



LINE FOLLOWER

Objective

To build an autonomous line follower robot that can follow the lines in the arena and lead the way to the finish point. A Line Follower Robot is an autonomous robot that is able to follow either a black or white line that is drawn on a surface consisting of a contrasting color.

Gameplay

The tournament will have two round mentioned in the order of occurrence:

1. Chase the speed
2. Escape from Time's Fury

1. Chase the Speed

- The line follower robot should trace the given track following the line in minimum time.
- The line follower robot must navigate the designated track, staying on the line, in the shortest amount of time possible.
- Teams that successfully complete the track within the minimum time frame will advance to the next round.
- The track will include checkpoints that carry different point values, the specifics of which will be revealed during the event.
- The final number of teams selected for the next round may vary depending on the number of registrations.
- Each team will have three opportunities to run the track, with their best time being recorded. Teams that reach the center of the track in the shortest time will be given priority.
- The end of the arena will be clearly marked and the line follower robot must come to a stop at this point.

Arena

- The layout of the arena will be revealed on the day of the event.
- The tracks will feature a combination of straight paths and smooth, circular turns.
- The lines will be 3 cm wide and white in colour, set against a dark background.
- The starting and ending points will not be located at the same location.
- A white strip will be placed at the end of the arena to indicate the finish line.

Scoring

- The time taken for the robots to reach the finish line will be recorded and used for scoring purposes.
- Robots that leave the designated track will be restarted from the last checkpoint.



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- If a participant's robot is unable to complete the track, the points earned from reaching intermediate checkpoints will be taken into account.
- The jury's decision will be final, impartial, and cannot be challenged.

2. Escape the Time's Fury

- This will be a surprise round for all finalists.
- Complete details about this round will be disclosed on the spot.

Scoring

- The robot that goes rogue or steps out of its respective track will be considered disqualified and another robot will be declared the winner.

NOTE: The number of qualifying teams and the number of races are subject to change depending on the number of registrations.

Robot Specification

- The robot must be completely autonomous.
- The robot should be controlled by an Arduino.
- The robot must be using a differential drive.
- At any time of the event, the robot dimensions must not exceed 250x250 mm in length and breadth. No constraint on height.
- The robot's weight has no constraints
- The maximum DC voltage between any two points in the circuitry must not exceed 12V.
- No pneumatics and hydraulics are allowed.
- Mechanisms that can harm other robots are NOT allowed.

Team Specification

- A team should consist of a minimum of 2 & maximum of 4 members with a valid id-card from SVNIT.
- All the team members must be from the first year.
- One member cannot be in two different teams for the same event.

Rules and Regulation

- Any damage caused to the arena at any point in time will lead to disqualification/penalty.
- A sample arena will be available for calibration and it will be calibrated before the event will start.
- The Robot has to follow the White line on a Black background and complete the track in the least possible time.



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- The robot should follow the line accurately. If the robot deviates from the line, contestants are allowed to keep the robot manually in its right direction by considering the hand touch penalty.
- Event Managers and Coordinators reserve the right to ask for an explanation about the robot at any time during the event.
- We reserve the right at any time and in our sole discretion to make changes to rules and regulations without prior notice.
- In case of any disputes, the organizer's decision will be final and binding.



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Components Required

Sr. No	Components	Quantity(min)	Cost(approx.)(per piece)
1	Solder wire	1 roll	70
2	GCB(6"x4")	1	40
3	Screw Connector	3	5
4	Male and female header	2 strips of each	20
5	Led (Red, Green, Blue)	6	4
6	Resistor (330ohm)	5	2
7	Sliding Switch or Push button switch	1	20
8	IR Sensor	5	50
9	Arduino Uno board + Cable	1	550
10	LM 7805 Voltage regulator	3	20
11	Lithium ion battery (11.1V)	1	350
12	Battery charger for Li-Ion battery with connector	1	120
13	Jumper wire (female to male, female to female, male to male)	20+20+20	2
14	Single strand wire	1	30
15	L293D (motor driver) IC with bed	1	50
16	Castor wheel (size	1	25
17	12V motor (200-300 rpm)	2	160
18	Chassis (readymade or self -made)	1	60
19	Wheels	2	30
20	Solder Iron	1	150
21	L Clamp for motor (in case of self-made chassis)	2	15
22	Diode(1N4007)	2	2
23	Capacitor (1uF and 10uF)	2	3



