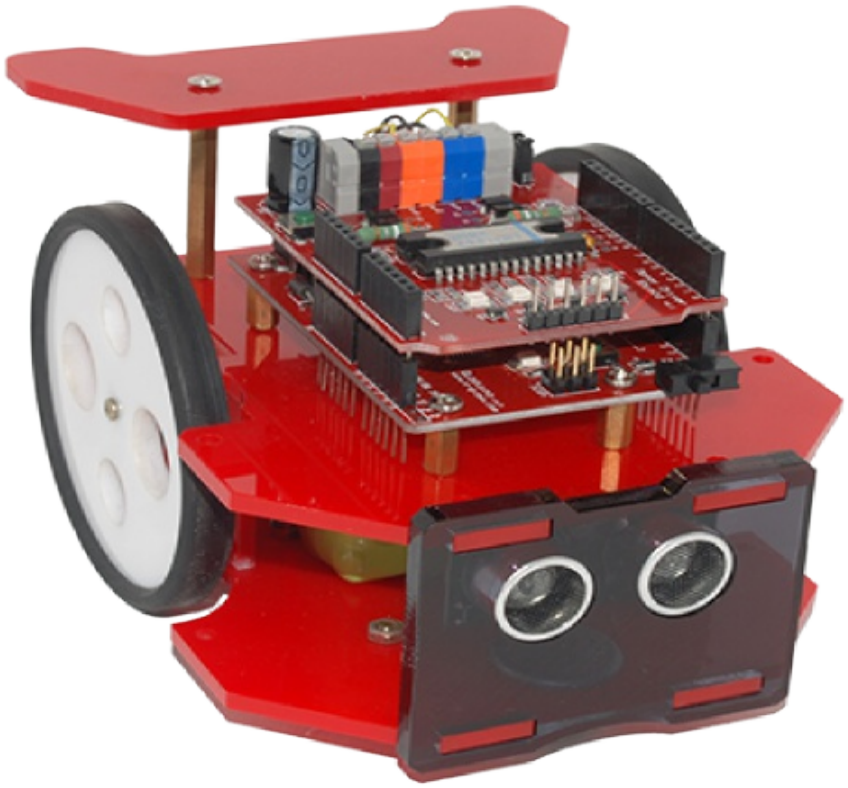
MINIBOT

Technical Manual Rev 1r0



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The e-Gizmo Minibot is a prototyping mobile robot available in either ultrasonic or proximity infrared sensor. As the name implies, the minibot is similar to its predecessor, the P-BOT, since it makes use of the same logic and algorithm as the P-BOT but differs in sensors used.

This mobile robot promotes mobility with 4.3 Sec/Meter (Running Speed) and flexibility in prototyping due to its detachable parts. The user may wish to change sensors anytime and remove certain features if desired. With same sample programs such as the classic line follower, mazebot, and sumobot, it is a good learning platform for hobbsists and students who wish to study basic MCU programming.

It includes an optional ultrasonic or proximity infrared collision sensor, 3 channel line sensor array, motor driver shield and a 7.2V 800mAH Ni-Mh battery pack. A toggle switch is also located behind the minibot and a charging port. Thus, it is also available disassembled and assembled depending on the purpose intended. Programming stands are also available to help the user have a hassle-free programming.

It is compatible for Gizduino, Gizduino +, Gizduino X, Pinguino, and Z8duino MCU boards.

Over-all hardware features:
- 2pcs 5V DC Motor (Back wheel)
- Baller wheel for front navigationand 360 degrees minibot rotation
- Optional Collision sensors: Ultrasonic Sonar Ranging Sensor/Infrared Proximity-Collision Sensor
- 3 Ch line tracker sensor array
- NI-MH 7.2V 800mAh power batteries

