REX

REX EVOLUTION SERIES
SUPER STAR TRANSFORMERS
8 IN 1

Immortal
Balance Robot Application

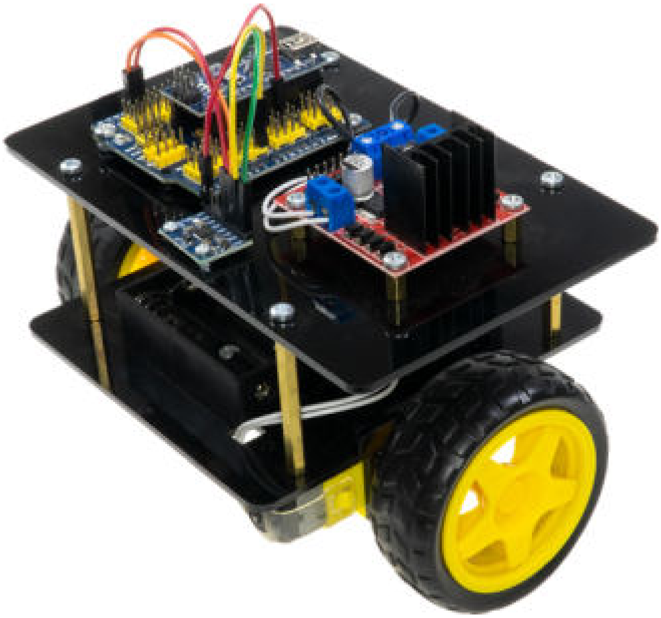
Immortal

Author: Mustafa Kemal AVCI

Balance robots appear in many areas of our lives. Balance robots are preferred in the industry, service sector, transportation and even in daily life due to their simple and useful structures.
It basically consists of 6-axis accelerometer and motors. The accelerometer measures the forward or backward tilt of the robot very quickly and precisely. We can make a balance robot by coding at what speed and in which direction the motors should rotate, according to these measurements.

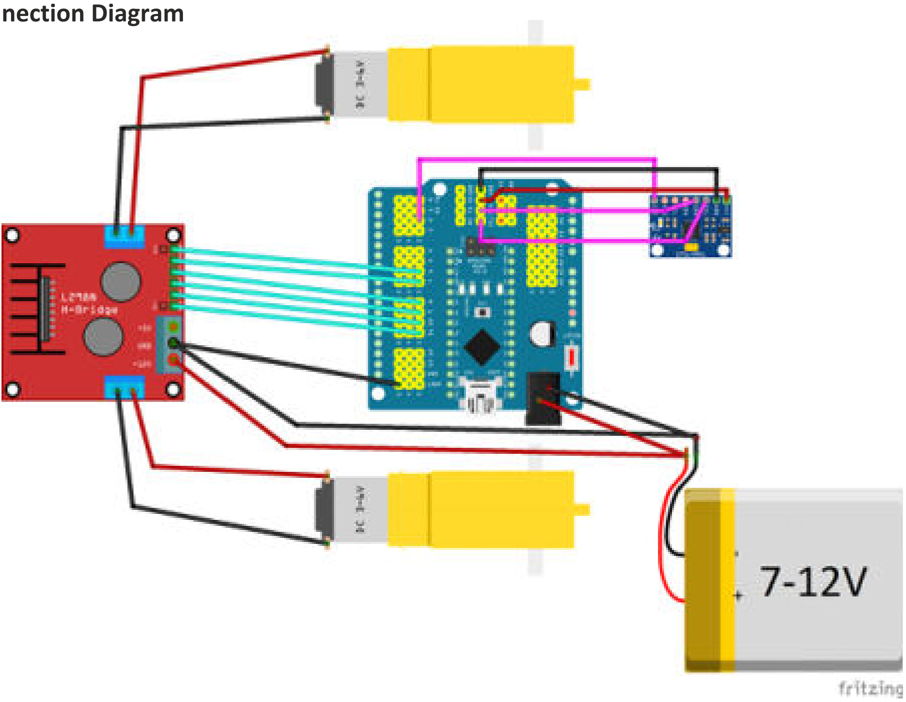
After completing the installation of the robot, let's look at how the Immortal balance robot is coded and how its settings are made.

You can make your connections with 10 cm jumper cables according to the connection diagram below. You should place the MPU6050 gyro sensor as shown in the image so that it will stand straight, the IC is up and the pin connections are facing towards the inside of the robot.



