TA0135
USER MANUAL
ARDUINO 4 WHEEL DRIVE WITH ULTRASONIC & LINE TRACER BLUETOOTH ROBOT KIT
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Chapter 1. Overview – TA0135

In this instruction, we will introduce you through the fun project of the Arduino 4 Wheel Drive with Ultrasonic & Line Tracer Bluetooth Robot Kit. This DIY Arduino based Bluetooth robot kit is based on Arduino Uno development board. It is based on a 4-wheel drive platform integrated with an ultrasonic sensor to avoid obstacles and line tracer sensors. Let’s get started!

Chapter 2. Getting started: the 4 Wheel Drive Ultrasonic & Line Tracer Bluetooth Robot Kit Robot Kit using Arduino UNO

2.1. What is Arduino?

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards can read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing.

2.2. What is IDUINO UNO?

The iDuino Uno is on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analogue inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button.

It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.
Chapter 3. Software installation

In this section, we will introduce you the development platform where you translate creative mind into codes and let it fly.

3.1. Arduino Software/IDE

Download from [here](#). Open Windows-based app by double clicking it and follow the instruction to complete (Remember to install everything driver for Arduino). Easy!

![Windows Security]

Would you like to install this device software?

Name: Arduino USB Driver

Publisher: Arduino LLC

Always trust software from “Arduino LLC”.

install [ ] Don't Install

You should only install device software from publishers you trust. [How can I decide which device software is safe to install?](#)

Connecting your UNO board with your computer

Connecting UNO and your PC by a blue USB cable, and if connected correctly you will see the green power LED light up and another orange LED is blinking.

![Device Manager]

Find your Serial COM number and note it down.

We need to figure out which channel COM is currently communicating between PC and UNO. Following the path: Control panel | Hardware and Sound | Devices and Printers | Device Manager | Ports (COM & LPT) | Arduino UNO (COMx)
Software installation

Note down the COM number as we require this later. As the COM port may vary from time to time, this step is vital. In this case for demonstration purpose, we are using the COM 4.

3.2. Play with your first “Hello World” LED example

Firstly, let’s tell IDE where to find our Arduino port and which board you are currently using: The following instruction (Figure 3 and 4) shows the details:
Software installation

It’s time to play with you first simple example. Following the path by File | Examples | 01. Basics | Blink. A new code window would pop up, press the arrow symbol to upload. You will notice the orange LED is blinking almost every second.

3.3. Run your Arduino 2 Wheel Drive code

Upload to UNO

Done uploading!
Chapter 4. Hardware installation

4.1. Unboxing and Component list

1. Acrylic Chassis with Protection Cover
2. Four DC Motors
3. L289N Motor Driver Board
4. Four Rubber wheels

1. Ultrasonic Sensor
2. LCD1602
3. Remote Controller
4. Three Line track sensors
5. iDuino UNO Development Board
6. Arduino Sensor shield V5.0
7. HC-06 Bluetooth Module
8. Infrared receiver
9. Servo package (Horns and brackets included)

1. 2 x 18650 Batteries
2. Battery Charger
3. 18650 Battery Box
4. USB cable
5. Jumper wires (30)
Hardware installation

Fastener package:
1. 6 x M3 35mm Spacers
2. 12 x M3 10mm Spacers
3. 6 x M3 10mm Screws
4. 8 x M3 8mm Screws
5. 14 x M3 6mm Screws
6. Hobnail (not used for this project)
7. 5 x M3 Nuts

4.2. Module Experiments
In this section, we are pre-testing and experimenting sensor modules separately to make sure that they function smoothly which are required to put together in the final Combination Module test. Be patient and have fun with each module.

4.2.1 LCD1602 Module with I2C Interface
This module is ideal for low power display up to 16 characters by 2 rows for a total of 32. Together with Arduino Sensor Shield V5.0, this LCD1602 module is just at your hand. With this I2C interface LCD module, you only need 2 wires to display information. If you already have I2C devices in your project, this LCD module uses no more pins at all.

Firstly, place Arduino Sensor Shield on top of the Arduino UNO and make sure Pins are lined up correctly.
Hardware installation

Identify the Pins from top to bottom:
- GND
- VCC
- SDA
- SCL

There is a backlight, and contrast adjustment potentiometer. You can adjust that to suit the ambient light.