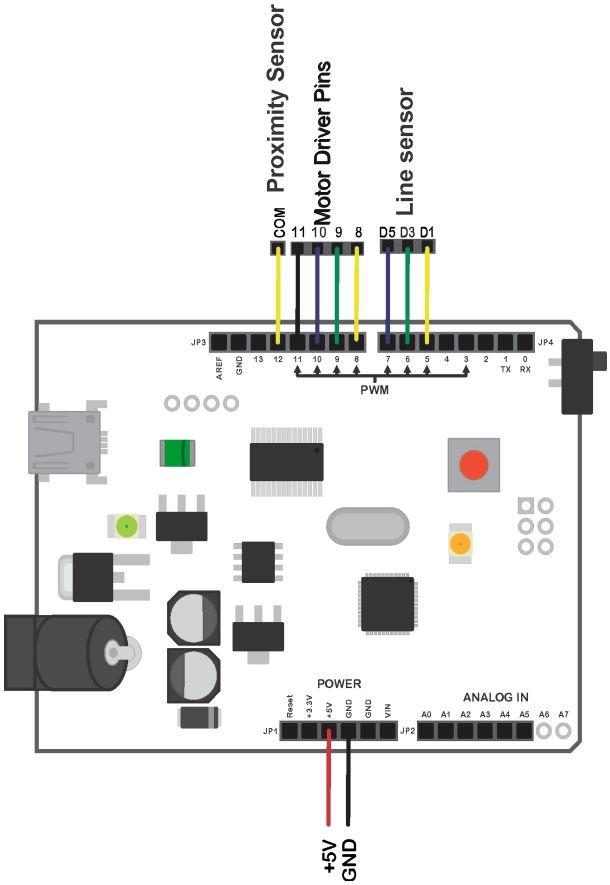


Figure 2. Wiring Diagram for GIZDUINO.

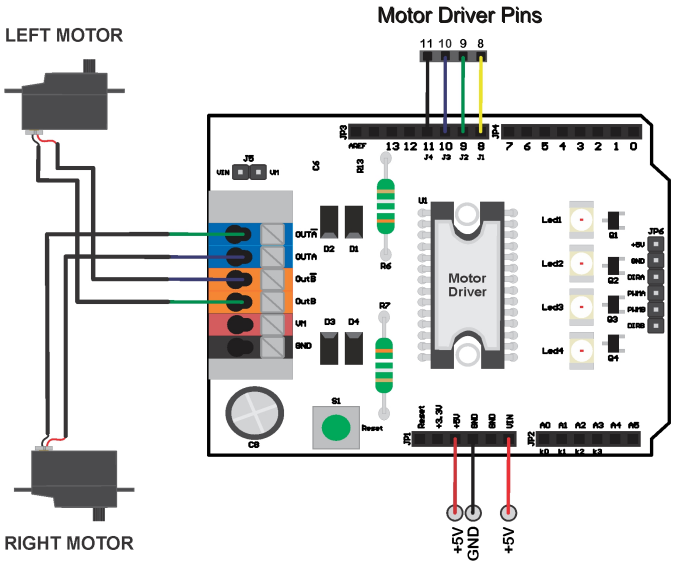


Figure 1. Wiring Diagram for Motor Driver Shield.

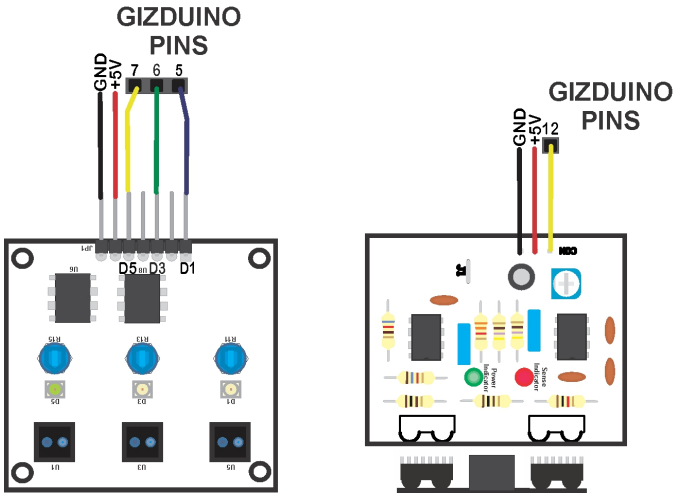


Figure 3. Wiring Diagram for Line Sensors and for Infrared Proximity Collision Sensor.

