

robotistan



Arduino Solar Tracking System



<http://rbt.ist/solarx>

Visit the product page for the latest installation guide

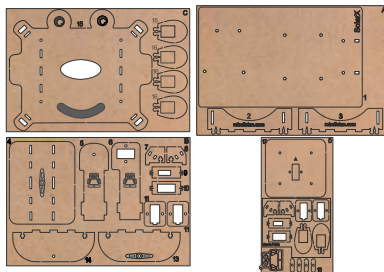
Why Solar Panel?

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.

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
12636	10 mm M3 Metal Female - Male Spacer	16
12669	M3 6mm Head Metric Screw	4
12675	M3 10mm Head Metric Screw	11
12668	M3 Nut	22
20540	Double-Sided Tape	1
16901	Extension cable (for LDR)	4
16980	USB Cable	1
20861	M3 Nyloc nut	1
	300 grit sandpaper	1
	0,28 inch LED voltmeter	1
	Small screwdriver	1
	Wooden sheets (Wood parts)	1
	Spare parts package	1

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.



LED voltmeter



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 Dependent 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.

Fasteners

-  ■ M3x 6mm - 4 pcs.
-  ■ M3x 10mm - 11 pcs.
-  ■ M3 x 10mm Spacers - 16 pcs.

* The dimensions of fasteners are 1/1 scale if this document printed in A5 booklet format.



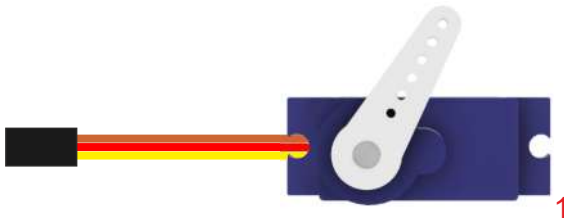
Magnetized Screwdriver

The use of the magnetic screwdriver allows the user to place a screw onto the tip of the screwdriver and have it remain attached to the screwdriver while being inserted and installed into fastening position

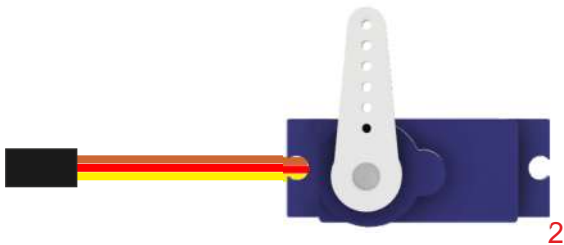
Assembly Steps - Tuning up the servo motors.

Attention !

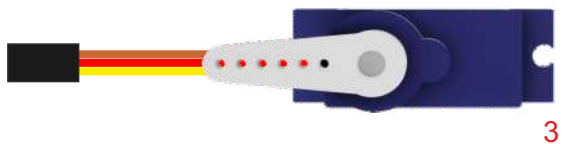
Servo motors which included in packages are already calibrated however, if you want to learn about calibrating about servo motors. you can follow these steps.



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



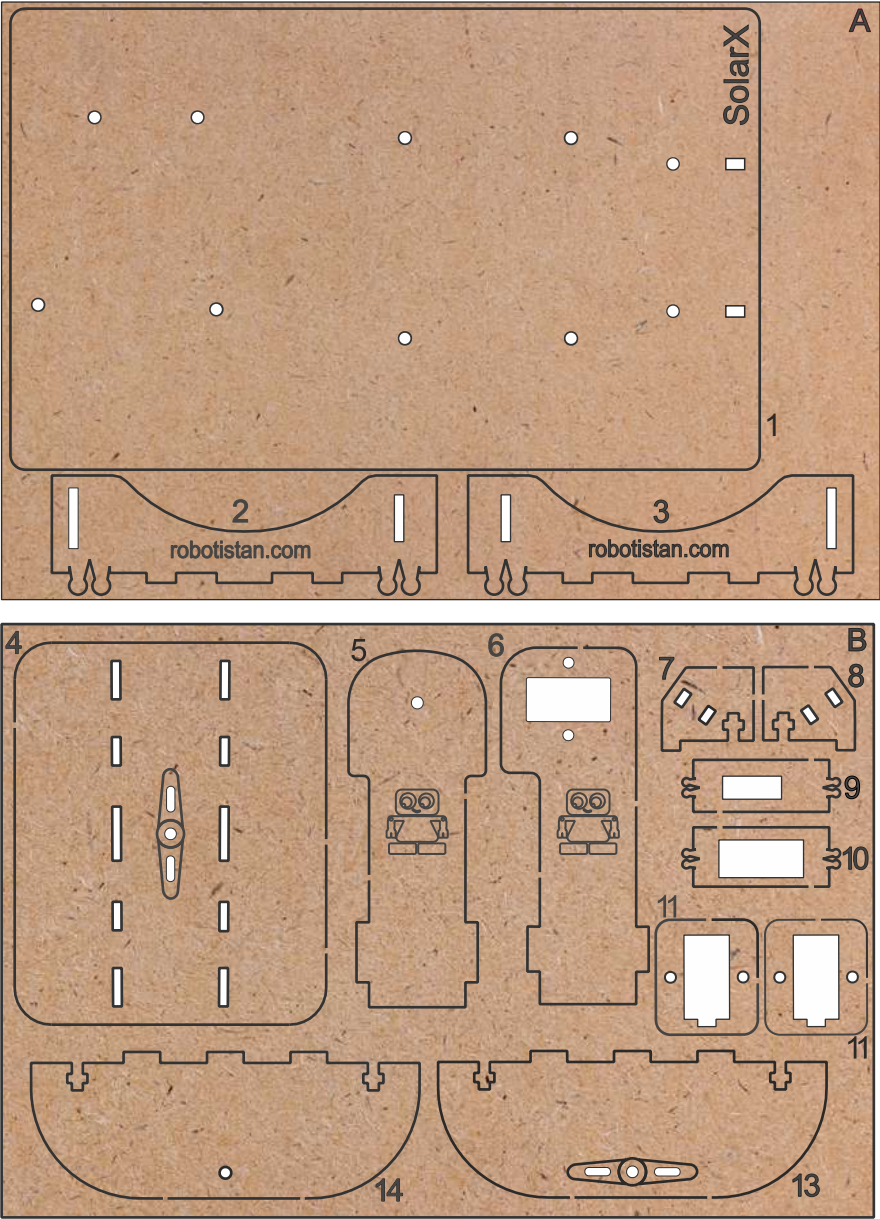
Remove the servo arm from the servo motor and reposition it perpendicular to the servo motor as shown.

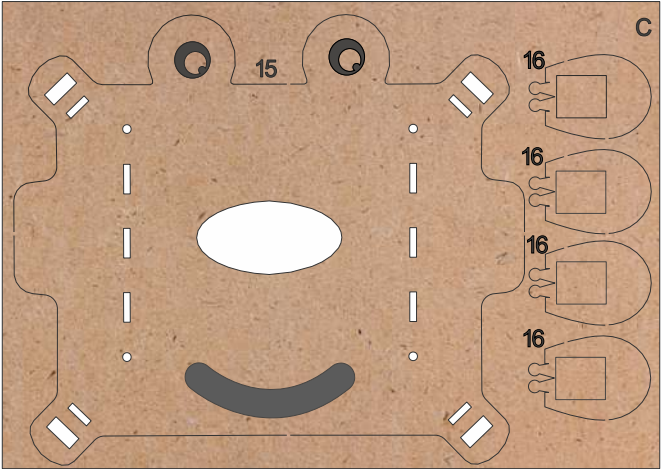


Slowly turn the servo horn counter clockwise until it is parallel with the servo motor, as seen in the image. When this step is finished, it means that the servo motor is in the center position. It is important that you apply this process to other servo motors in the set. After processing the other motors, remove the servo horn and set aside for assembly.

