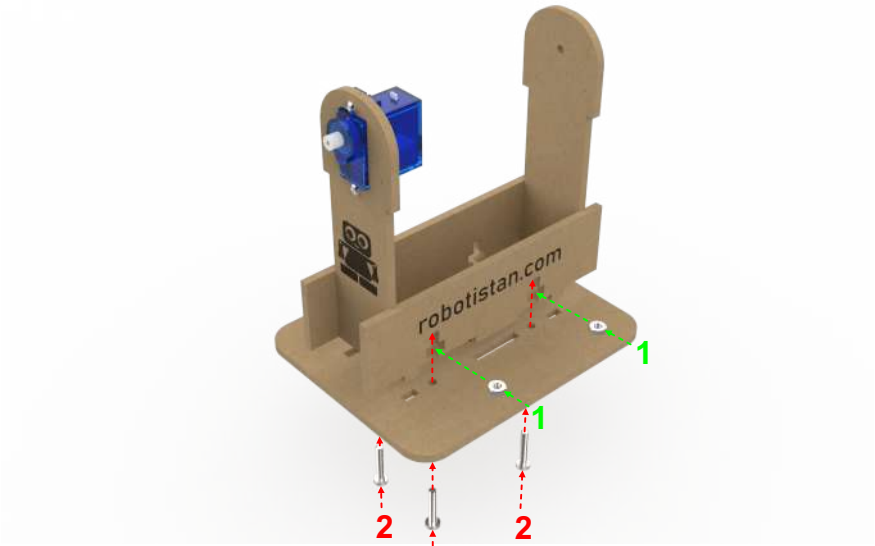


Mount the white servo head in the servo motor package to the part number 11 with 2 M2 bolts included in the set as in the image. Wooden There are 4 holes for mounting on it, you can use both holes you want. you can mount it. The 4 screws in the image are represented to show that there are two different ways of mounting.

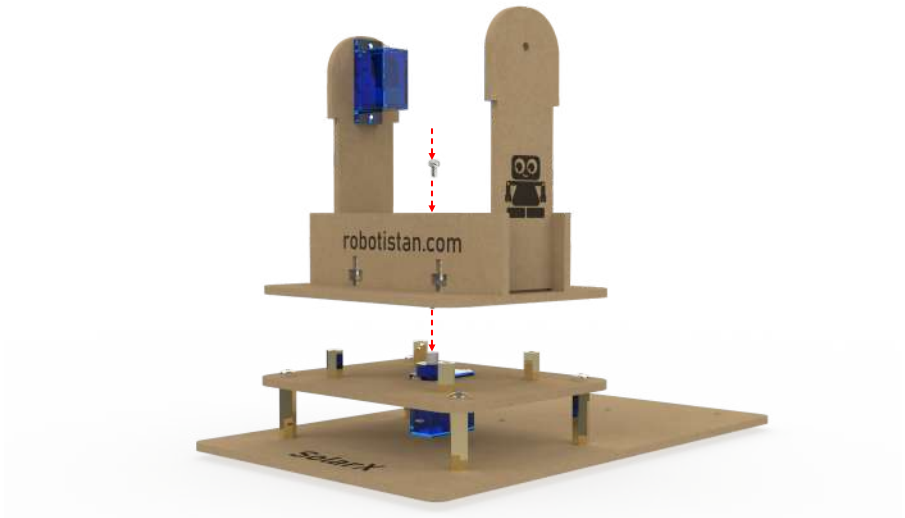


SolarX v2.0 Installation

Assemble the parts you have combined in the previous step to part 1 using 4 pieces of 10 mm bolts and nuts.

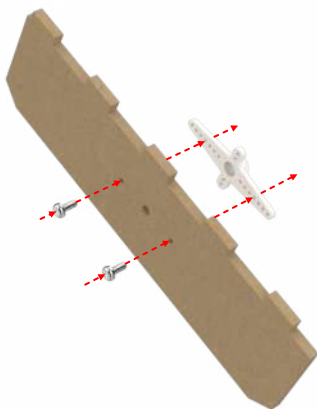


Fix the servo head that you mounted on the part number 4 to the servo motor in the part number 1 with the small screw in the servo package as in the image.