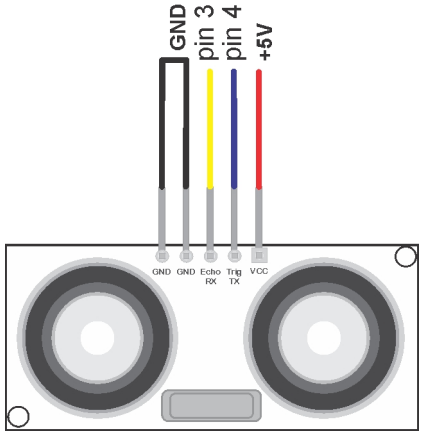


Figure 4. Wiring Diagram for Ultrasonic Sonar Ranging Sensor.

Another optional sensor which is the Ultrasonic Sonar Raging Sensor (Left) for MNI- BOT application. (see figure 4)

A simplified schematic diagram for 3- line sensor, ***Infrared Proximity Collison sensor***, motor driver and for the main Gizduino connections the microcontroller unit of the MINI-BOT.

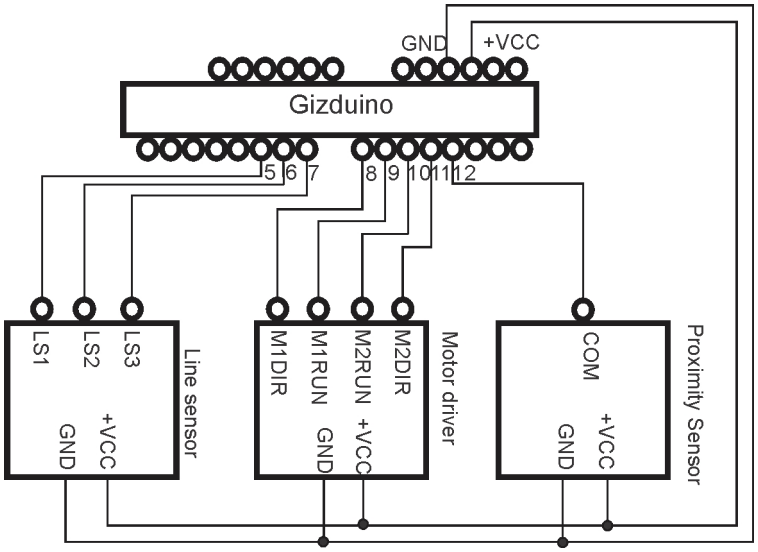


Figure 5. The Block Diagram of MINI-BOT with Infrared Proximity Collision Sensor.

