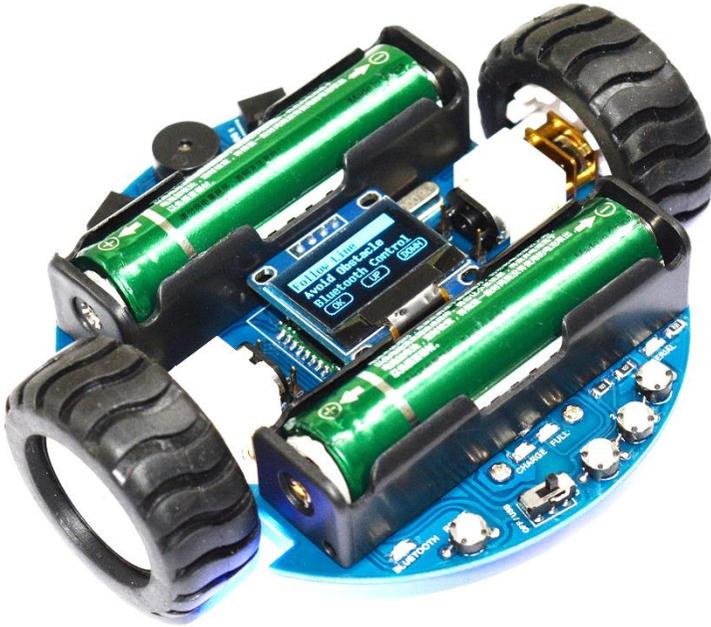
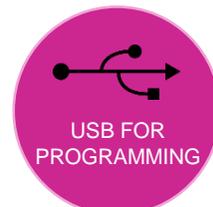
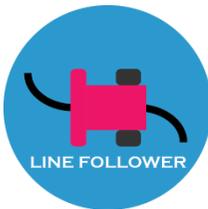




**TECHSHOP**  
bd.com



# 360 NANO BOT



Password for Codes and All in One Firmware:

**will be here in the user manual**

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## 1. Introduction

360 Nano Bot is the **all in one** robot from “TechshopBD”. This very small sized (10 cm diameter) and lightweight robot platform has got every features to satisfy the needs of beginner to advanced level robot enthusiasts. It has got the hardware and circuitry to become a

- Line Follower Robot
- Obstacle Avoider Robot
- Bluetooth controlled Robot
- Maze Solver Robot

It’s for people who wants to **learn robot programming** on a robust readymade platform. In terms of specifications, it’s similar to the “Arduino Robot” or the “3PI Robot” but with much more features.

## 2. Features

- Arduino Nano built-in with onboard programmer.
- Built-in Line Sensors, Obstacle Sensors, Bluetooth and Wheel Encoder.
- Compact design with high quality components.
- Rechargeable Li-ion batteries with built-in battery charger.
- Single USB port for battery charging and program uploading.
- Graphical OLED display.
- High quality motor driver with back emf protection circuit.
- Battery level indication, low battery warning, automatic shutdown when battery is empty.

## 3. Product Package

When you receive this product, make sure that you get the following components

	<b>Component Names</b>	<b>Quantity</b>
1	360 Nano Bot Main Body with Motors, Wheels, Ball Casters	1
2	Graphical OLED display	1
4	USB Cable	1
5	User Manual	1

