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Feel Motion

Glove Controlled Feel Motion Application

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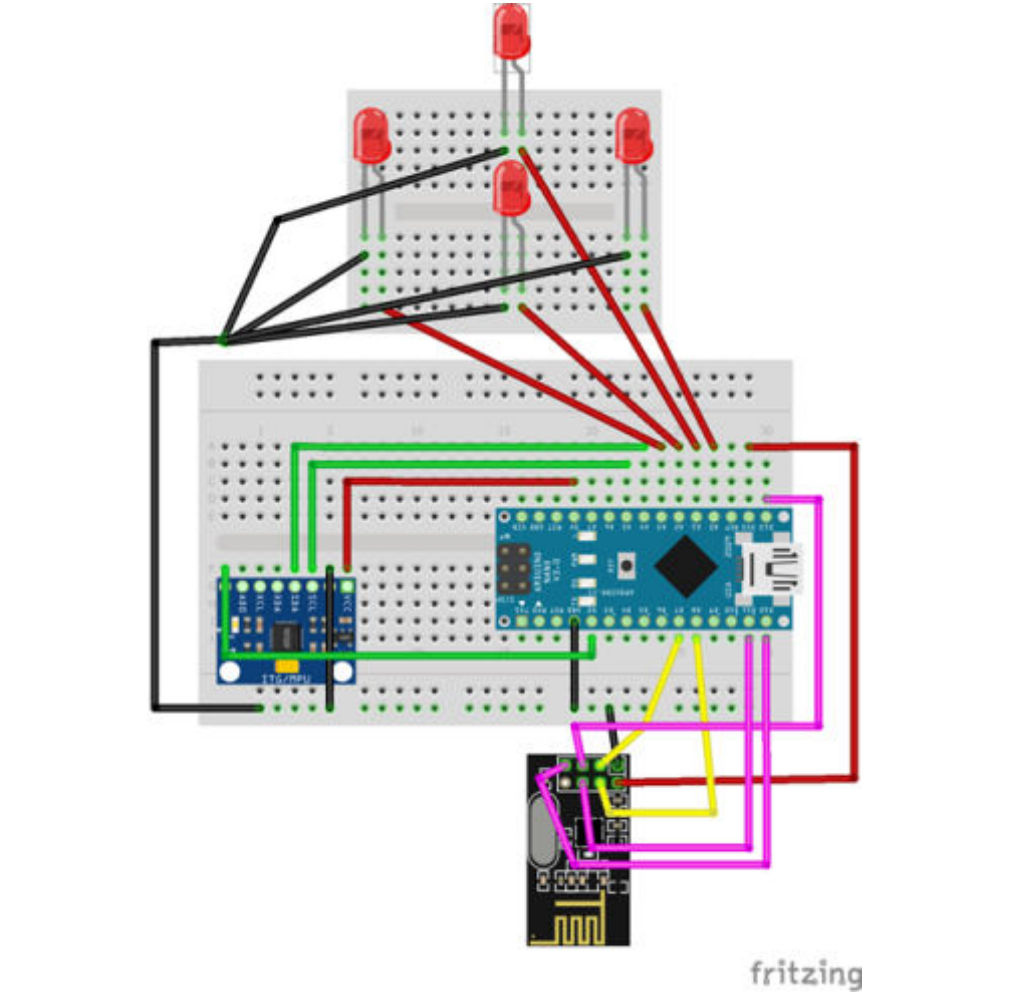
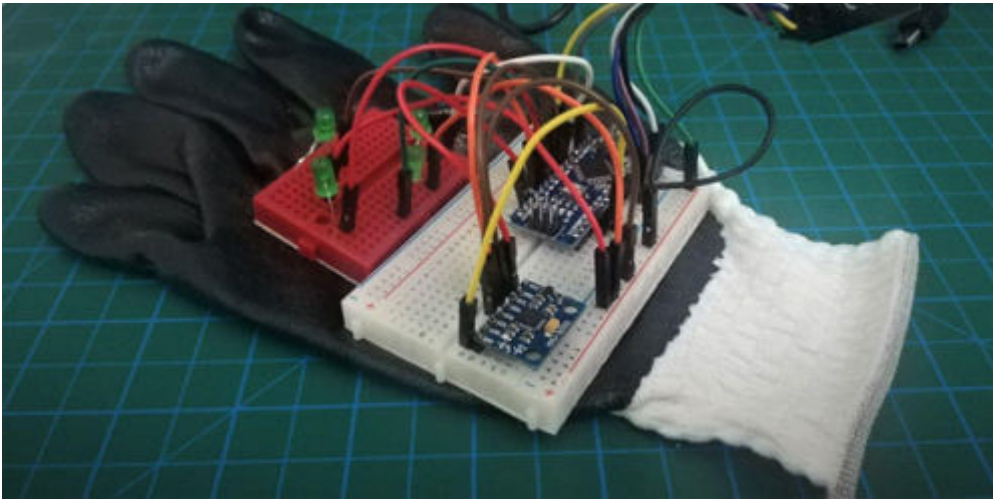
Feel Motion feels you. The movements you make with the glove you wear on your hand are felt by your robot. In which direction, at what speed and for what time you want your robot to move, Feel Motion moves in that way.

After completing the installation of your robot, make the connections on the gloves with 10 cm jumper cables using a breadboard, in accordance with the circuit design below. In order for the sticky surface under the breadboard to stick to the glove, peel off the yellow foil and stick it on the top of the glove. We connected 4 LEDs to the second breadboard. We will use these LEDs to check whether the movements of the gyro sensor are transmitted to the robot correctly.

