What is XMotion?

XMotion is Arduino Compatible all in one robot controller. Which designed specially for robotics, IOT and maker projects.It includes powerful Motor drivers, switching mode regulator, interface circuits and more. With protected features, it is all in one board for lots of different type robot projects.

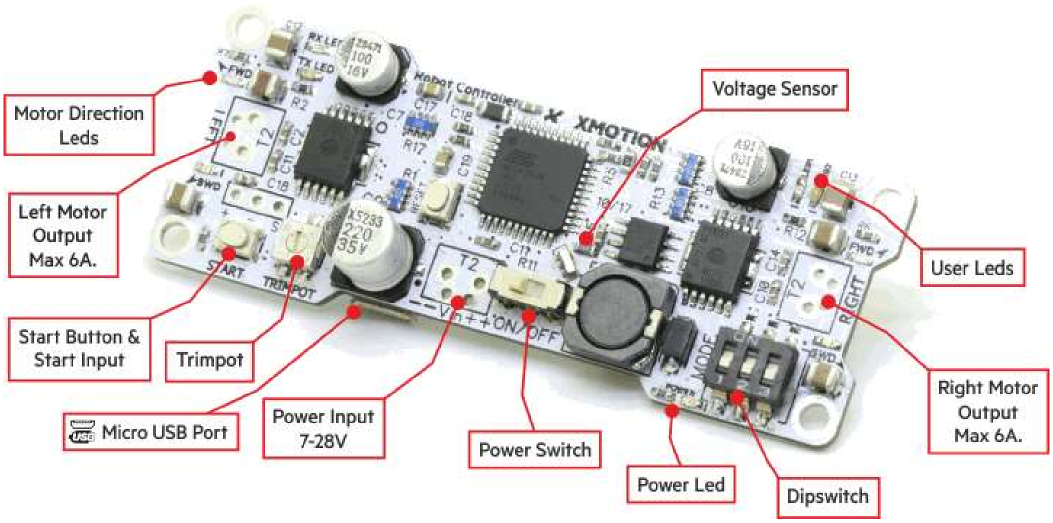
So in basic, we add sensors, battery, motors and all other blocks are inside XMotion board. With XMotion you can make these robots easily:

- Mini sumo Robot (500 grams 2- 4 motors)
- Midi sumo Robot (1 Kg 2-4 motors)
- Line Follower Robot (Light, fast maneuvering projects)
- Obstacle Avoiding, Maze Robot

- Mini Explorer Robots (Up to 3 kg)
- Bluetooth controlled robots.
- Light Arm Robots
- And your imagination.

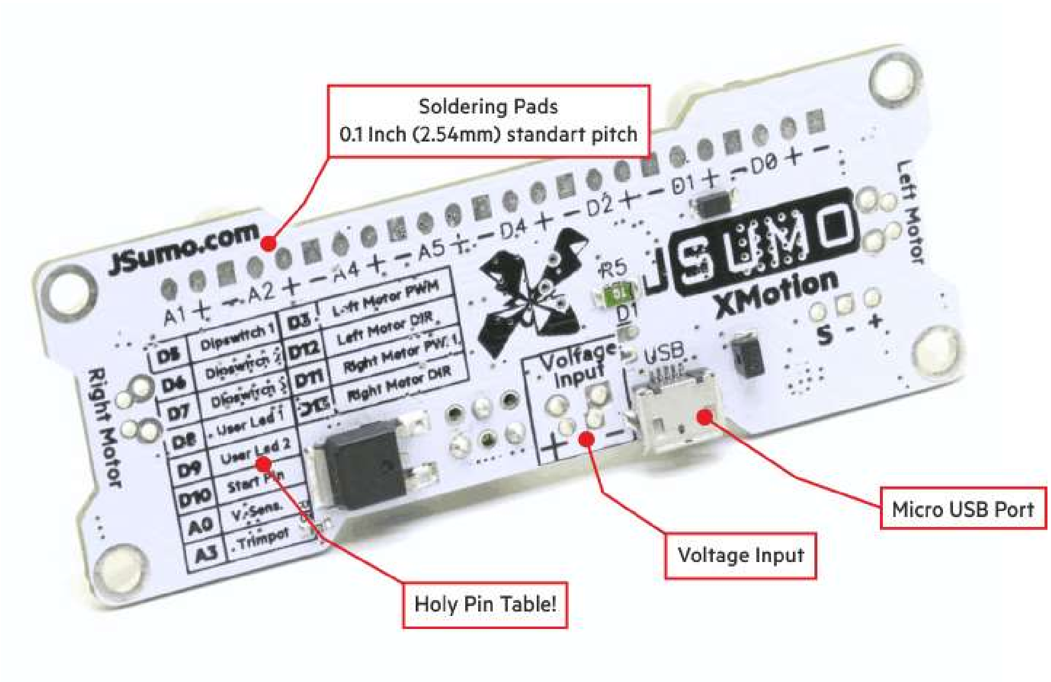
Topics, we will cover in this article:

