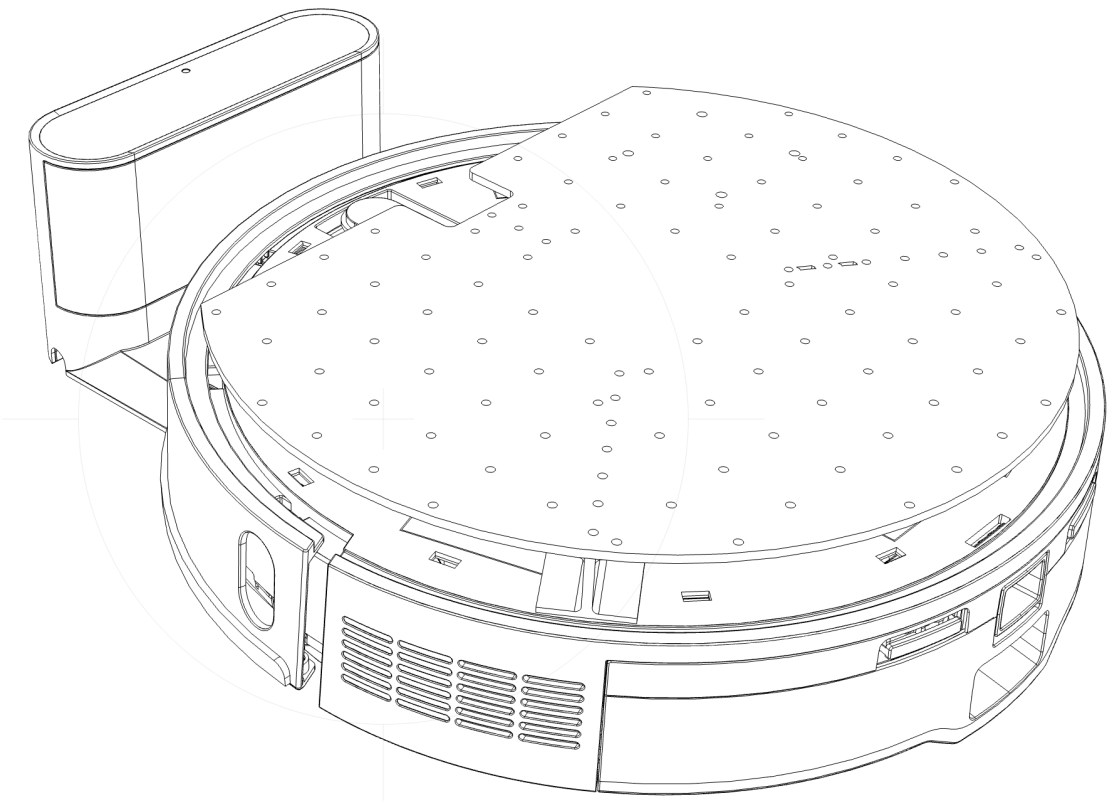
HACKERBOT INDUSTRIES

Getting Started with the **Hackerbot Base**



Document Revision - R1.7 : Updated - 12-05-2024

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Preface

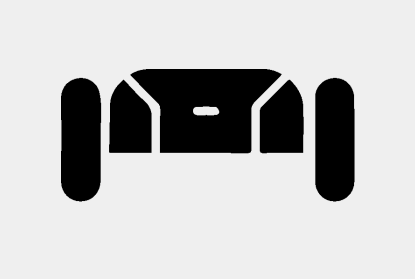
What is the Hackerbot Base?

The Hackerbot Base serves as the **Mobility** platform within a modular, three-part programmable robotic system. This system is designed to incorporate two additional components:

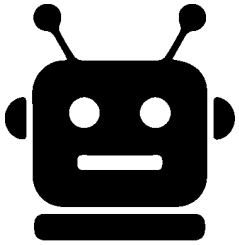
- **Head Module** – Designed for emotional response and character interaction, enabling advanced human-robot engagement and personality customization.
- **Arm Module** – Engineered for precision manipulation of physical objects within the environment, expanding the robot's functional capabilities.

These additional components are integrated into the **Hackerbot AI Pro, AI Reach, and AI Elite** models, providing a comprehensive solution for advanced robotics applications.

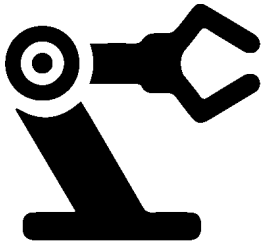
NOTICE: **Hackerbot AI** will be diagramed in this document, but the general information applies to the **base** of all the other Hackerbot models as well.



Hackerbot Lite, AI, Pro, Reach, Elite



Hackerbot AI Pro, Elite



Hackerbot AI Reach, Elite

Resources for Help

If you encounter any issues or things aren't working as expected, don't worry—**we're here to assist you!**

Get **Help**, Find **Documents**, and Join the conversation with us over on **Discord**.

Discord https://discord.gg/TXaJ7WSpD8

store.hackerbot.co

- **Purchase** Replacement Parts, Cables, Robots and Upgrades.