## 4. Safety & Handling Precautions

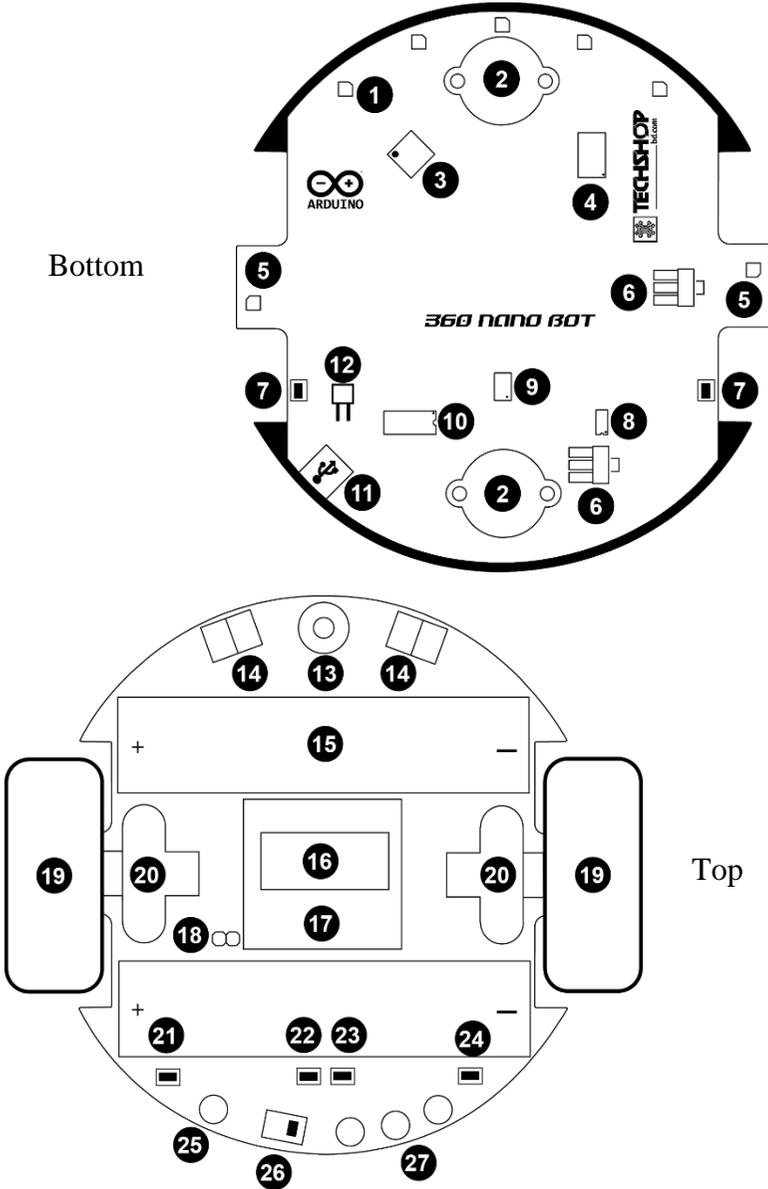
- Use the robot on flat and smooth surface. Running on rough surfaces might damage the underside of your robot's PCB. Run the robot on clean surface.
- Underside of the robots body is exposed PCB so don't touch it with wet hand. This will cause short circuit and might permanently damage the robot.
- Avoid placing the robot in a place (e.g.: a drawer filled with metal parts) where the underside of the PCB makes contact with conductive materials. This may cause short circuit while battery is connected even when the robot is powered off.
- It's a good practice to remove the battery from the robot's body before storage. Keep the battery in a plastic bag to avoid accidental short circuit of the battery connectors.
- While removing / attaching the batteries, grab the battery holder and not the robot's body. The battery holder might break or come off the robot's body otherwise.
- Avoid rotating the wheels by hand as this might damage the metal gears of the motors.
- When attaching the batteries, be very careful of the "+" and "-" polarity of the battery and battery holder. Attaching battery in reverse polarity will permanently damage the battery. Also the robot's PCB will be harmed.
- **IMPORTANT:** Note that there's a dual 6 pin connector under the display, between Bluetooth device and battery holder. These are for developer of the robot from TechshopBD, for troubleshooting certain hardware and firmware of the robot. Do not try to connect anything to these connectors ever as this may permanently damage the robot and void any applicable warranty.

## 5. Warranty

This product comes with a one year “**free service**” warranty. That means if any part gets damaged due to misuse, we'll repair it for free without any service charge. The customer has to pay only for the replacement part(s). Service warranty will be void in case of the followings.

- Warranty will be void if any of the circuit component gets damaged due to short circuit.
- Warranty will be void if any other battery other than the recommended ones is used.
- We will not replace the chassis (main pcb) in case of a mechanical damage.