1. How to start
2. First Code – Blink Led
3. Adding library
4. Toggle Leds Example
5. Motor Control Functions Example
6. XMotion functions full list
7. How to use built-in button & dipswitch
8. How to use Analog input elements (Trimpot & Voltage Sensor)
9. Motor Selection for XMotion
10. Battery Selection for XMotion
11. How to choose sensors & other circuits
12. How to solder parts to xmotion
13. Going further, developing projects

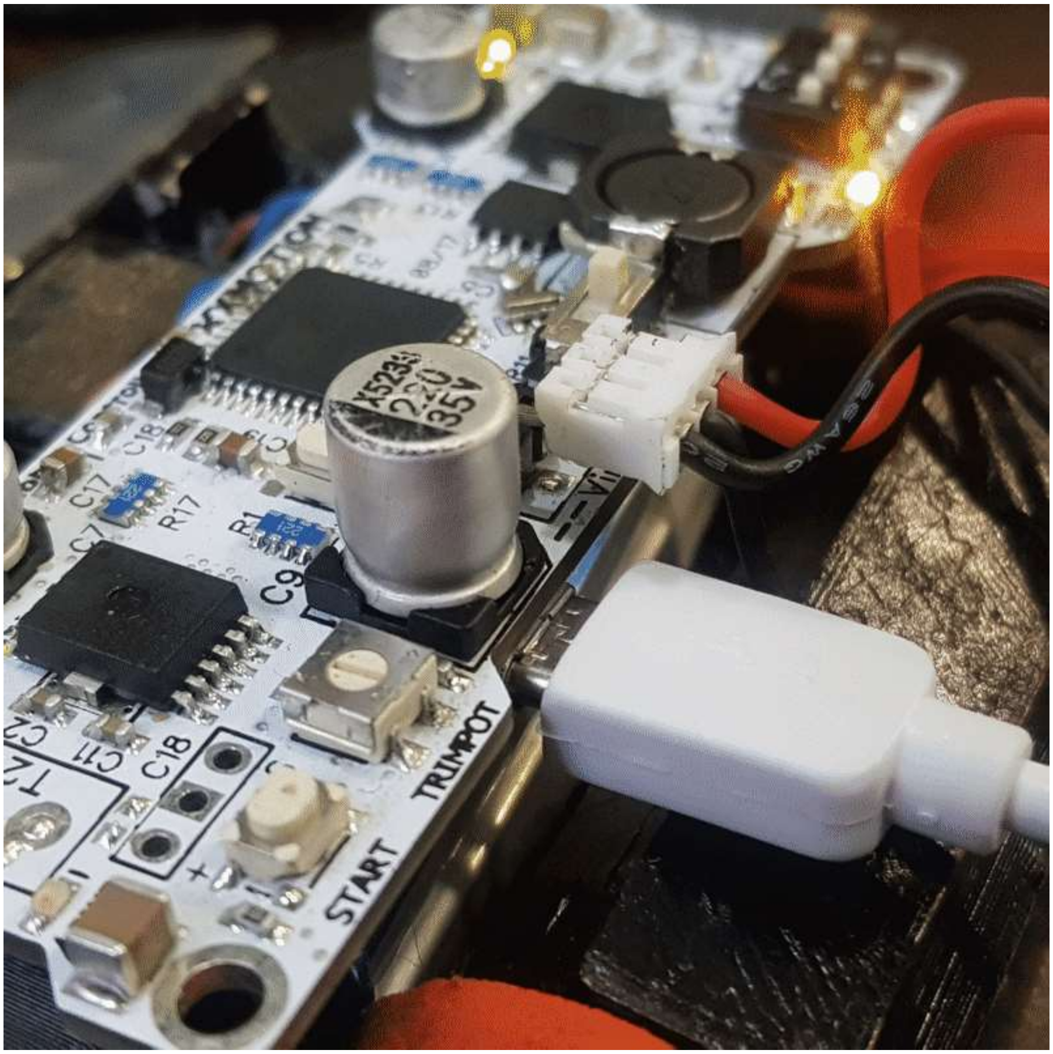


1. How to Start

Development with XMotion is very basic, we need to look to right image, back of board. (click the image for bigger size). For your needs xmotion has 8 spare I/O which means you have lots of pins for extra sensors interface circuits. At 8 pins 4 of them is digital and 4 of them is analog. (Remember, you can use analog Inputs also as digital I/O)



Back side table is important, there you can see all I/O usage at board.