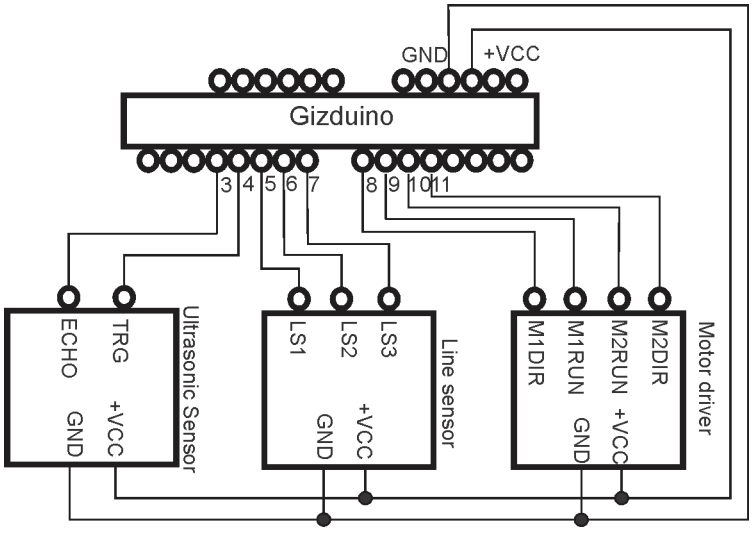
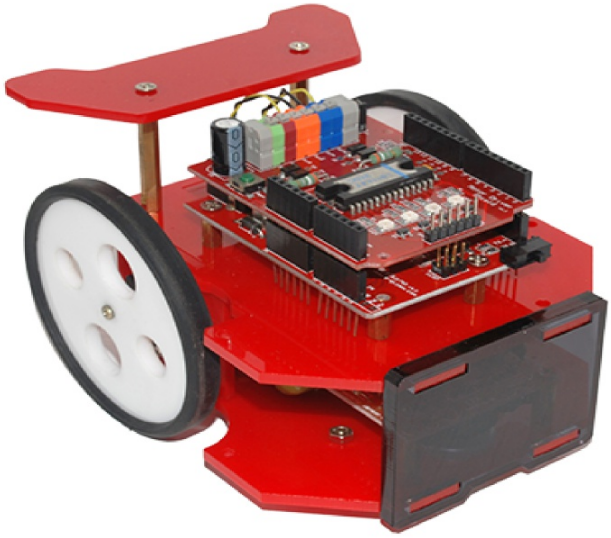
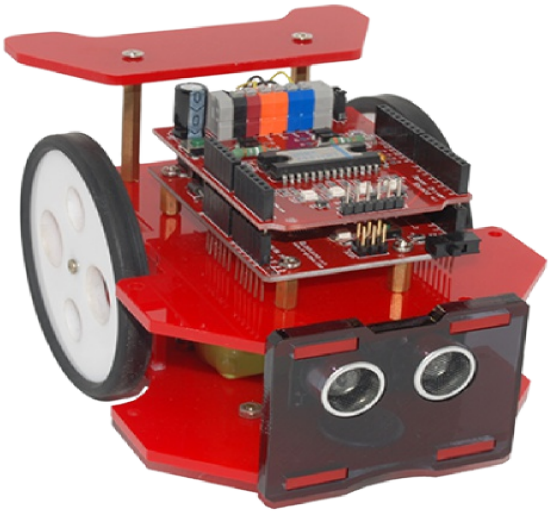


Figure 6. The Block Diagram of MINI-BOT with Ultrasonic Sonar Raging Sensor.

A simplified schematic diagram for 3-line sensor, ***Ultrasonic sonar ranging sensor***, motor driver and for the main Gizduino connections the microcontroller unit of the MINI-BOT.

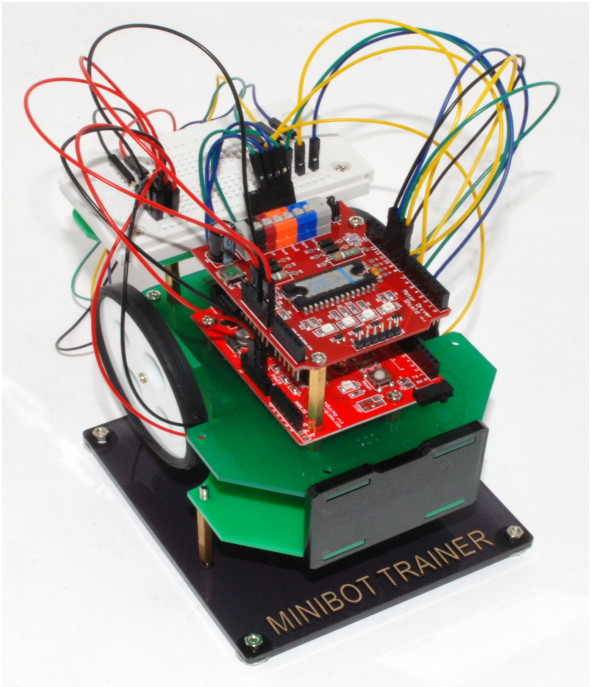


MINIBOT with Infrared Proximity Collision Sensor



MINIBOT with Ultrasonic Sonar Ranging Sensor

Similar in additional features of P-BOT, The spoiler of the MINIBOT chassis have firm screw holes for the user to at least integrate a breadboard for learning and prototyping use. It allows the use of a mini digital trainer positioned above the mobile robot kit so that other components may be added and tried out by the user. Take note of the unavailable pins of the MINIBOT board since it can't be used for other applications and for free pins for other experiments that the user can use for additional purposes.