SolarX Assembly Guide - Part List

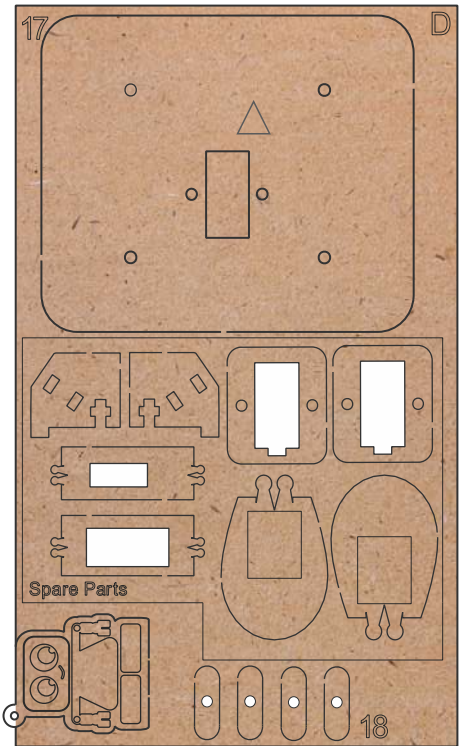
The Part list represents the number markers of the wooden parts. The parts are marked at each stage of the assembly.





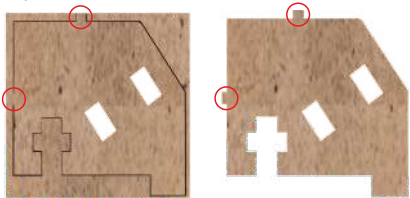
Wood Glue

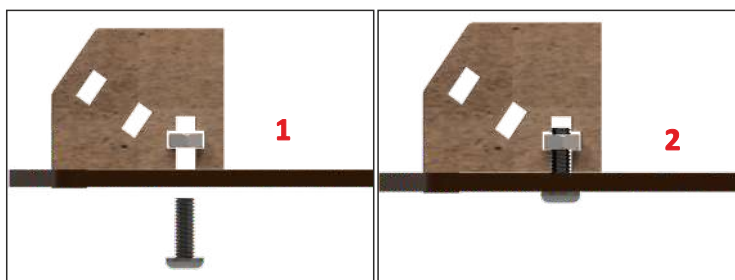
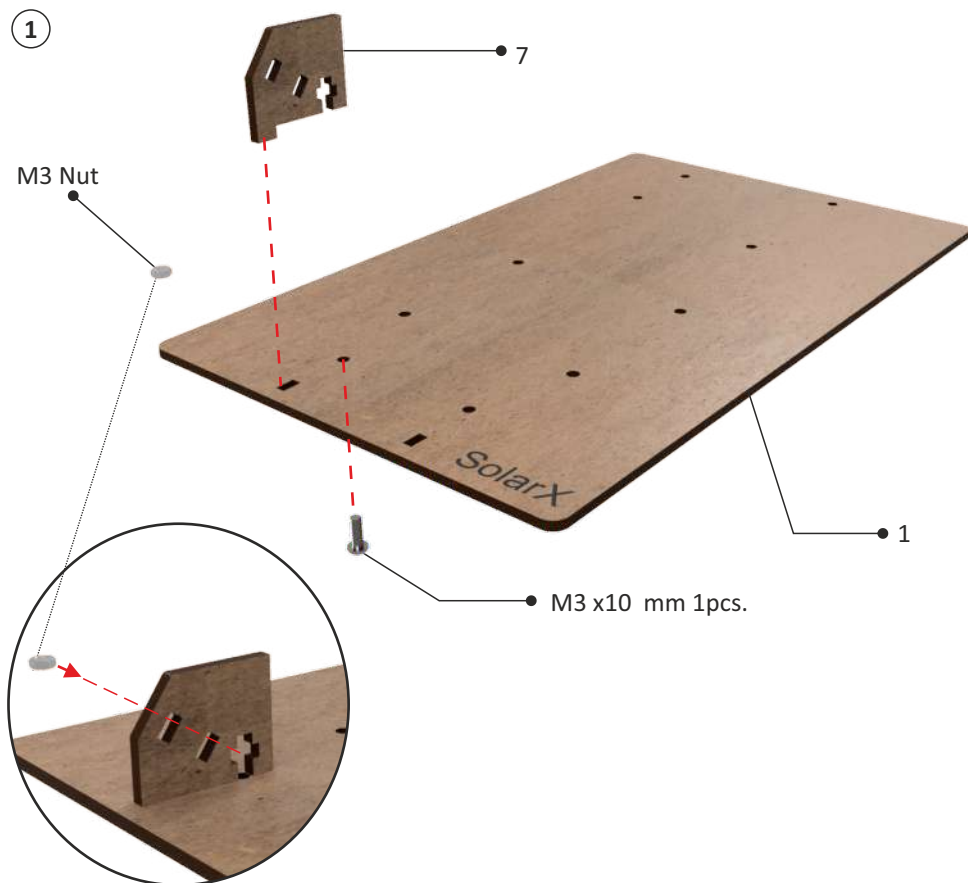
Just in case, some of the wood joints may feel a bit loose. for those joints you can use wood glue which can be found inside the kit package.



300 Grit Sandpaper

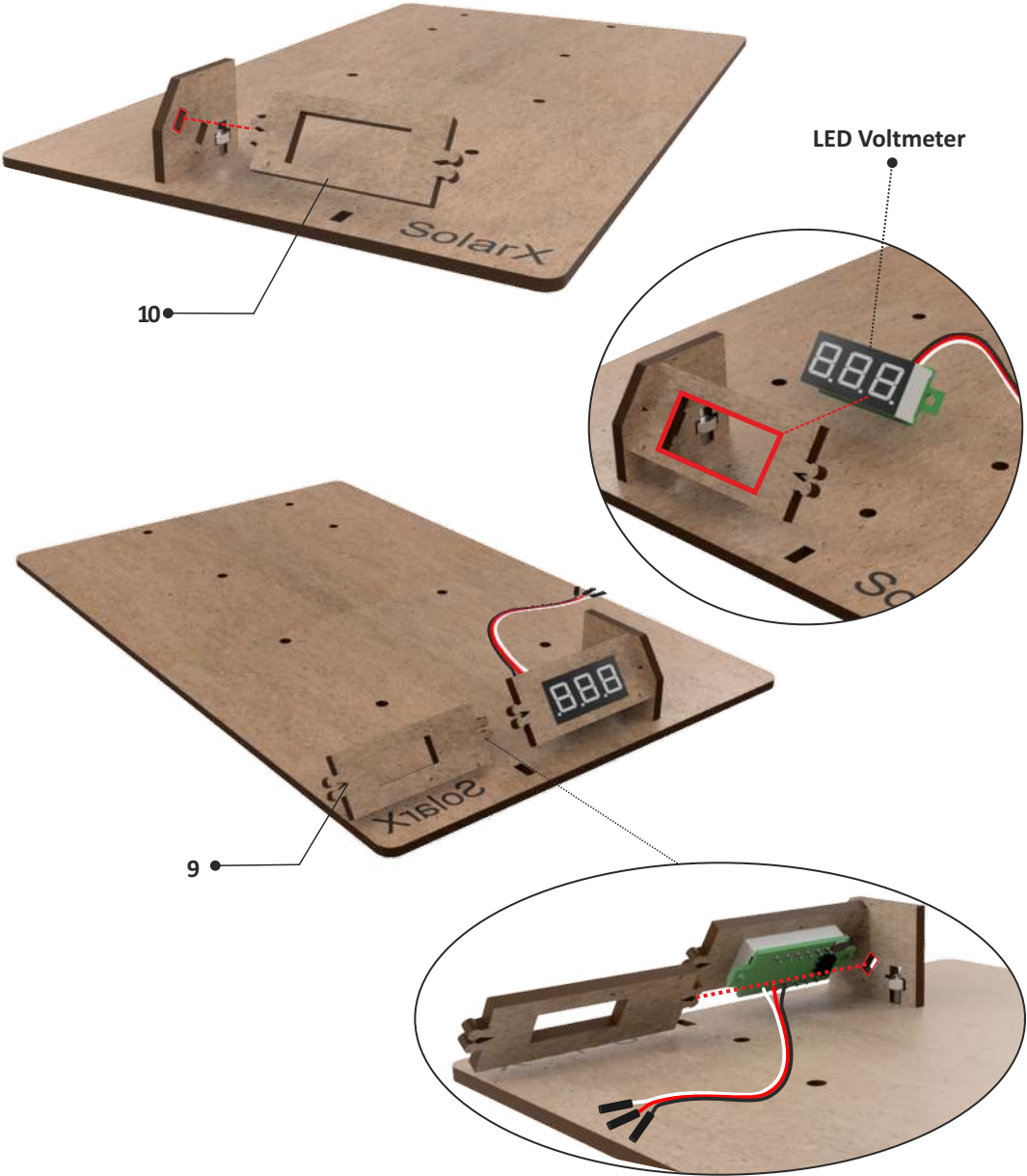
The parts are attached to sheets via small clamps, You can break out the parts by simply applying low pressure to them then, you can use the **300 grit sandpaper** to clear the clamp remains.