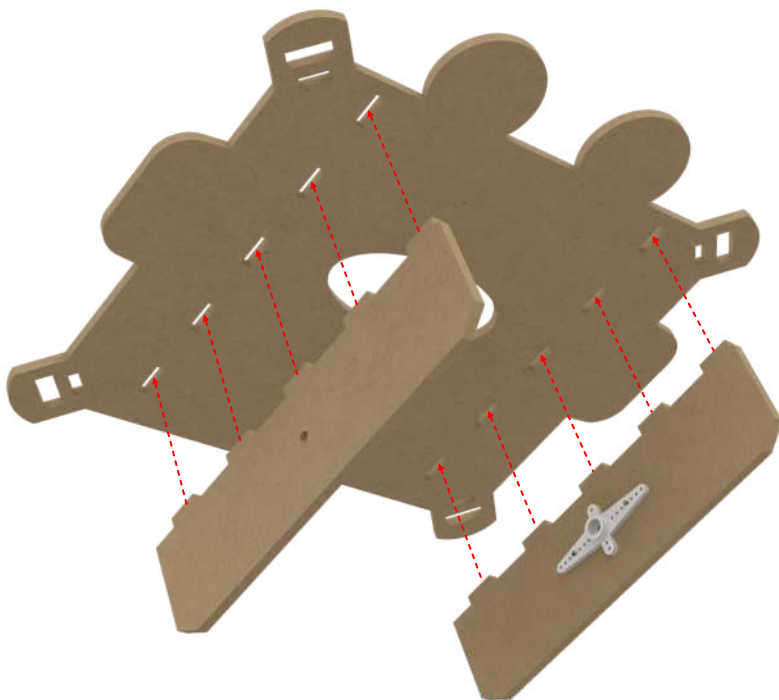


If you have completed all the steps so far, you can proceed to the assembly of the second part of the upper part. 7, 8, 9 and 10 for mounting the second partition. In order to screw the parts numbered, servo head and servo head, M2 bolt included in the set is required.

First, mount the servo head to the part number 8 with 2 M2 bolts in the set, as in the image.

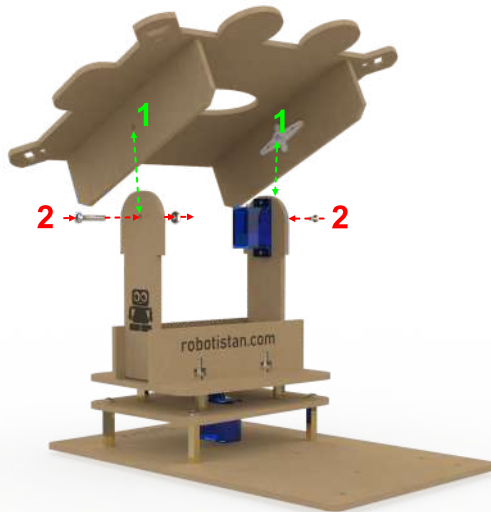


In this step, fix parts 7 and 8 by passing them through the holes in the unshaded side of part 9. Pieces may fit a little hard against each other, don't worry.

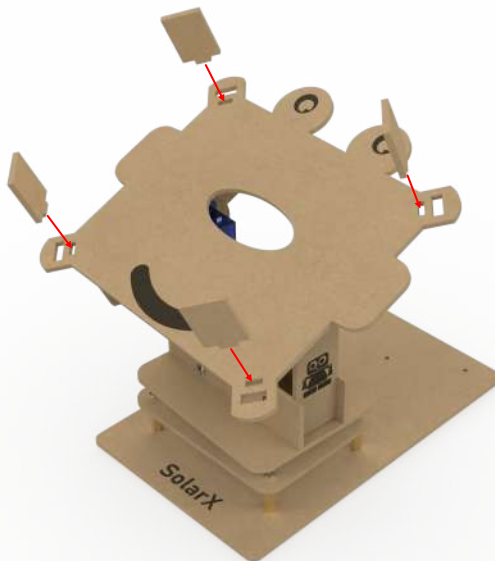


SolarX v2.0 Installation

Fix the 15 mm bolt, which helps the 9th part to move up and down, to the 7th part with 1 nut as in the picture. Do not tighten the bolt too much as it is a moving part. At the same time, fix the servo head in the 8th part to the 5th servo motor with the tiny screw that comes out of the package, without tightening it too much.