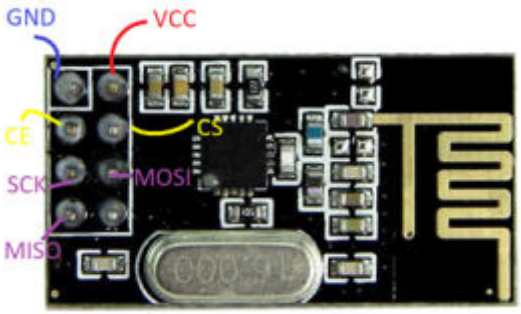
Glove Circuit Diagram And Design





If you solder the MPU 6050 gyro sensor's headers downwards as in this photo and use it directly on the breadboard, the sensor will detect your hand movements, front-back, left-right reverse. You can fix this situation while it is being interpreted during the coding phase.

Since the pin names are not written on the NRF24L01 wireless module, you can use the image below.



Make the pins to be connected according to the table below.

Front Led	Long leg	**A1**
	Short leg	**GND**
Back Led	Long leg	**A2**
	Short leg	**GND**
Left Led	Long leg	**A3**
	Short leg	**GND**
Right Led	Short leg	**A0**
	Short leg	**GND**
MPU 6050 Gyro	INT	**D2**
	SDA	**A4**
	SCL	**A5**
	VCC	**5V**
	GND	**GND**
NRF24L01	SCK	**D13**
	MOSI	**D11**
	MISO	**D12**
	CS	**D8**
	CE	**D7**
	VCC	**3.3V**
	GND	**GND**

Coding of the Glove System

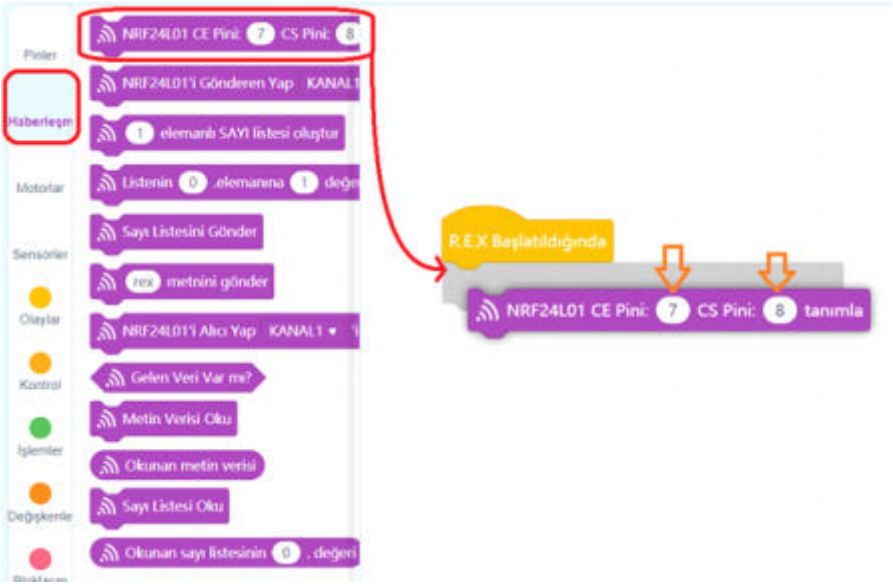
Let's start the mBlock 5 software and add R.E.X from the device library to the coding stage.

Our algorithm will be as follows;

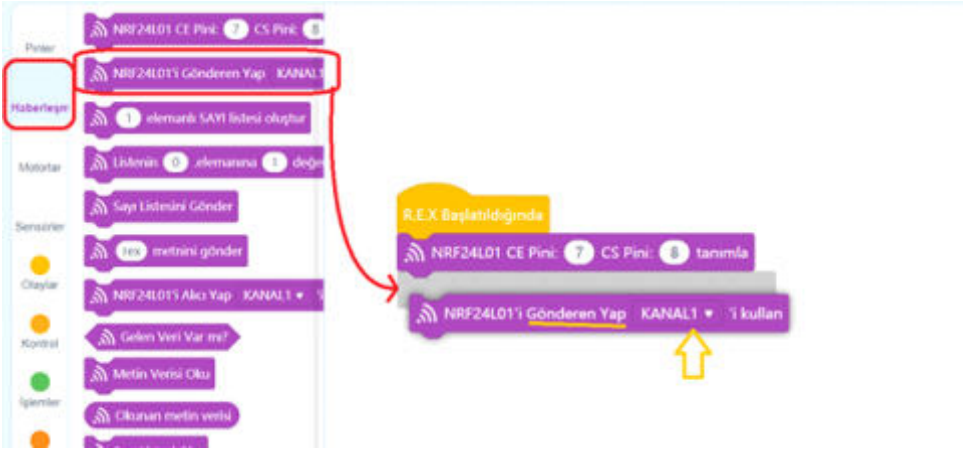
1. Start
2. Identify NRF24L01
3. Define NRF24L01 as SENDER
4. Initialize the accelerometer (MPU 6050)
5. Accelerometer Read
6. Light the Led when Backspin Detected, send text “back” by wireless
7. Light Up Led When Forward Rotation Detected, send text “on” via wireless
8. Light the Led when Left Turn Detected, send text “left” by wireless
9. Turn Right When Detected, Light the Led, send the text “right” via wireless
10. Go to step 5
11. Stop

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

Let's drag and drop the block where we will define our NRF24L01 wireless module from the "Communication" category, as expressed in the image below. Let's check the output numbers that we connect the CS pin and CE pin.