Technical Specifications

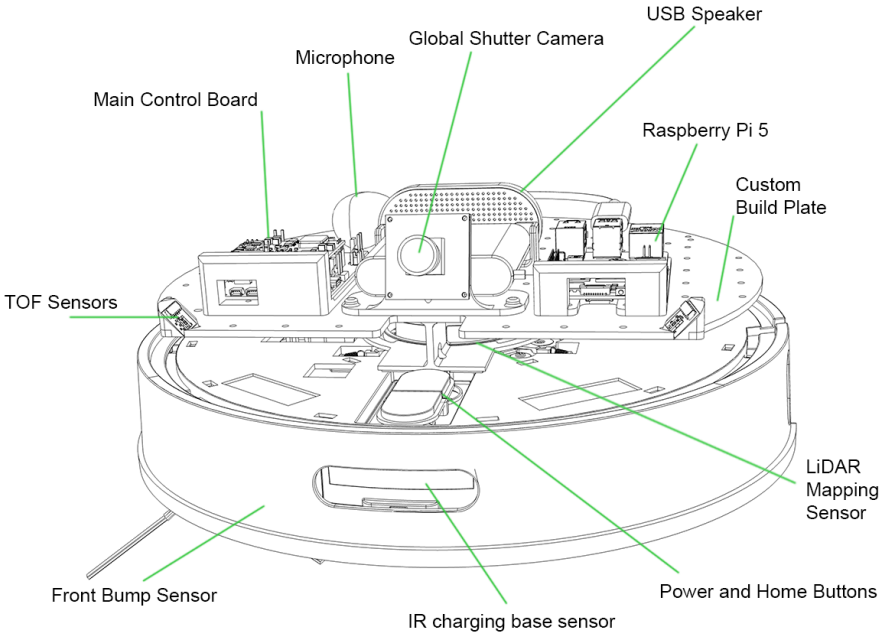
Hackerbot Base / Lite Model

- **Power Supply:**
  - Input Source : 19V DC @ 4.7 Amps to Charging Station
  - **Output on Robot : 5V DC @ 5 Amps**
- **Batteries:**
  - External Battery : 1100 mAH Lithium Polymer Battery (LiPo)
- **I/O Ports:**
  - Serial Port : UART 2300400 Baud 8NE
- **Sensors:**
  - LIDAR : Mapping and Obstacle Detection
  - Physical Bump Sensors x 2 : Obstacle Avoidance
  - Cliff Sensors x ? : Fall Avoidance
- **Connectivity:**
  - 2.4 GHz wireless network : Used for firmware updates and connection to the mobile App
- **Physical Dimensions:**
  - Weight :
  - Size :
  - Carrying Capacity :
- **Materials and Durability:**
  - Operating Temperature : 9℉ - 104℉
  - Waterproof : No, Indoor Conditions Only
- **Peripherals:**
  - Add-on Capability : Customizable Mounting Plate
  - Vacuum System :

Hackerbot AI Model

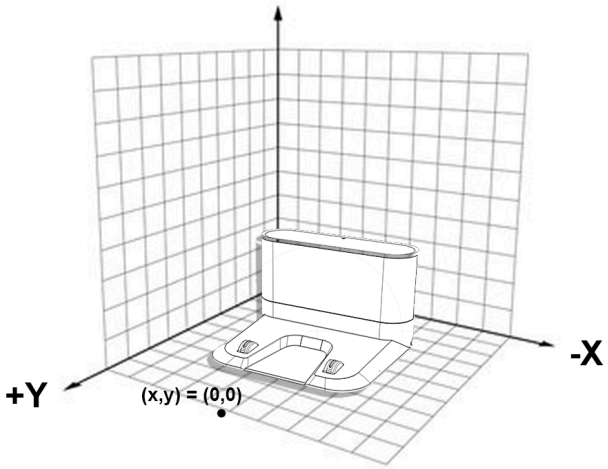
- **Processors:**
  - Raspberry Pi 5 : 2.4GHz quad-core 64-bit Arm Cortex-A76
- **Sensors:**
  - Global Shutter Camera : Object Detection, Vision
  - Time of Flight Sensors (TOF) x 2 : Obstacle Avoidance
- **I/O Ports:**
  - USB Microphone : Voice / Sound Detection
  - USB Speakers : Audio Out

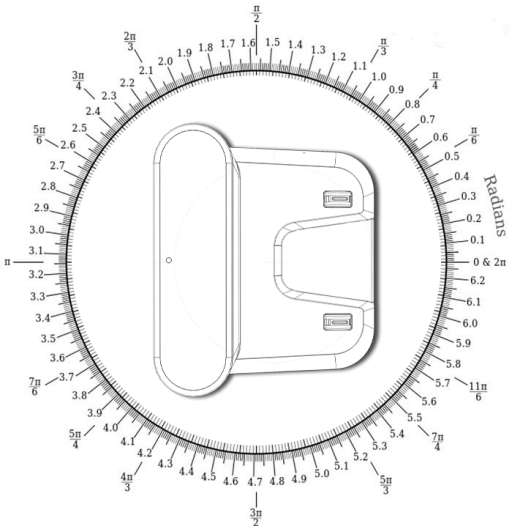
Getting to Know your Hackerbot



Coordinate System

The coordinate system utilized by the Hackerbot is a standard **Cartesian** x, y **system** and is measured in **meters**. This system is centered at **(0,0)** being just in front of the charging station.

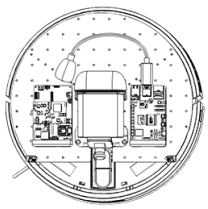




Getting Started

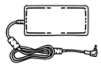
Unboxing Your Hackerbot

Hackerbot Base



Charging Station

AC Power Supply



When unboxing your Hackerbot, you will notice several essential components included to ensure functionality and ease of use. All Hackerbot units are equipped with a **Charging Station** and a compatible **power supply** as standard accessories to support charging and long-term operation.

