JAY ROBOTICS CLUB
learn with fun

www.jayroboticsclub.in   info@jayroboticsclub.in

"ROBOTICS SELF LEARNING GUIDE"

LINE FOLLOWING ROBOT

WITHOUT

MICROCONTROLLER

Skill Level – Easy

Age – 12+ years

Development Time – 1 Hour

No Soldering Required

JAY ROBOTICS CLUB
learn with fun
www.jayroboticsclub.in   info@jayroboticsclub.in

About Us

JAY Robotics Club, an innovative Robotics Training and Education Company in Chennai aims in providing robotics training to everyone, who has a wide interest in developing their own application-oriented robots.

"Innovative Learning is FUN"

In a note of promoting practical skills, we started to provide hands-on robotics training right from scratch, where everyone will feel the kick of practical and innovative learning.

We offer various kinds of robotics program such as:

Classroom Training:

- Simple Botix (Specially designed for Robotics Beginners)
- Wireless Botix (Control your Robots Wirelessly)
- Cembed (Learn Embedded C with Arduino IDE)
- Embeduino (Learn Embedded Systems with Arduino)
- Roboduino (Get Started to Program your Robots)
- FABRO – Basic (FABricating ROboticians)
- FABRO – Intermediate (Develop your own projects)
- FABRO – Advanced (Build up your Robot Ideas)
- FABRO Scientist – Level 1 (Pick and Place Robot with & without microcontroller)

Online Training:

- Robonline (Learn Robotics Online)

More robotics programs are in the research phase, which will be for your innovative learning as soon as possible.

We have a research and development team, where we like to prove something in robotics to this World on behalf of India.

Our trainers are well qualified and specialized in the field of robotics, and they have a lot of passion in robotics.

We aim in serving as a safe and fun robotics workspace for the students to pursue their interest in robotics.

Important Notes:

- Please read this self-learning guide carefully to assemble and build robots in a safe manner.

- The learner should be able to understand the working of electronic components to build this robot.

- It is designed only for learning purpose and robot components must be purchased separately to build this robot.

- If you find any queries, you can sign in to ask.jayroboticsclub.in to post your queries. Our Robotic Experts will reply to your doubts at the earliest possible time.

- This documented guide must not be shared commercially without prior written permission from JAY Robotics Club.

Line Following Robot:

Line Following Robot is a mobile machine, which senses and follows a line drawn on the floor. The line must be in visible black colour on a white surface.