## 6. At a Glance



## Component description

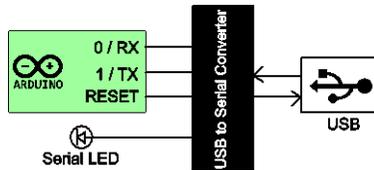
1. One of 5 infrared sensors for line following.
2. Ball casters in front and back for support during both acceleration and brake.
3. Atmega328p microcontroller flashed with Arduino Nano bootloader.
4. TB6612FNG dual dc motor controller.
5. Infrared based wheel encoder.
6. Voltage regulators (5V & 3.3V).
7. Power LEDs. Also act as battery level and low battery indicator.
8. Battery Charger IC.
9. Battery protection and health monitoring IC.
10. USB to Serial converter IC.
11. USB Mini-B port for battery charging and program uploading.
12. Charge-only jumper. Remove to turn off robot and only charge battery.  
Might be on the other side of the PCB on some products.
13. Buzzer.
14. Infrared distance sensors.
15. 18650 size Li-ion battery holder.
16. HC-05 Bluetooth.
17.  $128 \times 64$  graphical OLED display.
18. Bluetooth LED jumper. Remove to turn off Bluetooth status LED.
19.  $43\text{mm} \times 19\text{mm}$  wheel. Teeth inside the wheel work as encoder slit.
20. 9V 250 rpm high torque geared DC motor.
21. Bluetooth status LED.
22. Battery charging indicator LED.
23. Battery Full Indicator LED.
24. USB to Serial communication indicator LED.
25. Arduino Reset button.
26. Power switch. Slide to toggle between battery power and power off / USB power.
27. Programmable user buttons.

## 7. Component Description

### 7.1 Arduino Nano Inside

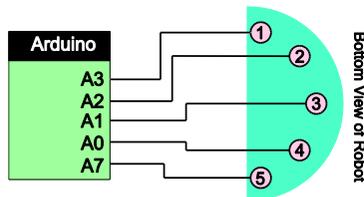
The robot has got an entire Arduino Nano built-in. There's an Atmega328P microcontroller <sup>(3)</sup> with Arduino Nano bootloader, a USB to serial converter <sup>(10)</sup> and a mini USB port <sup>(11)</sup> in this robot-the exact same things you will find in an Arduino Nano board. That means you can program the robot from Arduino IDE software and upload your program to the robot with a USB cable.

The serial communication indicator LED <sup>(24)</sup> lights up during serial communication using serial monitor.



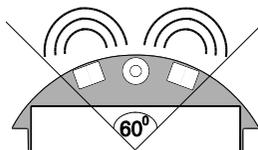
### 7.2 Line Sensors

Five Infrared line sensors <sup>(1)</sup> provide **analog voltage output** based on the brightness of surface beneath them. These sensors are connected to analog input pins of the built-in Arduino Nano. Sensors provide **high** voltage reading for **white** and **low** voltage reading for **black** surface.

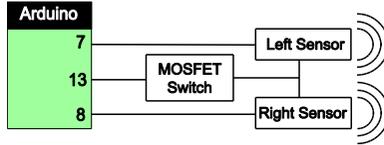


### 7.3 Obstacle Sensors

These infrared obstacle and distance sensors <sup>(14)</sup> can detect presence of obstacles and their distance up to 10cm in front of the robot. Two of them cover about 60 degree angular region in front of the robot.

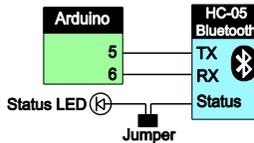


Obstacle sensors draw a lot of current and drain huge battery power. To prevent unnecessary usage, you can activate the obstacle sensors only when the microcontroller takes reading from them, using a MOSFET switch.



## 7.4 Bluetooth

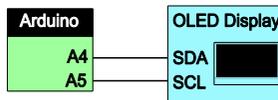
The very popular HC-05 Bluetooth radio <sup>(16)</sup> is placed under the OLED display. It lets you communicate with the robot from any Bluetooth enabled device like your cell phone or computer. Default Bluetooth baud rate is 9600 and password is 1234. You'll need to use Arduino software serial to make the Atmega328p talk to the Bluetooth device. Bluetooth status LED lets you know when the device is paired with your phone / computer.



Bluetooth status LED <sup>(21)</sup> can be deactivated by removing Bluetooth jumper <sup>(18)</sup> if you find the constantly blinking Bluetooth LED disturbing. This doesn't turn off the Bluetooth radio and only turns off the Bluetooth LED.