NOTICE: Power Supply is **120V AC** US Plug

The specific additional components provided depend on the model you selected, ensuring that each configuration is tailored to meet the needs of different use cases and user expertise levels.

1. **AI Models (Hackerbot AI, AI Pro, AI Reach, AI Elite)**
   If you purchased one of the AI series models—Hackerbot AI, AI Pro, AI Reach, or AI Elite—your package will include all the necessary hardware and software features to implement and test AI-based projects in real-world scenarios. These models come pre-configured with the essential tools for deploying and evaluating machine learning and artificial intelligence algorithms, offering a streamlined experience for advanced robotics and automation projects.

2. **Hackerbot Base Model**
   The Hackerbot Base model is specifically designed for users who wish to create a fully customized robotic control system. It is compatible with any System-on-Chip (SoC) or microcontroller platform capable of UART communication at a baud rate of 9600. This flexibility allows developers to interface with various chipsets and development boards, making the Base model an excellent choice for those seeking to experiment, prototype, or design bespoke solutions.

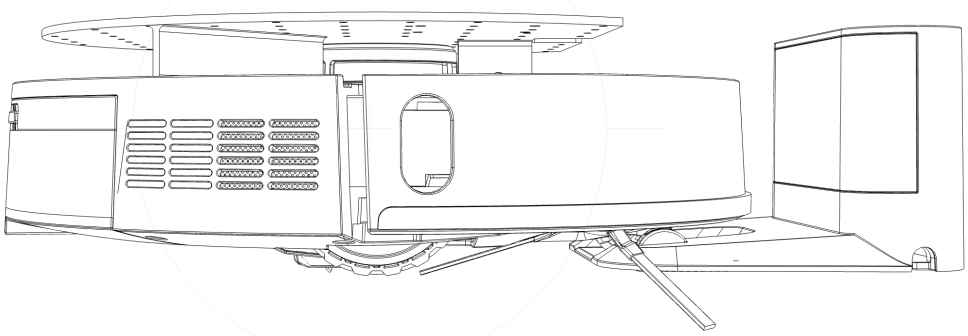
Setting Up Your Hackerbot

- **Connect the charger to a wall outlet**

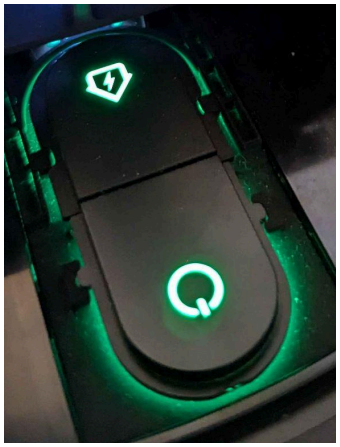
  Pick a spot that offers at least 2 feet of horizontal space. Ideally, this should be in a room with minimal foot traffic and where the furniture arrangement remains stable.

- **Position the base securely on the charger.**

  Ensure the base is properly positioned and securely placed on the charging station to guarantee stable contact and efficient charging. Verify that the alignment is correct and that the base is fully seated to prevent interruptions or charging errors.



- **Press and hold the power button**



To turn on your device, press and hold the **Power Button** located on the top of the hackerbot until the lights turn green.

Pressing the **Home Button** will send the robot to the charging station.

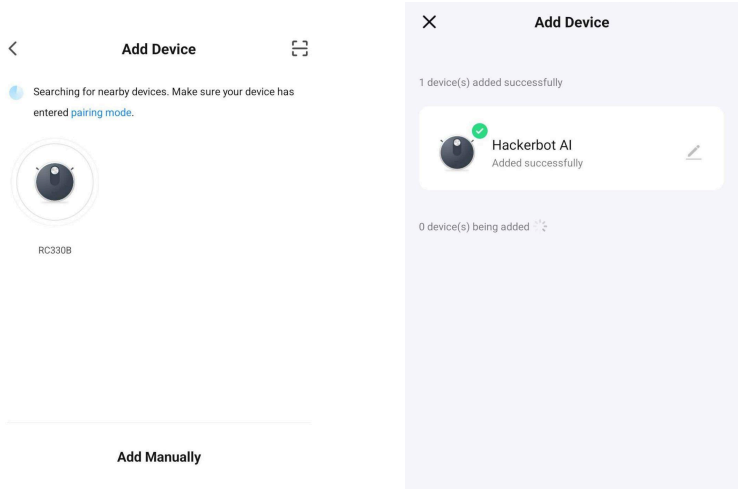
Making Your First Map

The **Tuya Smart app** is a versatile smart home application that plays a crucial role in creating the initial map for your Hackerbot. To get started, simply **download** the app from the Apple App Store or Google Play Store.