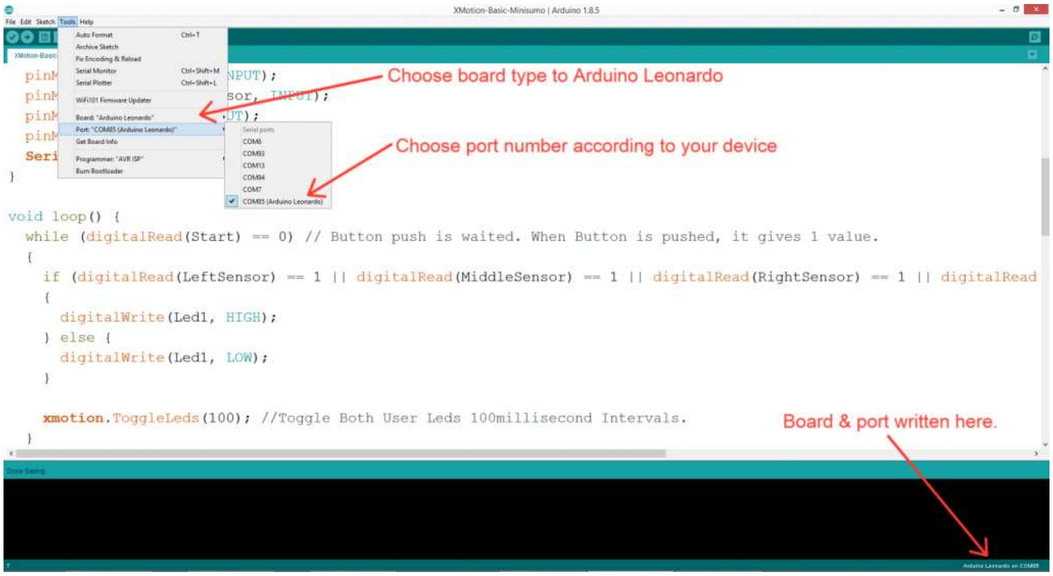


When you attach the XMotion with usb cable your computer will alert new hardware found. You can see com port from device manager too.

Let's try connecting XMotion to computer. We will use micro USB cable for this purpose. XMotion comes with cable but if you need more longer cable, Micro USB type phone cables should work well. Press gently to USB socket.

XMotion will be recognized by computer as an Arduino Leonardo. Sure we are assuming that you downloaded Arduino software (https://www.arduino.cc/en/Main/Software We are choosing windows installer there)

For programming & development with Arduino software, we need to choose port number and board type as Leonardo from tools menu. It must be same as bottom image.


XMotion-Basic-Minisumo | Arduino 1.8.5
File Edit Sketch Tools Help
XMotion-Basic
Auto Format Ctrl+T
Archive Sketch
Fix Encoding & Reload
Serial Monitor Ctrl+Shift+M
Serial Plotter Ctrl+Shift+L
WiFi101 Firmware Updater
Board: "Arduino Leonardo"
Port: "COM85 (Arduino Leonardo)"
Get Board Info
Programmer: "AVR ISP"
Burn Bootloader
Serial ports
COM6
COM93
COM13
COM94
COM7
✓ COM85 (Arduino Leonardo)
Done Saving.
Arduino Leonardo on COM85

Choose board type to Arduino Leonardo

Choose port number according to your device

```
  pinM                      NPUT);
  pinM                      sor, INPUT);
  pinM                      UT);
  pinM
  Seri
}

void loop() {
  while (digitalRead(Start) == 0) // Button push is waited. When Button is pushed, it gives 1 value.
  {
    if (digitalRead(LeftSensor) == 1 || digitalRead(MiddleSensor) == 1 || digitalRead(RightSensor) == 1 || digitalRead
    {
      digitalWrite(Led1, HIGH);
    } else {
      digitalWrite(Led1, LOW);
    }

    xmotion.ToggleLeds(100); //Toggle Both User Leds 100millisecond Intervals.
  }
```

Board & port written here.