Be sure to attach the sensor so that it does not shake when you touch your finger. Since it is a very sensitive sensor, it may be affected by the smallest vibrations and be mistaken in calculations.
In addition, the battery of the robot should be placed on the lower floor in such a way that its weight is evenly distributed, left, right, front and back. It should not blatantly tilt the robot back and forth.

Connection Diagram

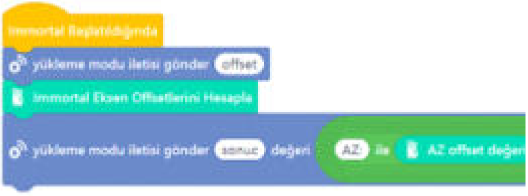


Artı (+) poles of the motors should be connected to OUT1 and OUT4 on the motor driver, and minus (-) poles should be connected to OUT2 and OUT3. We connect the ENA pin to the 11th pin on the Nano Shield and the ENB pin to the 6th pin. Let's connect the IN1 pin on the motor driver to the 10th pin on the Nano shield, the IN2 pin to the 9th pin, the IN3 pin to the 8th pin, the IN4 pin to the 7th pin.

Let's connect the MPU 6050 gyro sensor to the I2C pin on the shield correctly, paying attention to the SDA(A4), SCL(A5), VCC and GND pins. Let's be careful especially when connecting the VCC and GND pins. Reverse connection will break our sensor. We must connect the INT pin to the digital pin 2.

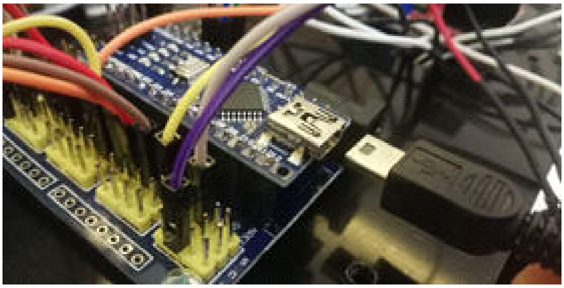
After completing the connection, we must determine the axis offset values of our balance robot. We will use the values we obtain here in the balancing process.

Making Immortal Offset Calculation
Download the immortal_offset.mblock file in the link below to your computer and open it.
https://drive.google.com/file/d/1XB4zNE6nHLUS1ppuRzfXwcMbRYSSwHoZ/view?usp=sharing

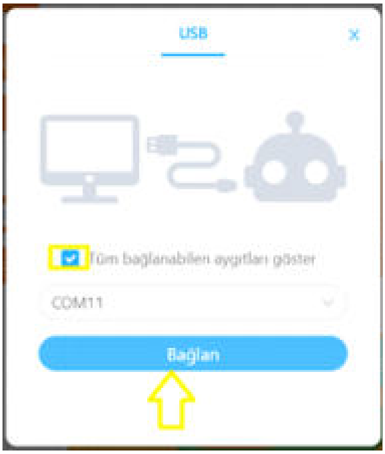


```
Immortal Başlatıldığında
yükleme modu iletisi gönder (offset)
Immortal Eksen Offsetlerini Hesapla
yükleme modu iletisi gönder (sonuc) değeri (AZ: ile AZ offset değer
```

Connect Arduino nano to your computer's USB port to upload the code to your robot.



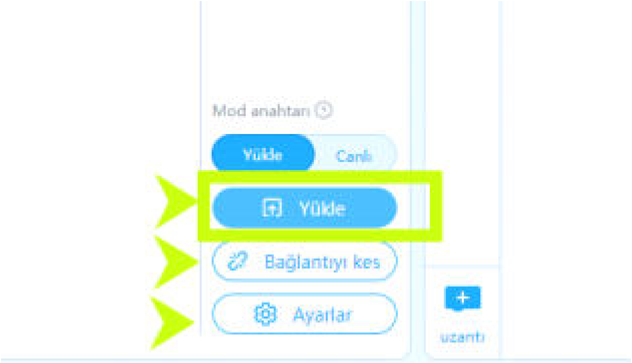
Click on the connect button in the installation mode and tick the show all connectable devices option. The mBlock software will automatically insert the COM port number to which our CH340 chip card is connected. If connection is not possible, you can select other COM port numbers from the drop-down list.