Use four jumper wires to connect LCD1602 module to the Arduino Sensor Shield

Schematic diagram
Hardware installation

Open the LCD1602 sketch by double clicking the file (.ino)

If this is your first LCD1602 project, then you might need to import LCD1602 I2C library. Follow - Sketch | Include Library | Manage Libraries

When this window pops up, type in the “LiquidCrystal_I2C” in the search bar on the top right corner and install it. Please wait for several minutes to complete the installation.
Hardware installation

Hit the Upload button to upload to your UNO board

Now the first line should show “Arduino” as in the code

4.2.2 Track Line Module

This reflective optical sensor has three channels as you can see three pairs of “Black/Blue” IR LED’s on the sensors. This module measures the reflectivity of a surface with an infrared emitter/detector pair. If infrared light is detected, the module S pin will send digital high voltage signal to Arduino board. Now let’s test it out!

This diagram shows a single-channel track line sensor pins

<table>
<thead>
<tr>
<th>Track Line Sensor Board</th>
<th>Arduino Sensor shield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left Sensor - Signal</td>
<td>6</td>
</tr>
<tr>
<td>Middle Sensor - Signal</td>
<td>9</td>
</tr>
<tr>
<td>Right Sensor - Signal</td>
<td>11</td>
</tr>
<tr>
<td>GND</td>
<td>GND</td>
</tr>
<tr>
<td>VCC</td>
<td>+5V</td>
</tr>
</tbody>
</table>
Hardware installation

As always, open sketch and upload it to UNO board

Based on the working principles of this reflective track line sensor, we are required to adjust their sensitivity by changing the corresponding potentiometers in white background with black strips. Place it round 1cm above the white paper and now the red indicators should light up. Move it above the black strip and the indicator should turn off. If not, adjust the potentiometer clockwise to increase its sensitivity.
Hardware installation

As shown in the LCD, the left IR detects the black line.

As shown in the LCD, the Left and Middle IR detects the black line.
Hardware installation

As shown in the LCD, the right, middle and left IR detects the black line.

4.2.3 Ultrasonic sensor Module

Ultrasonic sensor distance measuring module which a non-contact distance measurement module.

The sensor has 4 pins:
- VCC (5V)
- GND
- Trigger
- Echo
Hardware installation

The working principle is:

- Initialize TRIG pin with low voltage and then send at least 10µs High voltage from TRIG pin
- The sensor will send 8 cycles of square waves with 40KHz sonic burst
- Then sensor will automatically detect echo waves from the ECHO pin
- Then the distance is determined by the difference time

Distance = Duration of High voltage level * 170 m/s

Upload the sketch and position the ultrasonic sensor to different angles to test
Hardware installation

The distance is shown in the LCD1602 in the unit of centimetre.
4.2.4 Servo Module

Rotation angle ranges from 0 ~ 180

Pin connection

Servo has three pins:
- Signal
- GND
- VCC

The rotation angle is regulated by PWM (pulse width modulation) signal duty cycle. The frequency of PWM usually is in range from 30 to 60Hz – this is so called refresh rate. If this refresh rate is too small then then accuracy of servo reduces as it starts losing its position periodically if rate is too big, then servo can start chatter. It is important to select optimal rate, that servo motor could lock its position.
Hardware installation

Connect the light orange signal wire to the Arduino Sensor shield digital pin 3 as shown on the left picture.

Upload the sketch and open the Serial Monitor (remember to choose the corresponding Baud rate 9600).

By typing the angle in the dialog bar in the Serial Monitor and observe the servo change.
Hardware installation

4.2.5 Infrared Sensor Module
This is an infra-red emitting diode which produces near-infrared Light (black light) which mainly used in a variety of optical switches, remote transmitter circuit, infrared emission control structures.

This infrared sensor module has three pins:
- Signal
- GND
- VCC
Hardware installation

Use three jumper wires to extend infrared sensor pins.

Remove the plastic battery cover on the bottom of the remote controller, which used to isolate remote controller and button battery and extend the battery life.

Pull out the battery cover.
Hardware installation

Open the sketch

If this is your first remote control project, then you might need to import remote control library. Follow - Sketch | Include Library | Manage Libraries.

Search “irremote” in the search bar and install the package.

Aim the remote receiver and press the buttons and check the corresponding code for each button

Button on the remote controller:

a) Up
b) Back
c) Left
d) Right
e) Stop
f) 1
g) 2

IR receiver code:

a) FF629D
b) FF8577
c) FF22DD
d) FFC23D
e) FF02FD
f) FF6897
g) FF9867
4.2.6 Bluetooth Module

This inexpensive HC06 Bluetooth module is used to control the robot by sending data between an Arduino or compatible board and a Bluetooth-equipped device such as an Android smartphone or tablet.

Here we will guide you through the communication between Arduino and Bluetooth device running serial terminal software, in this case, an Android pad. Please note that this control process is not compatible with IOS devices.