2. First Code – Blink Led Example

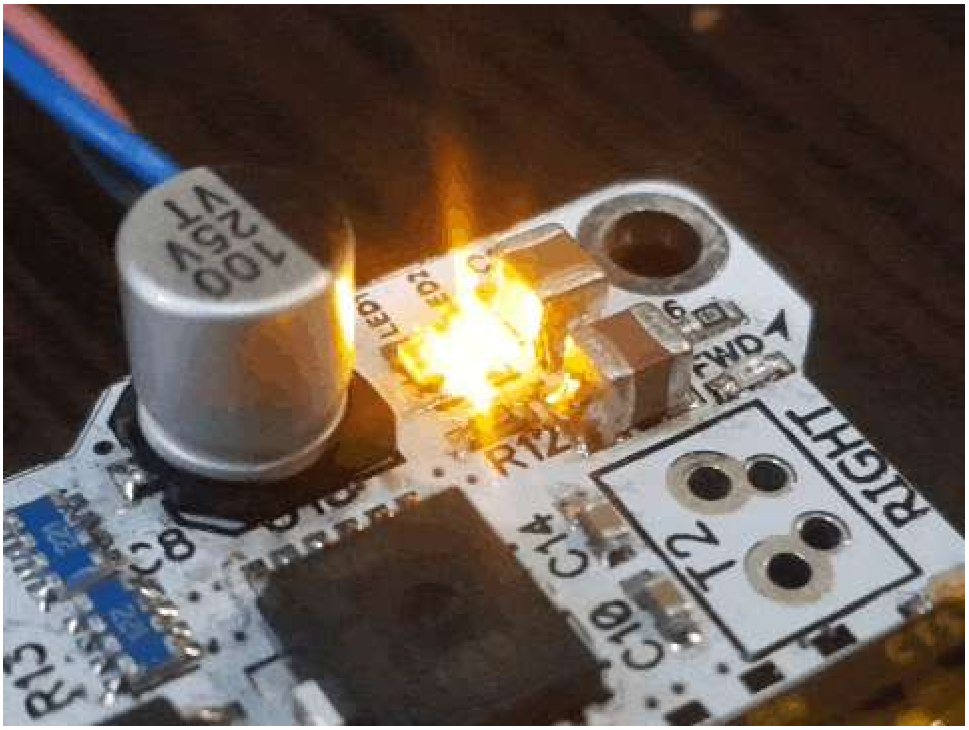
At first example we will blink led. It is the “hello world” of electronics. Please turn the XMotion board and read the pin table you will see there is two User Led definition. D8 and D9. Choose one. I chose D9. D9 is marked as Led2 at XMotion board. (Right upside corner Led2)

Copy/paste or write this code below.

```
int UserLed1 = 9; //Led Pin is D9
void setup() {
pinMode(UserLed1, OUTPUT); // Led as output element
}
void loop() {
digitalWrite(UserLed1, HIGH); // turn on the User Led 1, High Statement
delay(500); // wait for half second (500 ms)
digitalWrite(UserLed1, LOW); // turn off the User Led 1, Low Statement
delay(500); // wait for half second (500 ms)
}
```

After writing upload with ctrl+u button combination.

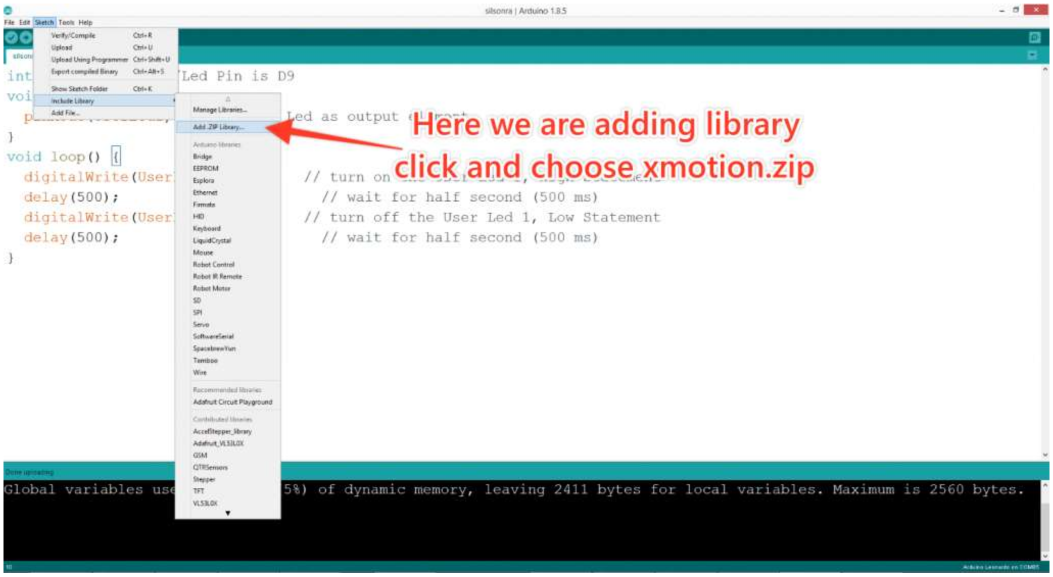
If you see led is blinking with 0.5 second intervals. Well done you succesfully uploaded 1st sketch. When uploading due to software based usb connection, interruptions between XMotion and computer can happen. That’s normal.