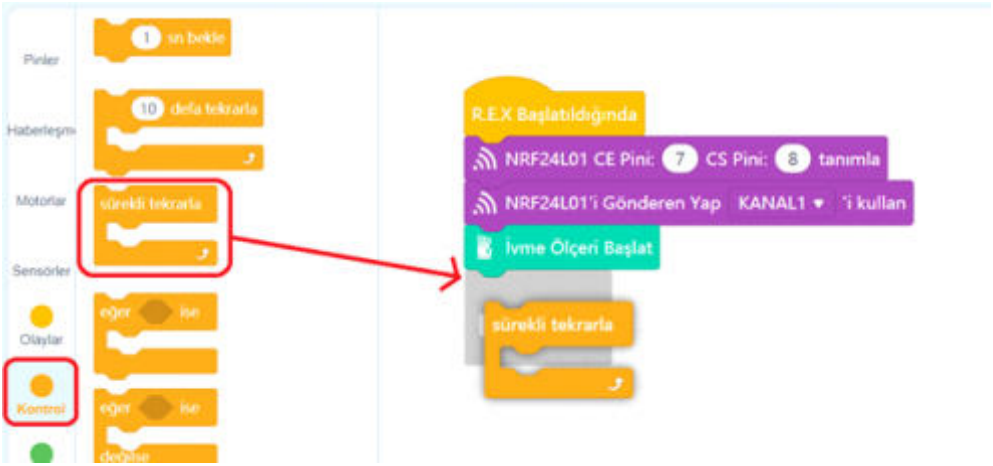


Since the NRF24L01 wireless communication module can be used as both a sender and a receiver, we need to set this feature. If we are going to use both the receiver and the sender in the same project, we must determine the Channel numbers separately. In this project, we are making our NRF24L01 module SENDER to use CHANNEL1, as it will only send the data produced by the gyro sensor to the robot as the SEND in the glove system.



Now let's define the accelerometer. In this way, let's ensure that the MPU 6050 Gyro sensor is ready for use for our glove system. Let's drag and drop the Start Accelerometer block from the Sensors category as in the image below.

By continuously reading the accelerometer, we will set up an endless loop so that the change in our hand movements can be transmitted instantaneously wirelessly. For this, let's drag and drop the Repeat Continuously block from the Control blocks.

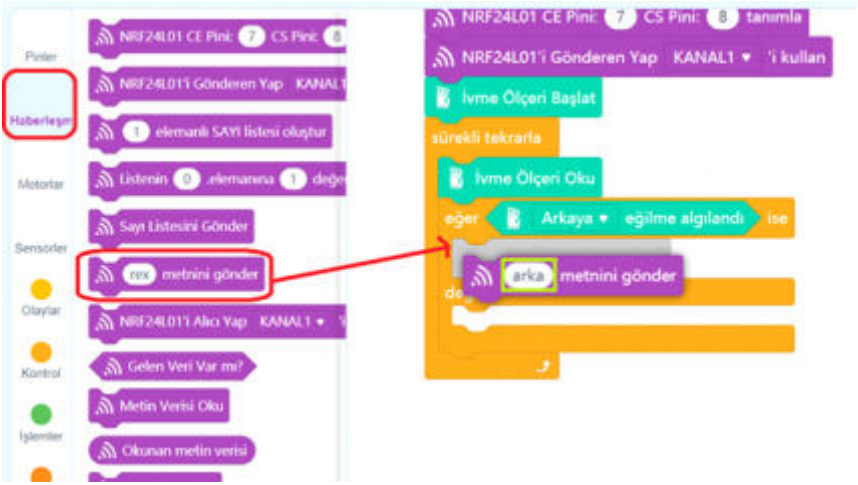


Each time the loop returns to the beginning, it must first read the values of the axes from the accelerometer. Because the comparisons we will make in the following steps will be based on the values we get as a result of this reading. Let's take the Accelerometer Read block from the Sensors category and place it inside the repeat continuously block.

Now we can create our condition statements and start making our comparisons. Each of our conditions will be tested if the previous condition is not met. So, let's take the If If Otherwise block from the control blocks and place it just below the Accelerometer Arrow block.

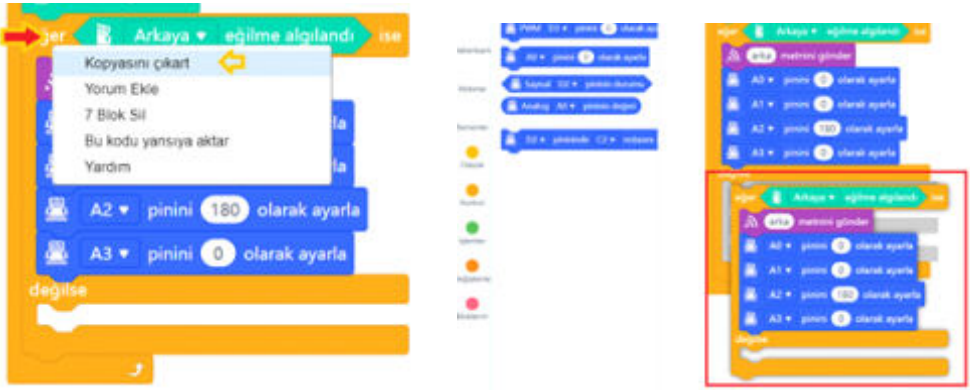
Let's set up our first condition. If Backward motion is detected, send the text “back” wirelessly and we will turn on the led connected to A2 and turn off the other leds. Let's take the Back rotation detected block from the Sensors category and place it in the corresponding part of the block if not, as shown below.

When this happens, we take the Send rex text block from the Communication blocks and insert it into the If field of the block, as in the image below, so that the "back" text can be sent wirelessly. We change the rex text to background.



Now we will turn the LEDs on and off. Since we will report the back tilting status with the LED connected to A2, we will set the value of the A2 pin to 180 and set the values of the A3, A1 and A0 pins to 0. As in the image below, drag the relevant block from the Pins category and insert the back text just below the send block and make the necessary adjustments.