As we have eliminated the use of microcontroller, you will feel comfortable in building your first robot without any knowledge on programming.
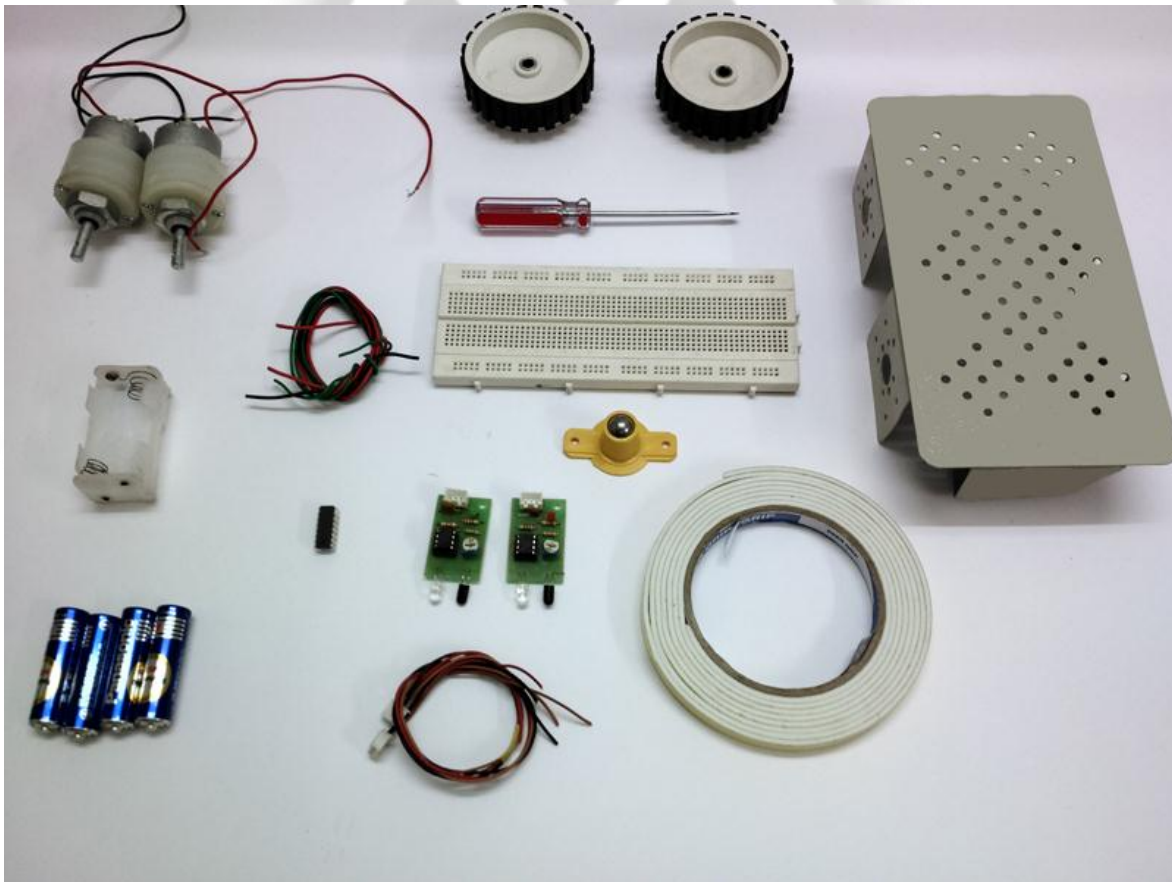
JAY ROBOTICS CLUB
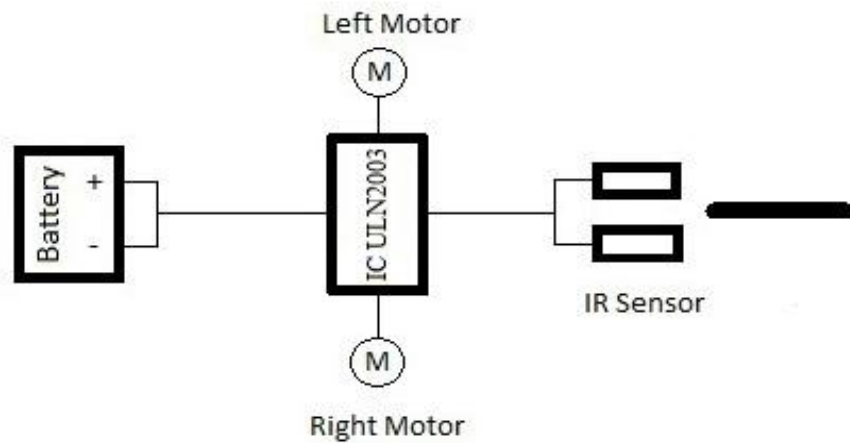### learn with fun
www.jayroboticsclub.in   info@jayroboticsclub.in
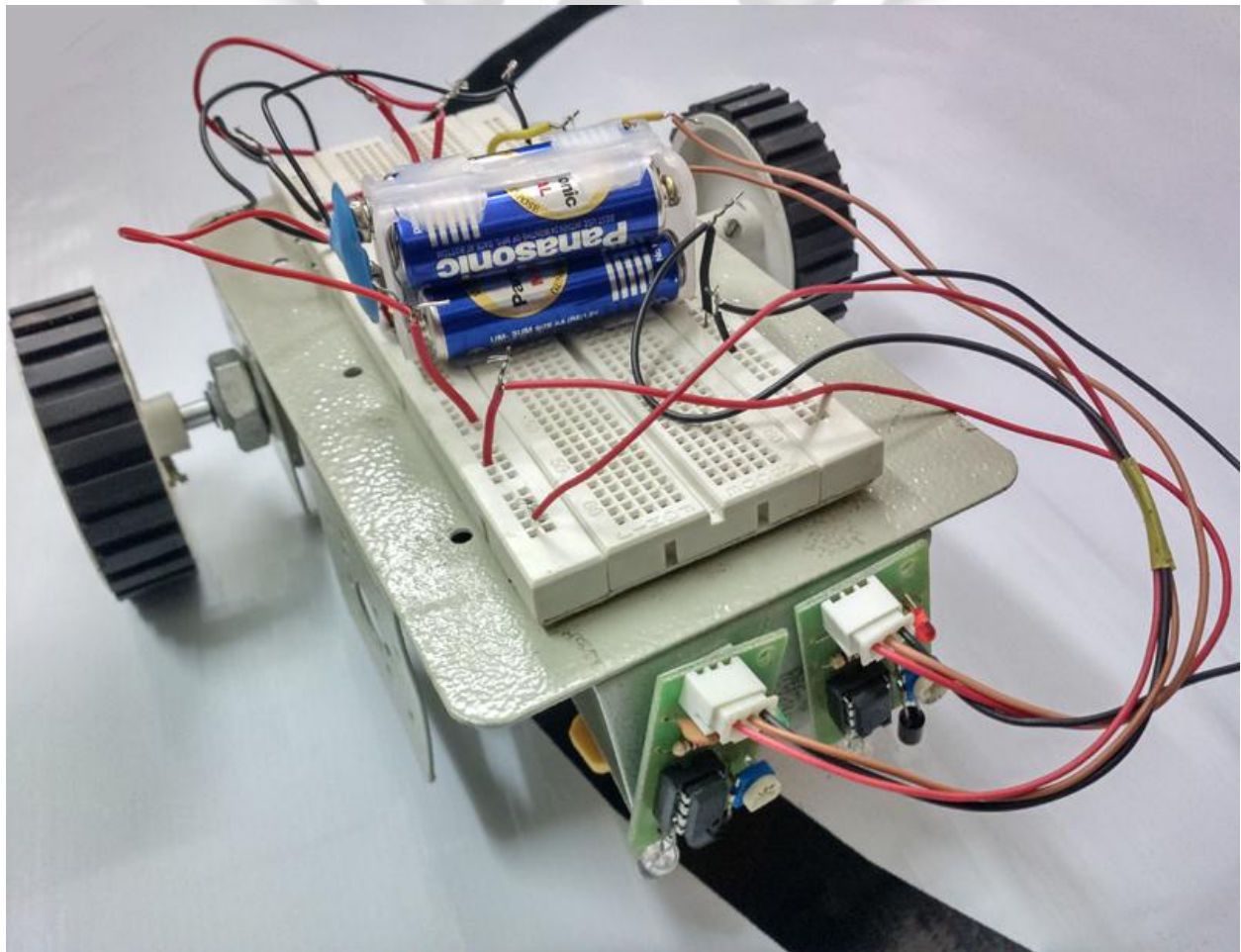
Components Required