At XMotion Led1 (Left) is D8, Led 2 (Right) is D9.

3. Adding Library

Now let’s make more advanced coding with XMotion library. You can download the library from **here.** After downloading xmotion.zip please export directory using arduino software (Sketch / Include Library / Add ZIP Library)



Here we are adding library

click and choose xmotion.zip

```
int                     Led Pin is D9
voi
  p                              Led as output
}
void loop() {
  digitalWrite(User              // turn on
  delay(500);                      // wait for half second (500 ms)
  digitalWrite(User              // turn off the User Led 1, Low Statement
  delay(500);                      // wait for half second (500 ms)
}
```

```
Global variables use          5%) of dynamic memory, leaving 2411 bytes for local variables. Maximum is 2560 bytes.
```

Restart Arduino software. After reopening Arduino software if library installed, you will see some codes in **File / Examples / XMotion** (Usually last at Menu)

4. Toggling Leds Example

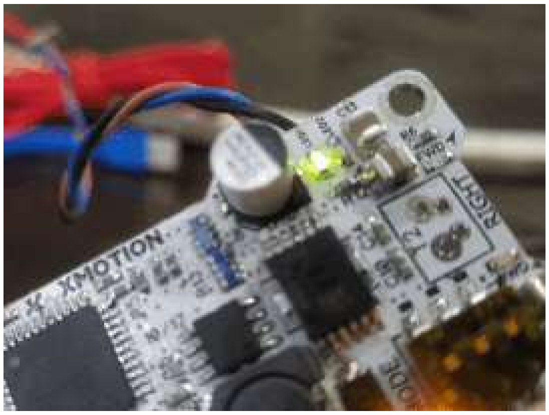
At this Menu we have 2 options. Open the basics / Blink_2_Leds example. (**So full address: Files/Examples/XMotion/Basics/Blink_2_Leds**) Code will be only this.

```
#include <xmotion.h>

void setup() {
}
void loop() {
  xmotion.ToggleLeds(1000);
}
```

With XMotion ready made library. (xmotion.h) we defined the leds before. please upload with ctrl+u. This will give you 1 second interval leds blinking. 2 user led’s will toggle continuously.

5. Motor Control Functions Example

At library we pre-written this Led’s setup functions and pin usages. Now continue to look to example files. You will see Motor Test Code. Now connect 2 dc motors to left and right inputs. For connections you can use green terminals. Later upload the code. Two motor will start to turn.



Toggle Led Example with 2 User Leds at right up corner.

```
include <xmotion.h>
```

```
void setup() {
xmotion.BlinkDelay(100); //Make Blink Both Leds 100 millisecs.
}

void loop() {
xmotion.Forward(100,100); // %100 Speed, both motor forward 100mS.
xmotion.StopMotors(100);  // 100ms Stop Both Motors
xmotion.Backward(70,250); // %70 Speed, both motor backward 250mS.
xmotion.Right0(51,1000);  // %51 Speed, 1 second Right 0 Turn.
xmotion.Left0(20,3500);   // %20 Speed, 3.5 second Left 0 Turn.
xmotion.ArcTurn(20,60,250); // 250 millisecond %20 Speed Left, %60 Speed Right Motor
xmotion.MotorControl(-150,190); //Timeless -150/255 Left, 190/255 Right Speed
delay(100); //Delay for last MotorControl statement
}
```

Motors will start to turn crazy like that below.

Try adding double slash to some motor control functions and upload sketch. Motors will turn according to functions.