All our subsequent condition tests will be of this nature and will be stuck in each other's if not fields. In order to quickly prepare the conditional statements, we right-click somewhere in the orange part of the If If If Not block and give the copy command from the pop-up menu.

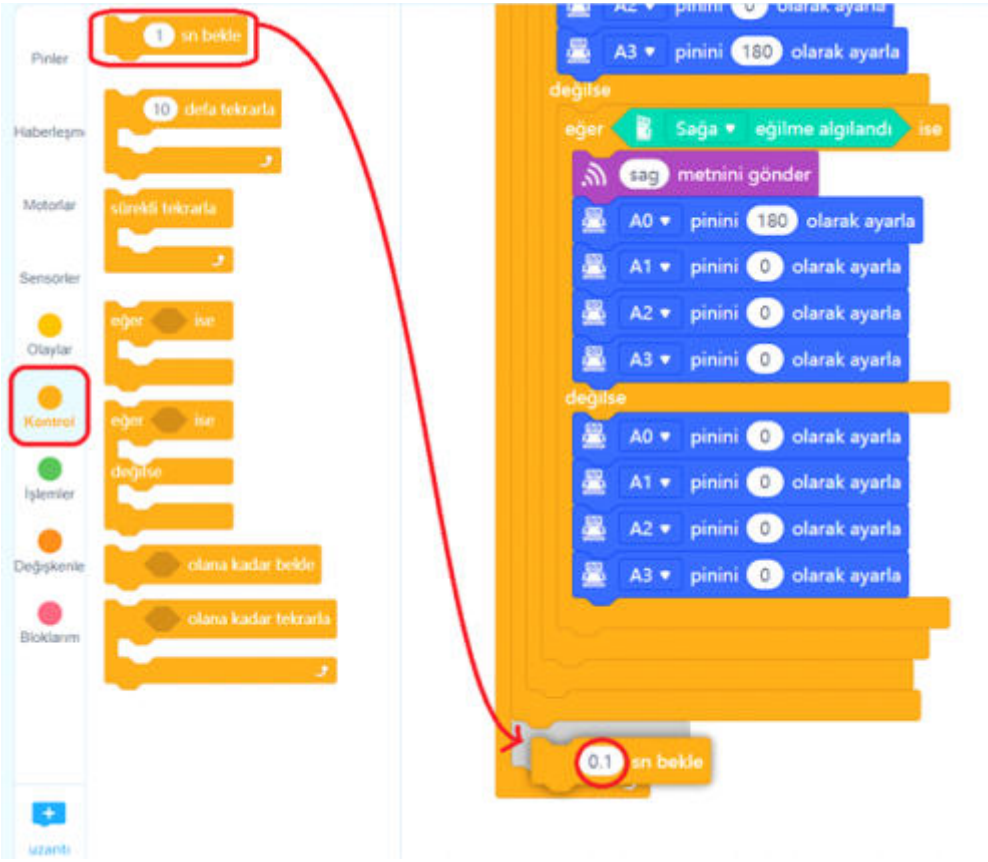


If not our newly created blocks, let's place them in the field and make the necessary changes as seen in the image below. We cannot use Turkish characters in the content.

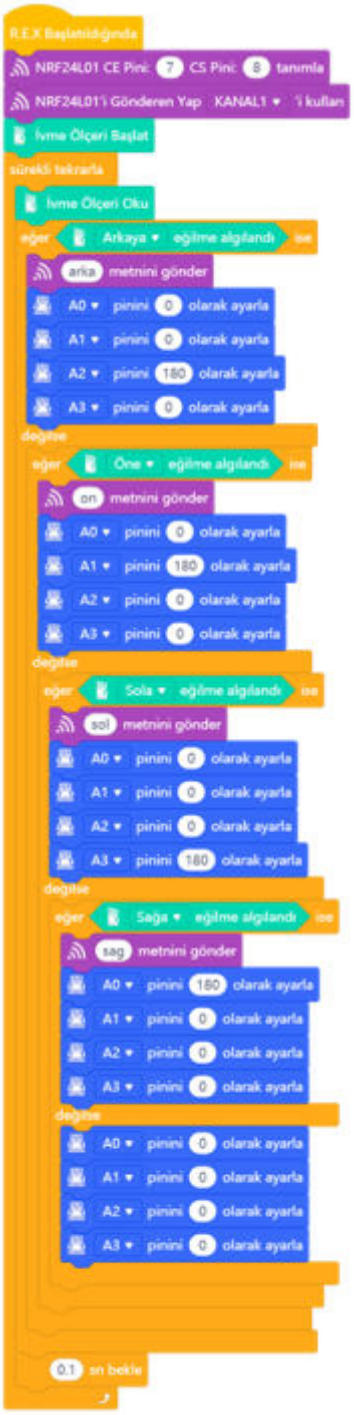
Let's copy the conditions we wrote in the 8th and 9th steps of the algorithm and create them with the technique we reproduced. Let's create the reactions to be given in the left and right bending operations as in the image below.

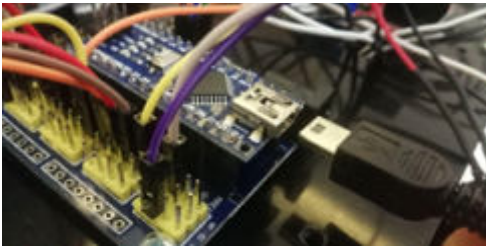
If the glove is not tilted backwards, forwards, left or right, it means it is straight. In this case, we don't need to send anything. We can express this situation by turning off all the leds on the glove. As in the image below, let's continue our coding by adding the necessary blocks to the if-if-not-if field of the last if-if-not-if-is-block.

