



NYPUNYAM  
THE LEADER FOR TOMORROW

**SKILL FIESTA 2016**



**KASE**  
KERALA ACADEMY FOR SKILLS EXCELLENCE

SKILL Development Mission of Government of Kerala



**NYPUNYAM**

SKILLS FOR TOMORROW

February 5-7 | **2016**, Thiruvananthapuram, Kerala

# **MOBILE ROBOTICS**

## **SKILL FIESTA – 2016**

## **Test Project Format – State Level**

### **Trade: MOBILE ROBOTICS**

Duration of the Test: **6 Hours**

### **Project Brief:**

The test project contains the following:

- 1- Mobile Robot Assembly
- 2- Programming
- 3- Arena Testing
- 4- Error Correction
- 5- Task Fulfilling
- 6- Speed Check

1. Your assignment is to assemble the robot using Elipzo Robotic Kit Using the material provided in the kit. The kit is provided with Ultrasonic Distance Sensor, Sevo Pan Kit, Robot Claw and Line Sensor.

You are supposed to program the robot and perform tasks which will be given to you on the day of the Test

A sample of the Test arena and tasks is also included in the description for your test preparation

## Competency and scope of work

1 - The individual needs to know and understand:

- The purposes, uses, maintenance and care of all equipment, together with their safety implications
- The purposes, uses, care and potential risks associated with materials
- The purposes and uses of manufacturers' specifications and drawings
- Search methods for specific and non-specific information, specifications and guidance
- The time available and associated with each activity
- The parameters within which activities need to be scheduled
- The health and safety standards applying at any one time
- The use of new technologies as a work aid
- Principles and their application to good housekeeping in the work environment
- Prepare and maintain a safe, tidy and efficient work area
- Select and use appropriate hand tools to complete every task safely
- Use the specified precautions when manual handling items and for long and heavy items
- Schedule work to maximize efficiency and minimize disruption
- Plan, prepare and complete each task within the available time
- Restore the work area to an appropriate condition
- Select and use appropriate personal protective clothing in all circumstances

## **2 - The contestant should also know:**

- Assembling of Robot using Kit
  - Apply experience in placing of the sensors and detectors
  - Programming Arduino UNO R3
- Understanding about various sensors, its output and interfacing

## **3 - Final outcome expected from the candidate:**

1. The proficiency in assembling Robotic parts and its strategic placement
2. The neatness and ideas followed in routing cables
3. Algorithm approach to solve the designated task
4. The efficiency of the program
5. The correctness in performing desired task
6. The schedule of completion of the tasks
7. Maximum performance achieved using the assembled robots

## **INSTRUCTIONS TO THE COMPETITOR:**

- 1- Aware of technical description, rules, safety rules & test project
- 2- Aware of evaluation criteria & competition time table
- 3- Work station allotment will be by drawing
- 4- Marking scheme including assessment criteria and all pre-filled objective and subjective marking forms for the test project
- 5- Before competition starts, competitors shall have prepare their work place and to become familiar with tools & equipments, raw material and processes
- 6- If any thing missing as per infrastructure list, he must inform to expert
- 7- Before starting the competition, every competitor will get 15

minutes to discussion about test project

8- After finishing assembly, 5 minutes for evaluation of the assembled Robo before proceeding to the next module

9- Have the right to expect fairness, honesty and transparency during the competition in terms of:

- a. Clear & explicit written instructions
- b. All the competitor will be given test projects at a time
- c. Marking schemes shall be uniform
- d. All materials as per technical description and infrastructure list will be provided
- e. No hindrance to the competitors from officials and spectators will be tolerated

## **TECHNICAL DETAILS:**

1. Each contestant will be given with EllipZo-Robotic Chassis with Servo Pan Kit unassembled

Parts included:

- 1 x Top Chassis
- 1 x Bottom Chassis
- 4 x DC Motor Hold
- 1 x Array Hold
- 1 x Pan Head
- 1 x Servo Neck
- 2 x 4xAAA//9V Battery Holder
- 1 x Toggle Switch
- 1 x Caster Ball Wheel



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2 x 100RPM B01 plastic geared motor  
1 x Off Road Wheels 65mmx30mm (Pair)  
1 x FS90 Analog Plastic Geared Micro Servo Kit

Stand offs

4 x M3 6mm HEX

10 x M3 25mm HEX

Screws

4 x M3 35mm STAR HEAD

26 x M3 6mm STAR HEAD

3 x M3 12mm STAR HEAD

2 x M2 12mm STAR HEAD

2 x 7mm 3mm diameter Mushroom head

Nuts

5 x M3 2mm HEX

2 x M2 2mm HEX

Parts included are:-

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### Specifications:

DC motor (100RPM B01 Plastic Gear Motor)

Operating Voltage 3V-12V DC

RPM 100rpm

No load Current 40-80 mA

Output Torque 4 Kg-cm

Wheel (RW002 Off Road Wheels 65mm X 30mm (Pair))

65mm diameter

30mm wide

Rubber wheel on plastic hub

Servo Motor (FS90 Micro 1.3kg Torque Analog Plastic geared Servo)

Operating voltage 4.8-6V DC

Operating Angle 120°

Operating Speed:

0.12sec/60° (4.8V)

0.10sec/60° (6V)

Stall Torque:

1.3kg.cm/18.09oz.in (4.8V)

Toggle Switch

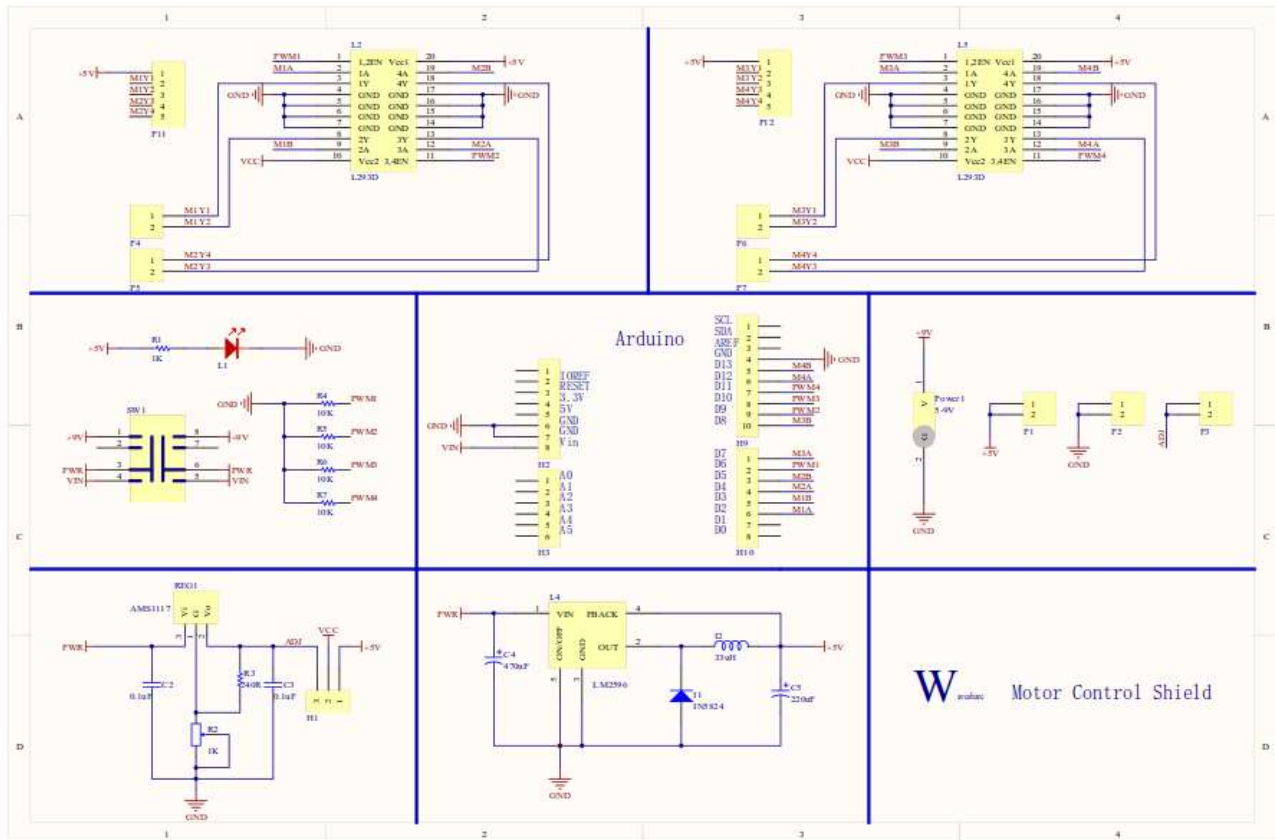
Double Pole Double Through with

Rated Current 3A , Rated Voltage 50V

## **Motor Control Shield**

The Motor Control Shield is based on the L293D motor driver IC, which is a dual full-bridge driver designed to drive inductive loads such as relays, solenoids, DC and stepping motors. With dual L293D ICs, the shield lets you drive 4 DC motors or 2 stepper motors at the same time with your Arduino board along with the control over speed and direction of each one independently. The shield has an adjustable power supply which can have output voltages ranging from 1.25V to 6.45V DC at a time





## Sharp GP2Y0D810Z0F Digital Distance Sensor with Carrier board

Description: This small digital distance sensor detects objects between 2 cm and 10 cm (0.8" and 4") away. With its quick response time, small size, and low current draw, this sensor is a good choice for non-contact object detection, and our compact carrier PCB makes it easy to integrate into your project.