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Tech Specifications of Arduino UNO R3

Board	Name	Arduino UNO R3
	SKU	A000066
Microcontroller	ATmega328P	
USB connector	USB-B	
Pins	Built-in LED Pin	13
	Digital I/O Pins	14
	Analog input pins	6
	PWM pins	6
Communication	UART	Yes
	I2C	Yes
	SPI	Yes
Power	I/O Voltage	5V
	Input voltage (Nominal)	7-12V
	DC Current per I/O Pin	20 mA
	Power Supply	
	Connector	Barrel Plug
	Main Processor	ATmega328P 16 MHz
Clock speed	USB-Serial Processor	ATmega16U2 16 MHz
Memory	ATmega328P	2KB SRAM, 32KB FLASH, 1KB
		EEPROM
Dimension	Weight	25 g
	Width	53.4 mm
	Length	68.6 mm



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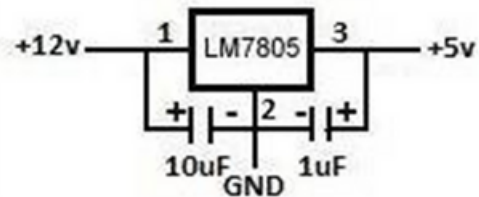
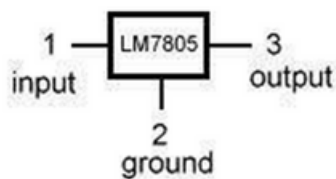
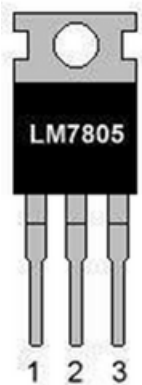
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Hardware Implementation

- Voltage Regulator

LM7805 PINOUT DIAGRAM



All 78xx IC are used to convert higher voltages to lower voltage of value "xx" as name of IC. Where, xx will be from 05 to 12. Input voltage should be from 7V to 35V. You will be using 7805 IC as you need 5V supply for microcontroller and other ICs. This IC is used to get regulated voltage supply of 5V. It is used in a circuit to convert 12V power supply to 5V. PIN1 will be connected to 12v or 9v input, PIN2 will be connected to GND. We will get regulated 5V output on PIN3. Capacitors can be connected between Input and GND and between Output and GND to filter out the AC component if any. Values of these capacitors should be in ratio 1:10 where lower valued capacitor will be connected between output and ground and the one with higher value will be connected between input and ground as shown.



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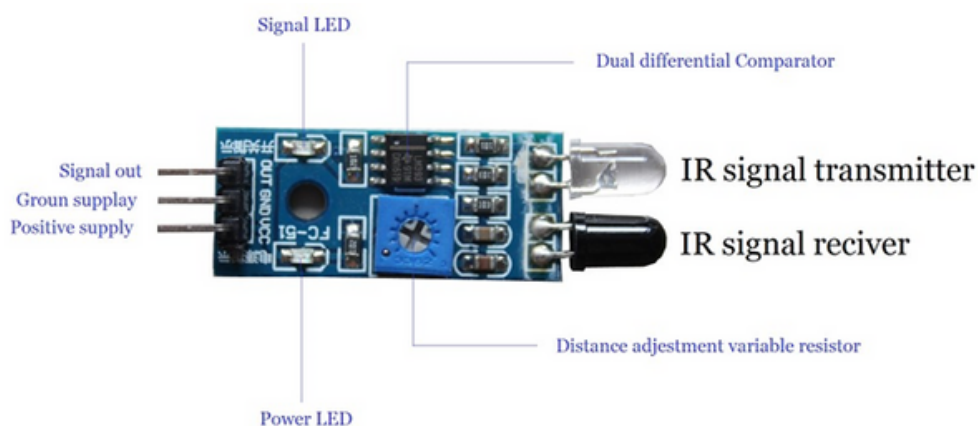
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• IR SENSOR

A line sensor is an Infra-Red or IR sensor which consists of an IR emitter and an IR receiver. The emitter is simply IR led and the detector is simply photodiode. Resistances and output voltages change in proportion to the magnitude of IR light received. The IR reflected back from the surface is received by the IR receiver if surface is light in colour. If transmitted IR signal is received back, this sensor gives a 5v (logic 1) output or 0v (logic 0) output depending on IR circuitry and vice versa for no detection.