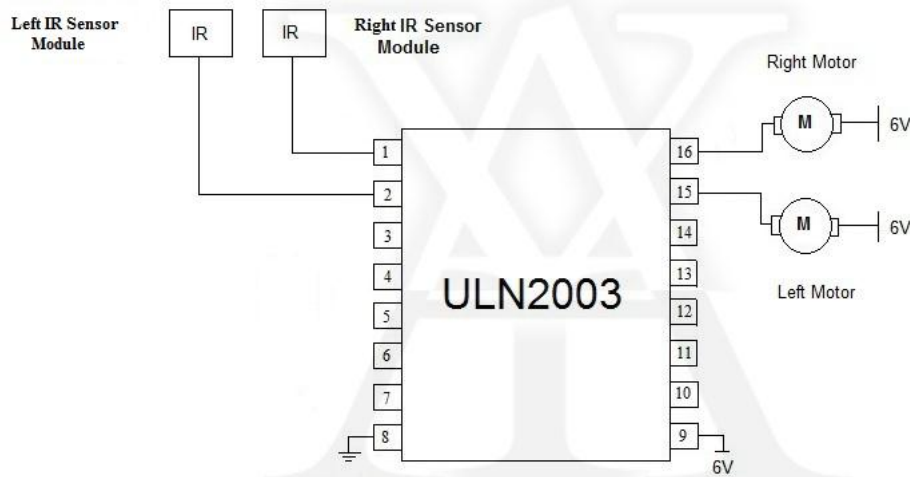| Qty	Components	Qty	Components
1	Two Wheeled Robot Chassis	1	IC ULN2003
2	Plastic Wheels	2	IR Sensor Module
1	Castor Wheel	2	3 pin RMC Wire
2	12V DC Motor 60 RPM	1	Hook up wires
1	Breadboard	1	Double Side Tape
4	AA Batteries	1	Screw Driver
1	AA Battery Holder		

Block Diagram:

Circuit Diagram
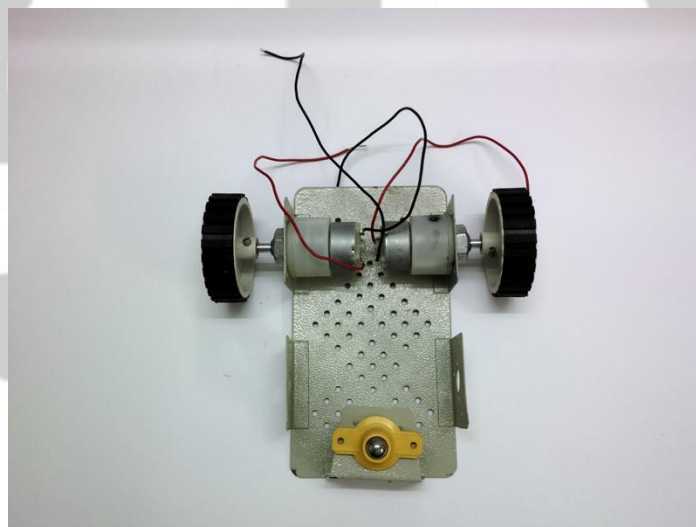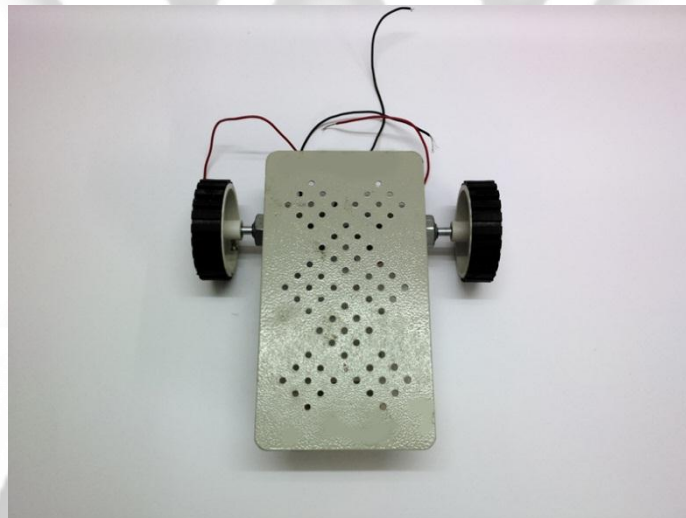
Step 1