Finally, we will add a 0.1 second wait at the end of each loop so that the wireless data transfer can work properly. As in the image below, after the first If If Not block, let's place the block so that it remains inside the Repeat Continuously block and complete the coding part of the glove system.



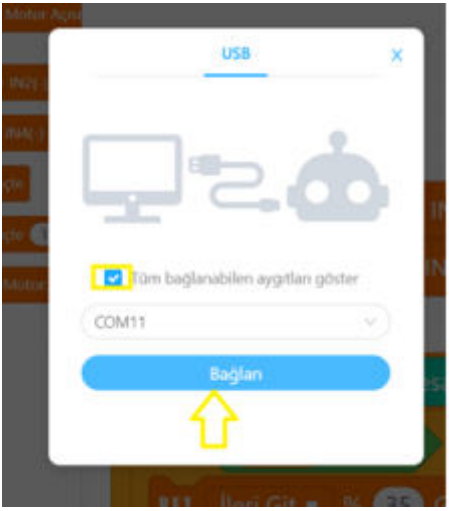
All of the code blocks we have prepared for the glove system should be as follows.


R.E.X Başlatıldığında
NRF24L01 CE Pini: 7 CS Pini: 8 tanımla
NRF24L01'i Gönderen Yap KANAL1 'i kullan
İvme Ölçeri Başlat
sürekli tekrarla
İvme Ölçeri Oku
eğer Arkaya eğilme algılandı ise
arka metnini gönder
A0 pinini 0 olarak ayarla
A1 pinini 0 olarak ayarla
A2 pinini 180 olarak ayarla
A3 pinini 0 olarak ayarla
değilse
eğer Öne eğilme algılandı ise
on metnini gönder
A0 pinini 0 olarak ayarla
A1 pinini 180 olarak ayarla
A2 pinini 0 olarak ayarla
A3 pinini 0 olarak ayarla
değilse
eğer Sola eğilme algılandı ise
sol metnini gönder
A0 pinini 0 olarak ayarla
A1 pinini 0 olarak ayarla
A2 pinini 0 olarak ayarla
A3 pinini 180 olarak ayarla
değilse
eğer Sağa eğilme algılandı ise
sag metnini gönder
A0 pinini 180 olarak ayarla
A1 pinini 0 olarak ayarla
A2 pinini 0 olarak ayarla
A3 pinini 0 olarak ayarla
değilse
A0 pinini 0 olarak ayarla
A1 pinini 0 olarak ayarla
A2 pinini 0 olarak ayarla
A3 pinini 0 olarak ayarla
0.1 sn bekle



We can now upload the codes we have prepared to our robot. We connect one end of the usb cable to Arduino nano and the other end to our computer.

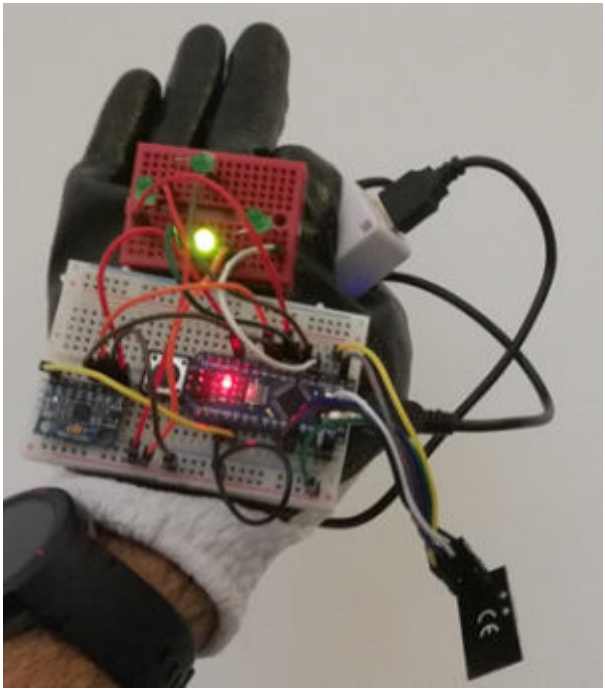
Click on the connect button in the installation mode and tick the show all connectable devices option. The mBlock software will automatically insert the COM port number to which our CH340 chip card is connected. If connection is not possible, you can select other COM port numbers from the drop-down list.



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

Operation of the Glove System

After uploading the codes, feed the Arduino Nano from the USB port with a power source such as a powerbank where you can get 5V output. You can hold the Powerbank in the palm of your hand. The codes will start working immediately.



Possible Problems and Solutions

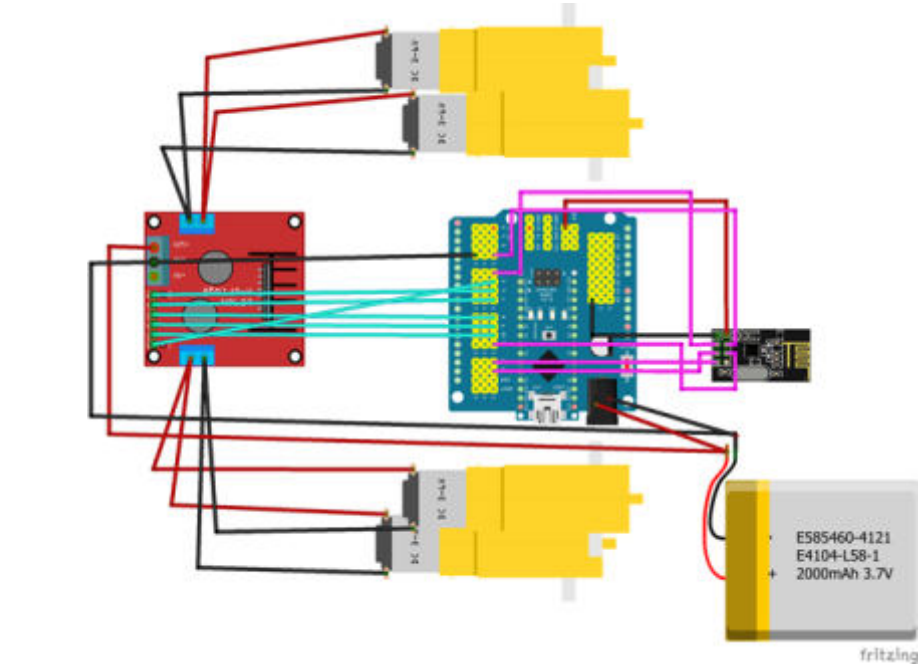
If the LEDs are lit on the chair opposite to the direction in which you bend your hand, If Front - Rear, Right - Left seems to have changed places;