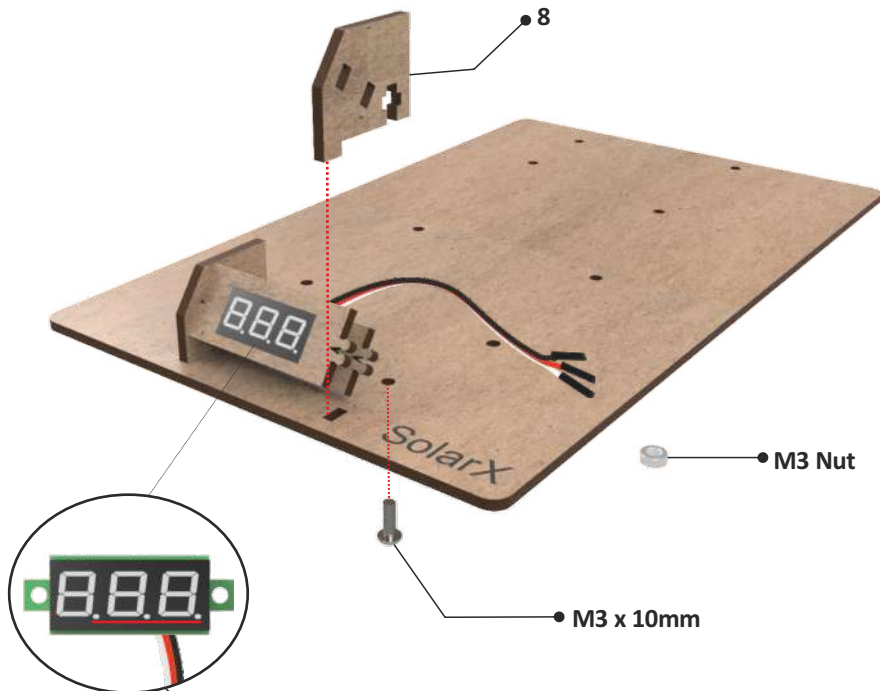


To tighten the screw first, **(1)** place the **M3 Nut** to referred slot then, use the **M3 x 10mm** bolt to tighten it. **(2)**

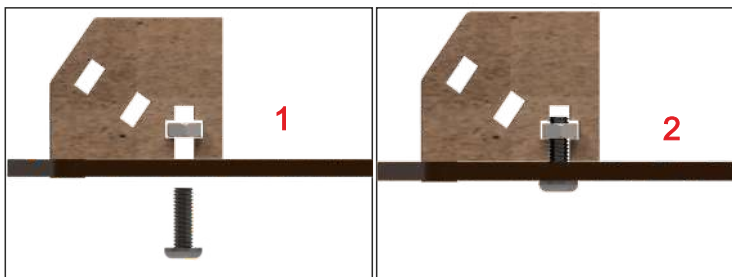
2



3

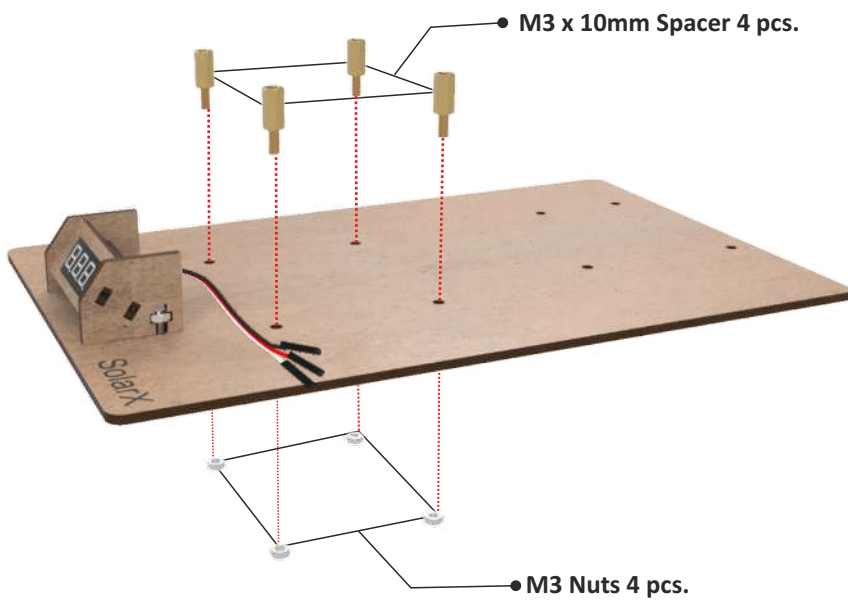


- Make sure voltmeter placed right direction as seen in the image (you can take three **dots** as reference)

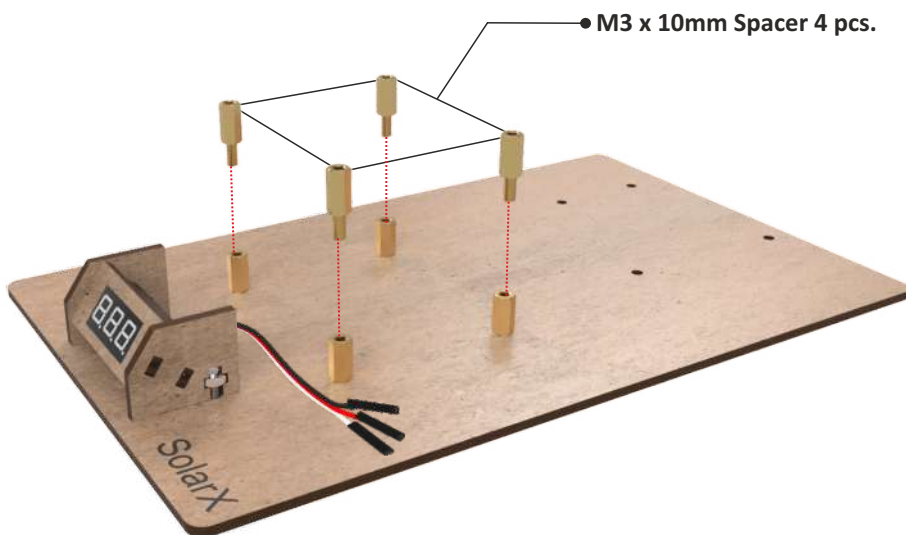


To tighten the screw first, **(1)** place the M3 Nut to referred slot then, use the M3 x 10mm bolt to tighten it. **(2)**