Robot Chassis

- Make your robot chassis ready by inserting 12V DC Motor at two ends attached with wheels.
- A castor wheel should be attached using screws or double side tape at the front-bottom to make the chassis move freely.
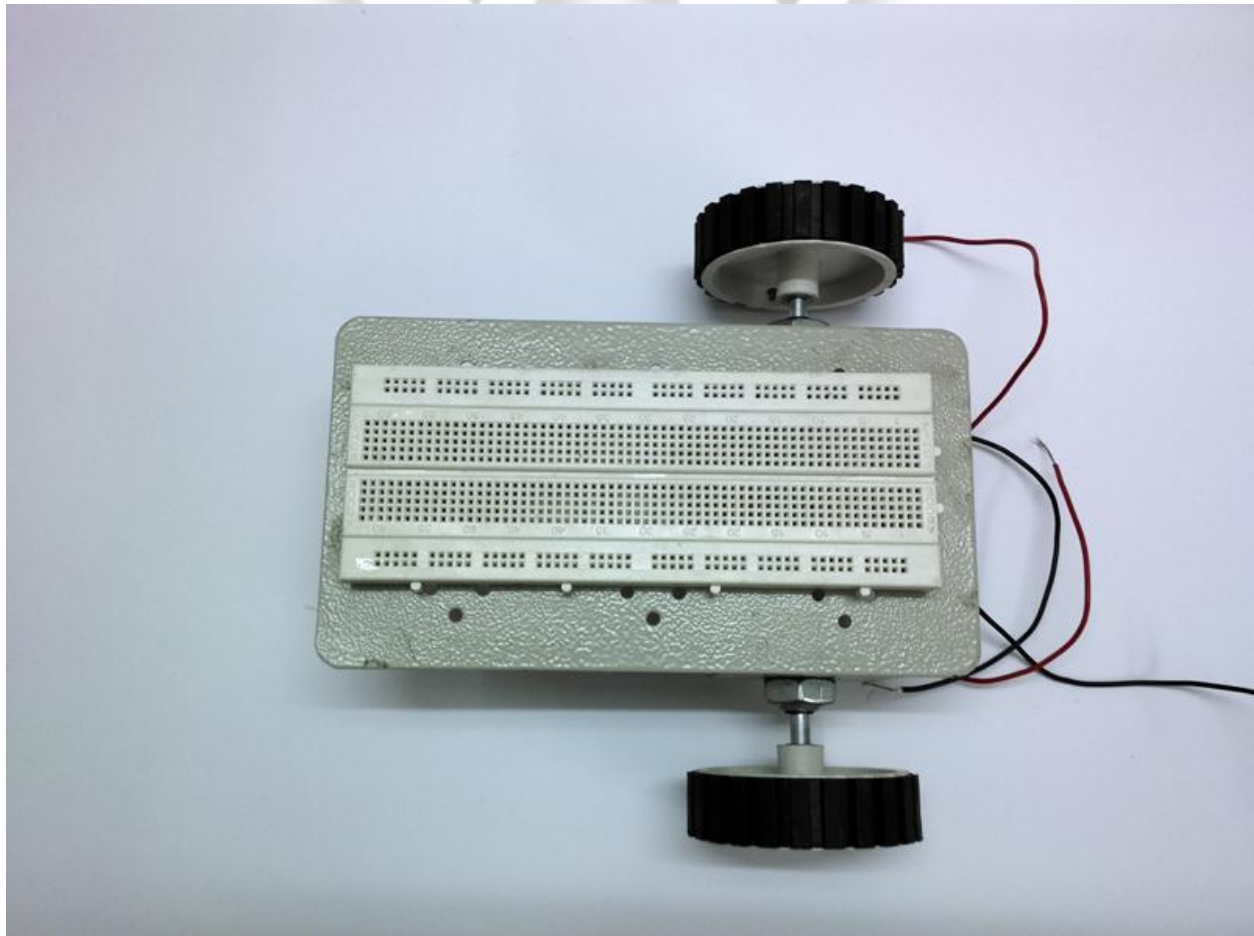