## General Specifications:

Maximum range: 10 cm

Minimum range: 2 cm

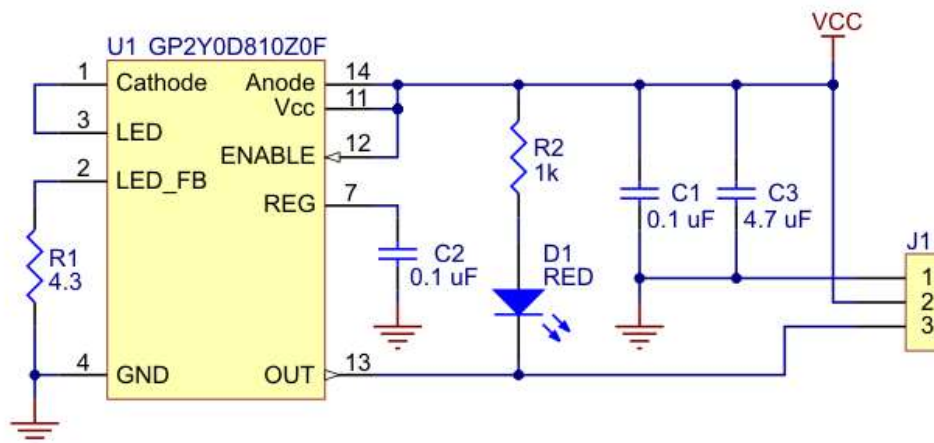
Sampling rate: 390 Hz<sup>2</sup>

Minimum operating voltage: 2.7 V

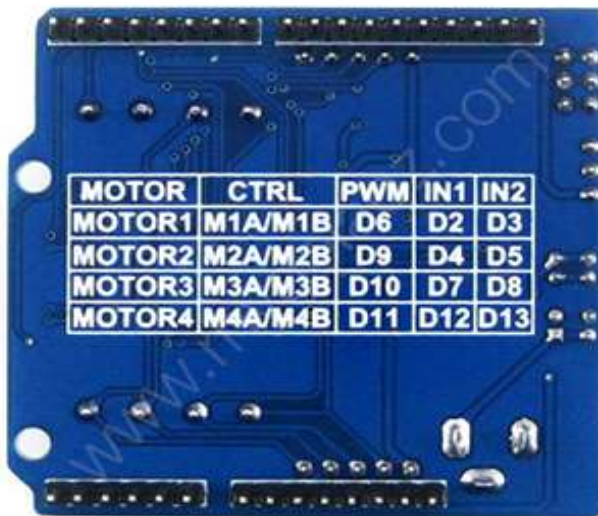
Maximum operating voltage: 6.2 V

Supply current: 5 mA<sup>3</sup>

**Output type: digital<sup>4</sup>**



Pololu carrier for Sharp GP2Y0D805Z0F, GP2Y0D810Z0F, and GP2Y0D815Z0F sensors schematic diagram.



MOTOR	CTRL	PWM	IN1	IN2
MOTOR1	M1A/M1B	D6	D2	D3
MOTOR2	M2A/M2B	D9	D4	D5
MOTOR3	M3A/M3B	D10	D7	D8
MOTOR4	M4A/M4B	D11	D12	D13

**Description:** The Motor Control Shield from wave-share is based on the L293D motor driver IC, which is a dual full-bridge driver designed to drive inductive loads such as relays, solenoids, DC and stepping motors. With dual L293D ICs, the shield lets you drive 4 DC motors or 2 stepper motors at the same

time with your Arduino board along with the control over speed and direction of each one independently. The shield has an adjustable power supply which can have output voltages ranging from 1.25V to 6.45V DC at a time (9V external power supply is required)

The Motor Shield must be powered only by an external power supply. Because the L293D IC mounted on the shield has two separate power connections, one for the logic and one for the motor supply driver. The required motor current often exceeds the maximum USB current rating. External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the Motor Control Shield's power jack.

