

Flipkart GRID 3.0

OBJECTIVE

A central monitoring/navigation system (such as a camera or multiple cameras) should be used to understand the arena and the position of the robots and instruct robots on actions to be taken.

Task :-

Built an autonomous bot which will carry 20*20*20mm cubical block from starting point to chute.

Component Used :-

Electrical :-

1. Esp8266 (node mcu)
2. 2 motor drivers
3. 1 stepper motor
4. 2 dc-motor
5. Camera
6. Central System over which code run

Mechanical :-

1. 2 mecanum wheels
2. 1 actuator
3. 3 D model of robot

Software Used :-

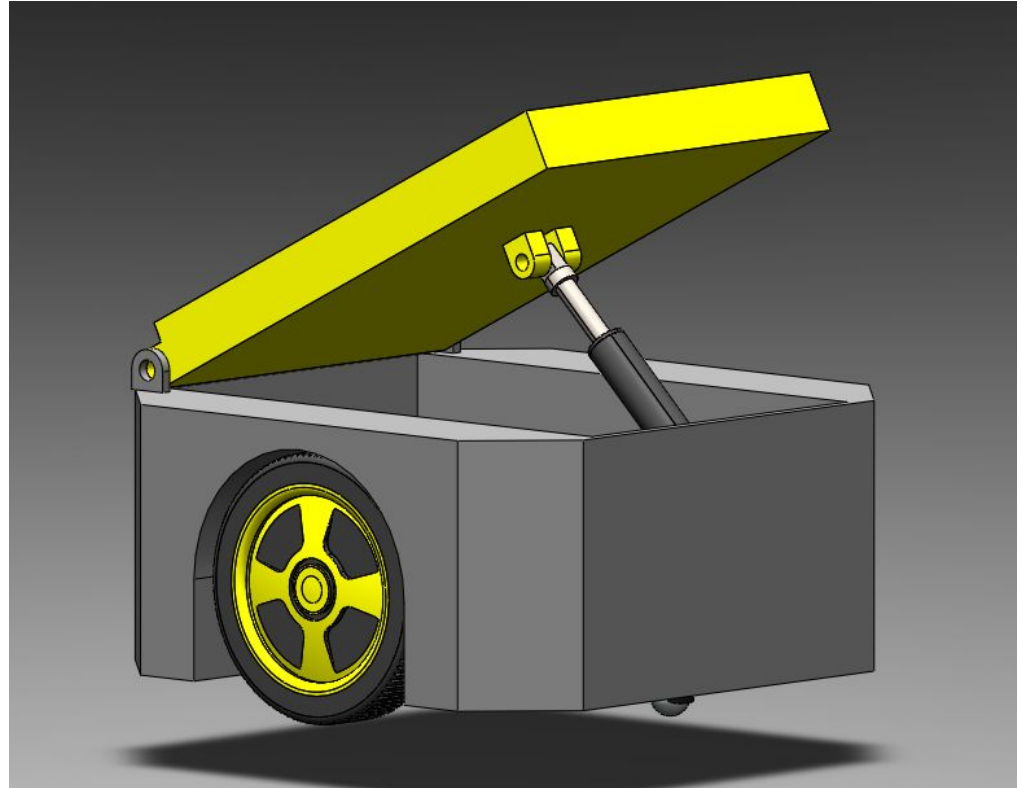
1. Arduino Ide
2. Solidworks
3. Python (opencv)

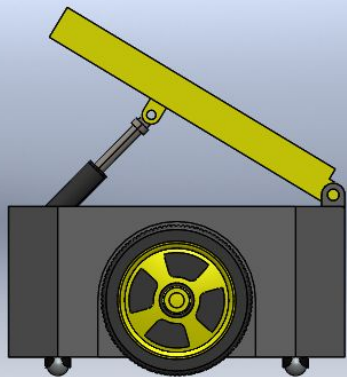
Specifications of Central System:-

1. A central navigation system is build which consist of camera which will installed over the height and able to scan whole arena of grid system over which autonomous bot will move.
2. Navigation system is also consist of laptop or any device which is connected to internet & over which python code will run.
3. Python code by image processing will generate instruction for bot according to its position.