6.XMotion Functions

So if I sum up with XMotion functions we make more tidy codes. And here the full list that you can use with xmotion.h library:

Basics:

- xmotion.UserLed1(time_ms);
- xmotion.UserLed2(time_ms);
- xmotion.ToggleLeds(time_ms);
- xmotion.CounterLeds(time_ms, int Multiplier);
- xmotion.Trimpot();
- xmotion.VoltageIn();
- xmotion.LipoCutOff(int Cell);

Motor Control:

- xmotion.Forward(%Percent,Time_ms);
- xmotion.StopMotors(Time_ms);
- xmotion.Backward(%Percent,Time_ms);
- xmotion.Right0(%Percent,Time_ms);
- xmotion.Left0(%Percent,Time_ms);

- xmotion.ArcTurn(%LeftPercent,%RightPercent,Time_ms);
- xmotion.MotorControl(LeftValue,RightValue);

In next lectures we will look more deeply to this functions. Now we must continue to exploring the board.

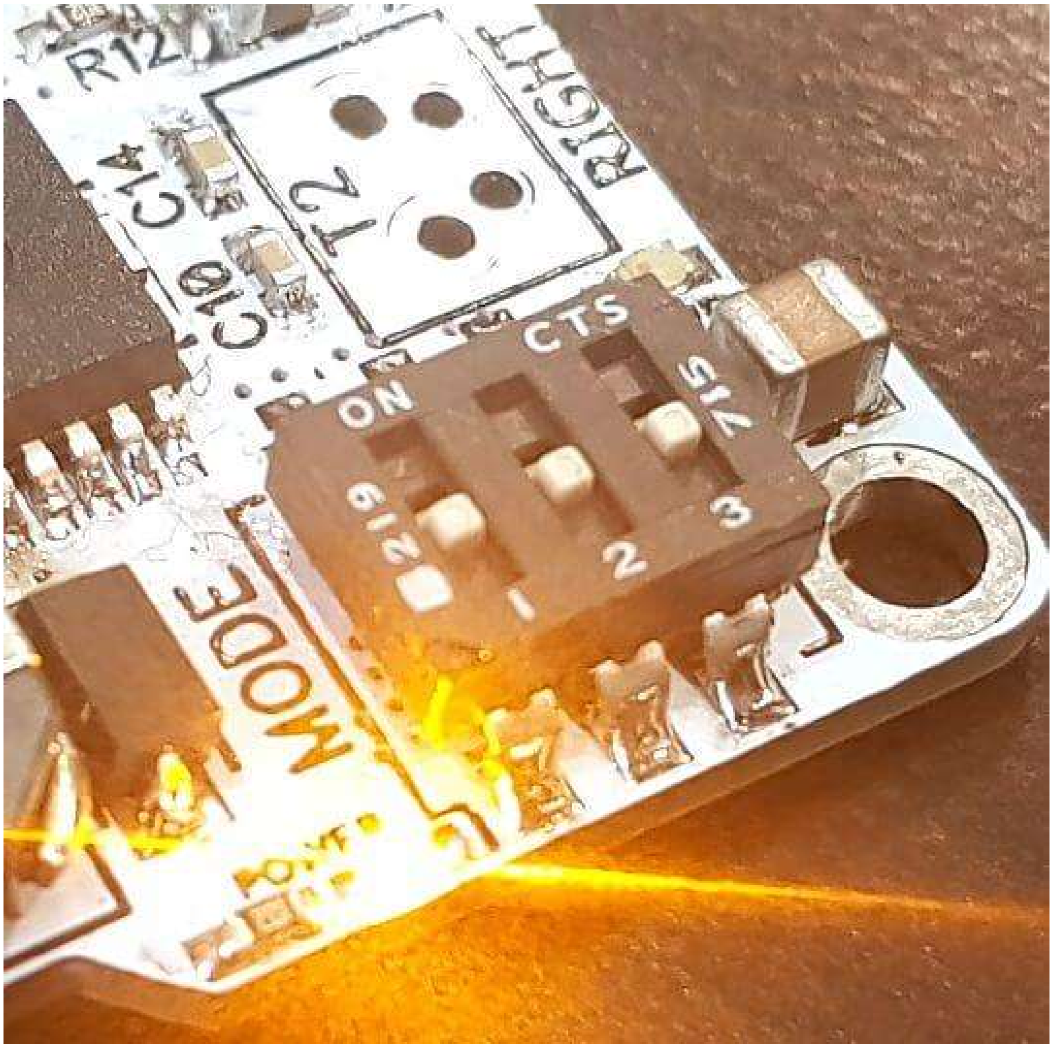
7.How to use built-in button and dipswitch? Digital Input Elements

XMotion includes 3 position dipswitch and 1 pushbutton. Now we will learn how to use them.