So, let’s get started! Our end goal for this Bluetooth module is to send data from your android devices and display information on LCD1602 previous you just built.

Pins configuration:

- GND: System / Arduino Ground
- VCC
- STATE: Tells if connected or not
- KEY: If brought HIGH before power is applied, forces AT Command Setup Mode. LED blinks slowly (2 seconds)
- TXD: Transmit Serial Data from HC-05 to Arduino Serial Receive. NOTE: 3.3V HIGH level: OK for Arduino
- RXD: Receive Serial Data from Arduino Serial Transmit
Hardware installation

Plug the HC06 module in the corresponding COM slot

Once the Bluetooth module has been connected and power applied, the LED will blink rapidly. This means that it has not been "paired" with another Bluetooth device. The LED stays on continuously when paired.

Use USB cable to connect your Arduino UNO board and your PC, in this case, we are using Windows 10

Open the Settings | Devices | Bluetooth

Then you will notice there is new Unknown device
Hardware installation

PC will automatically install the driver for HC-06 Bluetooth module

Wait for a second to download and install driver

If no response, then disconnect this module and re-insert in the COM slot

The HC-06 icon is shown and ready to pair.

Press pair to communicate with HC-06

The default passcode is 1234. Then hit the Next Button
Hardware installation

Successfully connected. Now you will notice the red LED on the module is on continuously.

Click the More Bluetooth Options.
Hardware installation

New dialog window pops up and choose the COM ports.

Note down the incoming Port number, in this case, it is shown as COM4, as required to configure in the next step.
Hardware installation

Download the Serial Debug Assistant from Windows store.

Search the “Serial Debug Assistant” in the right corner search bar and install it.

Open the software.

Choose the HC-06 device (COM4 in this instance) and keep other settings default as shown on the left.

Baud Rate: 9600 bps
Data: 8 bits
Stop Bits: 1 bit
Parity: None
Handshake: None

Open the serial port.

Type in character “A” and you will see it on the LCD1602.
Hardware installation

Try other character like a “C”

Now you have finished the Bluetooth test
The module has two modes of operation, Command Mode where we can send AT commands to it and Data Mode where it transmits and receives data to another Bluetooth module. You can also change the name or password of your unique Bluetooth module.

Command Mode Commands:
The format of commands is:
Always starts with "AT"
Then "+" followed by <ParameterName>
Then either:
? (returns current value of parameter)
= (New Value of parameter)

A few examples:
AT (AT Test command. Should respond with OK)
AT+VERSION? (show the firmware version)
AT+UART=9600,0,0 (Set baud rate to 9600, 1 stop bit, no parity)
Hardware installation

This step is optional:

Renaming your Bluetooth device:
- Check firmware version.
- Change name
- Change PIN

4.2.7 Motor Module

This 4-wheel drive is driven by the H-bridge L289N Motor driver board. This allows you to control the speed and direction of two DC motors, or control one bipolar stepper motor with ease. The L298N H-bridge module can be used with motors that have a voltage of between 5 and 35V DC. There is also an onboard 5V regulator, so if your supply voltage is up to 12V you can also source 5V from the board.

This L289N Motor driver board is ideal for controlling this 4-wheel drive. The speed is modulated by either the enable pins (ENA/ENB) or IN1/IN2/IN3/IN4 with PWM modulation.
Hardware installation

The motor direction is controlled by sending a HIGH or LOW signal to the drive for each motor (or channel). For example, for motor one, a HIGH to IN1 and a LOW to IN2 will cause it to turn in one direction, and a LOW and HIGH will cause it to turn in the other direction.

Prepare the jumper cable wires, LCD2602, Arduino Sensor Shield with UNO board, two 18650 batteries in the Battery Box and chassis (four motors and L289N Motor Driver Board included)

First step is to tighten the motor wire (red is positive and black is negative).

Then connect the Battery wires to L289N Motor Drive board. Red wire to VMS, black wire to GND

Please carefully secure the battery wires in the correct polarity to avoid burning our the L289N module.
Hardware installation

L289N Pin connection:
- ENA
- ENB
- IN1
- IN2
- IN3
- IN4
- GND
- VCC

In this instance, left two wheels are controlled by IN1/IN2/ENA, and right two wheels are controlled by IN3/IN4/ENB.

Use jumper cables to configure the connection between four motors and your Arduino Sensor Shield:
- IN1 – pin 2
- IN2 – pin 4
- IN3 – pin 7
- IN4 – pin 8
- ENA – pin 10
- ENB – pin 5

You will notice pin 10 and pin 5 has ~ indicators on the board, which means they are able to output PWM waves.

