

TURTLEBOT 4

1st report

TECHNICAL SPECS

Dimensions (L×W×H)

351×339×341 mm (13.8×13.3×13.4 in)

Weight

3.9 kg (8.6 lbs)

Max Payload

9 kg (default), 15 kg (custom)

Speed

0.31 m/s (safe), 0.46 m/s (max)

max speed disables cliff sensors

Computer

Raspberry Pi 4B (4 GB RAM)

Software

Ubuntu 20.04 + ROS 2

Battery

26 Wh Li-ion, 2.5 hr charge, 2.5–4 hr runtime



SENSORS AND ACTUATORS

Camera

OAK-D-Pro (IMX378 4K RGB, OV9282 stereo)

LiDAR

RPLIDAR-A1

Other Sensors

Cliff, bumper, infrared, IMU, gyro, accelerometer, odometry

Actuators

2x Drive Motors, 6x RGB LEDs, OLED Display, Speaker

SETUP PROCESS

- download ubuntu 22.04 and from there install ROS 2 packages

The robot setup is quite straightforward from the manual.

- put the turtlebot 4 on its dock and a green light will turn on and now the raspberry pi is on and can be setup.
- Connect to the wifi. The login and password is **Turtlebot4**
- Once connected, you can SSH into the Raspberry Pi to configure its Wi-Fi. Open a terminal on your PC and call: `ssh ubuntu@10.42.0.1`
- Once SSH starts up, use the turtlebot 4 setup tool: `turtlebot4-setup`
- Then you need to take the newly assigned IP from the turtlebot and access the “create 3 webserver” with the following command Raspberry Pi IP with the port 8080

*controller setup is bluetooth and manual gives the commands needed to connect

What is it commonly used for?

- Education: It's used in educational settings to teach robotics and programming from introductory levels to advanced research.
- Research and Development: lots of experiments using its robust hardware and ROS 2 integration.
- Autonomous Navigation: LiDAR and a spatial AI camera
- **AI and Machine Learning:** cameras can run AI models for tasks like object recognition and perception.
- Customization and Expansion: open source with accessible hardware

Cool Project

using turtlebot 4

<https://www.youtube.com/watch?v=fCQCbOA2CzY>

Turtlebot 4 hackathon project

- adding an amazon echo 4 to the turtlebot to use as a voice command receiver and could respond when given vocal commands



WEBSITES/VIDEOS I FOUND IMPORTANT

<https://vimeo.com/showcase/9954564?video=767165480> Explains every important aspect
of the turtlebot 4 and some of its uses

<https://www.youtube.com/watch?v=fCQCbOA2CzY> amazon echo
addition

APPLICATIONS FOR THE TURTLEBOT 4

- The turtlebot 4 is mainly used for teaching and research applications which allows for very heavy customization
- The Turtlebot 4 stock cant really be used for manufacturing apart from “spectating” since its speed and its carrying capacity is too low/slow for a real application. It could be useful to carry lighter things like screws and handtools

IDEA FOR A DEMONSTRATION AND POSSIBLE ROUTE FOR GOAL C

(DEVELOP WEB OR MOBILE DASHBOARDS FOR REAL-TIME REMOTE
MONITORING AND DATA VISUALIZATION)

The GitHub Moondream

- Ai vision language model
- very small model that can run entirely off a raspberry pi or can connect to server training platforms with wifi
- 2 models (2 and 0.5 billion parameters)
- Ability to train your own model and is the only model to have reinforced learning on object detection
- when prompted can output in JSON and other text forms

Moondream can be trained off of of Lidar and infared images allowing it to work everywhere like dark areas or foggy/dirty areas like factories

TURTLEBOT4 WITH MOONDREAM APPLICAITONS

- Can act as a realtime safety monitor which can roam the factory looking for certain things like OSEA violations as well as track whos where at what times
- Ability to track manufacturing such as quantities and locations of parts
- Improve lean manufacturing such as optimizing workflow and bottlenecks by being able to track every step of every part
- Using infrared it could also track the temperatures of everything on parts which currently don't have monitoring