Page 7

Step 2

Breadboard

- If you don't have knowledge on how to work with breadboard, please click the following link: How to use breadboard? – By Sparkfun
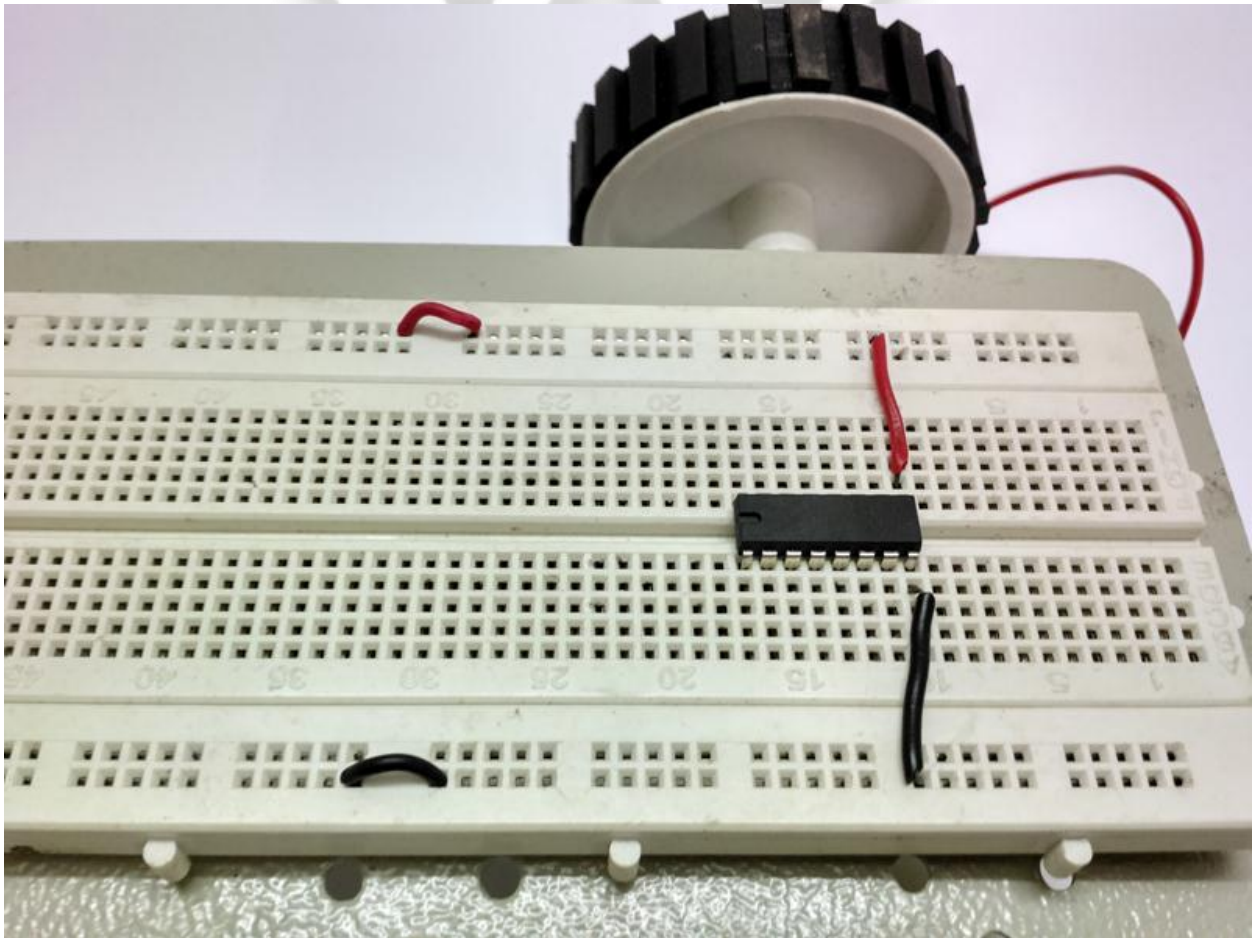- Take a breadboard and place on the top of the robot chassis using small strip of double side tape.

Step 3

IC ULN2003

- Insert IC ULN2003 in the breadboard as shown in the picture below.
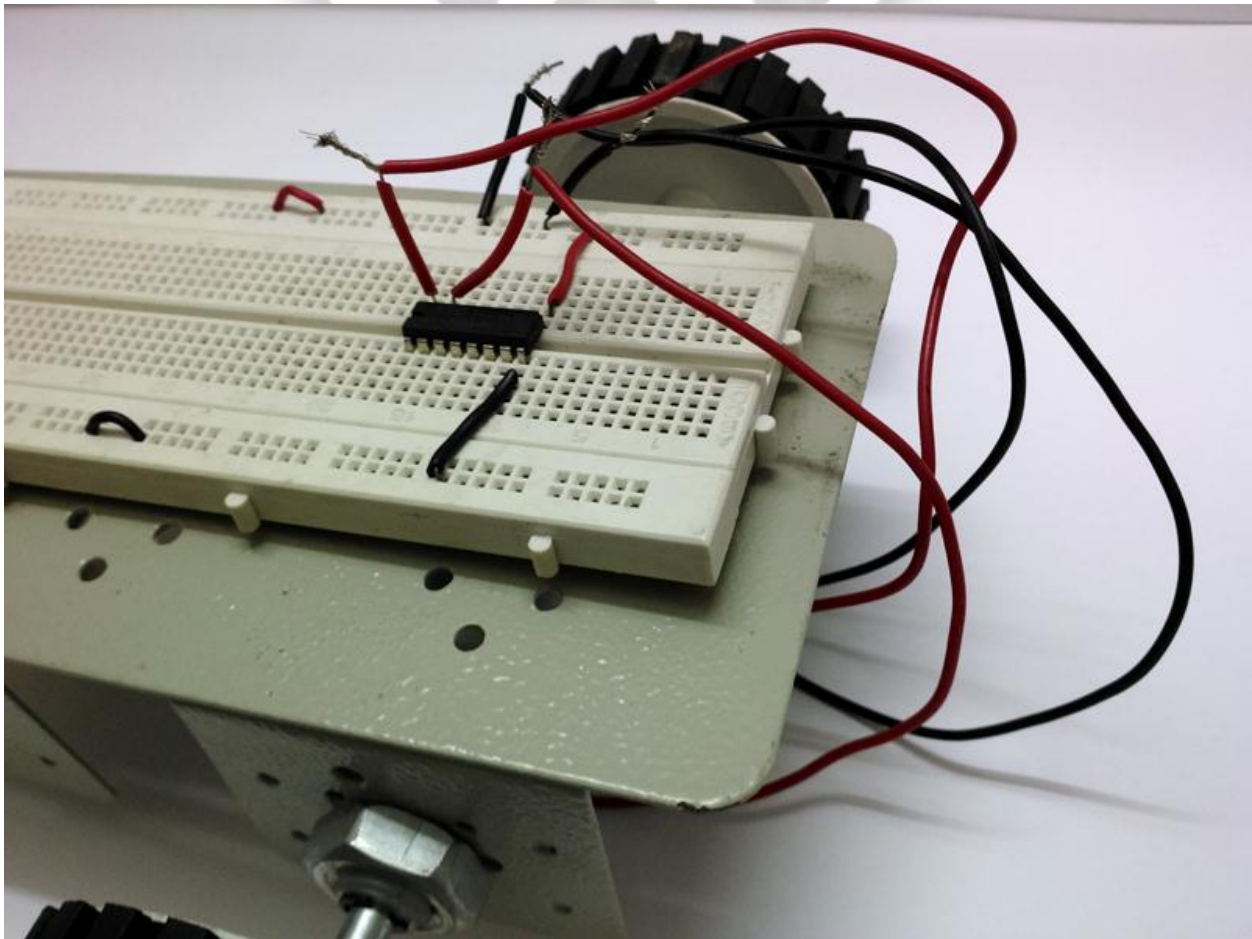- Connect 8th pin of IC ULN2003 to ground and 9th pin to 6V using breadboard wires.