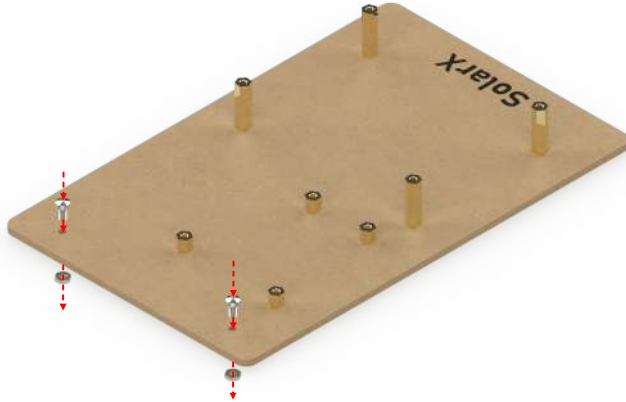


Fix the parts number 10, which are used to fix the LDR modules, to the four corners of the part number 9, as in the image. The parts may cross each other hard, don't worry.



SolarX v2.0 Installation

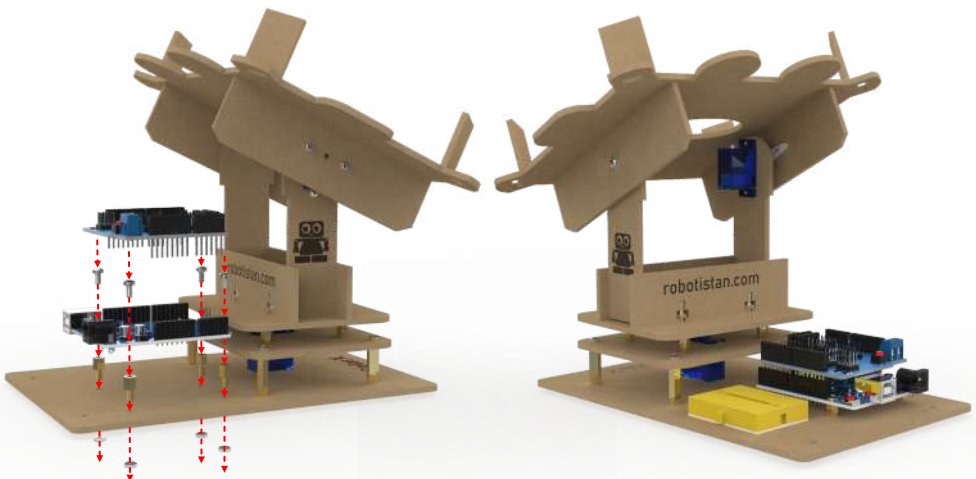
As the last step of the mechanical assembly, fix the part number 2 with 2 6 mm bolts and 2 nuts as in the image. The reason for doing this is to keep Solarx stable on flat surfaces without shaking.



You can install and operate all components in a modular way without the need for soldering in the electronics part. Uno R3 Board model is used in SolarX. There is also a breadboard that you can use while developing a project with the energy you get from the solar panel.

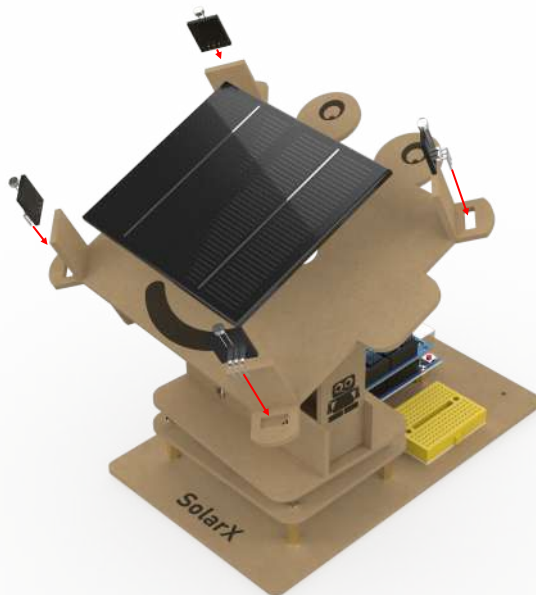
We do not use bolts when assembling the breadboard, thanks to the double-sided tape on the back, it will be enough to stick it to the specified place on the plate.