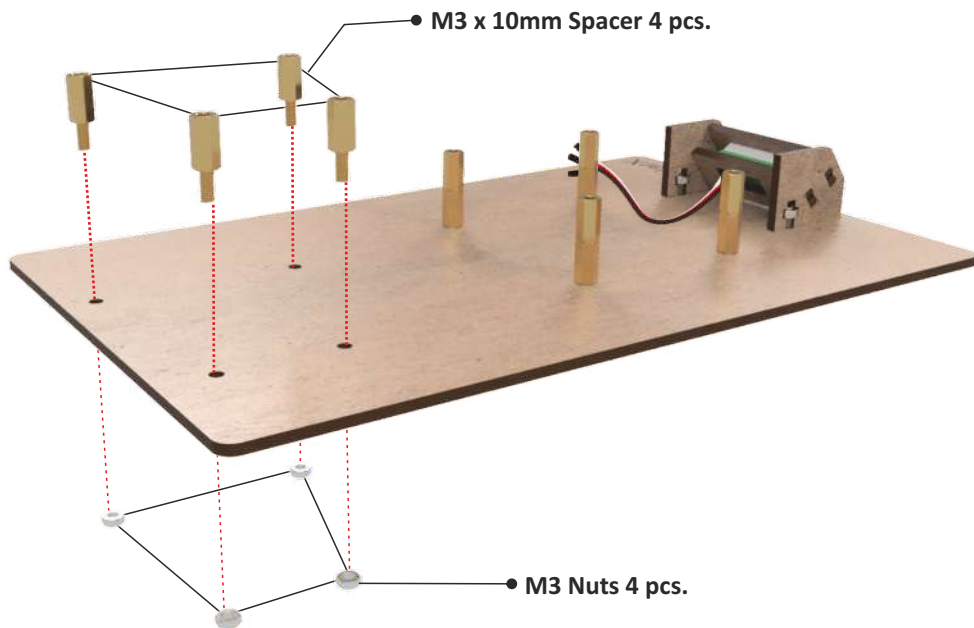
4



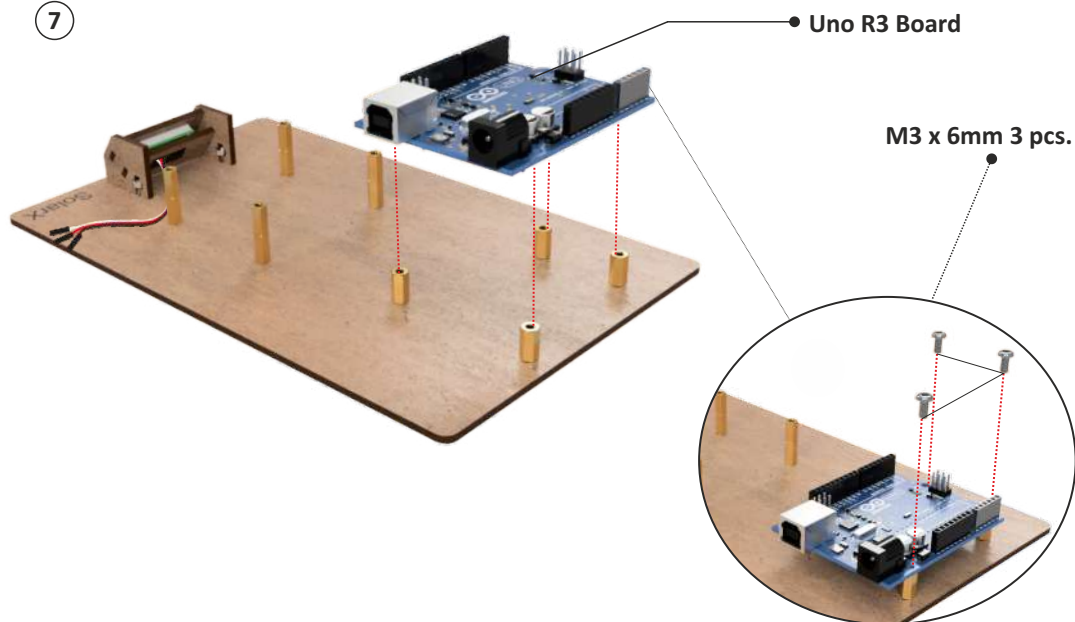
5



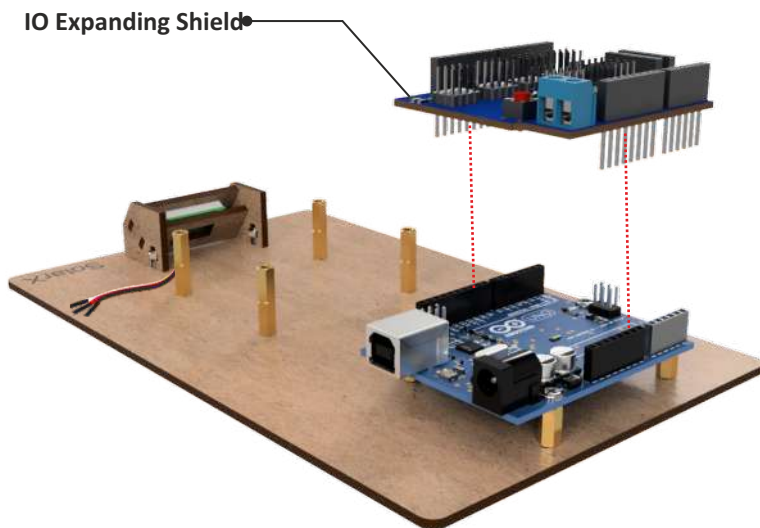
6



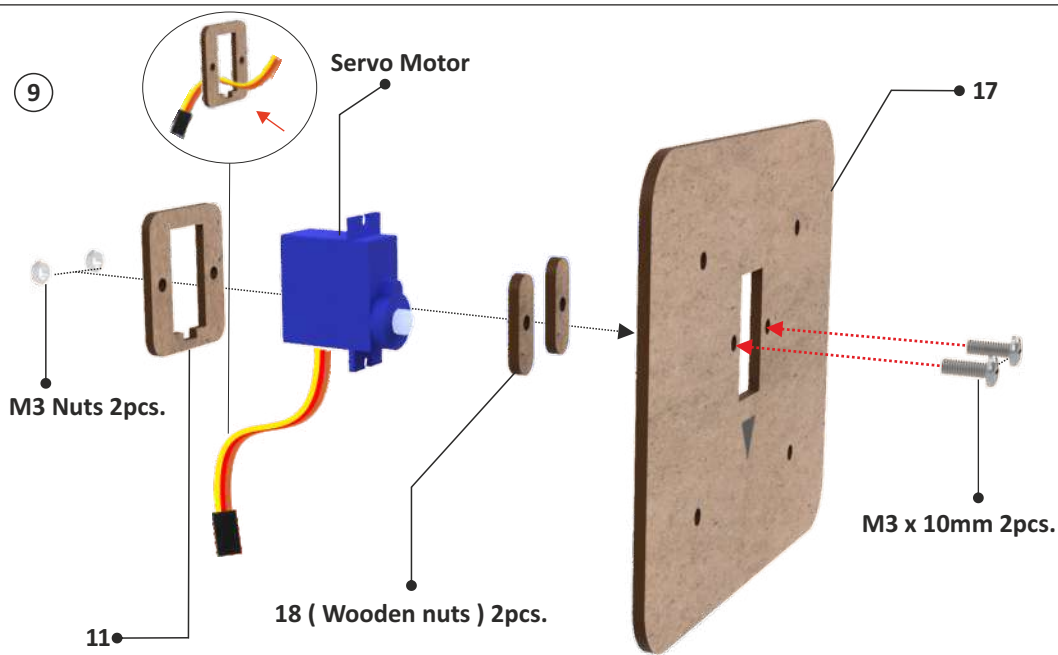
7



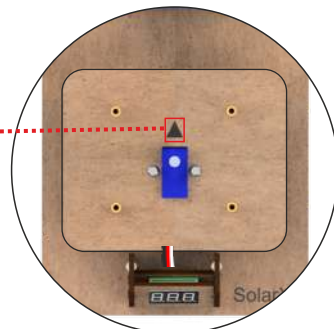
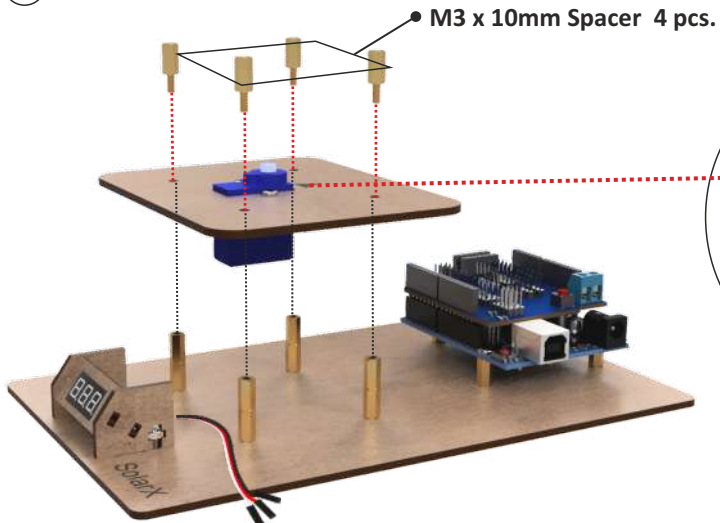
8