If you have checked the pin connections of your LEDs and you have made sure that they are correct, change the Forward Bend detected block to Back, right Tilt detected block to left, Back tilt detected block to Forward, left Tilt detected block to right and reload the card.

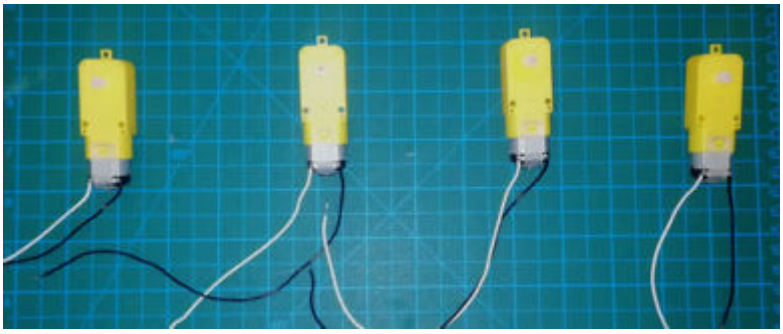
At this stage, the robot will not move. Because even if the glove sends the signal, we must encode it correctly so that the Feel Motion can detect the Signals. Let's make the connections of our Feel Motion robot and code it now.

Feel Motion Connect Diagram

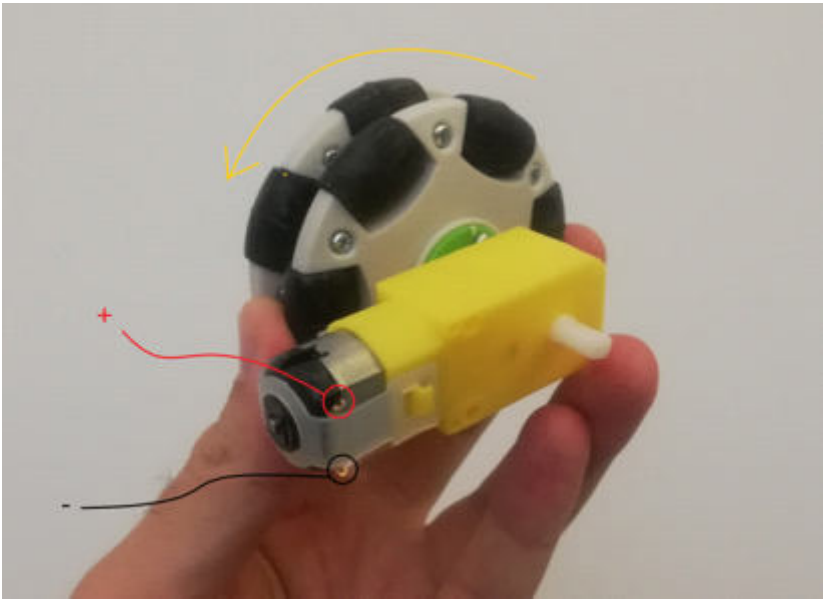
After completing the installation of our robot, let's make the connections between our electronic modules according to the connection diagram below.



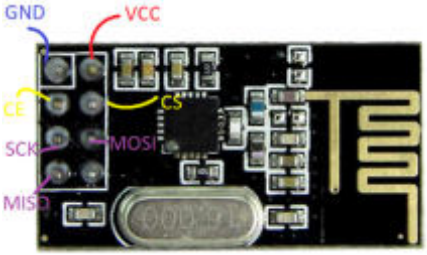
Connect the (+) poles of the 2 motors on the right side to Out 1, the (-) poles with the Out 2, the (+) poles of the 2 motors on the left side to Out 3 and the (-) poles with the Out 4. We will control the Out1, out2, out3 and out4 outputs on the motor driver (L298N) with IN1, IN2, IN3 and IN4 pins, respectively. For directional control of right motors, connect IN1 and IN2 pins to digital pins D7 and D8 on the sensor shield, respectively. Connect IN3 and IN4 pins to D9 and D10 digital pins for left motor direction control. Connect ENA pin to D6 pin for right motor speed control and ENB pin to D5 pin for left motor speed control.



You should solder the motors with 25-30 cm cable as in the photo. We will use the white leads (+) and the black leads (-) as poles. In this case, when we connect the (+) black cable (-) pole to the white wires of the motors, the wheels rotate clockwise.



Since the pin names are not written on the NRF24L01 wireless module, you can use the image below.



NRF24L01	SCK	**D13**
	MOSI	**D11**
	MISO	**D12**
	CS	**D3**
	CE	**D4**
	VCC	**3.3V**
	GND	**GND**

Coding of Feel Motion

Let's start the mBlock 5 software and add R.E.X from the device library to the coding stage.