## 7.5 OLED Display

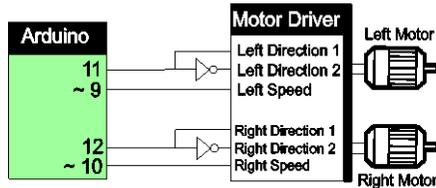
A graphical monochrome OLED display <sup>(17)</sup> lets you show texts and graphical objects as well as simple animation and user interface. The display resolution is 128×64 pixels and communicates with Arduino Nano through I2C protocol.



## 7.6 Motors and Wheels

360 Nano Bot comes with 250 r.p.m high torque DC geared motors running on 8V. They are connected to wheels of 42mm diameter and 19mm thickness. These thick wheels ensures better grip while ball caster placed on both front and rear side of the robot provide proper balance during acceleration & brake.

The motors are controlled by a TB6612FNG dual dc motor driver IC <sup>(4)</sup>. You can change the speed as well as direction of rotation of the motors.

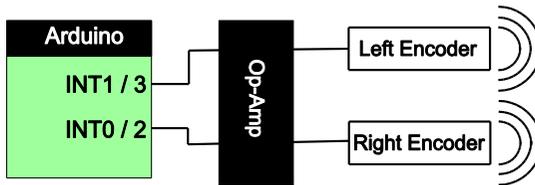


## 7.7 Wheel Encoders

Encoders <sup>(5)</sup> on both wheels let you measure wheel rotation angle as a feedback to the microcontroller. This is a very useful feature if you want to control your robot's motion precisely in certain applications (like maze solving).

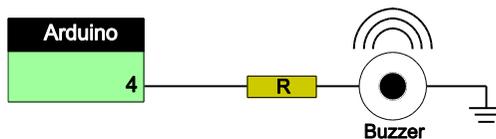
The encoders work by sending interrupt signal to the Atmega328p external interrupt pins and thus the microcontroller knows the angle of rotation of the wheels. Wheels of 360 Nano bot have 12 teeth in total. So, by using the encoder you can have either 12 (rising or falling edge) or 24 (logic change) interrupt bits for a full 360 degree rotation of a wheel.

Please note that you can only measure the angle of rotation, not the direction.



## 7.8 Buzzer

High quality buzzer for audio output.



## 7.9 Battery & Notifications

Two 18650 sized Li-ion batteries provide power to the robot. These are those popular laptop batteries that you can buy from computer parts stores. Use good quality 18650 sized Li-ion battery to run the robot, one that can supply at-least 2A current without voltage regulation. If a mediocre/ low quality battery is used, the robot might occasionally restart repeatedly.

**IMPORTANT:** When attaching new batteries, make sure that both of the batteries have **exactly the same voltage** (max difference 0.1V), as they get connected in parallel. Otherwise, the robot’s circuit and the batteries will get damaged. If you find the voltages to be different or simply if you don’t have a multimeter, just charge the batteries to full one at a time in the following method.

Attach only one battery to the robot (any battery slot). Slide the power switch to “OFF/USB” position. Then connect USB cable and wait till the green colored full battery indicator LED turns on. Then disconnect USB power and remove the battery from the battery slot of the robot. Do the same for the second battery. After that, you can be assured that both batteries are fully charged and at same voltage. Now you can attach both batteries to the robot.

### **Power LED Notifications:**

Battery protection and health monitoring IC <sup>⑨</sup> controls the power LEDs <sup>⑦</sup>, keeps track of battery voltage and monitors battery charging. The power LED displays battery status and power status in following manner.

#### **Battery Level Indication:**

When the robot is powered on, power LEDs blinks for a number of time to indicate battery charge level.

- 1 Blink = 25% or more battery
- 2 Blinks = 50% or more battery
- 3 Blinks = 75% or more battery
- 4 Blinks = 99% or more battery
- Continuous fast Blinks = Low battery

#### **Battery Low:**

Power LEDs blink continuously when the batteries are below 15%.

#### **Battery Empty:**

When the batteries are less than 10%, Power LEDs will turn off. The robot will also stop working automatically and enter a “HALT” mode, to save the batteries from over discharge, even if the power switch is ON. This “HALT” state continues until you turn off the robot and plug in a USB cable to charge the batteries.

**USB power:**

Power LEDs fades in and out when the robot runs on USB power from external power source.