9

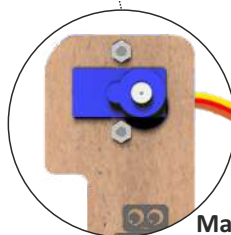
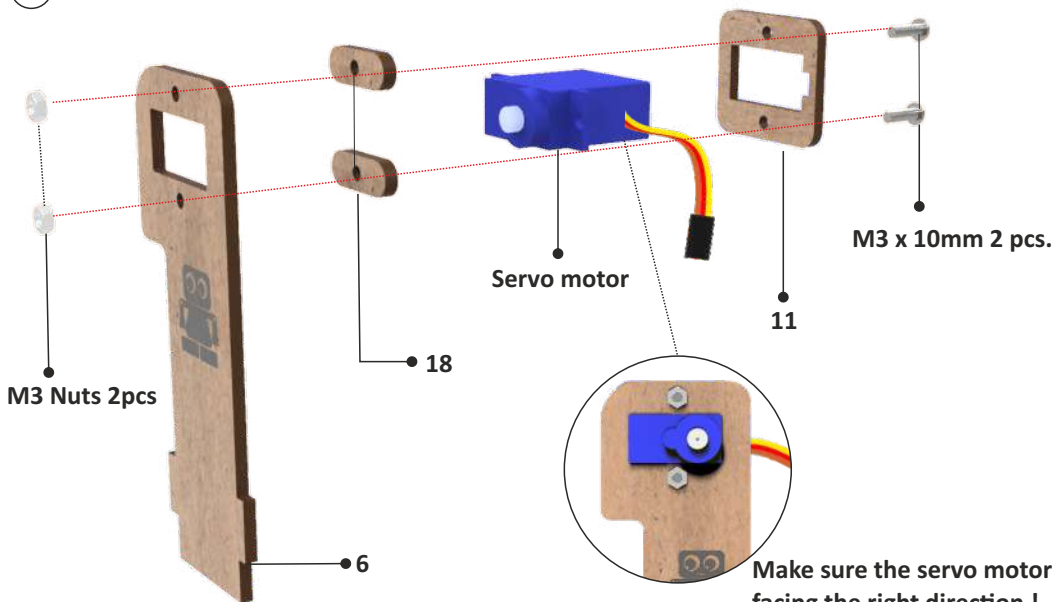


10



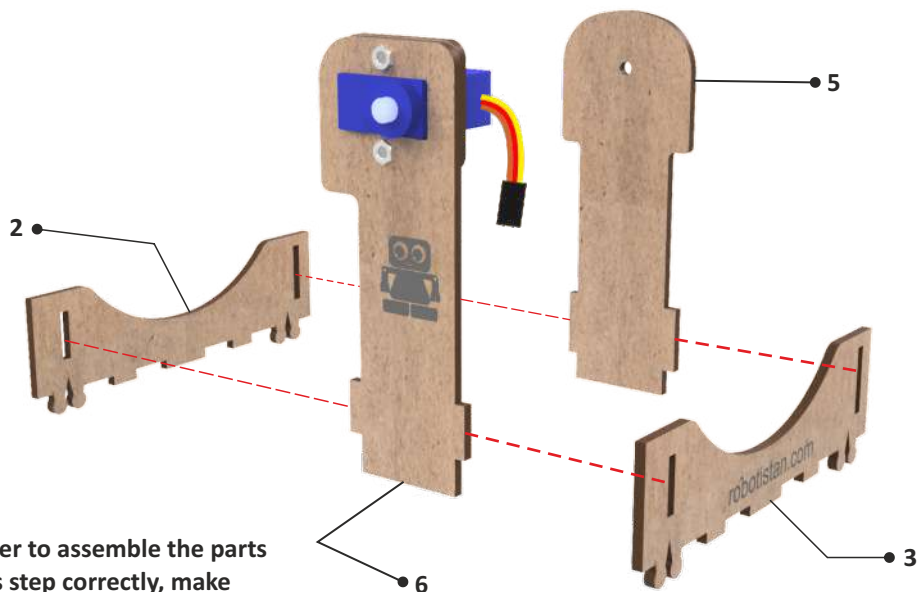
Make sure the servo motor facing the right direction. for that, you can use **arrow mark** for reference.

11



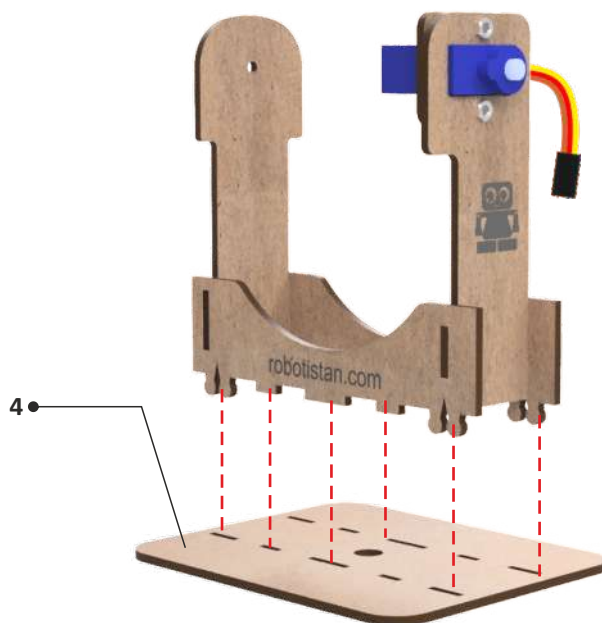
Make sure the servo motor facing the right direction !

12

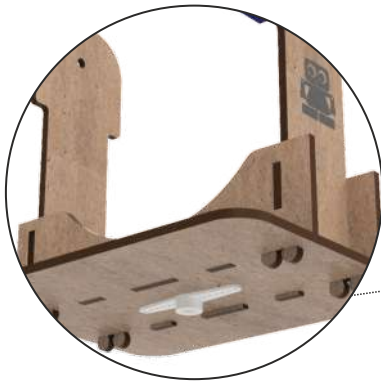


In order to assemble the parts of this step correctly, make sure the logos are pointing outside.

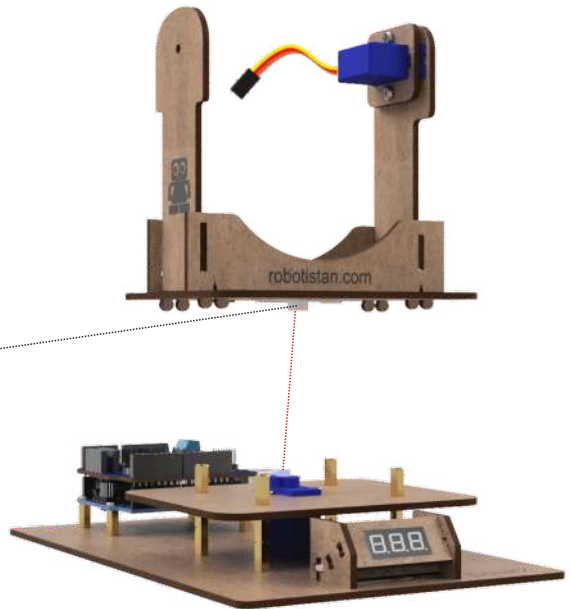
13



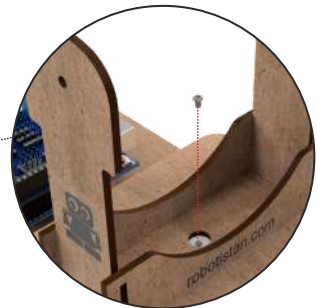
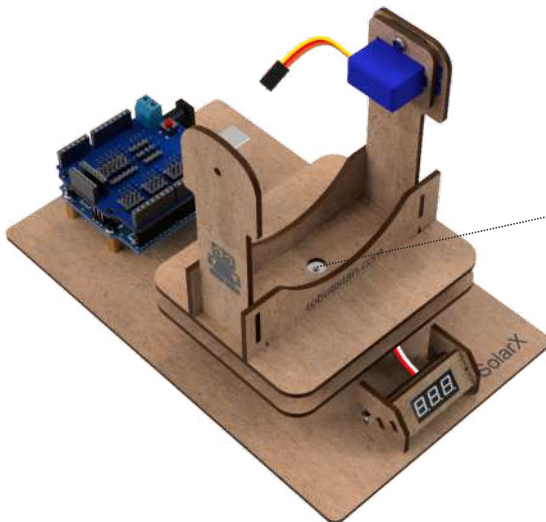
14