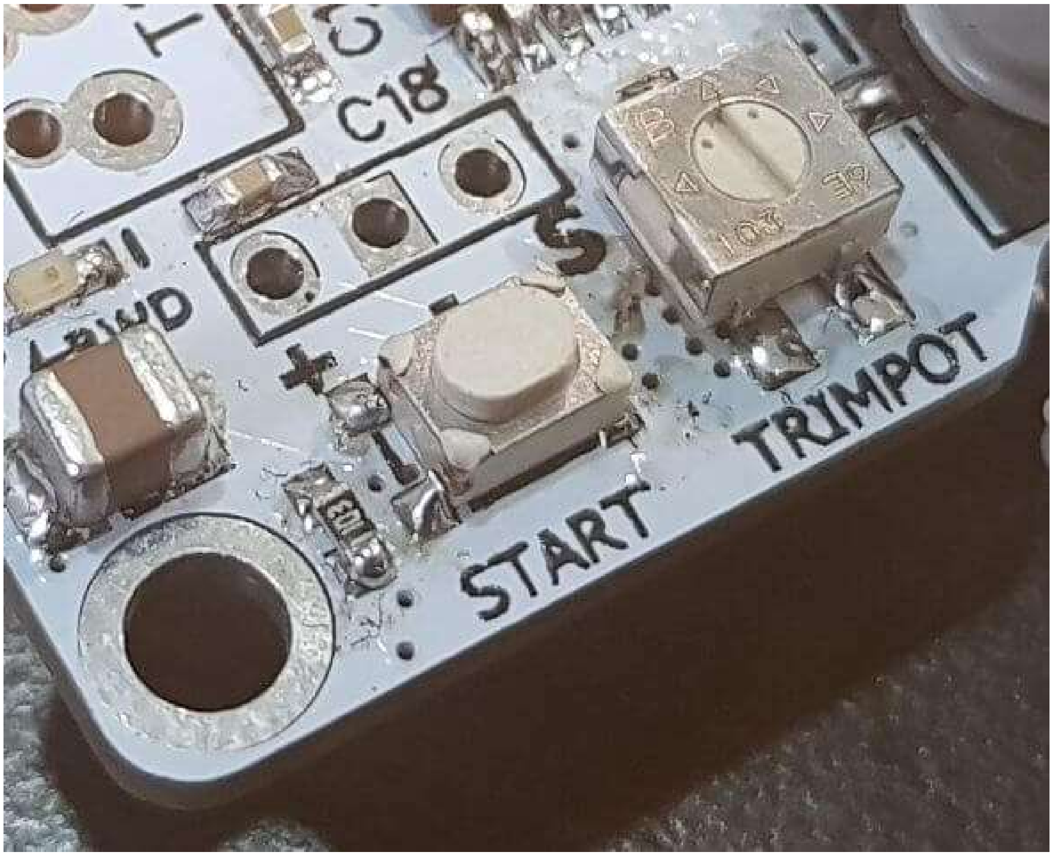
From backside of PCB I am reading button is connected to D10 (start Pin) and dipswitch pins connected to D5, D6, D7.

And as I know they are digital elements, we will look them with digitalRead function. I prepared this code. (Can be found at XMotion examples)