Occupied pins:
COM = Digital pin 12
LS1 (left) = Digital pin 5
LS2 (center) = Digital pin 6
LS3 (right) = Digital pin 7
M2DIR (left) = Digital pin 11
M2RUN = Digital pin 10
M1RUN = Digital pin 9
M1DIR (right) = Digital pin 8

Free pins:
Digital pin 0 & 1 = For Serial Communication
Digital pin 2, 3 & 4 = Digital Pins I/O PWM
Digital pin 13 = Reset/LED Indicator
Analog pins A0-A3 = Analog I/O Digital I/O
Analog pin A4-A5 = SCL and SDA (for I2C)

Occupied pins:
TRG (TX) = Digital pin 4
ECHO (RX) = Digital pin 3
LS1 (left) = Digital pin 5
LS2 (center) = Digital pin 6
LS3 (right) = Digital pin 7
M2DIR (left) = Digital pin 11
M2RUN = Digital pin 10
M1RUN = Digital pin 9
M1DIR (right) = Digital pin 8

FREE PINS:
Digital pin 0 & 1 = For Serial Communication
Digital pin 2 & 12= Digital Pins I/O
Digital pin 13 = Reset/LED Indicator
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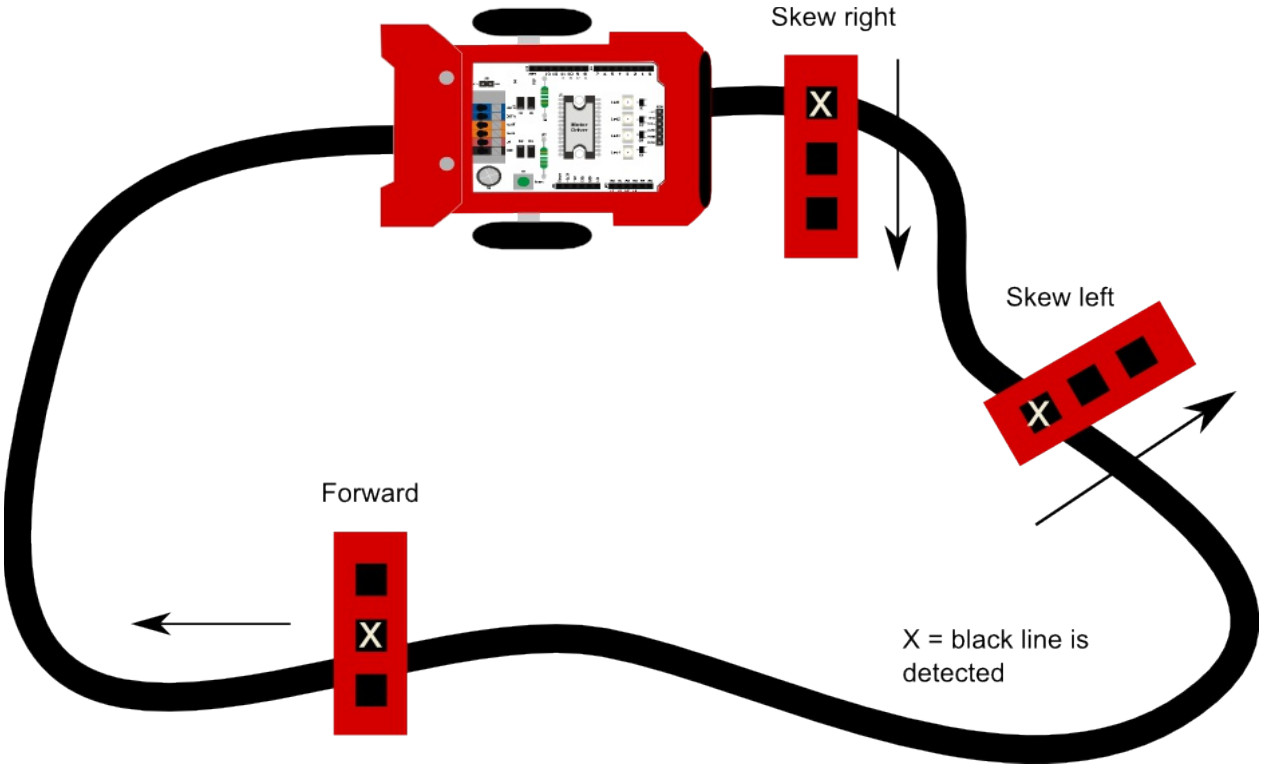