Once you finished the hardware connection, then upload the Motor sketch to your Arduino UNO board.
Motor running status will be displayed on the LCD1602.

Motor speed is modulated by the PWM output pin 10 and pin 5.

For now, all the sub-modules are working correctly.

It is time to put everything together.
Hardware installation

4.3. 4-wheel Drive installation
As each separate module works well, now we assembly them together.

Prepare six M3 * 35mm Spacers and six M3 * 10mm screws

Secure the spacers on the chassis
Hardware installation

It should look like this

Use Jumper cables to extend connection pins on the Track line sensor.

Three M3 * 8mm screws and nuts to secure the Track line sensor

Please note do not change the potentiometer as we have already calibrated.
Please Note: The 8 Jumper cables will eventually attach to the Sensor Expansion Board from the L289N board a few steps from now. Please leave the opposite side free for the following steps.

It should look like this

- LCD1602
- Four M3 * 10 mm Spacers
- Four M3 * 6 mm Screws
Hardware installation

- Arduino UNO Board
- Four M3 * 10mm Spacers
- Four M3 * 6mm Screws

Secure the screws to the Spacers
Hardware installation

Remove the protection cover of top acrylic chassis

Place the Arduino UNO on the top of the chassis and secure it with four M3 * 8 mm screws
Hardware installation

Please fasten the screws as shown on the left.

Place the LCD1602 and Battery Box on the top chassis and prepare six M3 * 8 screws to secure them.

It should look like this.
Hardware installation

Prepare the Servo package parts

Firstly, fasten the left side and then right-side bracket
Hardware installation

It should look like this

Secure the servo with two brackets and two self-tapping screws

It should look like this
Hardware installation

To fit the servo horn into the black holder we need to modify as pictured. Best tool to do this with is a side cutter.

Caution: Be carefully with cutter and sharp edges of the horn.

Place the modified servo horn inside the bracket and secure with 6 * M2.5 screws in the servo package.
Hardware installation

It should look like this

The back should look like this

To secure base mount on the Robot 4-wheel drive, four screw holes will need to be enlarged to fit for M3 screws. The original design is for small screw, not for M3.

One way to suit for M3 screws is to use a drill or a small screwdriver to punch through the holes.
Hardware installation

To fasten the rack, we need:
- Four M3* 10 mm Spacers
- Four M3* 6mm Screws

Tighten the screws as shown on the left

To tighten the ultrasonic sensor, we can use several cable ties (Not included in the Kit). Alternatively, you can use other methods:
- Use rubber bands
- Thread or Plastic Strings
Hardware installation
Hardware installation

Make sure the Robot is able to detect the distance ranging from 0º to 180º, the Servo with Ultrasonic sensor can turn from the very left to very right smoothly, i.e., 0º to 180º without any jitter.

Note: angle 90º of servo is equivalent to facing front of the Robot 4-wheel drive.

Once finished adjusting the angle of servo, then prepare the Self-tapping screw in the Servo package and tighten the sensor part with servo rack.
Hardware installation

The Ultrasonic sensor and Infrared sensor is ready to secure on the Chassis.

Use:
- Four M3 *8 mm Screws
- One M3 *10mm Screw
- One nut

Ultrasonic sensor from the bottom of the Chassis perspective should look like this
The Ultrasonic sensor can move from left to right

Fix the Infrared receiver on the side of the Ultrasonic sensor.
4.4. Wire Connection

You are almost there. Final step is to wire the cables to power supply (i.e. Battery Box), UNO board, ultrasonic sensor and Servo. The following diagram shows the connection map. Don’t panic if this is your first project, you can also follow the connection table 1. Take your time and be patient with the wiring.

Caution: Any incorrect wire connection will lead to problems including device malfunction, device failure, damage to the device or damage to other property.

Collect bottom and top chastises and Arduino Sensor shield as well as two 18650 batteries.

Please note do not place anything on the Infrared receiver and leave it in the open space in order to receive the signal easily.
Place the Arduino Sensor shield on the top of the Arduino UNO Board.

Please note Arduino Sensor shield is perfectly aligned with Arduino UNO. Make sure each pin is firmly connected.

Firstly, connect battery box positive and negative cables to the L289N Motor Driver Board.
Use eight Jumper wires to connect Arduino Sensor shield and L289N Motor Driver Board.

Please Note: The 8 Jumper cables will eventually attach to the Sensor Expansion Board from the L289N board a few steps from now. Please leave the opposite side free for the following steps.