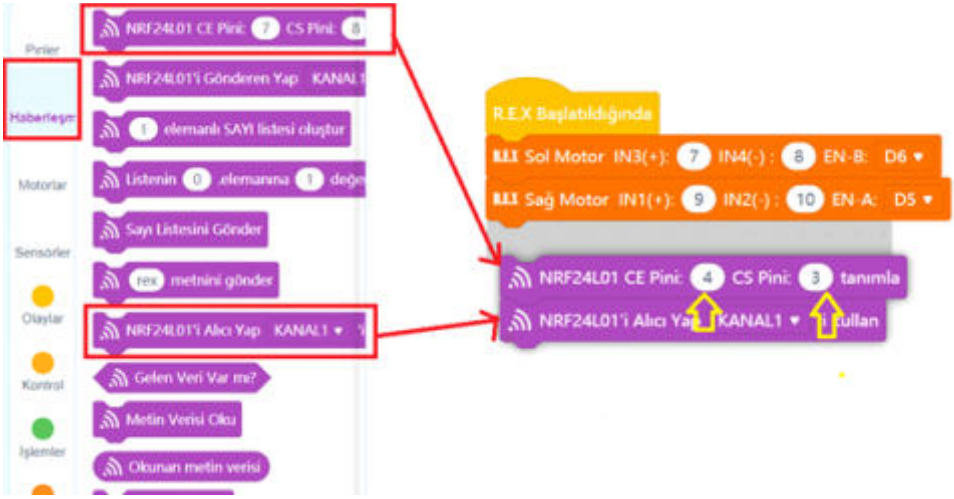
Our algorithm will be as follows;

1. Start
2. Identify engines
3. Identify NRF24L01
4. Set NRF24L01 as RECEIVER
5. Check incoming data
6. If there is no incoming data, go to step 9
7. Read incoming Text data
8. React according to the read me n data
9. Wait 0.005 seconds
10. Go to step 5
11. Stop

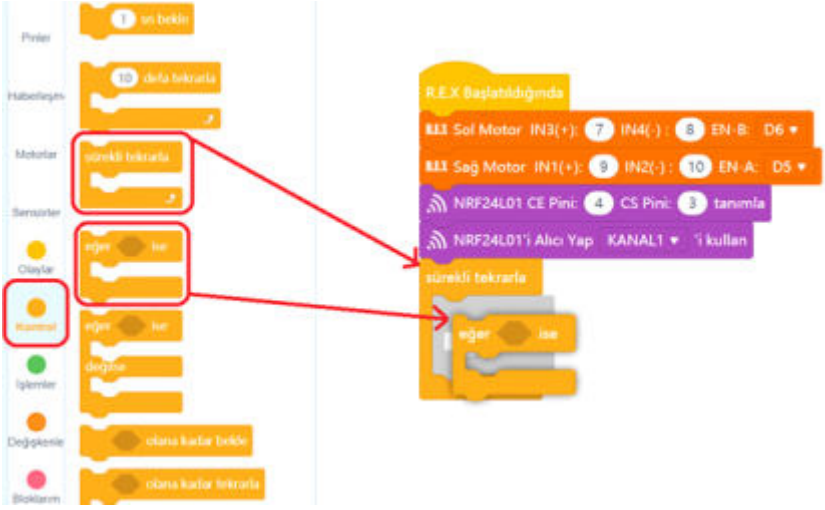
Drag and drop the "When REX Starts" block from the event blocks to the coding area.

We continue to code by defining our engines. Let's drag and drop the blocks that we will define from the motors category as in the image below. Then let's make the necessary pin number changes.

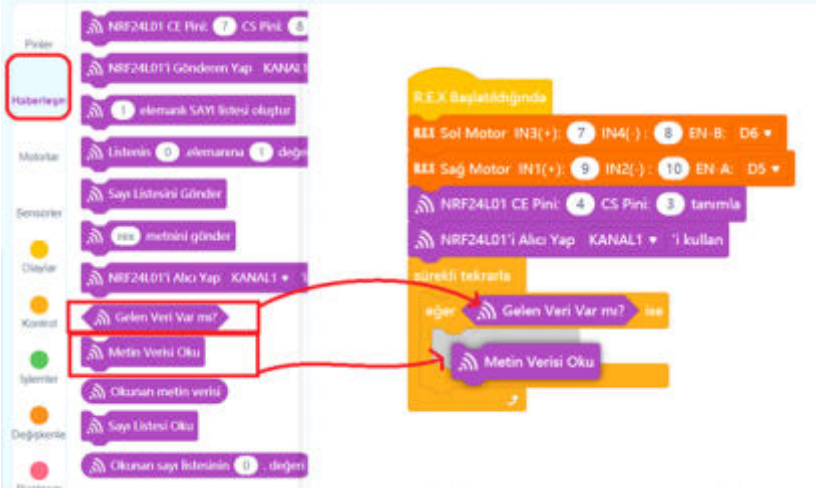
Now it's time to define our NRF24L01 module, which will receive messages from the glove by controlling the wireless communication, and set it as RECEIVER. Let's drag and drop the relevant blocks from the Communication category as in the image below. Since the glove system sends from CHANNEL1, NRF24L01, which we use as the RECEIVER in Feel Mo, must be set in CHANNEL1.



Let's continue coding by creating an endless loop that we will constantly check for incoming messages and repeat. For this, let's drag and drop the Repeat continuously block from the Control blocks category. We'll check to see if the following data is available. If there is data, we will make the necessary comparisons and react. If there is no incoming data, we will check whether the data is received again. So let's drag and drop the If block into the Repeat forever block.