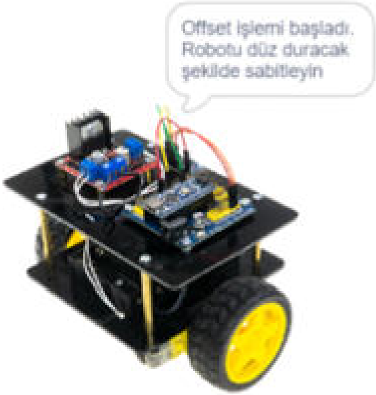
☑ Tüm bağlanabilen aygıtları göster

COM11

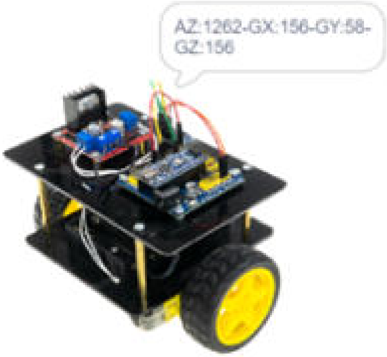
Once connected, “disconnect”, “settings” and “Install” buttons will be active. Let's upload the code to our robot by clicking the upload button.



DO NOT unplug your robot after the code has been uploaded. As soon as the code is loaded, it will start running and will communicate with the Immortal puppet on the stage. Do not touch the robot during the Offset process. Keep the robot level, still and vibration-free. Immortal in the scene will inform you about the calculations.


Offset işlemi başladı. Robotu düz duracak şekilde sabitleyin

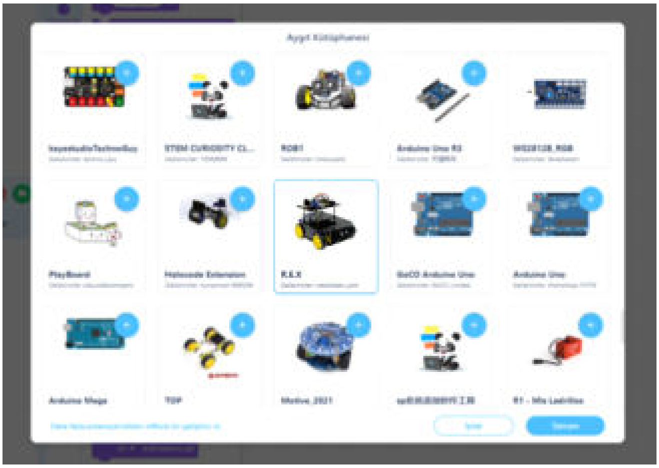
After 35-40 seconds, some values will appear in the speech bubble as in the image below. If these offset values do not appear after 1 minute, reset the Arduino Nano by pressing the button.


AZ:1262-GX:156-GY:58-GZ:156

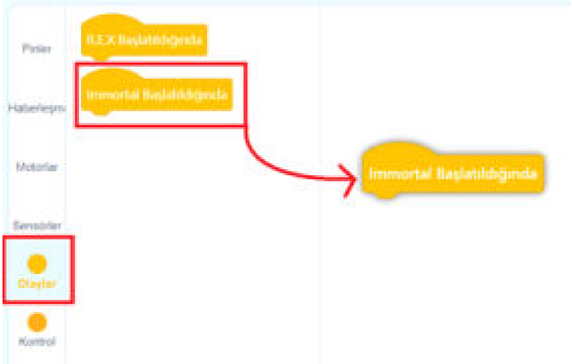
Let's write down these values and open a new mBlock file and prepare the codes that will keep our Immortal robot in balance.

Preparation of Immortal Codes

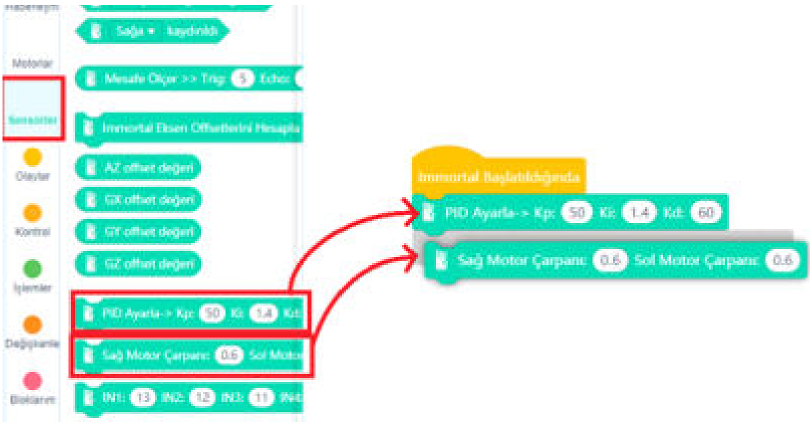
After the new mblock work is open, let's move on to the coding stage by adding R.E.X from the device library.