- 5V or VCC pin should be given 5v input to switch the sensor on.
- Ground should be connected to ground.
- OUT pin will give logic 1 or 0 depending on IR when it detects a surface bright in color.
- Component shaped "plus" in above diagram is a potentiometer which is used to calibrate IR sensor according to right conditions of surroundings.

This sensor will act as input for our Microcontroller to detect whether we are on white line or somewhat deviated.



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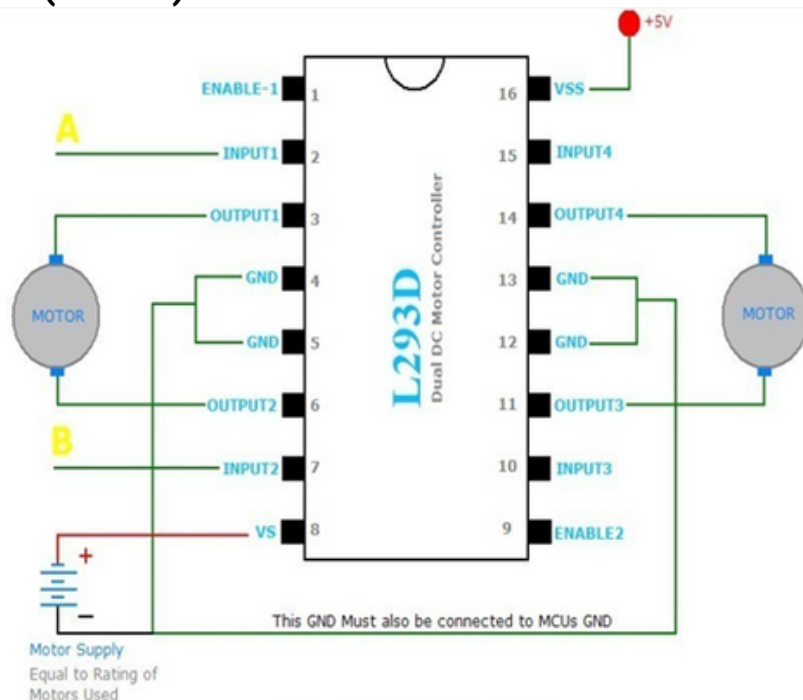
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• Motor Driver (L293D)



Motor Controller Using L293D

- Motor driver is the IC used to control motor.
- Enable 1,2 and Enable 3,4 are used to activate corresponding sides.
- Input 1,2,3 and 4 are used to give direction signals to L239D.
- Output 1,2,3 and 4 are used to connect motors to L239D.
- Vcc1 is given 5V signal w.r.t GND to the IC L239D to activate it.
- Vcc2 is given 12V supply w.r.t GND to run motors
- All 4 GND pins are connected to the common ground of circuit.
- Voltage output from microcontroller will go to input pins of L293D.
- Enable1(PIN1) and Enable2(PIN9) will be connected to 5v to activate the motor driver circuit
- Vs (12 Volts) (PIN8) will be provided to drive motor. Vss (PIN16) is connected to 5v required to switch on IC.



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- **Capacitor**

Capacitors (originally called electrical condensers) are analog electrical components that can collect and store electrical energy. As a direct current flows into a capacitor, it charges with energy and releases an alternating current flow back into the circuit.