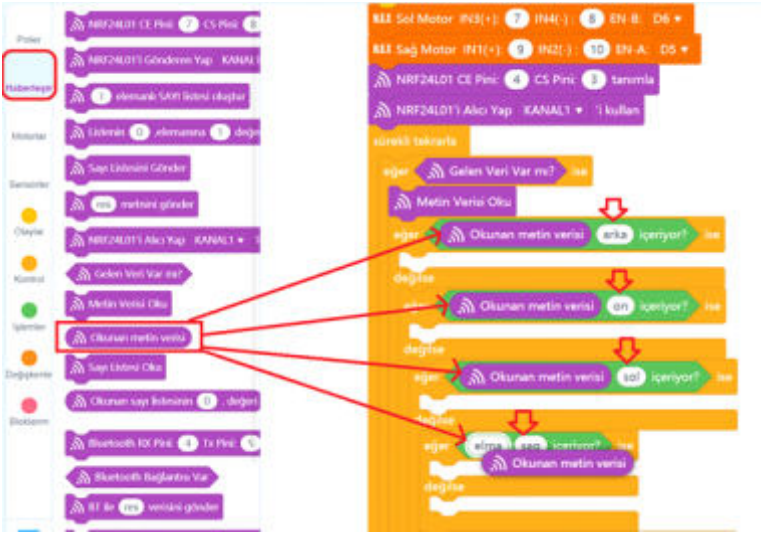
If there is incoming data, we will make comparisons by reading the Me n data. We call it "men data" because we know that the glove system Feel Mo sends messages made of words to it. Let's drag and drop the necessary blocks in the communication category as in the image below.



When there is incoming data, the Men data will be read and we will test this text with condition blocks. Since only one Men data will come in and be processed at a time, we will test our conditions by inserting the If If Not blocks into the If Not fields of the previous block. Since it will come with 4 different types, let's take the 4 if not block from the Control blocks category and drag and drop it right after reading the text data, as in the image.

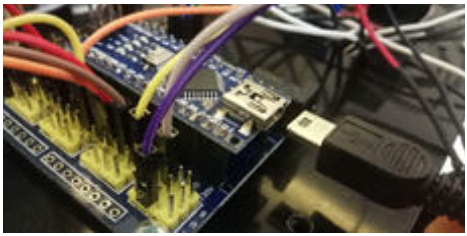
Since we will make a personal comparison, the apple in the Transactions category contains a? Let's drag and drop the block into our condition fields.

We will write the Read Me n data in the apple fields and the benchmark in the “a” fields. Does the me n data contain backgrounds? Does the me n data contain sol? etc. Let's drag and drop the blocks in the communication category to the appropriate places as in the image below.



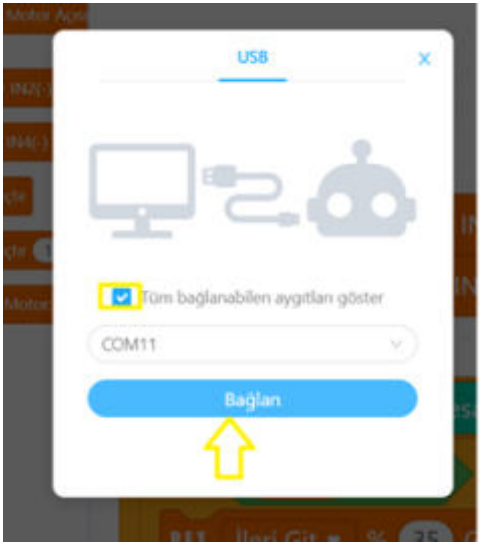
When it receives the goods with our robot, it will make 1 second turn movements. Let's make the necessary changes about the directions in the Go Forward at 50% power 1 second block in the Engines category and settle in the If fields as in the image.

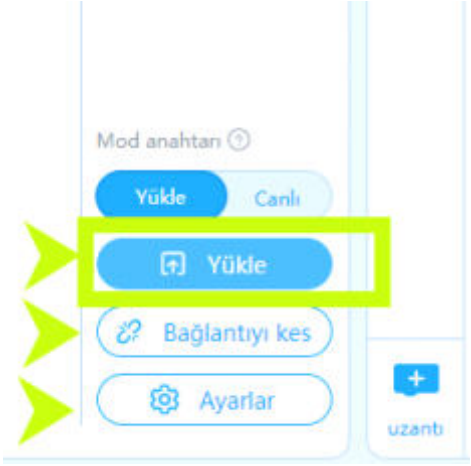
Finally, in order for the wireless reading process to be error-free, let's add the 1 second wait block in the Control category, which we placed in the 9th step of the algorithm, and set the time value to 0.005 and complete our code. Your codes should be as in the image below.



We can now upload the codes we have prepared to our robot. We connect one end of the usb cable to Arduino nano and the other end to our computer.

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.





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

Operating the System

After downloading the codes, connect the power. After the cables from the battery to the motor driver are made according to the connection diagram, plug the terminals from the battery into the power connection jack of the last Arduino Nano Sensor Shield to run the codes. The codes will start working immediately. As soon as we operate the glove system, our Robot will perform 1 second movements according to the movements of our Hand.

Possible Problems and Solutions

If your robot is only going back and forth, not turning left or right or vice versa,
Make sure to check the locations of IN1,IN2,IN3 and IN4 pins on the shield and on the motor driver. They may be confused.

If your robot turns back when you give the forward command and turns left when you give the right command;
Make sure that OUT1 and OUT 3 on the motor driver are connected to the (+) pole of the motors, and OUT 2 and OUT 4 are connected to the (-) pole of the motors. Also, make sure that the motors on the right of the robot are connected to OUT1 and OUT2 on the driver, and the motors on the left are connected to OUT3 and OUT4.

If Feel Motion exhibits movements in the opposite direction of hand movements;
There may be a problem with your positioning of the gyro sensor. You can solve the problem by reversing the motor movement directions in the feel moon codes or by sending reverse messages to the gyro sensor commands in the glove codes.

YouTube

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