While fixing the Uno R3 Board, 4 6 mm spacers, 4 nuts and 4 6 mm bolts are used. First of all, mount the 4 spacers to the chassis of solarx with nuts. Then screw the Uno R3 Board onto the spacers with 4 6 mm bolts. After assembling the Uno R3 Board, attach the shield to the Uno R3 Board.



SolarX v2.0 Installation

With the double-sided tape included in the set, first fix the solar panel to part 9 as in the image. Then fix the LDR modules with double-sided tape in the same way as to the parts number 10.

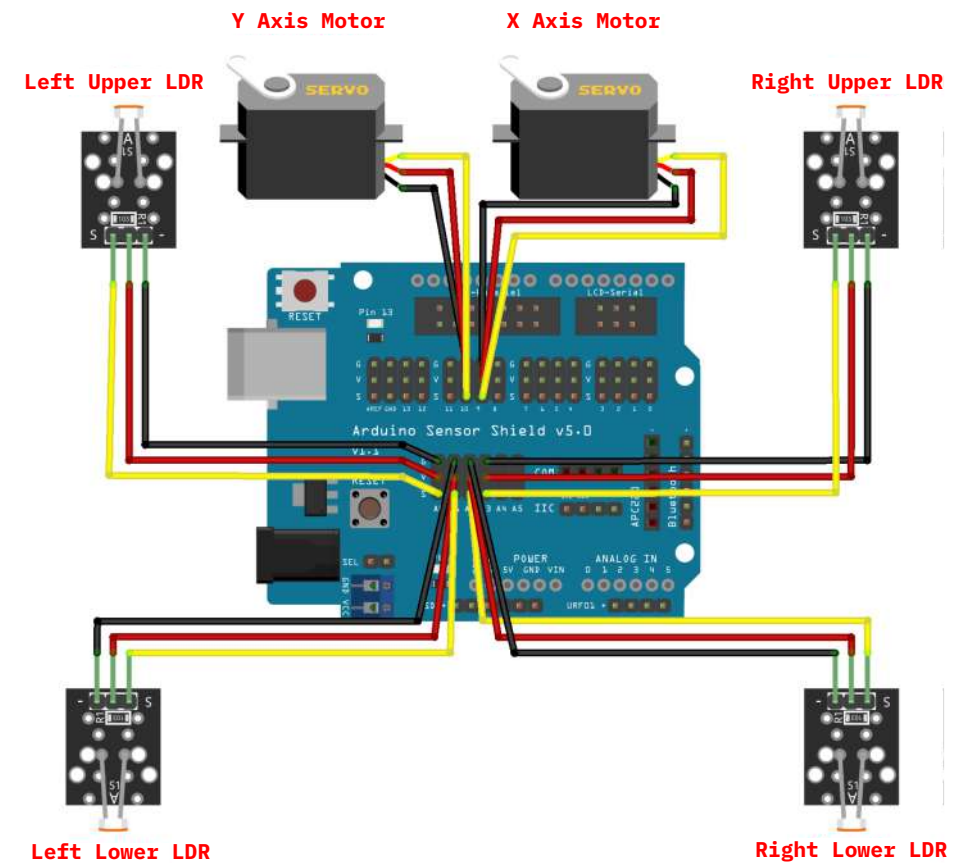


Electronic Assembly Stage

Now that all the mechanical assembly parts are finished, you can move on to the electronics part. You can make your connections based on the circuit diagram at the bottom. You can make all the connections by hand without the need for extra materials. All connections are socketed and do not require soldering. You can place the motor axes and the positions of the LDR modules by using the image below.



Circuit Diagram



If there is a part that is not understood in the circuit diagram, you can see the pin numbers of all the connections in the table below. You can make your connections based on the table.