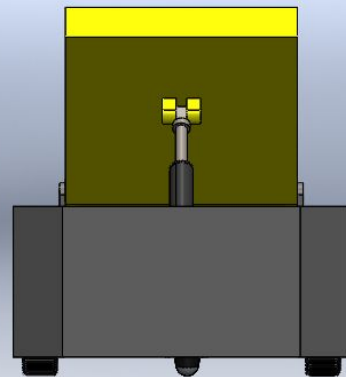
BOT CONSTRAINTS

1. Bot is to fit within 6x6 inch square
2. Bot has a tray on top to carry 20x20x20 mm cube
3. Tray has the ability to flip to drop items in chute with rotation of 60 degree

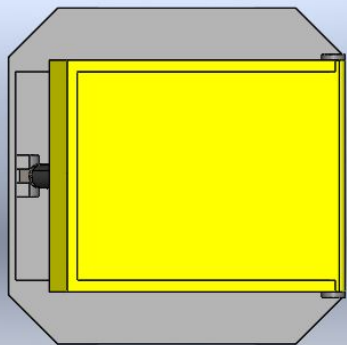




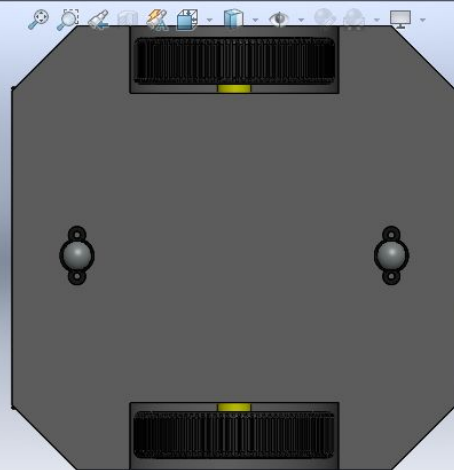
