





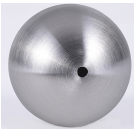


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1 Item - List

| Item | # | W.[g] | Weblink | Picture |
|--|-----|-------|-------------------------------------|---|
| OpenCR Board (Controlling the motors, IMU) | 1 | 60 | github_wiki |  |
| UpBoard (Main PC) | 1 | 96 | 127€ |  |
| Intel RealSense R200 | 1 | 9.4 | datasheet, 84.15€ |  |
| Laser Distance Sensor | 1 | 124 | specs, 100€ |  |
| Battery: LI-PO 11.1 1800mAh LB-12 19 | 1 | 132 | 44.90€ |  |
| Turtlebot3 Layers() | 4 | | | |
| XM430-W350-R Dynamixel (Motors) | 3 | 72 | robotis,250€ |  |
| Ball(alum., dia.: 140mm, material thickness 2.5mm) | 1 | 400 | ball-tech gmbh,40€. |  |
| Omni wheels(dia: 60mm, thickness:25mm) | 3 | 46 | 10.38€ |  |
| Kreisring (PLA, 3D printeted) | 1 | 28 | | |
| Halterung (PLA, 3D printeted) | 3 | 8 | | |
| Mitnehmer (PLA, 3D printeted) | 0.8 | 18 | | |
| plain washer (beilagscheibe) (PLA, 3D printeted) | 0.8 | 18 | | |
| Total Cost: 1176€ + Cost of opencr board and all plastic (incl. tb3 structure) and scrwes | | | | |
| TODO: | | | | |

1. Abmessungen von einer struckture layer
2. upboard1-link noch eintragen

2 Simulation

2.1 Launch

These files are executed one after another:

1. bb_simulation: ballbot.launch
2. bb_description: bb_description.launch
3. bb_description -> urdf: bb.xacro
4. bb_description -> urdf: bb.urdf.xacro
5. bb_description -> urdf: common_properties.xacro
6. bb_description -> urdf: bb.gazebo.xacro

2.2 Simulation design

Ballbot SDF Reference: [Ballbotmodel](#)

We use not the sdf but the xacro description as in this example [here](#).

```
rrbot_control
├── CMakeLists.txt
├── config
│   └── rrbot_control.yaml
├── launch
│   ├── rrbot_control.launch
│   ├── rrbot_rqt.launch
│   └── rrbot_rqt.perspective
├── package.xml
├── rrbot_description
│   ├── CMakeLists.txt
│   ├── launch
│   │   ├── rrbot.rviz
│   │   └── rrbot_rviz.launch
│   ├── meshes
│   │   └── hokuyo.dae
│   ├── package.xml
│   ├── urdf
│   │   ├── materials.xacro
│   │   ├── rrbot.gazebo
│   │   ├── rrbot.xacro
│   │   └── rrbot.xml
├── rrbot_gazebo
│   ├── CMakeLists.txt
│   ├── launch
│   │   └── rrbot_world.launch
│   ├── package.xml
│   └── worlds
│       └── rrbot.world
```

Gazebo uses different physics engines:

- Open Dynamics Engine (ODE) (Default)
- Bullet
- Dynamic Animation and Robotics Toolkit (DART)
- Simbody

which all have different friction etc. models.

Files:

- bb.urdf.xacro: Link's: Visual description of the Robot and its collision model(STL file). Pose Mass and Inertias. Joint's: Pose,axis,effort and velocity limits, friction.

- common_properties.xacro: Macros for color definition.
- bb.gazebo.xacro: gazebo references dynamics of the links: friction parameters (mu1,mu2),

Gazebo Parameter's List:

| name(xacro) | description | value | sdf group |
|-------------|---|-------|-----------|
| mu1 | is the Coulomb friction coefficient for the first friction direction | 1.0 | ode |
| mu2 | is the friction coefficient for the second friction direction (perpendicular to the first friction direction) | 2.0 | ode |
| kp | spring constant equivalents of a contact as a function of SurfaceParams::cfm and SurfaceParams::erp | | ode |
| kd | spring damping constant equivalents of a contact as a function of SurfaceParams::cfm and SurfaceParams::erp. | | ode |
| cfm | Constraint Force Mixing parameter. | | ode |
| erp | Error Reduction Parameter. | | ode |
| min_depth | Minimum depth before ERP takes effect. | | ode |
| max_Vel | Maximum interpenetration error correction velocity. If set to 0, two objects interpenetrating each other will not be pushed apart. | | ode |
| slip1 | Artificial contact slip in the primary friction direction | | ode |
| slip2 | Artificial contact slip in the secondary friction direction. | | ode |

See: [ODESurfaceParams](#)

2.3 Gazebo Parameters

```
git@git.sim.informatik.tu-darmstadt.de:TurtleBot/jsonlab.git
git@git.sim.informatik.tu-darmstadt.de:TurtleBot/octave_rosbridge.git
```

2.4 Control

sobald diff drive plugin angeschaltet drehen sich die raeder viel zu schnell ...

2.4.1 Plugins

- gazebo-ros-control
- diff drive

2.4.2 Launch

```
roslaunch rrbot_control rrbot_control.launch
```

These files are executed one after another:

1. load config
2. controller_spawner

2.5 Sensors

2.5.1 IMU

We want to simulate the IMU of the opencr board. STRG+T to see imu topic values! [Imu of opencr board simulated](#)

Simulate like this: rviz rviz dann als fixed frame nimm: imu_link. Und add topic imu und waehle als topic ballbot/sensor/imu

bbbb