LDR Connection Table	
A0	Left Upper
A1	Left Lower
A2	Right Upper
A3	Right Lower

Servo Motor Connection Table	
9	X Axis Servo Motor
10	Y Axis Servo Motor

Software Installation

You can download the special code written for Solar X V2 with the QR code at the bottom or with the short link. This code is given to you completely as an example. You can run Solar X with the code and develop a project with the energy you get from the sun. You can improve your project by making changes and updates to the code yourself.

```
1 #include <Servo.h>
2 //defining Servoss
3
4 #define TOLERANCE      10
5 #define STEP_DELAY     7
6 Servo servohori;
7 int servoh = 0;
8 int servohLimitHigh = 160;
9 int servohLimitLow = 20;
10
11 Servo servoverti;
12 int servov = 0;
13 int servovLimitHigh = 160;
14 int servovLimitLow = 20;
15 //Assigning LDRs
16 int ldrtopl = A0; //top left LDR green
17 int ldrtopr = A3; //top right LDR yellow
18 int ldrbotl = A1; // bottom left LDR blue
19 int ldrbotr = A2; // bottom right LDR orange
20
21 void setup ()
22 {
23   servohori.attach(10);
24   servohori.write(45);
25   servoverti.attach(9);
26   servoverti.write(45);
27   Serial.begin(9600);
28   delay(500);
29 }
30
31 void loop()
32 {
33   servoh = servohori.read();
34   servov = servoverti.read();
35   //capturing analog values of each LDR
36   int topl = analogRead(ldrtopl);
37   int topr = analogRead(ldrtopr);
38   int botl = analogRead(ldrbotl);
39   int botr = analogRead(ldrbotr);
40   // calculating average
41   int avgtop = (topl + topr) / 2; //average of top LDRs
42   int avgbot = (botl + botr) / 2; //average of bottom LDRs
43   int avgleft = (topl + botl) / 2; //average of left LDRs
44   int avgright = (topr + botr) / 2; //average of right LDRs
45   Serial.println(avgtop);
46 }
```

```
47  if (TOLERANCE < avgbot - avgtop)
48  {
49      servoverti.write(servov + 1);
50      if (servov > servovLimitHigh)
51      {
52          servov = servovLimitHigh;
53      }
54      delay(STEP_DELAY);
55  }
56
57  else if (TOLERANCE < avgtop - avgbot)
58  {
59      servoverti.write(servov - 1);
60      if (servov < servovLimitLow)
61      {
62          servov = servovLimitLow;
63      }
64      delay(STEP_DELAY);
65  }
66
67  else
68  {
69      servoverti.write(servov);
70  }
71
72  if (avgleft - avgright > TOLERANCE)
73  {
74      servohori.write(servoh + 1);
75
76      if (servoh > servohLimitHigh)
77      {
78          servoh = servohLimitHigh;
79      }
80      delay(STEP_DELAY);
81  }
82
83  else if (avgright - avgleft > TOLERANCE)
84  {
85      servohori.write(servoh - 1);
86
87      if (servoh < servohLimitLow)
88      {
89          servoh = servohLimitLow;
90      }
91      delay(STEP_DELAY);
92  }
93
94  else
95  {
96      servohori.write(servoh);
97  }
98  delay(STEP_DELAY);
99 }
```

The codes shared here are loaded on the Uno R3 Board board in the set. After making the necessary circuit connections, you can run Solarx.