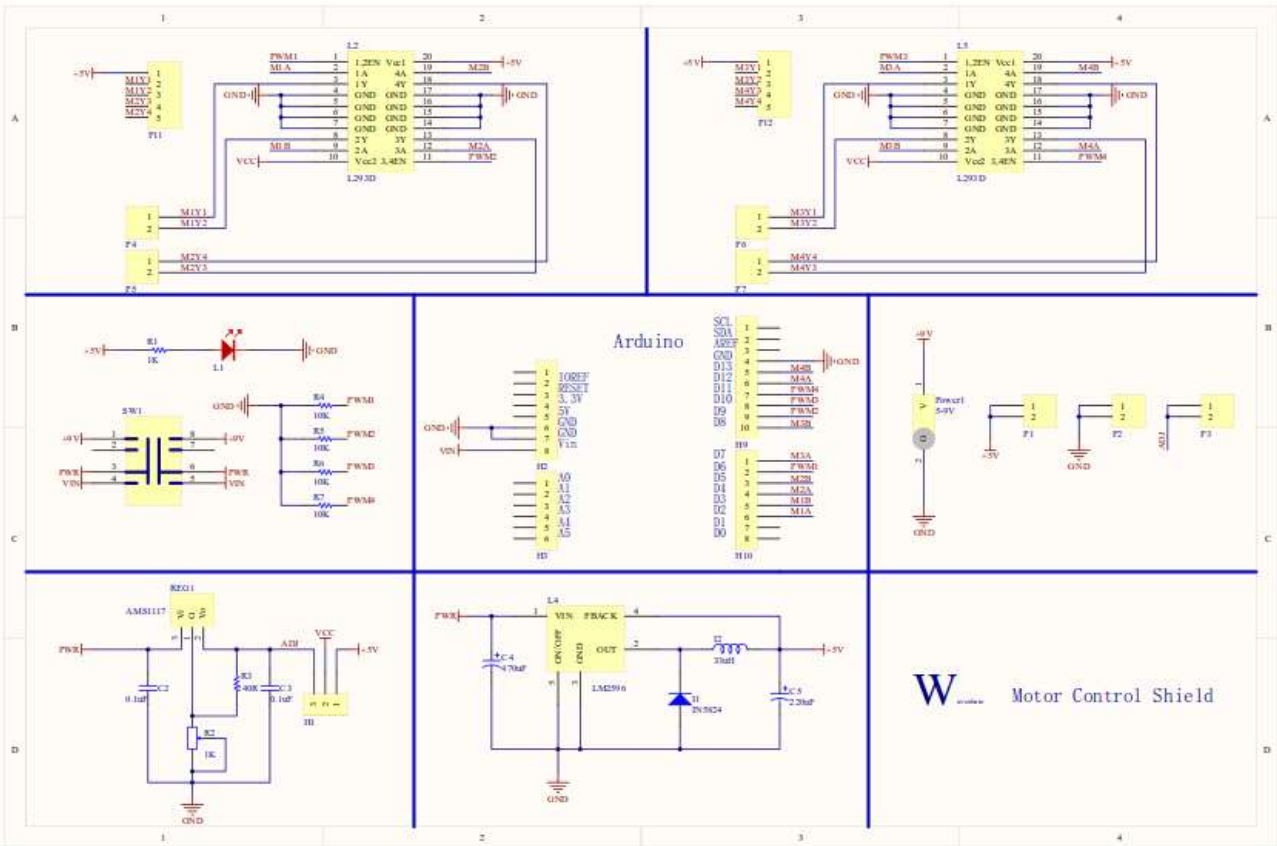
To avoid possible damage to the on board ICs, we recommend using an external power supply that provides a voltage between 5V to 9V. The shield has a dual H-bridge driver with a total of 4 channels. Each channel can supply up to 600mA output current, that makes up to a 1.2A peak output current per H-bridge.

## Features:

- Configurable motor power supply via on-board jumper
  - when using 5V motor power supply : drives four 5V DC motors at one time
  - when using adjustable motor power supply : drives two 1.25V-6.45V DC motors at one time (9V external power supply is required)
- On-board two dual H-bridge driver L293D
  - each L293D can drive 2 DC motors or 1 stepping motor at one time
  - totally 4 channel H-bridge, with 600mA output current (peak 1.2A) per single bridge
  - ESD protection

## Package Includes:

- 1 x Motor control shield
- 2 x Copper heat sinks



W WORLDWIDE Motor Control Shield

**Description:** This claw is a fun, easy-to-use light weight claw for hobbyists. The box contains everything needed to assemble this claw,



except the batteries, namely- Laser cut acrylic parts, 90 RPM Double Shaft Straight DC Motor, Screwdriver, Small wrench, Spring, Nuts and Screws, Battery holder (2 AA batteries) with built in switch, and assembly instructions. To assemble, simply remove the acrylic parts from the sheet and follow the pictures of the assembly instructions. The battery holder has a built in switch and 2 wires with male headers attached to it. The

motor has a gear ratio of 1:120 and a torque of 0.8 kg\*cm and works in 3-6V range. The motor has 2 wires with female headers attached to it for easy connection to the battery holder.