*Front



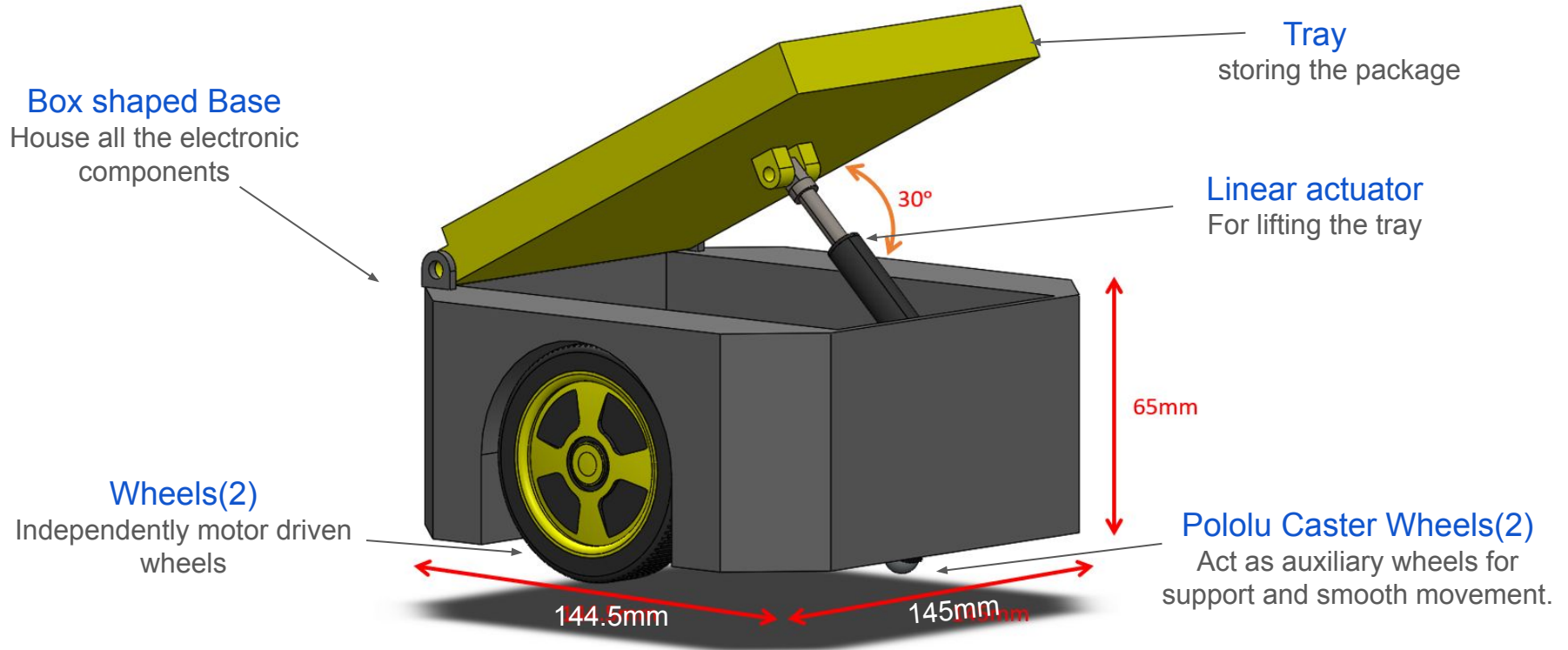
*Left



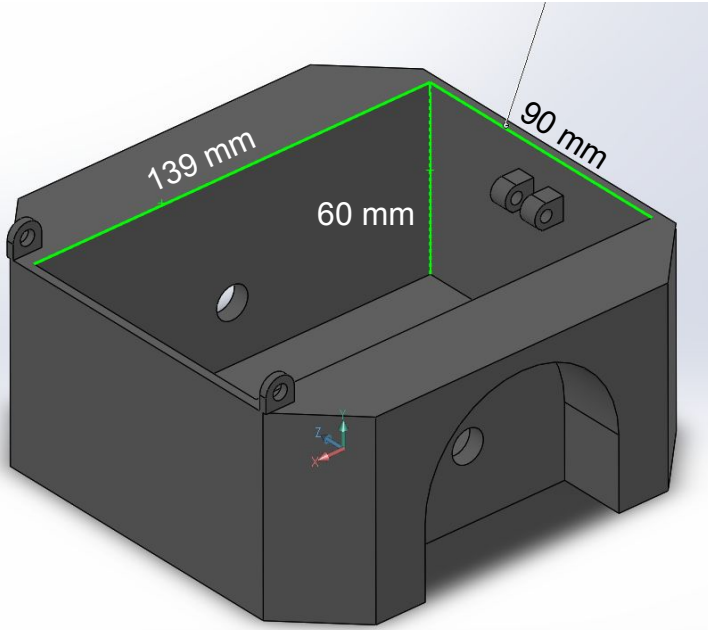
*Top



MECHANICAL DESIGN

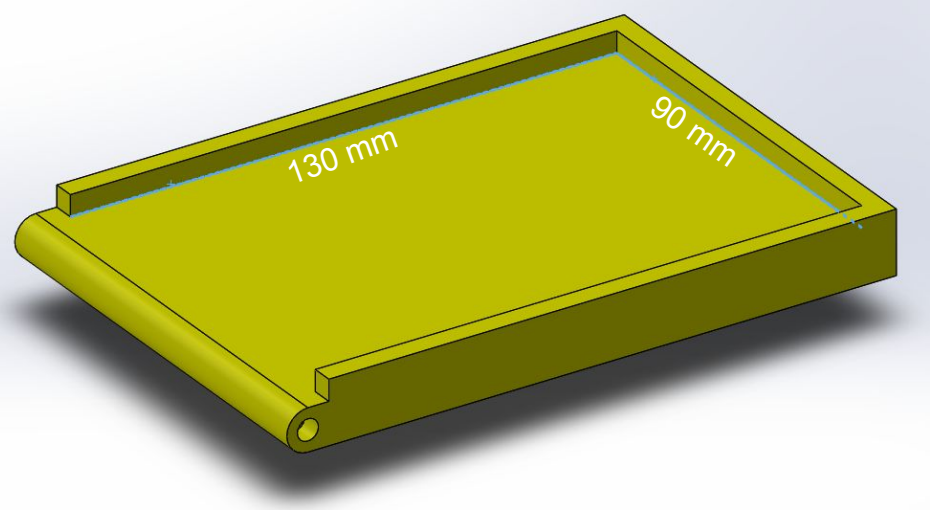


BOT SPECIFICATIONS



Base:

Internal space of dimensions 139 mm x 60mm x 90mm
Outer dimensions 144.5 mm x 145 mm x 60mm



Tray:

Internal dimensions of tray : 130 mm x 90mm
Overall dimensions : 142.5mm x 100mm

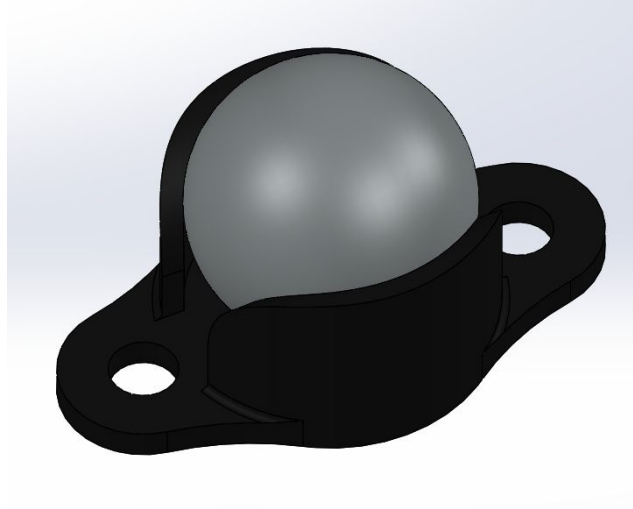
BOT SPECIFICATIONS



Wheel

Overall diameter : 61mm

Width : 13.65 mm

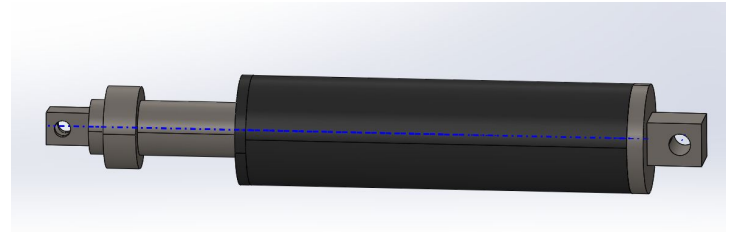


Pololu Caster Ball

Height : 10.5mm

Ball diameter : 9.52mm

Linear Actuator

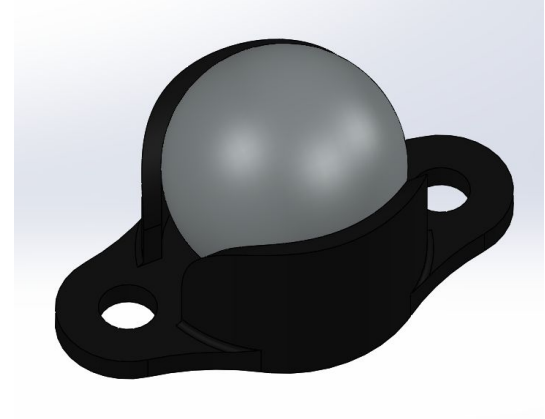


SELECTION OF WHEELS

1) Pololu caster Ball/wheel

Since, the bot is small, less number of wheels is desirable. Having just two motor driven wheels made bot unstable. Pololu caster wheels are used due following reasons:

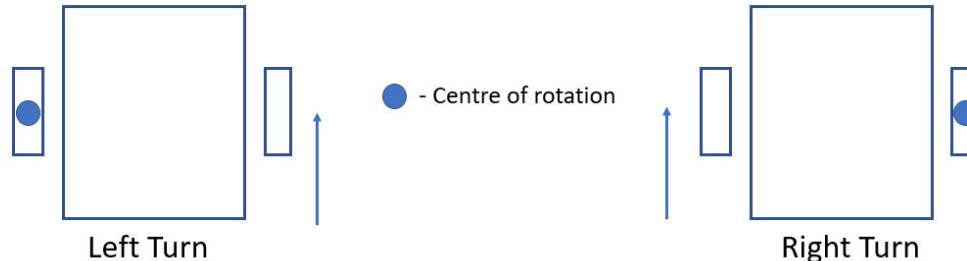
- Provide stability and support
- Omnidirectional motion
- Compact size



2) Cylindrical wheels

Possible choices for wheels : Cylindrical, Omni, Mecanum

- Grid type arena. Only forward/backward motion and right-left turn required. Can easily be done using two independently driven cylindrical wheels. Also, caster wheel facilitates turn due to its omnidirectional nature.



This motion car. er, following factors outweighs their advantages making them less desirable for bot.

1. Cost
2. Complexity
3. Limited surfaces they can drive on
4. Slow speed of mecanum wheels
5. Vibration in omni wheel

Electrical :-

1. Use of minimum boards and circuits
2. Make the board accessible other than serial communication.
3. Python code for image processing and detect the motion of the bot and send command through WiFi / Internet.

Solution :-

1. Esp8266 board with two motor-driver is used.
2. Esp8266 can be access through internet as a client to give instruction according to the position.
3. Contour detection , Line detection ...etc concepts help to build the python code.

Comparison between materials that can be used:

Materials used:

- *Steel

- *ABS

- *Aluminium alloy

- *Wood oak

Comparison between materials that can be used:

FOS(Factor of Safety)-

*Steel-15

*ABS-14.998

*Aluminium alloy - 15

*Wood oak - 15

❖ Hence, ABS has minimum FOS while others have equal FOS.

Comparison between materials that can be used:

Weight

*Steel - 4.3501 kg

*ABS - 0.6049 kg

*Aluminium alloy - 1.5746 kg

*Wood oak - 0.55235

- ❖ So wood oak is the lightest and it would be very easy to transport it while Steel is the heaviest of all and it is not ideal to make a bot of such high weight.

Comparison between materials that can be used:

Deformation:

*Steel - $1.7909e-004$

*ABS - $1.473e-002\text{mm}$

*Aluminium alloy - $5.478e-004\text{mm}$

*Wood oak - $3.874e-003\text{ mm}$

- ❖ Aluminium alloy has minimum deformation while ABS is showing maximum deformation. So, with deformation perspective ABS is least ideal to use but there is as such no huge difference between their deformations so we can't decide solely on this basis.

Comparison between materials that can be used:

- From manufacturing point of view, ABS is the most difficult to manufacture while wood oak would be the easiest.
- Cost price for manufacturing will also be least for wood oak and ABS would be the expensive one and others two are moderately expensive.
- Using ABS will provide durability to our bot and it has high tensile strength and it is very resistible.
- So, considering all the factors ,it is concluded that it would be preferable to use wood oak as a material to manufacture.