Drag and drop the “When Immortal Starts” block from the Events category into the coding area.

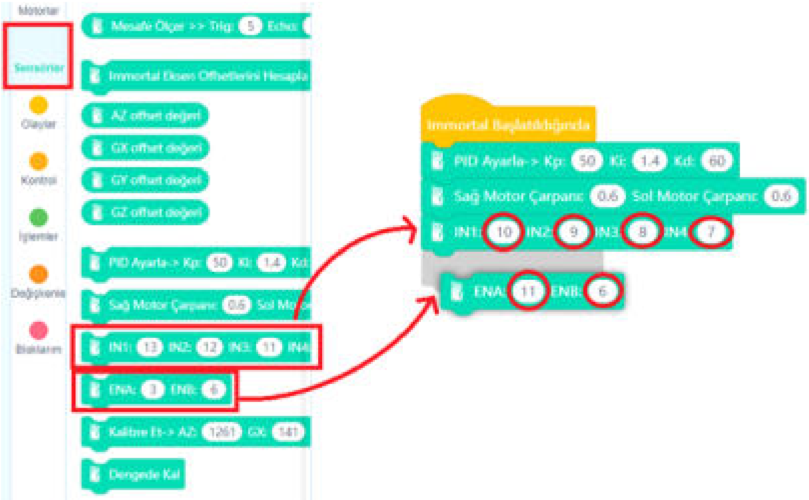


Let's use the blocks where the PID adjustment is made from the Sensors category and the motor multipliers are adjusted as in the image below. Let's pay attention to the order in which the blocks are used. The Kd: value in the PID set block indicates the speed of the robot's response to bending. A value of 60 is an ideal value, but you can change this value for your own robot by playing up and down while running.


Motorlar
Sensörler
Olaylar
Kontrol
İşlemler
Değişkenler
Blokların
Sağa ▾ kaydırıldı
Mesafe Ölçer >> Trig: 5 Echo:
Immortal Eksen Offsetlerini Hesapla
AZ offset değeri
GX offset değeri
GY offset değeri
GZ offset değeri
PID Ayarla-> Kp: 50 Ki: 1.4 Kd:
Sağ Motor Çarpanı: 0.6 Sol Motor
IN1: 13 IN2: 12 IN3: 11 IN4:

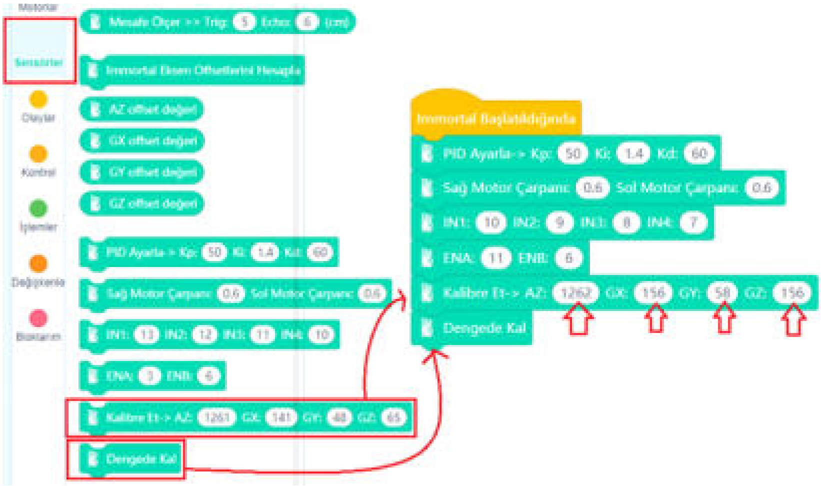
Immortal Başlatıldığında
PID Ayarla-> Kp: 50 Ki: 1.4 Kd: 60
Sağ Motor Çarpanı: 0.6 Sol Motor Çarpanı: 0.6

In order to transfer the results of the measurements taken by the robot from the accelerometer to the motors correctly, let's set the pin numbers we used when establishing the connection by using the blocks in the image below.