- Apple
  https://apps.apple.com/us/app/tuya-smart/id1034649547
- Google Play
  https://play.google.com/store/apps/details?id=com.tuya.smart

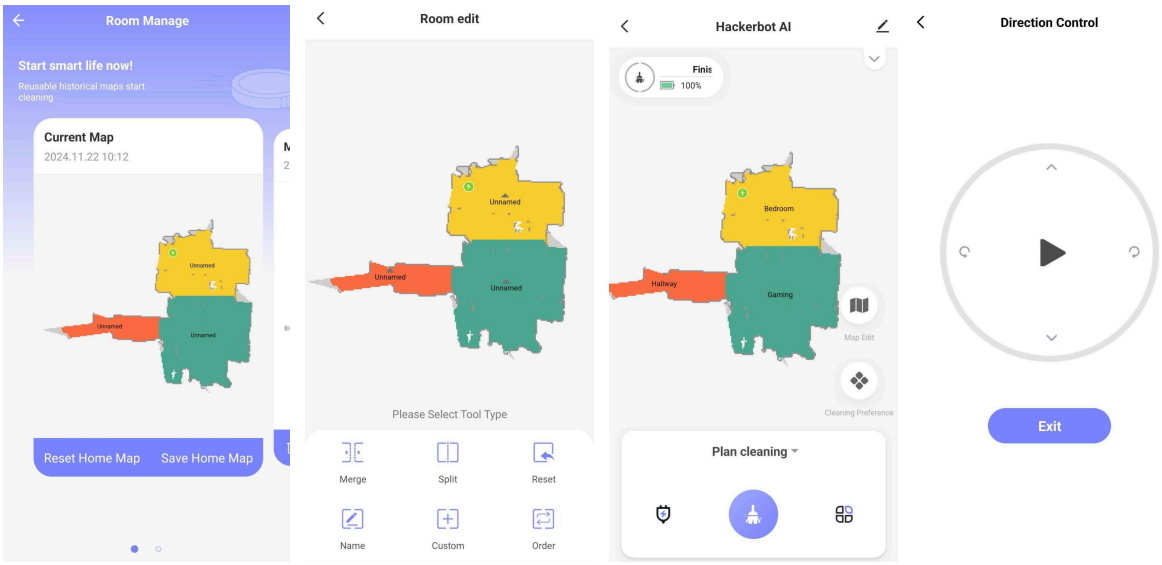
TROUBLESHOOTING TIP : If the Hackerbot does not appear in the application.
It is often due to a prior connection with another user's account. To resolve this issue, reset the robot's Wi-Fi settings and attempt the connection again.
• Press and hold both the **Home** and **Power** buttons until you hear the base announce, "Wi-Fi reset."

1. **Launch the application and add a new device.**



2. **Navigate to the robot and make a new map**
   a. Navigate to Settings, select Manage Room, and then choose Save Map as Home. This action will generate a map of the room

3. **Customize your map and robot within the application.**
    a. Assign specific names to the various rooms and sections within your map for easier identification and organization. Navigate the robot or locate it by utilizing the application to control its movement or trigger an audible signal.