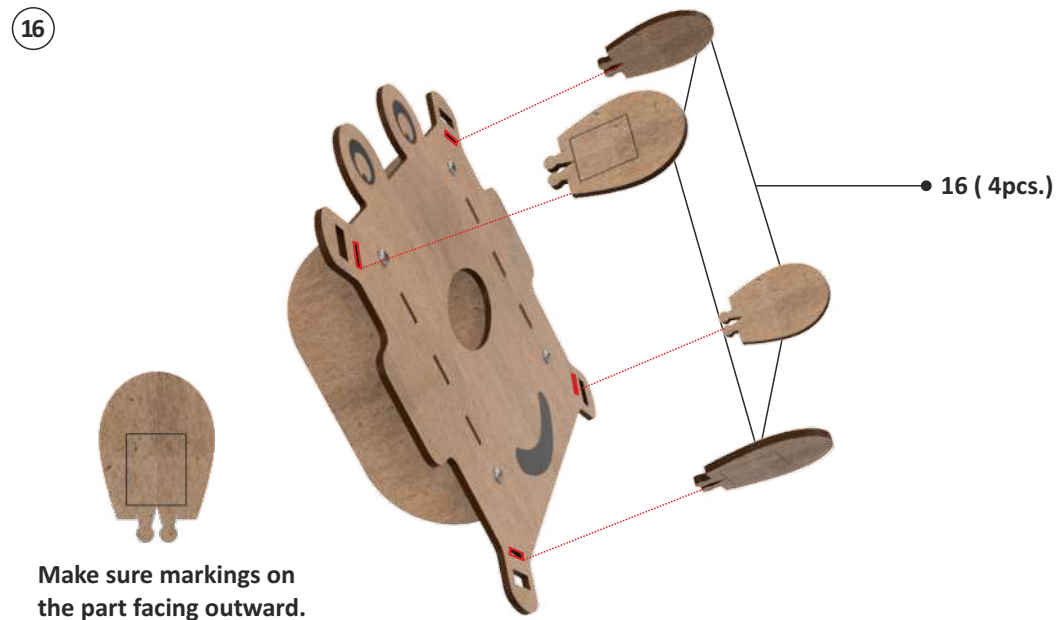
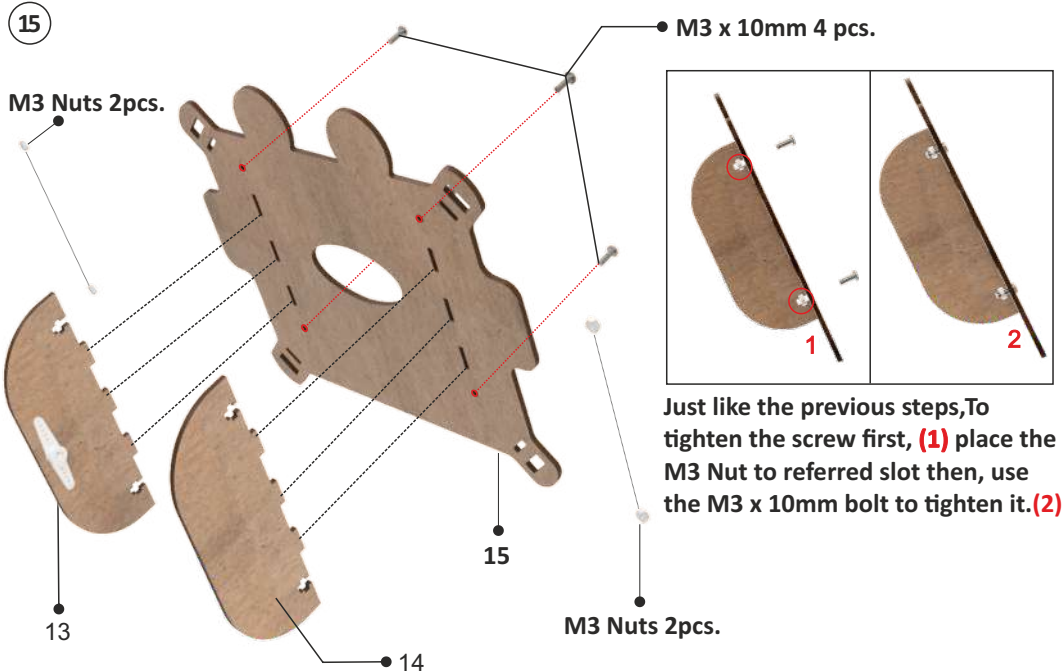
Connect the upper part to the servo motor by servo horn



15



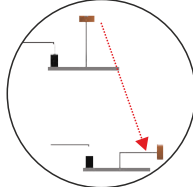
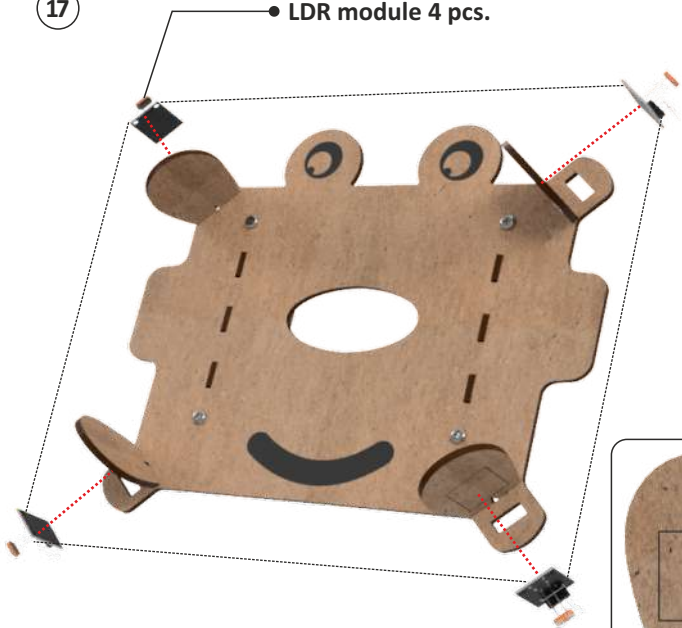
After joining the parts together tight the joint with the servo horn bolt. The required servo horn bolts are inside the packages of servo motors.



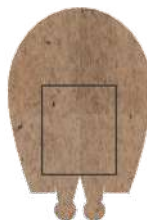
SolarX Assembly Steps

17

• LDR module 4 pcs.

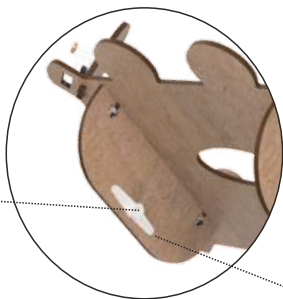
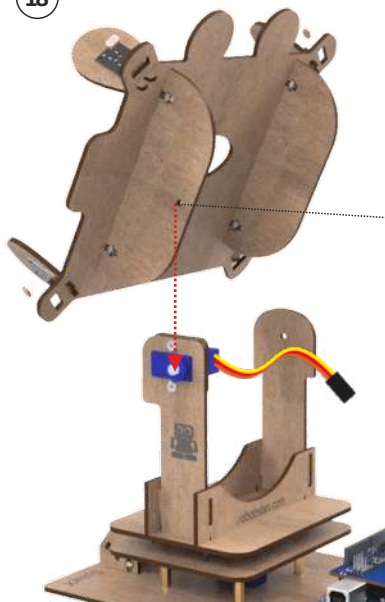


For LDR modules to work more effectively, we recommend bending the LDR sensor as seen in the images above. as they are closer to the surface, they will have much better light ray readings.

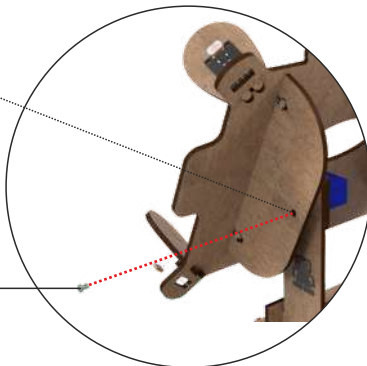


You can use the **marked area** for double-sided tape to fix the LDR module.
(Double sided tape can be found inside the package.)