Figure 7. Minibot line follower application guide

In this application, the MINIBOT is basically a line follower robot that follows a certain path by sensing the black line track. This simple application makes use of line sensors and motor logic for applying conditional statement such as if-statements, while-statements, etc for programming.

This application makes use of infrared reflective sensors from optical sensors that detects black lines. The infrared transmitter (IR LED) outputs infrared light like a typical LED and thus received by a infrared receiver (IRDA). Each time the receiver senses the bounced back infrared light, a certain amount of voltage is fed as output to the comparator, thus gives a digital output.

In figure 7, shows the simplest line following logic for a line follower mobile robot. As shown when the line sensor which is facing on the black lines if the Line sensor (left) detects the line, the mobile robot should turn to the right direction(skew RIGHT), but when the line sensor(right) detects the black line track the mobile robot should turn to the left direction(skew LEFT). However, if the center line sensor is triggered, the MINIBOT should not hesitate to go forward and continue line tracking. The sample program contained in the folder “MiniBOT Sample Programs” should contain the sketch on how does the line-follower completely work.

Sensors applied:
- 3 Channel Line Sensor

Other applications:
- Racebots
- Doodlebots

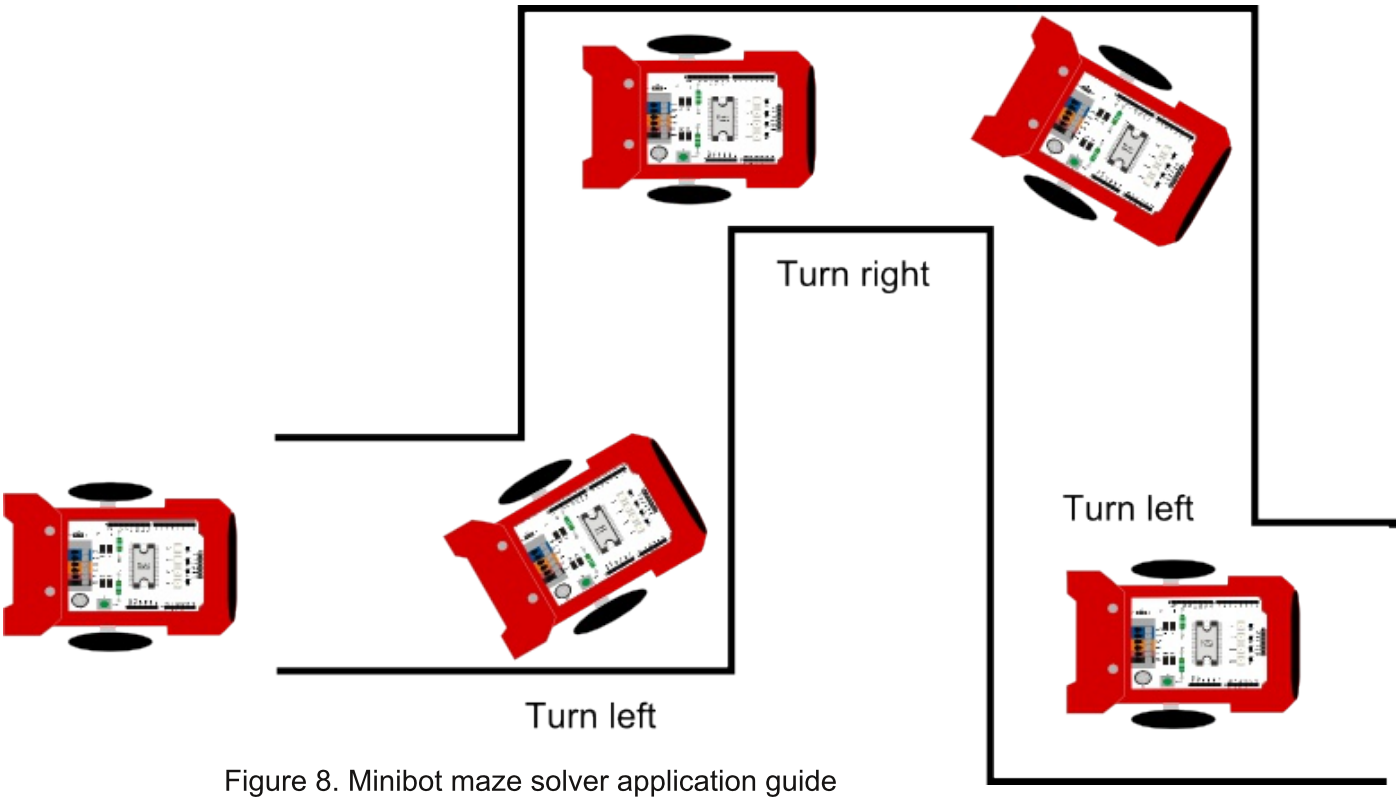

Figure 8. Minibot maze solver application guide

A mazebot or maze solver is also one of the well-known programs for an obstacle detecting robot. Its goal is straightforward; to solve the maze, but the logic is complex for some beginners. What you need for a good quality mazebot is the correct timing and breaking in so that your mobile robot can solve a maze quick and precisely. Like the sumobots and line followers, competitions are also supposed for those mazebots that can solve a maze with the least total of time.

Several tips are to define conditions whenever one or more collision sensors are triggered. If the mini-bot is about to hit the wall, it should turn right to avoid it. Then if the right is not the way, it should turn left. This logic is the similar when the right sensor detects an obstacle. Some would make a stuck detecting function to allow the robot to turn back and choose a different path. The problem will arise when you need to choose whether after turning back, if you should go left or right as shown on the image above. For infrared-proximity collision sensor, it is noted that it outputs a digital output thus giving it a fixed range before detection. For the ultrasonic sensor, the user can assign a certain range wherein the MINIBOT should turn or go back due to its distance measuring function.

Sample codes are located on the same folder of this hardware manual.

Sensors applied:
- Infrared proximity collision sensor
- Ultrasonic distance measuring sensor

