



Task 3A: Bot Design

Task 3A has two main objectives:

- **CAD Model**
Use the hardware details provided and create a detailed design of your robot on a CAD software of your choice.
- **Circuit Design**
Design the circuit board of your robot.

CAD Model

It's time to bring our model out from the gazebo world to the real world!

The first step towards this, (after conceptualising your design) is to create the detailed design in a CAD software. It's crucial to create the model in a CAD software before fabricating the hardware for multiple reasons. One good reason would be, depending on your choice for fabrication you will need to use different files from your detail design for fabrication (explained below).

Fabrication

- if you choose to use **laser cutting and etching** during fabrication: you would need to export **.dxf** files from the sketches in the CAD model,
- to **3D print** different parts: you would need to export **.stl** files from solid bodies in the CAD model.
- you'll need the above files (or similar files) to generate G-code for any other CNC machine as well.
- even if you choose to fabricate different parts using **hand tools**, it would be good to see how the bot would turn out once completed and also use convenient tools like inspect/measure every now and then during fabrication.

Design

Teams are free to use any CAD modelling softwares and also any fabrication technique to design and build their bots.

Some of the CAD modelling software popularly used by mechanical engineering students:

- Fusion 360, AutoCAD and Autodesk Inventor
- SOLIDWORKS and CATIA by Dassault Systèmes.

There also some open source softwares that one could explore.

However for a beginner **Autodesk Fusion 360** might be a good software to start with. A good bonus is that it comes with a free educational license for students.

Here are some resources for Fusion 360 from the official Autodesk Fusion 360 channel

Playlist for basics of CAD Modeling

(we recommend to start with Arduino UNO case, and Laptop Stand in this playlist, which should cover a lot of the fundamentals)

Following files describe the dimensions of different parts used in the bot. This will be needed while designing the bot.

Component		Drawing File
1.	ESP32	
2.	Omni-wheel (38mm)	
3.	MG995: 360 Continuous Servo	
4.	MG90S: micro servo	
5.	Buck Converter XL4015	
6.	Pen	
7.	Orange 2200mAh Li-Po Battery	L = 106mm W = 34mm H = 23mm

Task:

Make a first iteration of a CAD model of the bot you plan to build.

Notice we said "first iteration" because this is an iterative process. The design may change as we proceed to fabrication and future tasks. But this is a starting point.

Circuit Design:

Now, it's time to delve into the electronics aspects of your robot. There are two parts to circuit design:

- A PCB layout is like a 3D model of a circuit board, which contains accurate information about the component placement, their sizes, pads, signal tracks width, hole diameter, etc.
- A PCB schematic diagram is a blueprint for the layout.

Design

Teams are free to choose any circuit design software that suits their preference. Nevertheless, a good recommendation for those who are unsure would be: [EasyEDA](#).

You can explore the [EasyEDA playlist](#) to learn more about it.

Fabrication

When it comes to fabricating the electric circuit, you have the flexibility to choose between a large variety of options available out there! For Example:

- Perf boards
- Ferric Chloride etching
- PCB Milling (CNC)

Please avoid bread boards and jumper wires in your final bot.

Task:

Make the PCB schematic diagram and a first iteration of the PCB layout of the circuit board you plan to build.

Once again notice we said "first iteration" because this is an iterative process. The design may change as we proceed to fabrication and future tasks. But this is a starting point.

**IMPORTANT REMARK**

We would like to encourage the teams to think of design and fabrication of the bots as designing a product for a customer. Going the extra mile beyond functionality will be rewarded by the Scoring Formula as well at the Finals.

Teams are allowed to use additional components for the purpose of ergonomics and aesthetics like switches, LEDs, buzzers etc.. But ofcourse it is mandatory to use only the components listed by us for the essential functionality of the bot (Sense-Think-Act-Power of the robot described in the rulebook as well).

Submission Instructions:

For CAD Model: You are required to submit the design files and images/renderings of the bot (first iteration).

For Circuit Design: You are required to submit the PDF/image file of your schematic diagram and the PCB Layout of the bot (first iteration).

- Rename you files to **hb_task_3a_<team_id>.stl** , **hb_task_3a_<team_id>.pdf** and **hb_task_3a_<team_id>.png** etc.
- Select all the files and compress into a single ZIP file.
- Name your zip file as:

hb_task_3a_<team_id>.zip



- Submit this single ZIP file on [eYRC Portal](#).
-