Step 4

12V DC MOTOR

- Connect one wire of left motor to 15th pin of IC ULN2003 and other wire to 6V.
- Connect one wire of right motor to 16th pin of IC ULN2003 and other wire to 6V.

JAY ROBOTICS CLUB
learn with fun
www.jayroboticsclub.in   info@jayroboticsclub.in

Step 5

IR Sensor Module

- To build an IR Sensor Module, please click the following link: Making of IR Sensor Module – by Robotics Bible
- Connect the positive wire (red colour) of left IR sensor module to 6V, negative wire (black colour) to ground, and output wire (brown colour) to 1st pin of IC ULN2003.
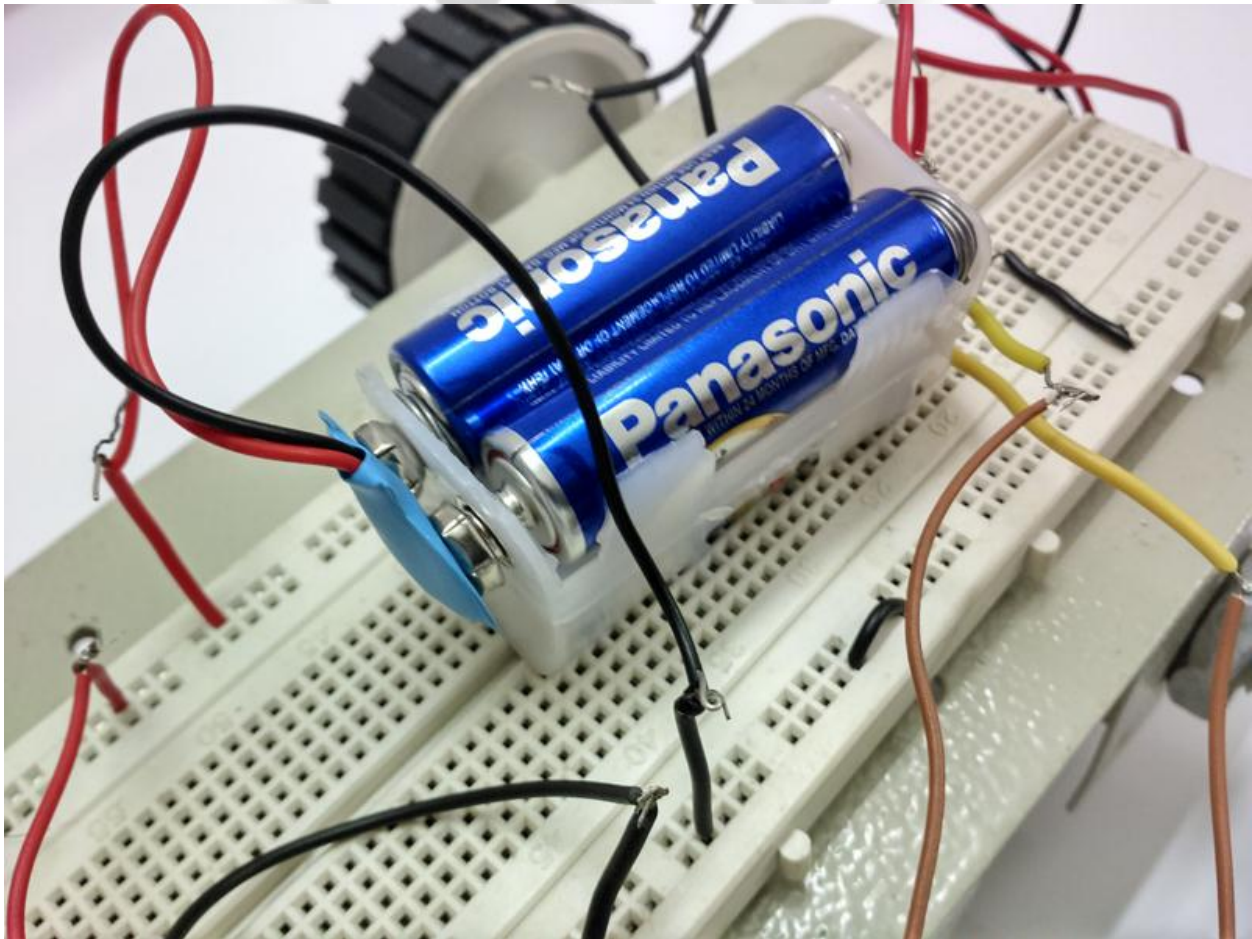- Same applies to right IR sensor module in which output wire goes to 2nd pin of IC ULN2003.