Simple instructions and supplied tools make this project easy and fun to build. The transparent body allows you to see the mechanism in action. This gripper can be used in a variety of application which require pick and place operations. Did you create a project using this product?

## Features:

- 3V operation
- Easy to assemble
- Transparent body
- Clutch to prevent damage
- NO Soldering required

## Specifications:

- Gear Ratio: 1:120
- Voltage: 3V DC
- Speed: 90 RPM
- Torque: 800 gm\*cm

## Package Includes:

- 1x Laser Cut Acrylic Sheet (Claw parts)
- 1x Motor with gearbox
- 1x Assembly manual
- 1x Screwdriver
- 1x Small wrench
- 1x Spring
- 2x AA Battery holder with built in switch
- Screws and Nuts

**Description:** This sensor module has 8 IR LED/phototransistor pairs mounted on a 0.375" pitch, making it a great detector for a line-following robot. Pairs of LEDs are arranged in series to halve current consumption, and a MOSFET allows the LEDs to be turned off for additional sensing or power-savings options. Each sensor provides a separate digital I/O-measurable output.

The QTR-8RC reflectance sensor array is intended as a line sensor, but it can be used as a general-purpose proximity or reflectance sensor. The module is a convenient carrier for eight IR emitter and receiver (phototransistor) pairs evenly spaced at intervals of 0.375" (9.525 mm). Each phototransistor uses a capacitor discharge circuit that allows a digital I/O line on a microcontroller to take an analogue reading of reflected IR by measuring the discharge time of the capacitor. Shorter capacitor discharge time is an indication of greater reflection.

The outputs are all independent, but the LEDs are arranged in pairs to halve current consumption. The LEDs are controlled by a MOSFET with a gate normally pulled high, allowing the LEDs to be turned off by setting the MOSFET gate to a low voltage. Turning the LEDs off might be advantageous for limiting power consumption when the sensors are not in use or for varying the effective brightness of the LEDs through PWM control.

The LED current-limiting resistors for 5 V operation is arranged in two stages; this allows a simple bypass of one stage to enable operation at 3.3 V. The LED current is approximately 20-25 mA, making the total board consumption just under 100 mA.



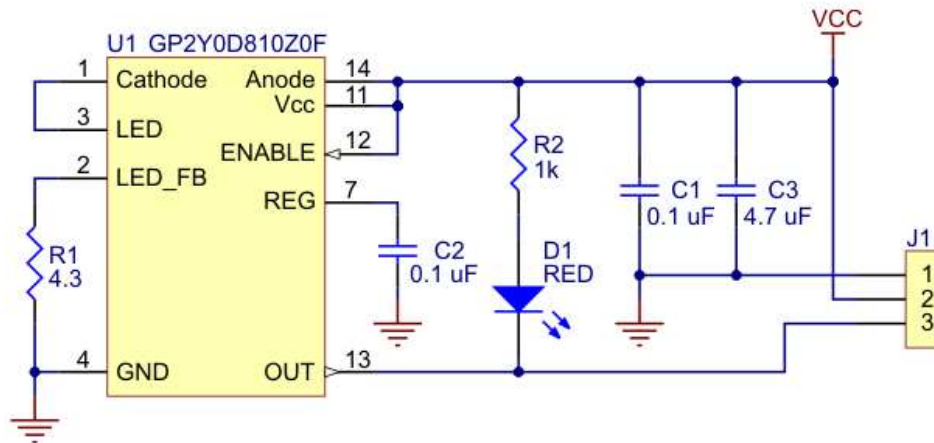
## Specifications

- Operating voltage: 3.3-5.0 V
- Supply current: 100 mA
- Output format: digital I/O compatible
- Optimal sensing distance: 0.125" (3 mm)
- Maximum recommended sensing distance: 0.375" (9.5 mm)
- Weight without header pins: 0.11 oz (3.09 g)

## Dimensions:

- 2.95" x 0.5" x 0.125" (without header pins installed)





Pololu carrier for Sharp GP2Y0D805Z0F, GP2Y0D810Z0F, and GP2Y0D815Z0F sensors schematic diagram.