Now pull the jumper wires of three Track line sensor through the hole of top chassis. As usual, leave the opposite side free for connection with Arduino Sensor Board for the following steps.
Secure the top chassis with:
- Six M3 *8mm Screws
Hardware installation

Fix the four wheels on the Motors

Finish!
Hardware installation

**Table 1 Connection table**

<table>
<thead>
<tr>
<th>UNO board</th>
<th>L298N</th>
<th>Battery Box</th>
<th>Two Motors left</th>
<th>Two Motors Right</th>
<th>Servo</th>
<th>Ultrasonic sensor</th>
<th>Infrared sensor</th>
<th>LCD1602</th>
<th>Bluetooth</th>
</tr>
</thead>
</table>

| GND | GND | VMS | VMS | +(Left) | +(red) | -(Left) | - | +(Right) | +(red) | -(Right) | - | (black) |
|-----|-----|-----|-----|---------|--------|--------|   |----------|--------|----------|   |        |

<table>
<thead>
<tr>
<th>V</th>
<th>ENA</th>
</tr>
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<tbody>
<tr>
<td>5</td>
<td>IN1</td>
</tr>
<tr>
<td>6</td>
<td>IN2</td>
</tr>
<tr>
<td>11</td>
<td>IN4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>V</th>
<th>ENB</th>
</tr>
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<td>G</td>
<td>GND</td>
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<table>
<thead>
<tr>
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<tr>
<td>V</td>
<td>+</td>
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<td>G</td>
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<table>
<thead>
<tr>
<th>RX</th>
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<tr>
<td>G</td>
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<tr>
<td>V</td>
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</tr>
</tbody>
</table>
Hardware installation

Figure 3 Arduino Sensor shield v5.0 Diagram

Figure 4 Overview
Bluetooth Mobile Control

Chapter 5. Bluetooth Mobile Control

In this chapter, get your Android Device to control 4-wheel drive.

Copy the Bluetooth control application: “BluetoothSPP.apk” to your android device, in this instance, we are using Samsung Pad.

Install the app from the device file manager.
Bluetooth Mobile Control

Application installed!
Open the app and it will initialize with searching for Bluetooth devices nearby.

The name of Bluetooth device of your Robot 4-wheel drive may not be the “HC06” shown on the left. This name is the default name for HC-06. It may vary as you have changed in the previous firmware AT command settings, see Chapter 4.2.6 for changed name and Pin.

Please note enable the Bluetooth function on the Android device and turn on the Robot 4-wheel drive to ensure HC-06 is powered on.

Click the HC-06 device which is the one on the Robot 4-wheel drive and then choose the Keyboard Mode as we are controlling via the Keyboard Touch screen.
On the top left dialog, the app shows successfully connecting with your HC-06 on the Robot 3-wheel Drive. Now the red LED indicator on the Bluetooth Module should stop blinking and is on continuously, which means they paired successfully.

Define the Keyboard button by pressing the MENU button on your Android device (if there is no MENU button on your Android, please hold this button for seconds)

Then a dialog window will pop up and choose the “Set Button function”.

Define the name and Serial Value.

Start: w
Define the name and Serial Value.

Right: 6

Define the name and Serial Value.

Stop: 5
Define the name and Serial Value.

Left: 4

Define the name and Serial Value.

Backward: 2
Define the name and Serial Value.

Forward: 8

Define the name and Serial Value.

Terminate: E
Now press the number 3 on the Remote controller to trigger the Bluetooth Mode on the Robot 4-wheel drive. When you press any button on the remote controller, the red LED on the Infrared receiver will be blinking twice.

Then you will notice LCD1602 display “BluetoothControl” which means the Robot is in the standby mode waiting for command from you Android Bluetooth device.

Then press the 3 again to tell Robot ready to go.
Now have fun with your Robot 4-Wheel drive!
Have fun

Chapter 6. Have fun

Now it’s time to have fun! Turn the power on, and see how your DIY Arduino Robot car goes! After final assembly and activation, the Robot car may require adjustments and debugging. The Robot will perform on how it is programmed. Figuring out what the code is doing is part of the learning process. Reopen your Arduino IDE and we assure you will learn a lot once you gain a deep understanding of the code.

Please unplug the Sensor board from the Arduino UNO board and disconnect 18650 power box supply to modify your code. Otherwise, it may cause irreparable harm to your Robot and PC as it may drive a large current through your USB port.

This kit is just a starting point and can be expanded to incorporate other sensors and modules. You are limited by your imagination.

Check our website for more at Here. (https://www.auselectronicsdirect.com.au/arduino/arduino-starter-kit/)