JAY ROBOTICS CLUB
learn with fun
www.jayroboticsclub.in   info@jayroboticsclub.in
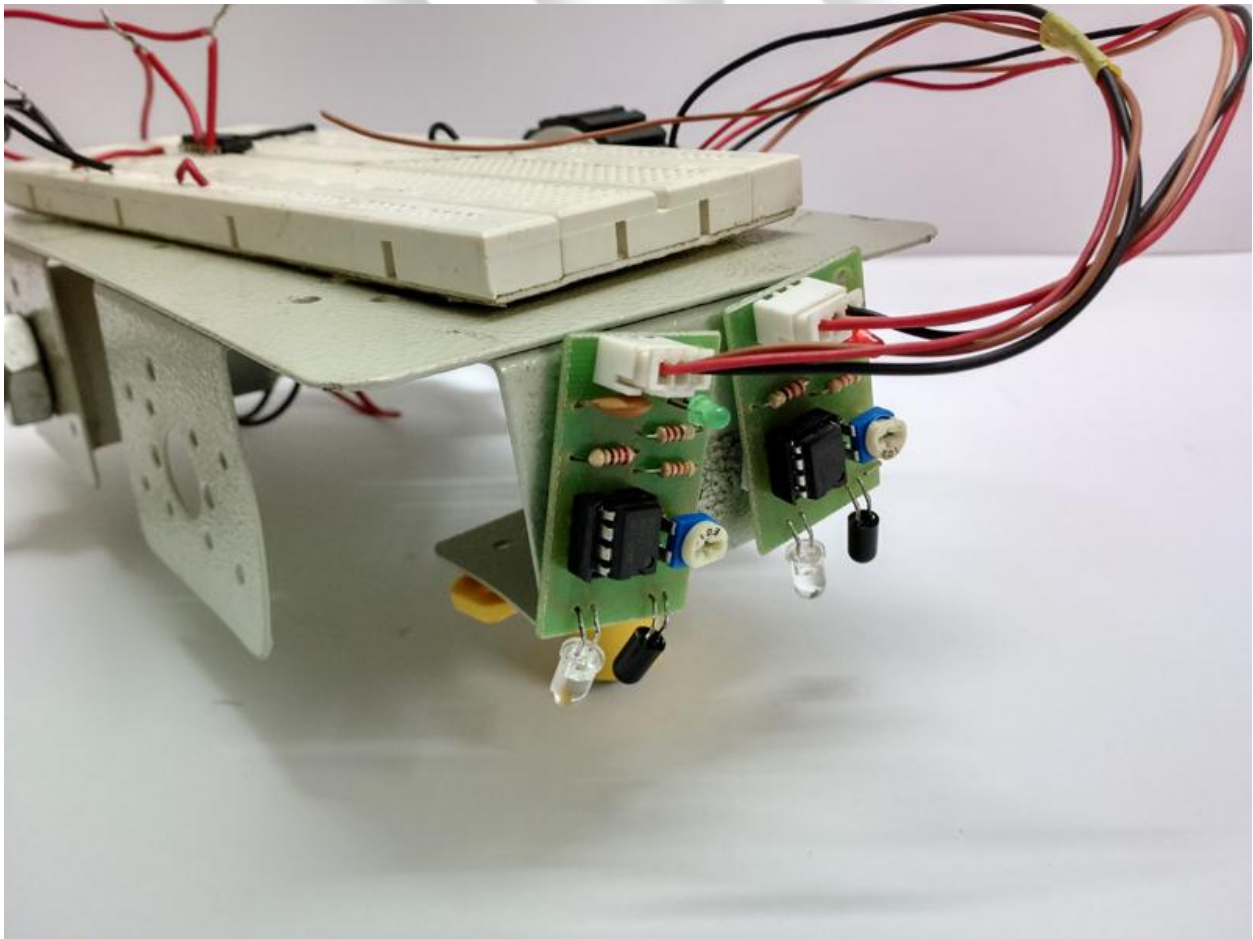
Step 6