## Arduino UNO - R3

Package includes:

1 x Arduino UNO - R3 (Arduino-Italy)

1 x USB A to B cable

Description: The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog 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

Specifications:

Microcontroller ATmega328 (PDIP)

Operating Voltage 5V

Input Voltage (recommended) 7-12V

Input Voltage (limits) 6-20V

Digital I/O Pins 14 (of which 6 provide PWM output)

Analog Input Pins 6

DC Current per I/O Pin 40 mA

DC Current for 3.3V Pin 50 mA

Flash Memory 32 KB (ATmega328) of which 0.5 KB used by  
bootloader

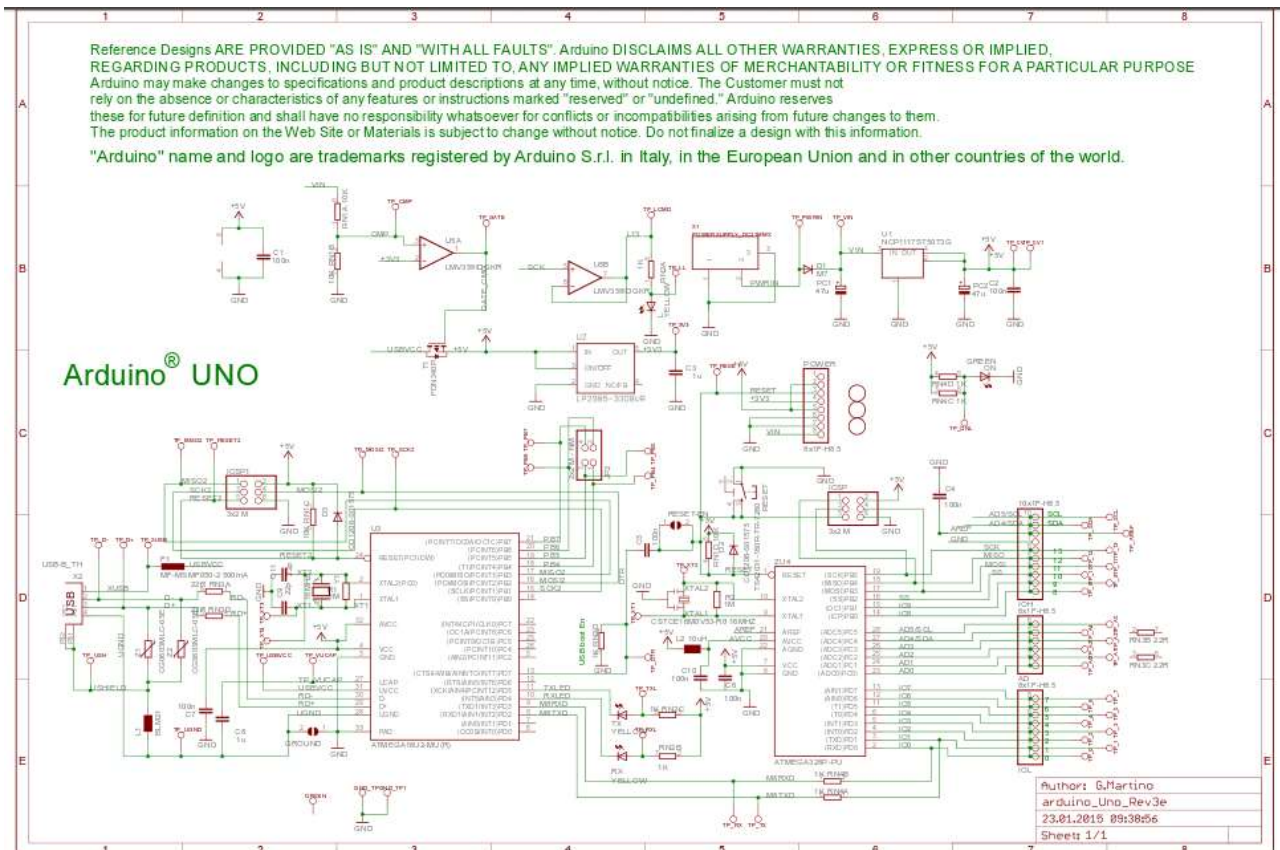
SRAM 2 KB (ATmega328)

EEPROM 1 KB (ATmega328)      Clock Speed 16 Mhz

## **Programming**

For programming Arduino Software (IDE) installed PC / Laptop with  
USB port will be provided

Each contestant can make a folder in their name and can start their  
programming and porting



## Programming the Arduino UNO

The Arduino UNO can be programmed with the Arduino software. Select "Arduino UNO" from the "Tools > Board" menu.

ATmega328 on the Arduino UNO comes pre-burned with a boot-loader that allows you to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol.