Other applications:
- Navigation robots

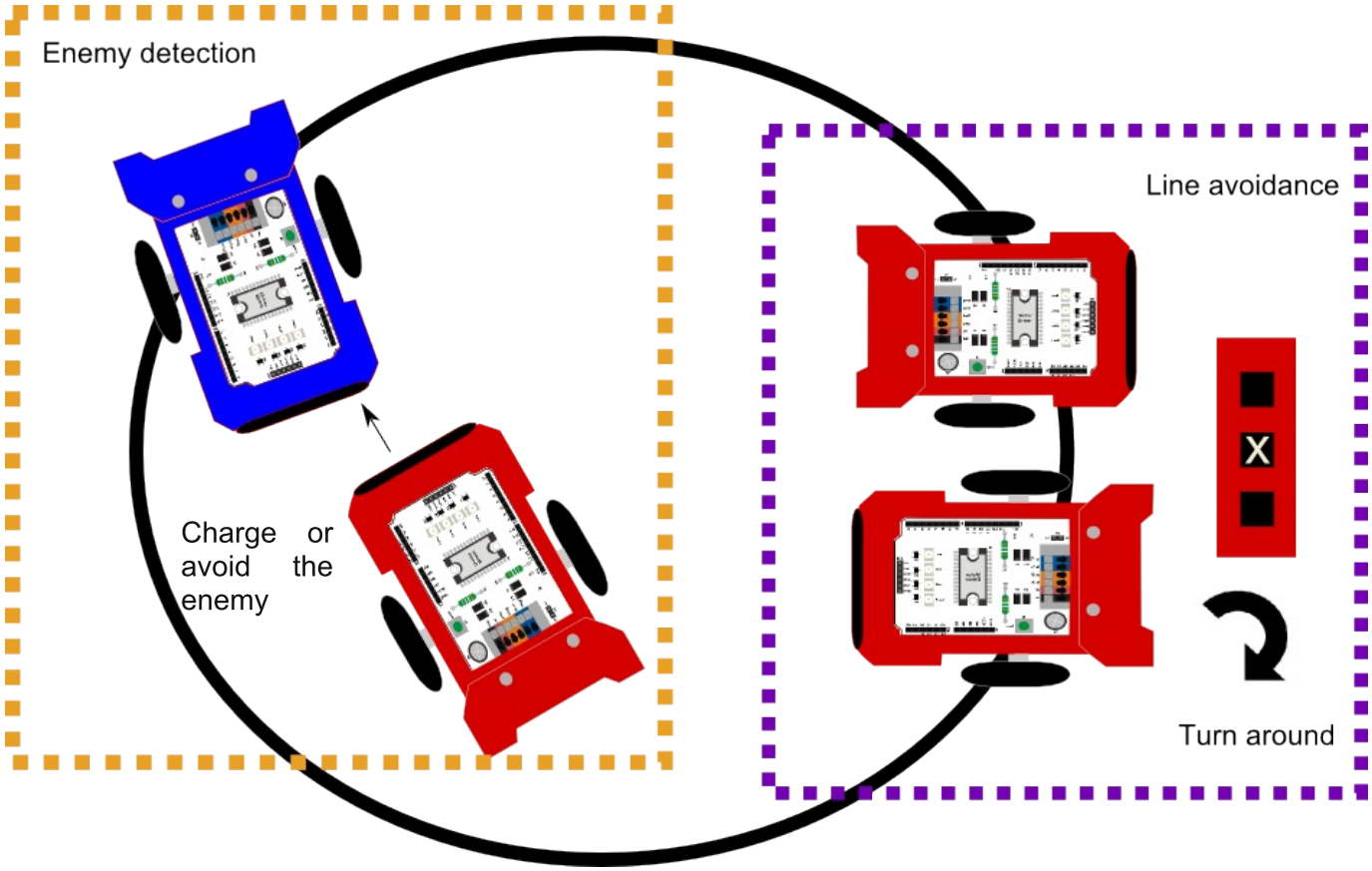

Figure 9. Minibot sumobot application guide

In this MINIBOT sumobot application is theoretically a mobile robot programmed to be like a sumo wrestler. On its basic logic is that to move away the target out of the ring while avoiding getting out of the ring itself. The method of sumobots started as collision sensors were integrated on mobile robots as a king of sport or game. Several people would also organize sumobot competitions wherein hobbyist several robot specifications should be met. Due to MINIBOT's light weight built, it should be good as a practice robot before making your own sumobot.

On proposition behind the sumobot is the use of infrared transmitters and receivers. Similar to the line sensor, a certain voltage output is fed to logic gates to identify digital logic. In other words, when an object is detected, a “HIGH” logic level will be fed to the Microcontroller unit (MCU) wherein conditions may be applied. For the ultrasonic sensor, the logic should be the same but the user can apply a certain strategy to for example immediately push away the target when the MINIBOT sees the opponent on a certain distance.

For a sumobot, the collision sensors may trigger the mobile robots maneuvers wherein the robot may turn around and avoid an enemy or ram the enemy directly so that its enemy is thrown away form the ring.

Sensors applied:
- Line tracking sensors
- Ultrasonic sensor
- Infrared proximity collision sensor