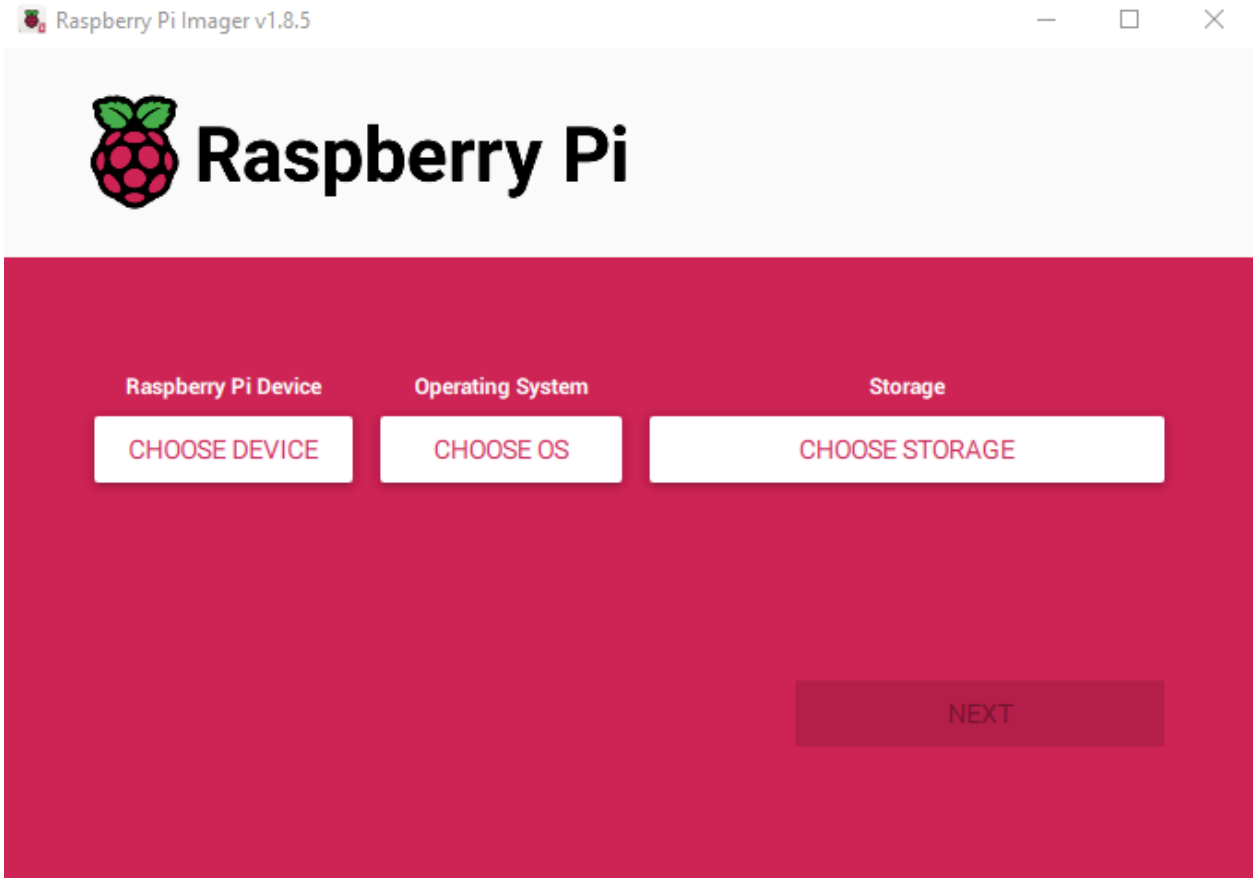


Setting up your Raspberry Pi

Install the Raspberry Pi OS + WiFi

Step 1: Download and install the Raspberry Pi Imager
[Raspberry Pi OS – Raspberry PiRaspberry Pi]

Step 2: Insert the included 64GB MicroSD card into your computer and open the Raspberry Pi Imager. Click **"Yes"** if prompted to allow the software to make changes to your device.



Step 3: Click on **"CHOOSE DEVICE"** and select **"Raspberry Pi 5"**

Step 4: Click on **"CHOOSE OS"** and select **"Raspberry Pi OS (64-bit)"**

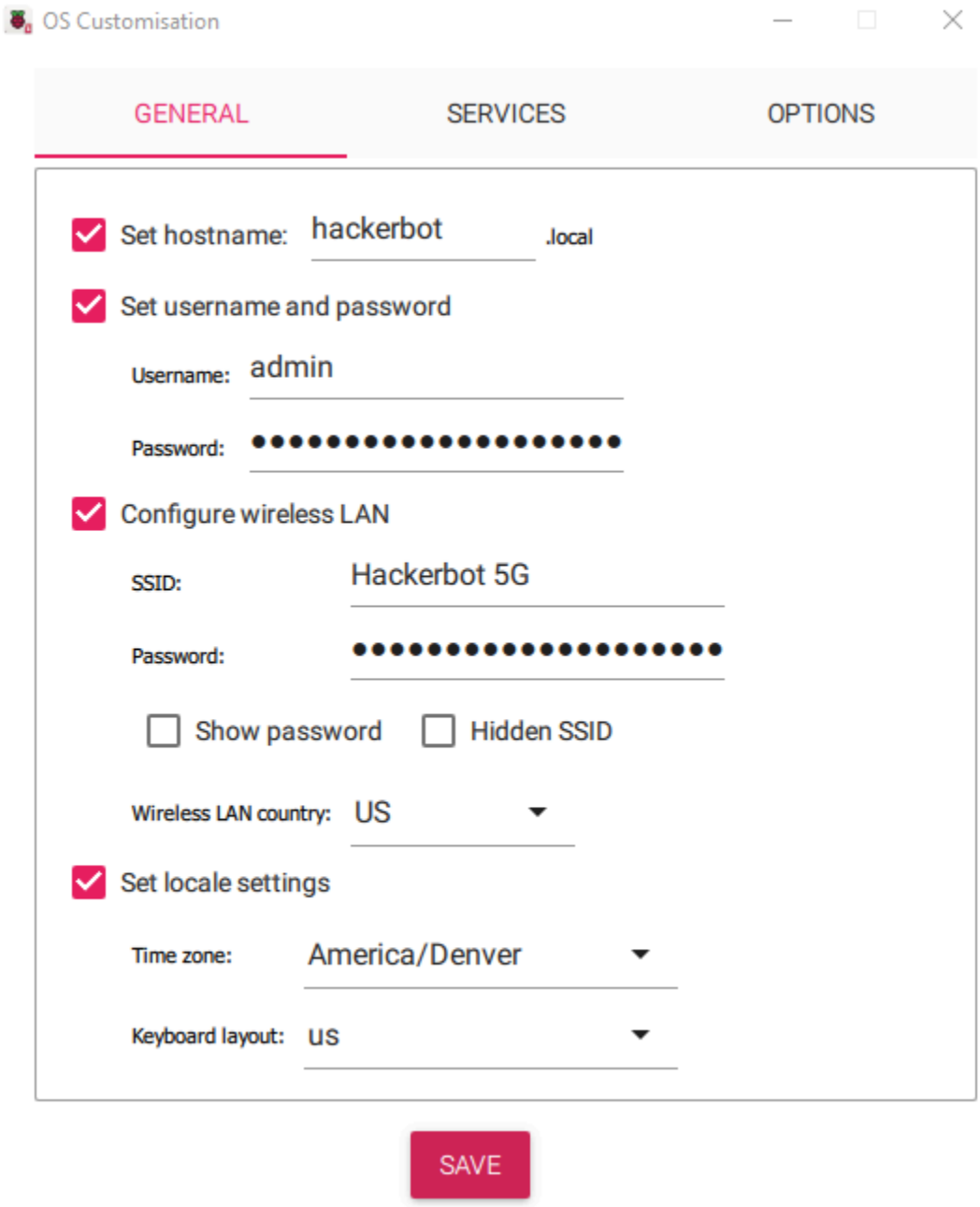
Step 5: Click on **"CHOOSE STORAGE"** and select the MicroSD card. This will show up as something like **"Generic STORAGE DEVICE USB Device - 62.5 GB"**. Then click "NEXT"

Step 6: On the **"Use OS customization?"** window click **"EDIT SETTINGS"**. Under **"GENERAL"**...