You can also bypass the boot-loader and program the microcontroller through the ICSP (In-Circuit Serial Programming) header using Arduino ISP or similar.

## **Installing Drivers for the UNO**

### **Windows**

If you previously installed Arduino IDE, you already have drivers installed.

If you haven't yet installed Arduino IDE, download the Windows version of the Arduino software is available for download.

When the download finishes, launch the file to install the software and the drivers.

If you downloaded the .zip version of the IDE, unzip the downloaded file. Make sure to preserve the folder structure.

Now your drivers will be downloaded and installed from Internet, directly from Windows.

If you have issues, you can find the "drivers" folder inside the unzipped file, for manual installation. Linux

There is no need to install drivers for Ubuntu 10.0.4

In some computers, you need to setup user permissions and some udev rules.

You can find detailed information on how to achieve this at [this page](#).

### **Uploading Code to the UNO**

Click the upload button in the Arduino IDE and your sketch will be automatically uploaded onto the board and then started. The Arduino software initiates a reset of the board, launching the boot-loader - which is responsible for receiving, storing, and starting the new sketch.

However, because the serial port is virtual, it disappears when the board resets, the Arduino software uses a different strategy for timing

the upload than with the Uno and other boards. In particular, after initiating the auto-reset of the UNO (using the serial port selected in the Tools > Serial Port menu), the Arduino software waits for a new virtual (CDC) serial / COM port to appear - one that it assumes represents the boot-loader. Then it performs the upload on this newly-appeared port.

These differences affect the way you use the physical reset button to perform an upload if the auto-reset isn't working. Press and hold the reset button on the UNO, then hit the upload button in the Arduino software. Only release the reset button after you see the message "Uploading..." appear in the software's status bar. When you do so, the boot-loader will start, creating a new virtual (CDC) serial port on the computer. The software will see that port appear and perform the upload using it. Again, this is only necessary if the normal upload process (i.e. just pressing the uploading button) doesn't work. (Note that the auto-reset is initiated when the computer opens the serial port at 1200 baud and then closes it; this won't work if something interferes with the board's USB communication - e.g. disabling interrupts.)

## **INSTRUCTIONS TO THE CANDIDATES**

180cmX180cm area with specific obstructions, marked with lines and designated tasks also to be carried out within a stipulated time to calculate the efficiency of your robot

The obstacles will be placed, approximately with necessary clearance minimum passage width of at least for the robot which is fabricated is guaranteed. Also the thickness of the lines in such a way that is detectable by the sensors provided and the object which can be handled by the claw is guaranteed

## **RULES FOR THE CONTEST**

The objective of the competition would be for the robot to reach the target and complete the task in the shortest time.

All robots must travel on the surface of the domain. Clearing certain points will be awarding points according to predetermined check points

The time of start and finish for each one robot will be noted and bonus points for crossing certain points

Before the start of the competition, entrants are allowed to inspect the layout to satisfy themselves that all blocks are spaced in such a way that robot can pass through and lines are of sufficient width so that provided sensors are able to detect. The task provided can be easily handled by claw.

Under any circumstances, participants are not allowed to touch the block obstacles. If any positional adjustment be made to the block obstacles, it will be performed by the event timers/ helpers/ judges.

The start of the maze is located at one of the four corners. The start square is bounded on three sides by walls. That is, as the robot exits the corner square, the time starts. The destination square has only one entrance. From there, to start a line follower version and task completion depends upon the no of tasks completed and points scored will be increased

Decision of the Judges will be final.

Any disputes arising during the competition must be brought up immediately to the judges

## MARKING SCHEME

### Proficiency of Assembly can be evaluated on 10%

S No	Subjective Marking	
1.	Neatness	3
2.	Wiring /Cable tying	3
3.	Clearances between Data/Sensor cables and Power cable	2
4.	Time for completion (Max :30mts)	2