18

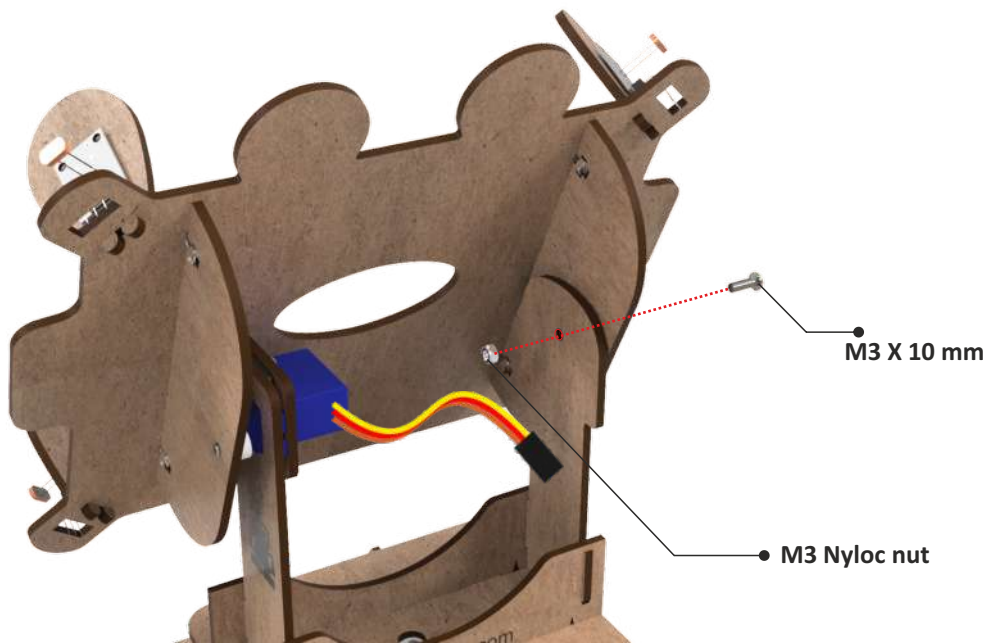


Just like the previous steps, After jointing the parts together tight the joint with the servo horn bolt. The required servo horn bolts are inside the packages of servo motors.

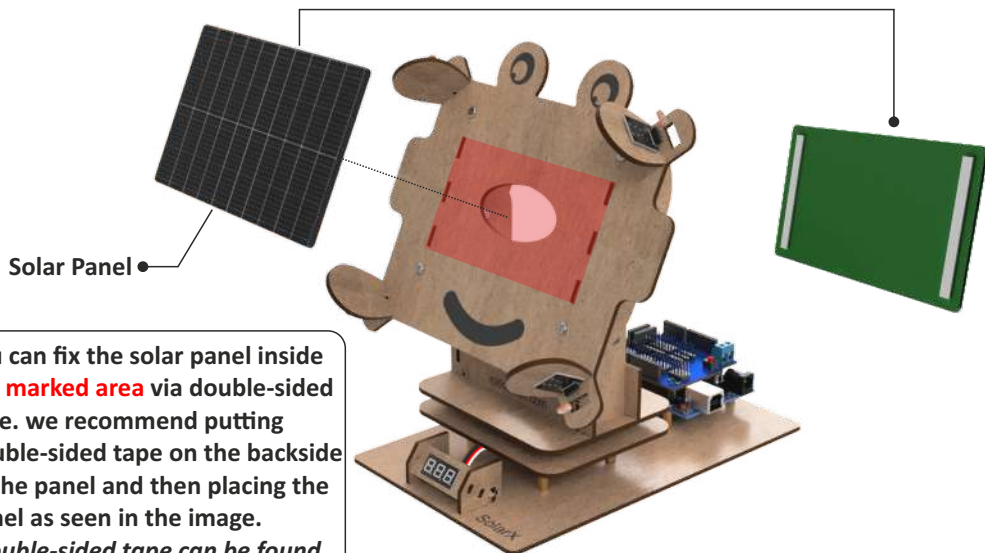


Servo horn screw •

19



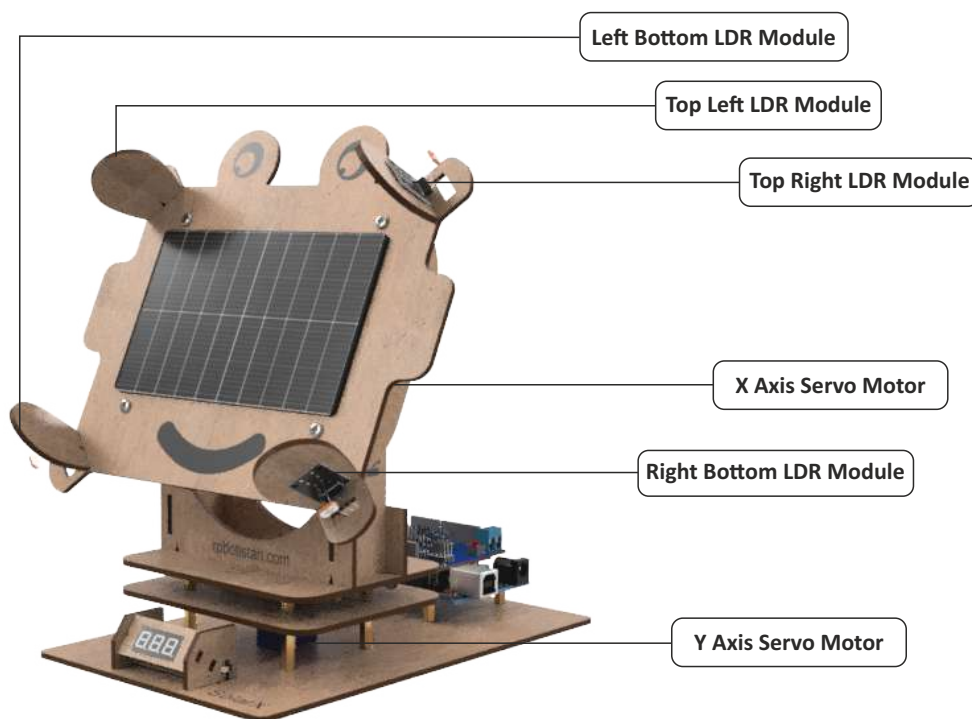
20



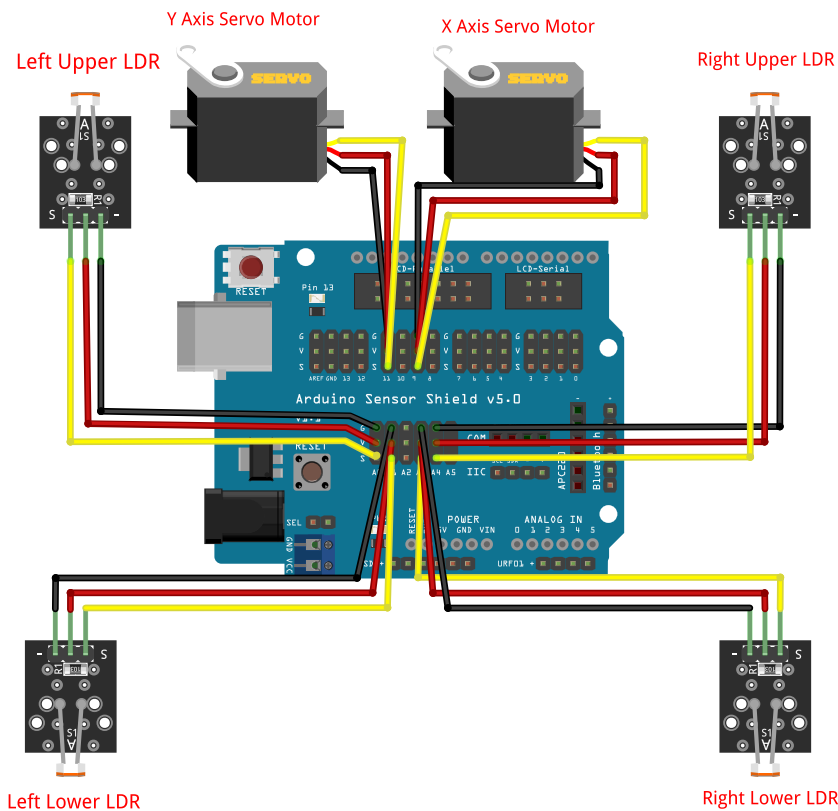
You can fix the solar panel inside the **marked area** via double-sided tape. we recommend putting double-sided tape on the backside of the panel and then placing the panel as seen in the image.
(Double-sided tape can be found inside the package.)