## 7.10 Power Switch

The power switch <sup>(26)</sup> is used for power source selection. When no USB power is connected, sliding towards “**OFF/USB**” will turn off the robot and sliding towards “**ON**” will turn it on. However, while the robot is connected to a computer via USB cable, sliding towards “**OFF/USB**” will power up the robot from the computers USB port (and also charge battery) and sliding towards “**ON**” will power it up from the onboard battery of the robot.

Power Switch Position	USB Connected	USB Disconnected
<b>ON</b>	<b>Robot ON, Battery Not Charging</b>	<b>Robot ON</b>
<b>OFF/ USB</b>	<b>Robot ON, Battery Charging</b>	<b>Robot OFF</b>

**All functions of the robot will work perfectly on USB power except for only the motors. The motors run only on battery power.**

## 7.11 Battery Charger

The onboard TP4056 battery charger IC <sup>(8)</sup> charges the batteries at about 1A current when the robot is connected to any power source via the USB port. The USB port of the robot is a 2 in 1, acting as both battery charging and program uploading port. So, when you connect the robot to a computer for program uploading, the batteries get charged from your computers USB port meanwhile. The charging indicator LED <sup>(22)</sup> lights up while battery is charging and full charge indicator led <sup>(23)</sup> is turned on when batteries are fully charged.

**Battery Charging Method 1:** Slide the power switch towards “**OFF/USB**”. Connect the robot to your computers USB port using the USB cable. Your computer should be able to provide sufficient current through the USB port (almost all modern computers do).

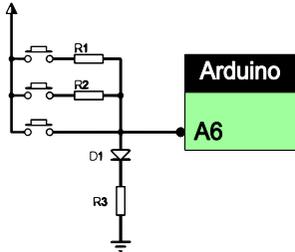
**Battery Charging Method 2:** Slide the power switch towards “**OFF/USB**”. With USB cable, connect to an USB power adapter (like your phone charger). You can also remove the charge only jumper <sup>(12)</sup> so that the robot doesn’t turn on while the batteries are charging. This way the batteries will charge faster.

**Battery Charging Method 3:** Remove the batteries from the robot and charge them using an external 18650 sized Li-ion battery charger (like the “portable battery charger” from TechshopBD).

**IMPORTANT:** If using external charger, make sure that both of the batteries have **exactly the same voltage** (max difference 0.1V), before attaching them to the robot. Otherwise, the robot's circuit will get damaged.

## 7.12 User Buttons

Three programmable user buttons <sup>(27)</sup> connected to a single analog pin of the arduino lets you make any type of user interface.



## 8. Arduino Connection Summary

Component	Component Pin	Arduino Pin
Line Sensors	1 (leftmost, view from bottom)	A3
	2	A2
	3	A1
	4	A0
	5 (rightmost, view from bottom)	A7
Obstacle Sensors	Left Obstacle Sensor	7
	Right Obstacle Sensor	8
	Activator	13
HC-05 Bluetooth	TX	5
	RX	6
OLED Display	SDA	A4
	SCL	A5
Buzzer	Power	4
Motor Driver	Direction 1 & 2 (Left motor)	11
	Direction 1 & 2 (Right motor)	12
	Speed / Enable (Left Motor)	9
	Speed / Enable (Right Motor)	10
Wheel Encoder	Left Encoder	3
	Right Encoder	2
User Buttons	Signal	A6
USB to Serial	TX	0
	RX	1

## 9. Specifications

Dimensions	10 cm (diameter) × 4.2 cm (height)
Weight	130 gram (without battery)
Operating voltages	8V, 5V and 3.3V
Motor type	Brushed DC Gear
Motor rpm	250 (at 8V)
Standby current	170 mA
Line sensor span	6 cm
Obstacle sensor range	~ 10 cm
Bluetooth range	~ 12 m
Wheel encoder accuracy	15 degree
Arduino bootloader type	Arduino Nano
USB port type	USB mini-B
Programming language	C & C++ (arduino)
Supported battery capacity	1000 mAh (min) to 2000 mAh (max)
Battery type	Lithium ion 18650 size

## 10. Coding

### Arduino Test Codes:

Please go the following link to download sample Arduino codes. You can also visit the product page of “360 Nano Bot R2” and click on Documents tab to get it.