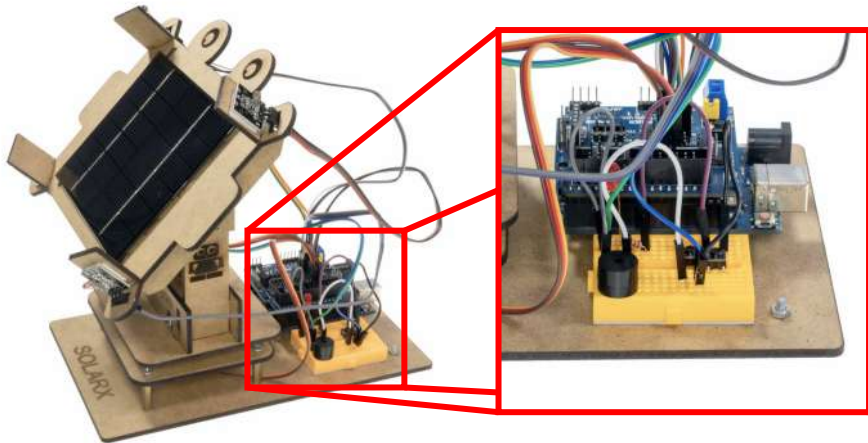
<http://rbt.ist/r2b>



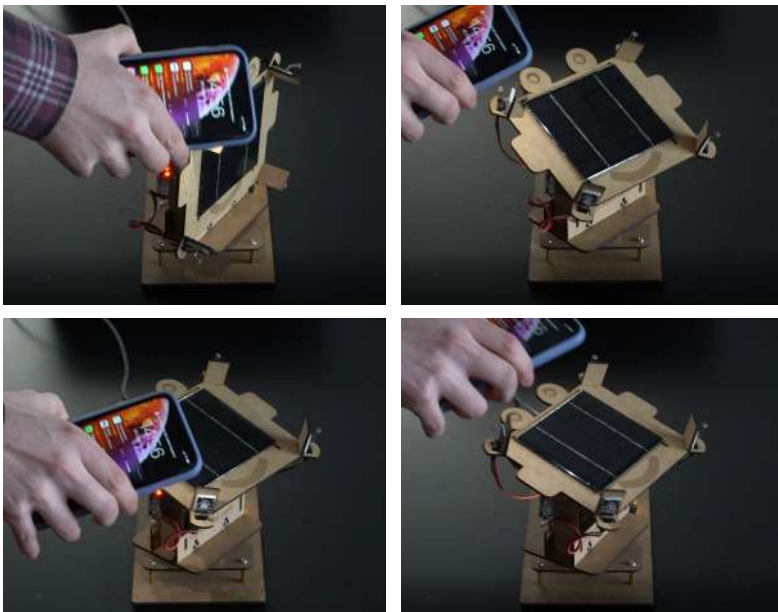
SolarX v2.0 Installation

Final

After SolarX V2 is assembled according to the manual and uploaded the code, the final version will be as in the images below.



Solarx does not work with the energy it receives from the sun. It uses the energy it receives from the sun to operate the buzzer and the LED. Solarx gets its energy from the USB cable that comes with it.



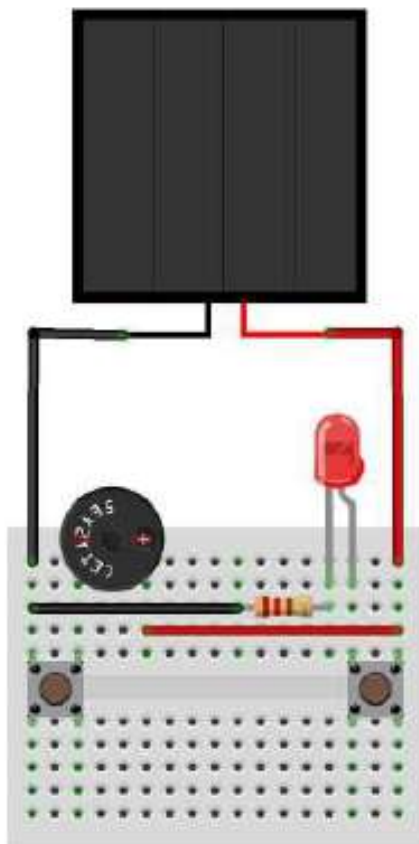
Sample Project

After connecting the LDR and servo motors, you can start running something with the energy you get from the solar panel.

Using the energy you get from the solar panel is left to your imagination. With energy, you can either store it, charge the battery or feed your Uno R3 Board.

In order to set an example for you, the circuit diagram drawing was carried out with the buzzer and led included in the set. You can use the energy you get from the solar panel with the help of the image below.

When you do this project, when you press the first button with the energy you get from the sun, the buzzer will work, and when the second button is pressed, the LED will work.



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