Motorlar
Sensörler
Olaylar
Kontrol
İşlemler
Değişkenler
Blokların
Mesafe Ölçer >> Trig: 5 Echo:
Immortal Eksen Offsetlerini Hesapla
AZ offset değeri
GX offset değeri
GY offset değeri
GZ offset değeri
PID Ayarla-> Kp: 50 Ki: 1.4 Kd:
Sağ Motor Çarpanı: 0.6 Sol Mo
IN1: 13 IN2: 12 IN3: 11 IN4:
ENA: 3 ENB: 6
Kalibre Et-> AZ: 1261 GX: 141
Dengede Kal

Immortal Başlatıldığında
PID Ayarla-> Kp: 50 Ki: 1.4 Kd: 60
Sağ Motor Çarpanı: 0.6 Sol Motor Çarpanı: 0.6
IN1: 10 IN2: 9 IN3: 8 IN4: 7
ENA: 11 ENB: 6

Finally, we drag the Calibrate and balance blocks and drop them to the bottom as in the image below. At this stage, we write our Offset values correctly in the appropriate places in the Calibrate block. These values of each robot may differ, and each of your measurements may differ. You can find your ideal values by experimenting.



Motorlar
Sensörler
Olaylar
Kontrol
İşlemler
Değişkenler
Bloklarım
Mesafe Ölçer >> Trig: 5 Echo: 6 (cm)
Immortal Eksen Offsetlerini Hesapla
AZ offset değeri
GX offset değeri
GY offset değeri
GZ offset değeri
PID Ayarla-> Kp: 50 Ki: 1.4 Kd: 60
Sağ Motor Çarpanı: 0.6 Sol Motor Çarpanı: 0.6
IN1: 13 IN2: 12 IN3: 11 IN4: 10
ENA: 3 ENB: 6
Kalibre Et-> AZ: 1261 GX: 141 GY: 48 GZ: 65
Dengede Kal

```
Immortal Başlatıldığında
PID Ayarla-> Kp: 50 Ki: 1.4 Kd: 60
Sağ Motor Çarpanı: 0.6 Sol Motor Çarpanı: 0.6
IN1: 10 IN2: 9 IN3: 8 IN4: 7
ENA: 11 ENB: 6
Kalibre Et-> AZ: 1262 GX: 156 GY: 58 GZ: 156
Dengede Kal
```

Our robot is ready to work. Let's connect the Arduino Nano to our computer and perform the upload process. After the installation is complete, unplug the USB cable.

Operating the System
As soon as the battery is connected to the Motor driver and Arduino Nano shield, our robot will start working. By pressing the reset button on the Arduino Nano before placing the robot on the ground, you provide a better balance. Balance performance may decrease slightly on shiny and slippery surfaces. Balance performance will be very good on carpets, rugs and wooden surfaces. It will not fall over when you push with your hand. Even if he falls, he will return to the balance position as soon as his wheels touch the ground.

Possible Problems and Solutions
If the robot tends to turn sharply to the right or left, check the + and - cables from the motors in the motor driver. The + poles must be connected to OU1 and OUT4 - the OUT2 and OUT3 poles must be connected. If the problem persists even though the connection is correct, let's make sure that the connections between IN1-IN4 are made correctly on the Nano shield.
If the robot tends to go backwards when it falls forward and forward when it falls backwards, you have reversed the + - poles on the driver. + Poles must be at OUT1 and 4 - Poles must be at OUT2 and 3. Or you can solve this problem by swapping the pin numbers of IN1 and IN2, IN3 and IN4 from the blocks.
Although everything is right, if the balance cannot be achieved; Make sure that the MPU 6050 gyro sensor is firmly mounted. Because the smallest gap and swing affect the operation of the sensor. In addition, when placing the battery, placing it in the middle in such a way that its weight is evenly distributed to the right, left and front and back will contribute positively to the state of balance.

YouTube

youtube.com/robotistan

FORUM

robotistan

forum.robotistan.com

BLOG

robotistan

maker.robotistan.com

Robotistan Electronics Company

Mustafa Kemal AVCI (Content) - Fadıl PALA - Mehmet AKÇALI (Editor) - (Mehmet Nasır KARAER (Graphics) - Mert ALTUNTAS (Translation)
info@robotistan.com - www.robotistan.com
Phone: 0850 766 0 425