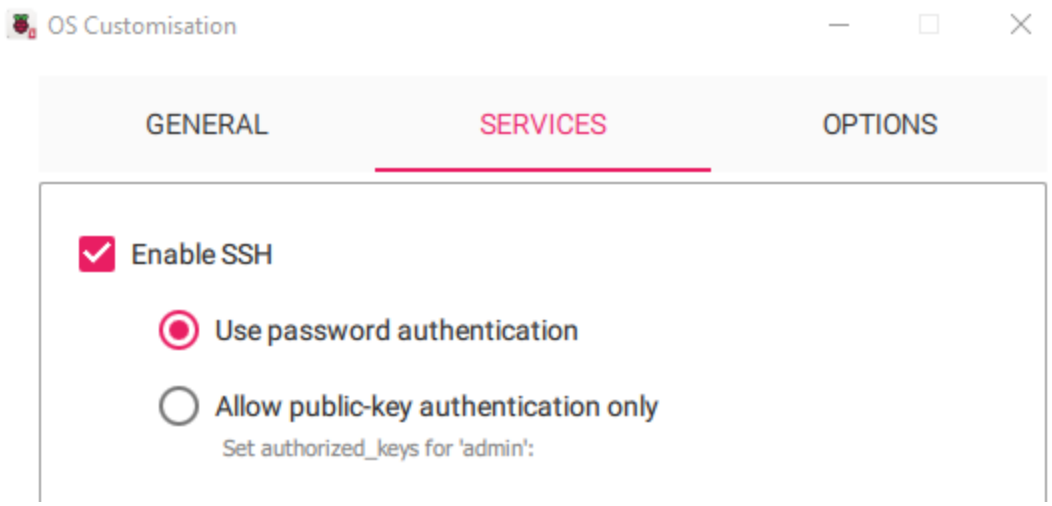
Set a **hostname** to something unique on your network. Like "hackerbot", or, if you have more than one robot, something like "hackerbot2".

You can also name your robot here, like, "jim". **Don't forget this name!**

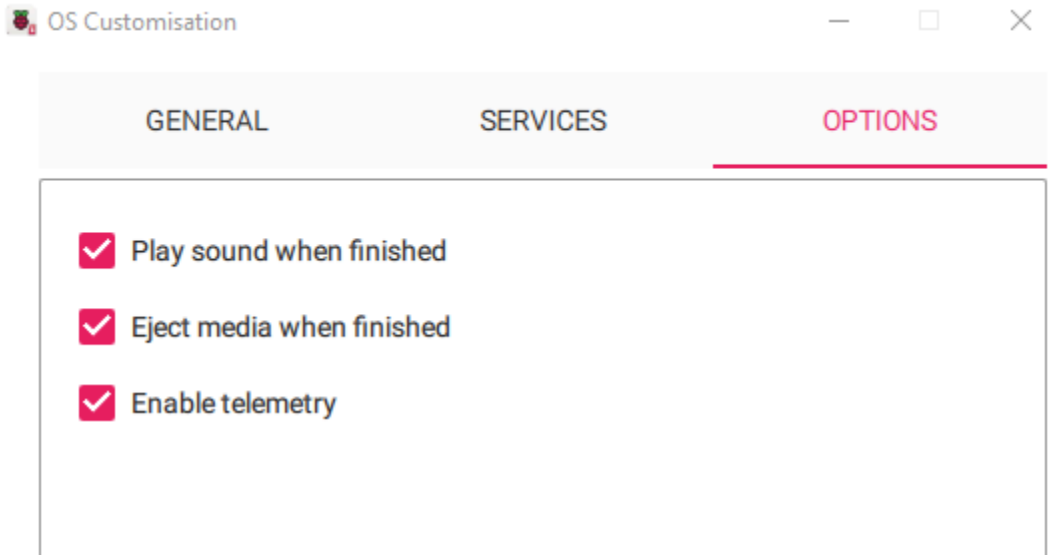
- Create a username and password. **Again, don't forget this information!**
- Enter your WiFi's **SSID** and WiFi **password**
- Set your time zone and keyboard layout



Under the **"SERVICES"** tab enable SSH and **"Use password authentication"**

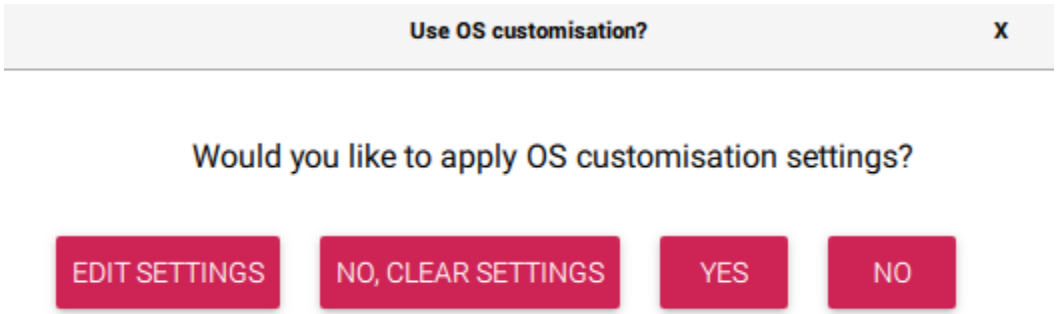


Finally, check all of the boxes on the **"OPTIONS"** tab.