- **Diode**

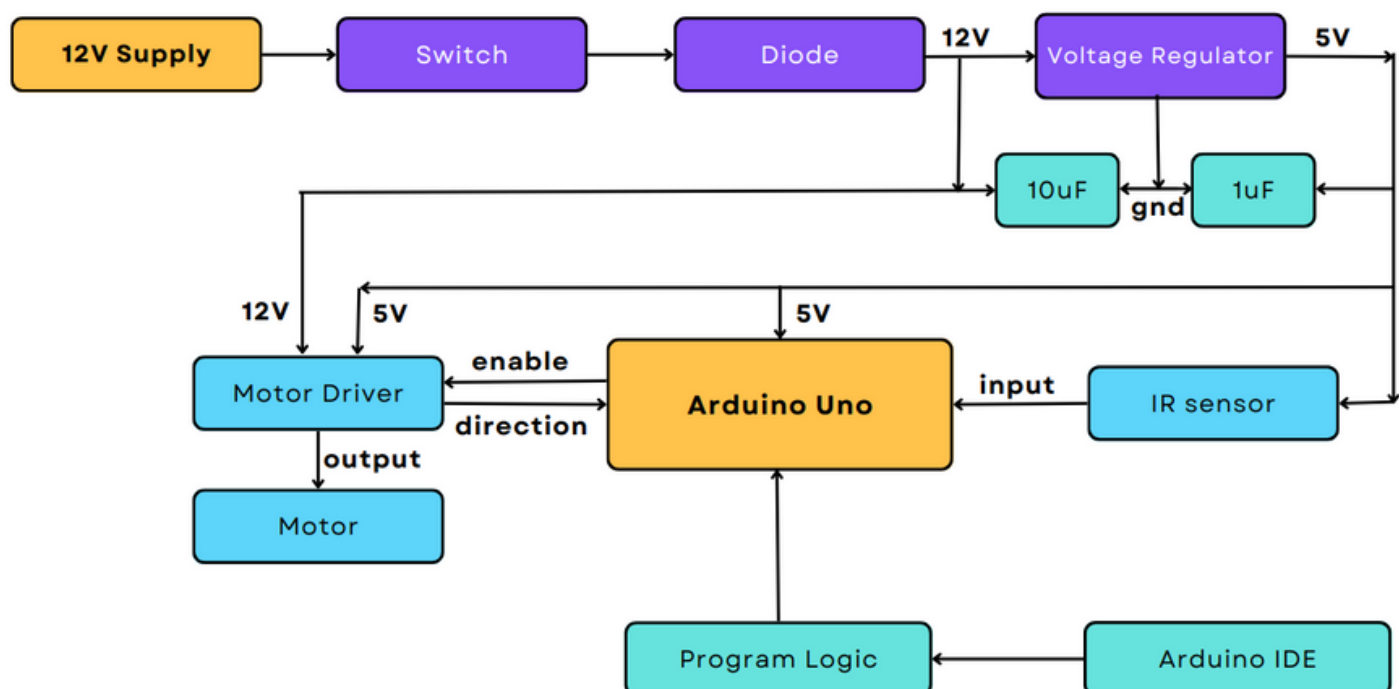
1N4007 belongs to the silicon family of 1N400X series. It is a general-purpose rectifying diode that serves its purpose of converting alternating current signals (AC) to direct current signals (DC) in electronic products.

- **Interfacing Arduino With The Computer**

You need to install the Arduino IDE (Version 1.8.19) from the given link below

Download Link :- <https://www.arduino.cc/en/software>

Complete Schematic of Line Follower



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• Reference Link

These are some reference links for the programming of Arduino board.

- <https://docs.arduino.cc/tutorials/uno-rev3/Blink>
- <https://docs.arduino.cc/tutorials/uno-rev3/AnalogReadSerial>
- <https://docs.arduino.cc/tutorials/uno-rev3/DigitalReadSerial>

Note: For safety purpose buy Capacitors (1uF and 10uF)

Miscellaneous Items:

1. Digital Multimeter
2. Double sided tape
3. Stripper
4. Insulation Tape
5. Screw Driver (small)

• Precautions

- DO NOT solder any microcontroller or IC directly on the GCB, always use an IC bed or make one with female headers.
- DO NOT short positive and negative terminals of supply with each other.
- NEVER SUPPLY VOLTAGE WITH REVERSE POLARITY TO YOUR CIRCUIT, it will cost you a lot.
- Make sure your microcontroller and other ICs get 5V from 7805 circuit wherever needed. DO NOT GIVE 12V TO ANY COMPONENT UNLESS IT IS MENTIONED.
- Use diodes on 12v supply on positive terminal as reverse polarity protection
- Add an insulation below your circuit board to avoid shorting.
- Always mark polarities on connectors. Ideal convention is Left side positive and Right side negative.
- IR sensors detect infrared radiation so they will NOT work as expected in sunlight.
- Make common ground for all IC present on your GCB.
- Always check the orientation of your ICs before placing them in their beds.
- Try to minimize jumps when you design your circuit.



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