### Programing logic 10%

1	Programming logic using flow chart	3
2	Succesful Program implementation	7

### Working robot after programming 15%

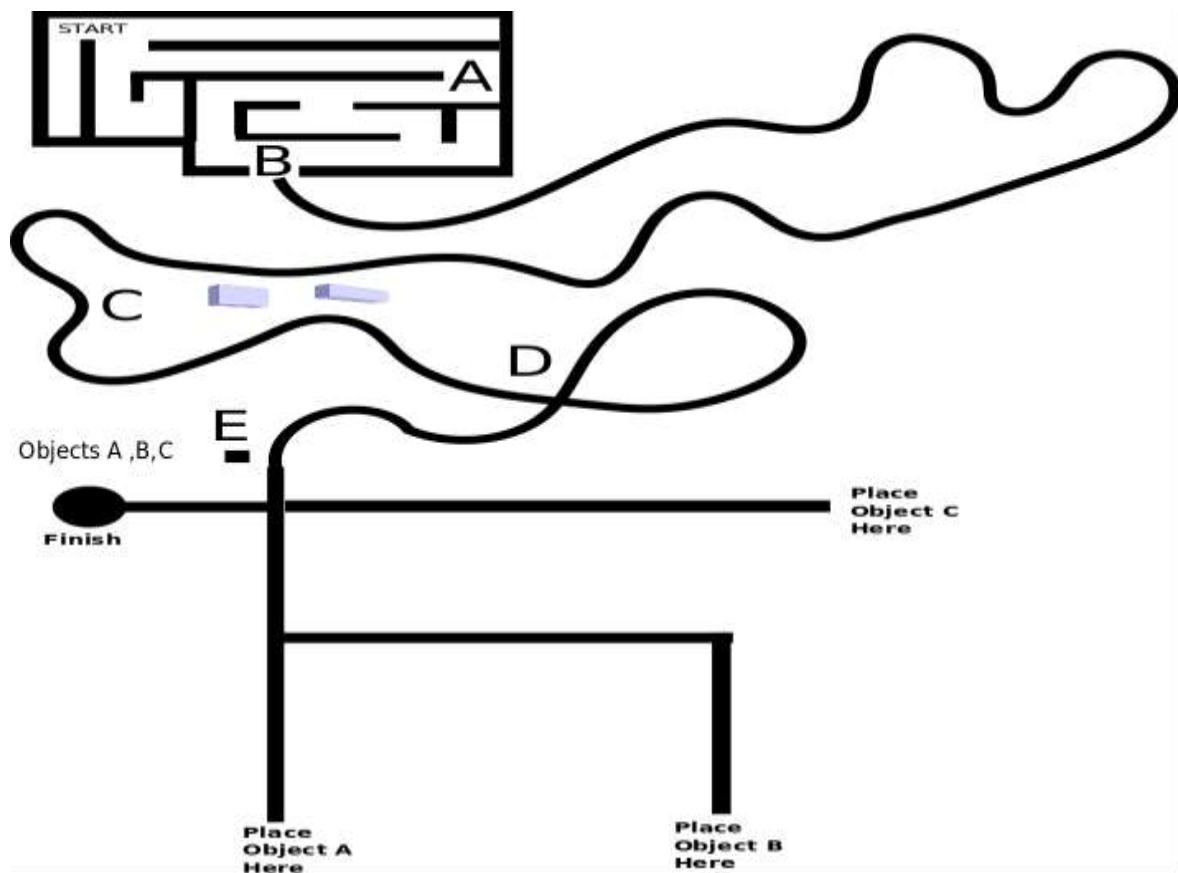
1.	Placement of Sensors and Claw	5
2	All Sensors data detection and interfacing logic	5
3	Working Robot with Program	5

### Testing and Error Correction 20%

1	Error Correction Single Time within 10mts	20
2	Error Correction Two Time within 20mts	15
3	Error Correction Three Time within 25mts	10
4	Error Correction Four Time within 30mts	5
5	Error Correction Four Time within 45mts (Permitted Limit)	No Marks

## Testing 55%

1	Robot Crossing 1 <sup>st</sup> Marking A Max 10mts from start of the Test	10
2	Robot Crossing 2 <sup>nd</sup> Marking B Max 20mts from start of the Test	20
3	Robot Marking C Line follower Max 25mts. from start of the Test	25
4	Robot Finishing 1 task. Max 30mts from start of the Test	35
5	Robot Finishing 2 <sup>nd</sup> task. Max 40mts. from start of the Test	45
6	Robot Crossing Marking. Max 45mts. from start of the Test	55



Each participant will be provided with following:

1. A PC with ARDUINO programming software with USB
2. A Table for assembly of the kits provided to them
3. Soldering Iron, Paste, Solder Lead, De-soldering Pump  
Different coloured wires  
Cutter/Stripper, Heat Shrinkable sheild of necessary size  
according to the wires  
One Multimeter  
Glue Stick /Gun for Securing Wires  
Instant Adhesive
4. Necessary Screwdriver Set, Plier, Tweaser
5. Maze Board fabricated as per the Question
6. Timer for each participant
7. Necessary batteries for the robot
8. UPS Points for the PC and Soldering Iron and SMPS Adaptor for UNO Board
9. CD Marker Pen for each contestant
10. Cello Tapes, Insulation Tapes
11. A4 White Paper
12. Instruction Sheets