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 page after. 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

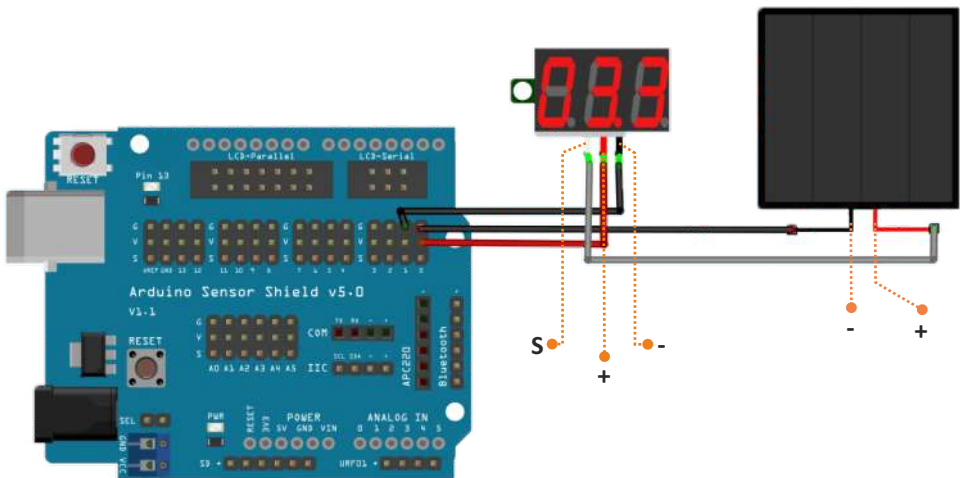


If there is a part that is not understood in the circuit diagram, you can see the pin numbers of all the connections in the table below. You can make your connection based on the table.

LDR Connection Table	
A0	Top Left
A1	Bottom Left
A3	Bottom Right
A4	Top Right

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

Circuit Diagram

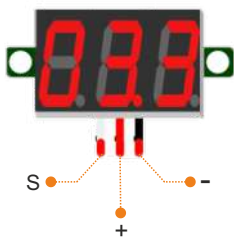


Connection Table of Voltmeter

+	Sensor Shield V (5V)
-	To GND(-) Lead of shield
Signal	To (+) Lead of Solar Panel

Solar Panel Connection Table

+	To the Signal Tip of the Voltmeter
-	To GND(-) Lead of Voltmeter



It is a mini screen that shows the energy from the sun as 0v - 6v. You can think of 0 as the minimum 6 maximum value. The more efficiently Solarx receives energy from the sun, the higher the value written on the screen will be.

The codes shared here are loaded on the Uno R3 Board board in the set. Afer making the necessary circuit cconnectionsyou can run Solarx.

<http://rbt.ist/solarx>



```

1
2
3
4  /*
5   SolarX / Arduino Solar Tracker System
6
7   SolarX detects the position of the sun via LDRs and follows the sunlight by the motors. Project works better with updated code.
8
9   Website, Contact and Product Link:
10
11
12   You can check the other products:
13   https://www.robotistan.com/robotistan-special-products
14
15   by Robotistan R&D
16 */
17
18 #include <Servo.h>           // Library for servo motors.
19
20 Servo servo_horizontal;      // Define horizontal servo.
21 int servoh = 90;             // Horizontal servo first position.
22 int servohLimitHigh = 150;   // Servo move positon maximum limit.
23 int servohLimitLow = 30;     // Servo move positon minimum limit.
24
25 Servo servo_vertical;        // Define vertical servo.
26 int servov = 90;             // Vertical servo first position.
27 int servovLimitHigh = 150;   // Servo move positon maximum limit.
28 int servovLimitLow = 30;     // Servo move positon minimum limit.
29
30 #define SERVO_H_LIMIT_H 160 // Servo horizontal high limit value.
31 #define SERVO_H_LIMIT_L 30  // Servo horizontal low limit value.
32 #define SERVO_V_LIMIT_H 140 // Servo vertical high limit value.
33 #define SERVO_V_LIMIT_L 60  // Servo vertical low limit value.
34 #define LTL_PIN A0          // LDR top left definedinput.
35 #define LTR_PIN A4          // LDR top right defined input.
36 #define LBL_PIN A1          // LDR bottom left defined input.
37 #define LBR_PIN A3          // LDR bottom right defined input.
38
39
40 void setup() {
41   Serial.begin(9600);
42   pinMode(LTL_PIN, INPUT);
43   pinMode(LTR_PIN, INPUT);
44   pinMode(LBL_PIN, INPUT);
45   pinMode(LBR_PIN, INPUT);
46   servo_vertical.attach(9);
47   servo_vertical.write(90);
48   servo_horizontal.attach(11);
49   servo_horizontal.write(90);
50   Serial.println("TL\tTR\tBL\tBR\tTL\tTL\tBL\tTR\ttservov\ttservoh"); // Shows the values that described on the Serial Port.
51 }
52
53 void loop() {
54   int TL_value = analogRead(LTL_PIN); // Reading value of top left LDR.
55   int TR_value = analogRead(LTR_PIN); // Reading value of top right LDR.
56   int BL_value = analogRead(LBL_PIN); // Reading value of bottom left LDR.
57   int BR_value = analogRead(LBR_PIN); // Reading value of bottom right LDR.
58   int T_value = (TR_value + TL_value) / 2; // Average of top LDRs.
59   int L_value = (BL_value + TL_value) / 2; // Average of left LDRs.
60   int B_value = (BR_value + BL_value) / 2; // Average of bottom LDRs.
61   int R_value = (TR_value + BR_value) / 2; // Average of right LDRs.
62
63

```

```

64 //Serial.println("TL\tTR\tBL\tBR\tT\tL\tB\tR\ttservov\ttservoh"); // Shows the values that described on the Serial Port.
65 Serial.print(TL_value); // Printing Values to Serial port.
66 Serial.print("\t");
67 Serial.print(TR_value);
68 Serial.print("\t");
69 Serial.print(BL_value);
70 Serial.print("\t");
71 Serial.print(BR_value);
72 Serial.print("\t");
73 Serial.print(T_value);
74 Serial.print("\t");
75 Serial.print(L_value);
76 Serial.print("\t");
77 Serial.print(B_value);
78 Serial.print("\t");
79 Serial.print(R_value);
80 Serial.print("\t");
81 Serial.print(servov);
82 Serial.print("\t");
83 Serial.print(servoh);
84 Serial.println("\t");
85
86
87 if (T_value - B_value < 0) {
88 // if difference of top value and bottom value are smaller than 0, decrease servo vertical angle value.
89 servov--;
90 }
91 else if (T_value - B_value > 0) {
92 // else if difference of top value and bottom value are bigger than 0, increase servo vertical angle value.
93 servov++;
94 }
95 if (L_value - R_value < 0) {
96 // if difference of left value and right value are smaller than 0, decrease servo horizontal angle value.
97 servoh--;
98 }
99 else if (L_value - R_value > 0) {
100 // else if difference of left value and right value are bigger than 0, increase servo horizontal angle value.
101 servoh++;
102 }
103
104 if (servoh < SERVO_H_LIMIT_L)
105 // if servo horizontal angle value smaller than servo horizontal limit low value,
106 // equalize servo horizontal angle value and servo horizontal limit low value.
107 {
108 servoh = SERVO_H_LIMIT_L;
109 }
110 else if (servoh > SERVO_H_LIMIT_H)
111 // if servo horizontal angle value bigger than servo horizontal limit high value,
112 // equalize servo horizontal angle value and servo horizontal limit high value.
113 {
114 servoh = SERVO_H_LIMIT_H;
115 }
116
117 if (servov > SERVO_V_LIMIT_H)
118 // if servo vertical angle value bigger than servo vertical limit high value,
119 // equalize servo vertical angle value and servo vertical limit high value.
120 {
121 servov = SERVO_V_LIMIT_H;
122 }
123 else if (servov < SERVO_V_LIMIT_L)
124 // if servo vertical angle value smaller than servo vertical limit low value,
125 // equalize servo vertical angle value and servo vertical limit low value.
126 {
127 servov = SERVO_V_LIMIT_L;
128 }
129
130 servo_horizontal.write(servoh);
131 // Available this delays if you have shutdown when you run your project.
132 delay(50);
133 servo_vertical.write(servov);
134 delay(50);
135
136 }

```

The codes shared here are loaded on the Uno R3 Board board in the set. Afer making the necessary circuit cconnectionsyou can run Solarx.

<http://rbt.ist/solarx>



SolarX Assembly Steps

Final

Afer 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.



**We're Here to Help
Feel free to
reach out to us at**



+1 628 267 3834



support@robotistan.com

Robotistan INC

**3 Germay Dr, Unit 4 #2442 Wilmington DE 19804
shop.robotistan.com - make.robotistan.com**