Click **"SAVE"**

Step 7: Apply OS Customizations

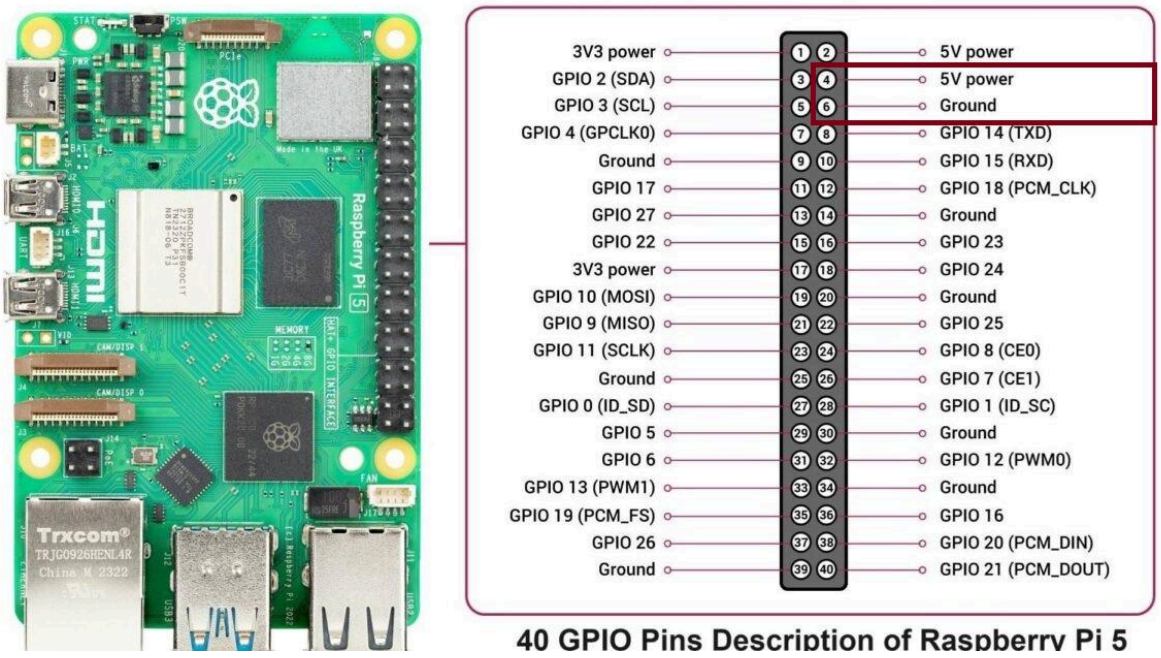


Press **"YES"** and **"YES"** again confirmed that the SD card would be erased. The writing and verification process takes 5-10 minutes, so feel free to move on to the next step.

Step 8: When the process is finished, **remove** the MicroSD card from your computer and insert it into the Raspberry Pi 5 on your hackerbot using the included smart **tweezers**.

Powering Up Your Raspberry Pi

A Crucial Step !
[Picture of the power plugged in on a hackerbot up close.]



40 GPIO Pins Description of Raspberry Pi 5

Connecting to Your Hackerbot

Step 1: Open a Terminal Window

On Mac OS, open a **"Terminal"** window.
On Windows, open a **"Windows PowerShell"** window.

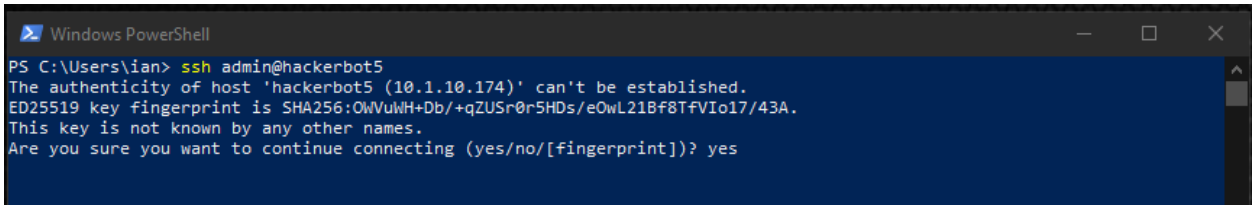
Then enter, **"ssh <your_rpi5_username>@<your_robot_hostname>"**.

The **username** and **hostname** are the ones you set in the Raspberry Pi Imager setup screens.

For example...

```
ssh admin@hackerbot
```

When asked if you are sure you want to continue type '**yes**' and hit the enter key



Next, when prompted, enter your **password**. Then hit the enter key. You are now connected to your Raspberry Pi 5 over the WiFi network.

Step 2: You will now want to enable **VNC**. Type...

```
sudo raspi-config
```

Now use the arrow and enter keys to go into **"3 Interface Options"** and then **"3 VNC"**. Set enabled to **<Yes>**. F exit out by selecting **<Finish>**.

Step 3: Download the open-source VNC client called **"Tiger VNC"**

TigerVNC is a free and open-source implementation of the Virtual Network Computing (VNC) protocol, which
allows users to remotely access and control a computer over a network connection.