Battery

- Place 4 AA batteries in the battery holder and power the breadboard by connecting the positive wire to 6V and negative wire to ground.
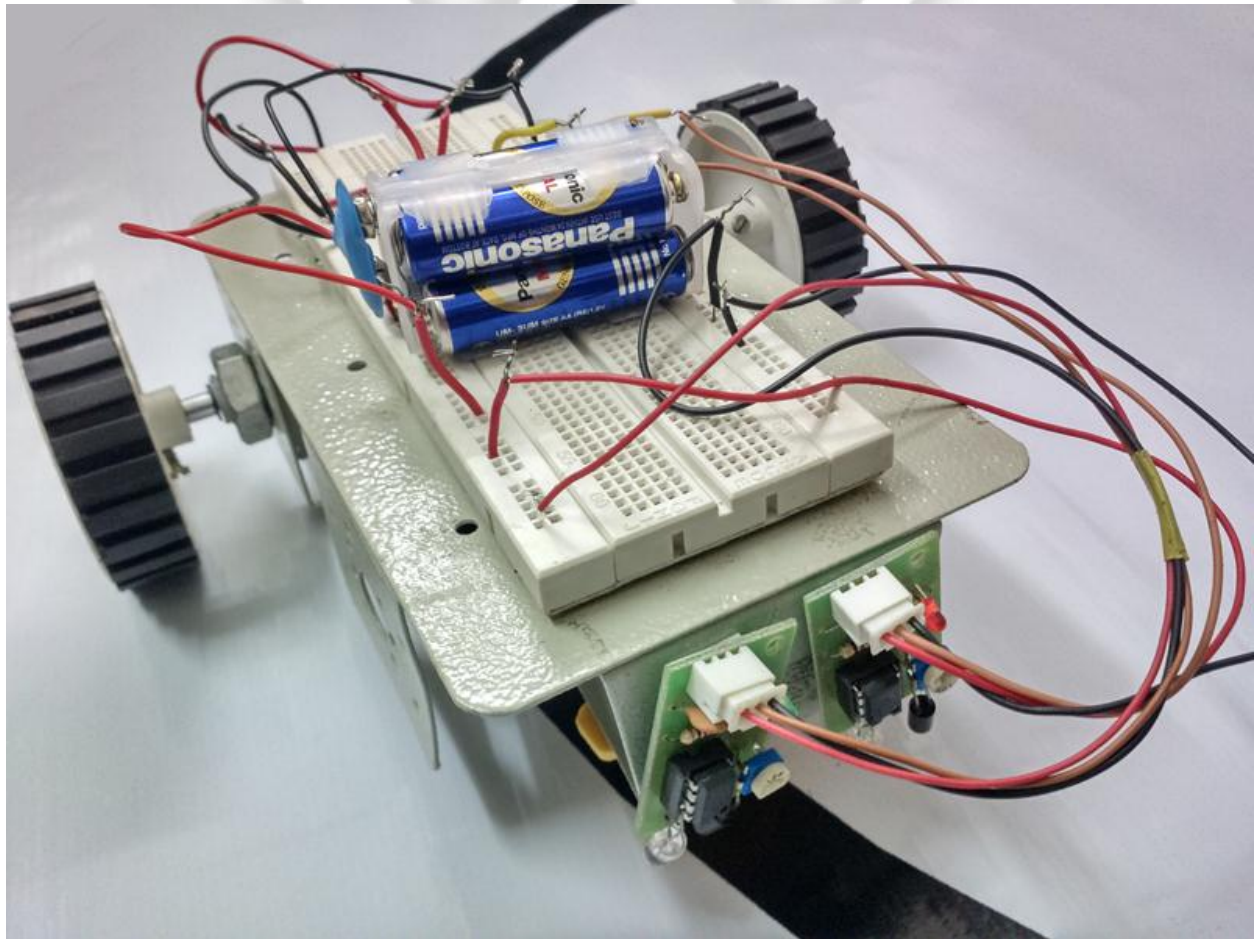
Startup Process

- Make sure you have a white colour chart.
- You can draw black line using permanent marker or stick black insulation tape on it.
- Now place your robot on it and make IR Sensor module to face the edges of black line.
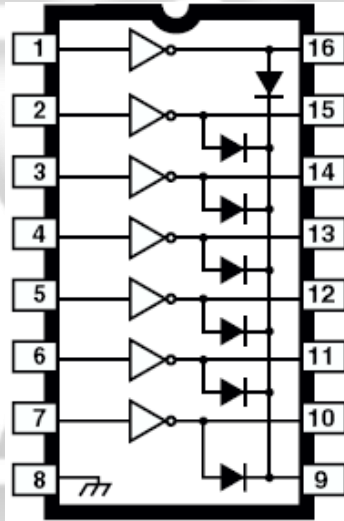- Power the robot and be ready to see its performance.

www.jayroboticsclub.in   info@jayroboticsclub.in

How it Works?

- IC ULN2003 is made of Seven NPN Darlington pairs (see below), which we use here for driving the motors.

- When 1st pin is 0 (LOW), the 16th pin becomes 1 (HIGH) and vice versa. It is because of NOT Gate attached to 1st pin and 16th pin of IC ULN2003. To know more about IC ULN2003, click the following link: ULN2003 Description – Engineers Garage
- The nature of NOT Gate is:

INPUT	OUTPUT
1	0
0	1

- IR Sensor modules (placed at 1st & 2nd pin of ULN2003) will transmit & receive IR rays when it detects white surface.
- If IR Sensor module detects the black line, it doesn't receive IR rays. It works based on the below principle:

"Black colour Absorbs Light, White colour Reflects Light"

- The 12V DC Motor (connected to IC ULN2003) requires 0 (also known as LOW or 0V) in 16th & 15th pin to run the motor. In case, if the motor gets 1 in 16th & 15th pin, it will stop.

- The robot takes a turn when anyone of the motor gets HIGH output in 16th or 15th pin of IC ULN2003.

Now let's see how Line Following Robot circuit works:

- The Line Following Robot is designed and assembled as per the circuit given.
- The robot is left on the field to follow black line on a white surface.
- When IR Sensor modules (connected to 1st & 2nd pin of IC ULN2003) detects white colour, the motors (connected to 15th & 16th pin of IC ULN2003) starts running.
- If right IR Sensor module detects black line, the right motor stops and turns till it finds a white surface.
- This is the technique that helps the robot to follow the black line.

Still confused! Check the performance of the robot in the below given YouTube link:

http://www.youtube.com/watch?v=BmehsRnL_Mw

Applications

- Automated Guided Vehicle - Wikipedia

- Loading and unloading purposes

- Transportation Systems

- Blind Assistance

Advantages

- Repetitive material movement from one place to another
- Travels in hazardous places
- Does the work frequently with less human assistance
- On time delivery of loads

Disadvantages

- Does not follow complicated black lines because of no microcontroller