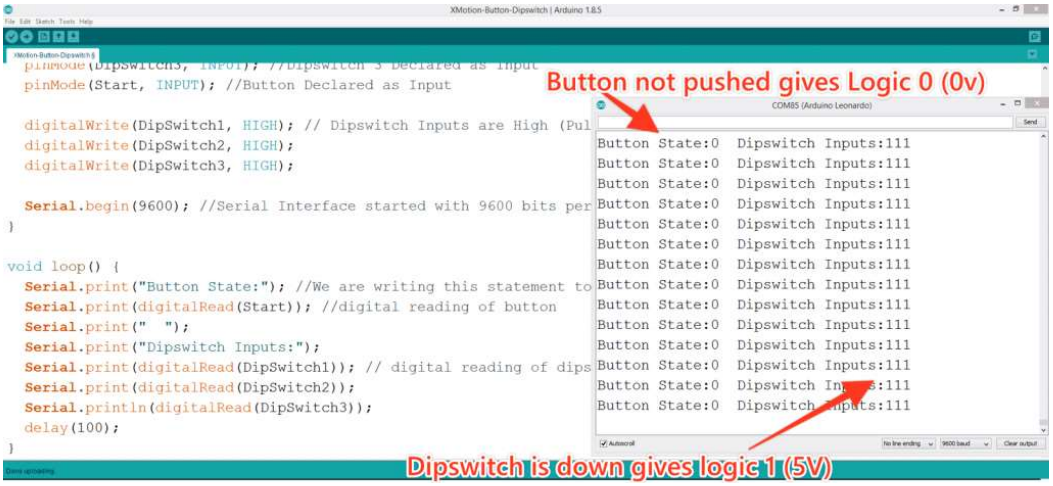
```
#define DipSwitch1 5 // Dipswitch 1 tied to Digital 5
#define DipSwitch2 6 // Dipswitch 2 tied to Digital 6
#define DipSwitch3 7 // Dipswitch 3 tied to Digital 7
#define Start 10 // Button tied to Digital 10

void setup() {
pinMode(DipSwitch1, INPUT); //Dipswitch 1 Declared as Input
pinMode(DipSwitch2, INPUT); //Dipswitch 2 Declared as Input
pinMode(DipSwitch3, INPUT); //Dipswitch 3 Declared as Input
pinMode(Start, INPUT); //Button Declared as Input

digitalWrite(DipSwitch1, HIGH); // Dipswitch Inputs are High (Pull-up made)
digitalWrite(DipSwitch2, HIGH);
digitalWrite(DipSwitch3, HIGH);

Serial.begin(9600); //Serial Interface started with 9600 bits per sec.
}

void loop() {
Serial.print(“Button State:”); //We are writing this statement to serial Monitor
Serial.print(digitalRead(Start)); //digital reading of button
Serial.print(” “);
Serial.print(“Dipswitch Inputs:”);
Serial.print(digitalRead(DipSwitch1)); // digital reading of dipswitches
Serial.print(digitalRead(DipSwitch2));
Serial.println(digitalRead(DipSwitch3));
delay(100);
}
```



Dipswitch is used mostly at mini sumo robots for starting modes. And also used for on-board software development.



Start button connected to D10 is used for giving starting signal.


XMotion-Button-Dipswitch | Arduino 1.8.5
File Edit Sketch Tools Help
XMotion-Button-Dipswitch §
COM85 (Arduino Leonardo)
Send
☑ Autoscroll
No line ending
9600 baud
Clear output
Done uploading

```
  pinMode(DipSwitch3, INPUT); //Dipswitch 3 Declared as Input
  pinMode(Start, INPUT); //Button Declared as Input

  digitalWrite(DipSwitch1, HIGH); // Dipswitch Inputs are High (Pul
  digitalWrite(DipSwitch2, HIGH);
  digitalWrite(DipSwitch3, HIGH);

  Serial.begin(9600); //Serial Interface started with 9600 bits per
}

void loop() {
  Serial.print("Button State:"); //We are writing this statement to
  Serial.print(digitalRead(Start)); //digital reading of button
  Serial.print("  ");
  Serial.print("Dipswitch Inputs:");
  Serial.print(digitalRead(DipSwitch1)); // digital reading of dips
  Serial.print(digitalRead(DipSwitch2));
  Serial.println(digitalRead(DipSwitch3));
  delay(100);
}
```

Button not pushed gives Logic 0 (0v)

```
Button State:0  Dipswitch Inputs:111
Button State:0  Dipswitch Inputs:111
Button State:0  Dipswitch Inputs:111
Button State:0  Dipswitch Inputs:111
Button State:0  Dipswitch Inputs:111
Button State:0  Dipswitch Inputs:111
Button State:0  Dipswitch Inputs:111
Button State:0  Dipswitch Inputs:111
Button State:0  Dipswitch Inputs:111
Button State:0  Dipswitch Inputs:111
Button State:0  Dipswitch Inputs:111
Button State:0  Dipswitch Inputs:111
Button State:0  Dipswitch Inputs:111
Button State:0  Dipswitch Inputs:111
```

Dipswitch is down gives logic 1 (5V)

After uploading code, don't remove the USB cable and click the serial monitor. (Right up corner at Arduino editor) XMotion will start to send some values to computer.

With this code you can see what's going on at dipswitch and button. Button gives logic 0 when not pushed. And dipswith inputs give logic 1 when they are at down.

And if you want to use at the code we use them with if, while statements like these:

if (digitalRead(DipSwitch1)==1) {Kp=0.30;} else {Kp=0.35;}