File Link: [rebrand.ly/360BotCodes](https://rebrand.ly/360BotCodes)

Password: **will be here in the user manual hardcopy**

Arduino codes are provided for

1. Motor Control (Speed & Direction)
2. Reading Line Sensors
3. Using User Buttons and OLED display
4. Using Buzzer
5. Using Obstacle sensors
6. Controlling the Robot using Bluetooth
7. Using the encoders
8. Making Line Follower Robot
9. Making Obstacle Avoider Robot
10. Making Bluetooth Controlled Robot
11. Making Maze Solver Robot (algorithm only)

### **All in One Firmware:**

We have prepared an All in one code for you so that you can use all features of the robot without writing a single line of code. The robot is shipped with the code flashed inside the inbuilt Arduino Nano. You can also flash the firmware anytime you want. Download the necessary files and tutorial from the link below.

The firmware lets you use the following features.

1. Line Following
2. Obstacle Avoiding
3. Bluetooth Control
4. Obstacle sensor testing
5. Encoder testing
6. Audio generation

File Link: [rebrand.ly/360BotAIO](https://rebrand.ly/360BotAIO)

Password: **will be here in the user manual hardcopy**

## 11. Troubleshooting

While using this robot, you might have to troubleshoot the below mentioned situations.

### **USB device not recognized**

This might happen on windows 7/8 computer when you plug in the robot to your PC via USB port. It's because there's no proper USB to serial driver on your computer. If you have the blue PCB variant of the robot, Search google by "Download CH340 driver". If you own the black blue PCB variant of the robot, Search google by "Download FT232RL driver". Then download & install the driver to your computer. **If you are using windows 10, download Arduino IDE from Microsoft store to avoid this issue.**

### **Ball caster jammed / not rotating**

This might cause because of dirt and dust accumulating inside the ball caster due to running the robot on dusty / dirty surface. You need to clean the ball caster with a clean cloth in this case.

### **Motor not rotating**

Check your code first. Try with the example motor testing code from us. Check if the power switch is at "ON" position. Check battery voltage level by restarting the robot and power LED blink numbers. If voltage level is at 25% (1 blink), recharge battery. If the motor is still not running, check the two red pins on the back of the motor and verify if they are properly connected to the robot's PCB.

### **Obstacle sensor false reading**

The obstacle sensor might read presence of an obstacle even if there is no obstacle in front of the robot. This happens when any of the sensors faces downwards in case the user accidentally push it down and reads the ground / surface as obstacle. Just slightly raise the sensor upward with your finger and this problem will be solved.

### **Battery not charging**

Make sure the power switch is at “OFF / USB” position. Check if the batteries are connected correctly. Check if the USB cable is connected correctly to the USB port of the robot correctly. If charging from the USB port of an old computer, your computer might suspend USB as old USB 1.0 cannot supply more than 500 mA current. In that case use any USB 2.0, 3.0 or 3.1 gen port. You can also use the DC adapter of your smartphone.

### **Battery charging very slowly**

This might happen if you plan to use high mAh batteries rather than the stock ones. Remove the charge only jumper <sup>(12)</sup> to charge faster.

### **Robot suddenly shuts down while running**

The robot is designed to shut down automatically when battery level reaches below 3.2 V, to save the battery from under-voltage, even if the power switch is ON. A 25% battery level (1 blink of power LEDs during startup) might be the cause because at lower voltage, the stock batteries cannot supply enough current at high performance application of the motors (like maze solving). The solution is pretty simple: keep voltage level of the stock batteries above 75% (3 or 4 blinks of power LEDs during startup) or use a high mAh (about 2000 mAh) battery.

### **Program not uploading**

Check if you've selected Arduino Nano as board and Atmega328p as processor on Arduino IDE software.

## 12. About Us

TechShop Bangladesh is the largest online shop of components for robotics and electronics in Bangladesh. We are famous for our excellent after sales services, professional technical support and transparent warranty & return policy.

You can open an account very easily and order products. You can have your products delivered to you within just 1-5 business days, regardless of where you live in Bangladesh.

### **Website**

[www.techshopbd.com](http://www.techshopbd.com)

### **Technical support:**

[technicalsupport@techshopbd.com](mailto:technicalsupport@techshopbd.com)

### **Customer care:**

09678-110-110



Google Map Link