- **Mac & Windows**

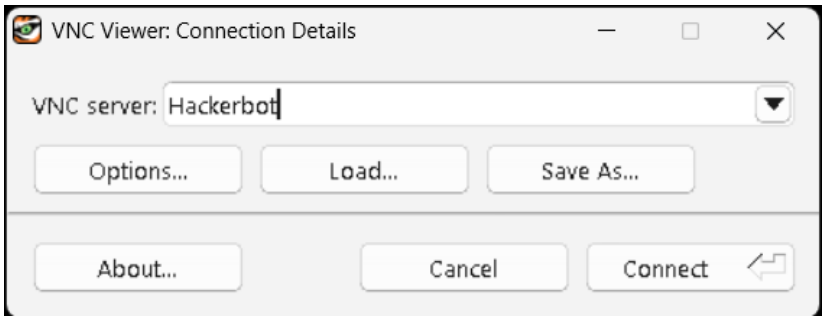
  https://github.com/TigerVNC/tigervnc/releases

- **Linux**

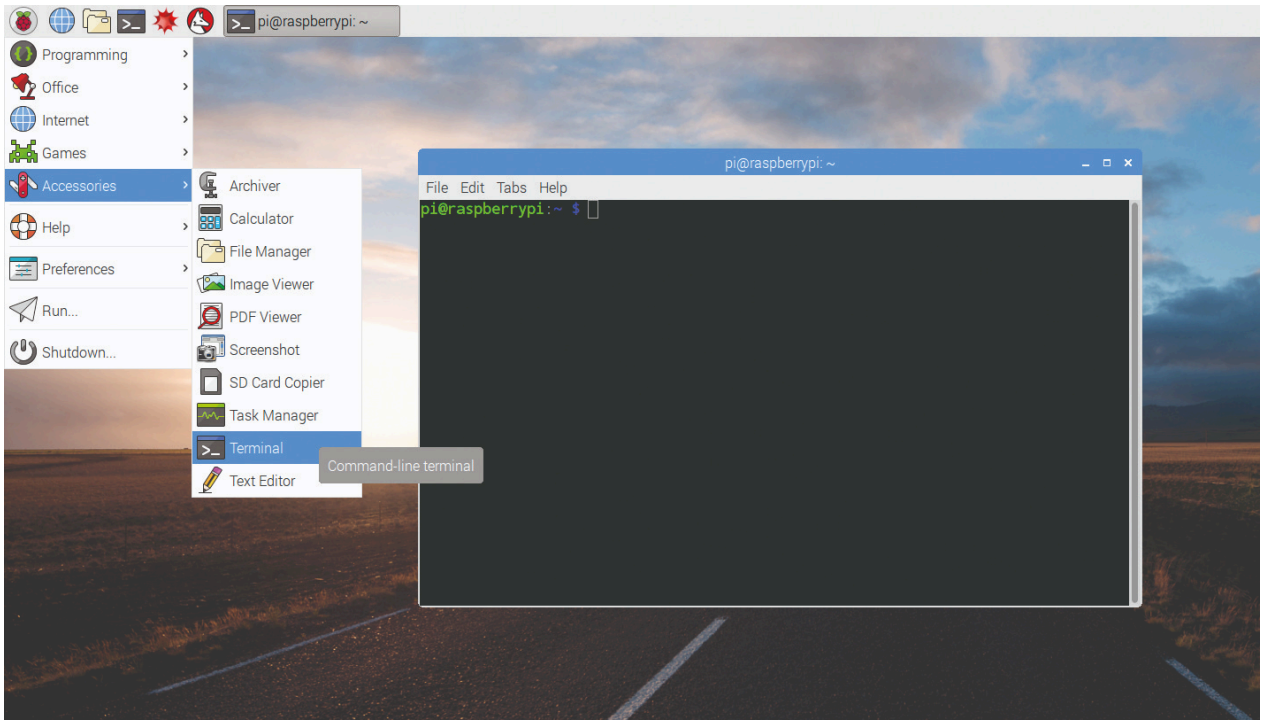
```
sudo apt install tigervnc-standalone-server
```

Step 4: Connect to your Hackerbot's VNC Server

- Recall your **Hostname** and enter it into the vnc server box



- Enter your **Username** and **Password** and Connect to your Hackerbot
- Open a new **Terminal** once you are connected to your Hackerbot



Step 5: Test out your Hackerbot with **Simple Serial Commands**

Install **Minicom** the text-based terminal emulator

```
sudo apt install minicom
```

- Run **Minicom** and connect to the internal system inside the Hackerbot.

This is connecting to the serial port at **/dev/ttyAMA0** running at **9600** Baud

```
minicom -D /dev/ttyAMA0 -b 9600
```

You are now connected to the Serial Port of the internal system. Before the system will take commands it must be initialized.

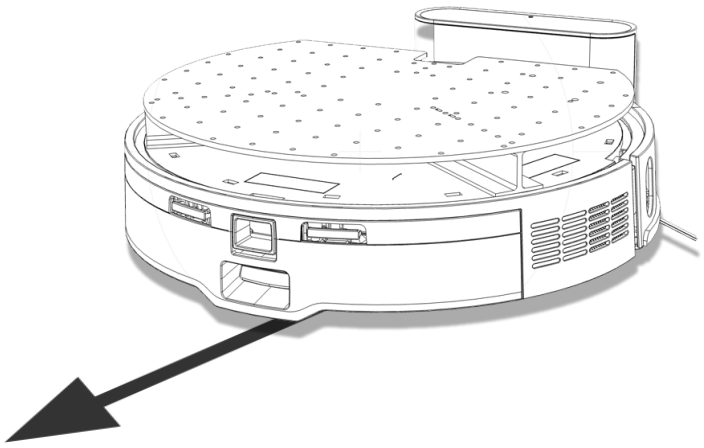
Send the **INIT** command to start things up.

```
INIT
```

Send a **GOTO** Command to the hackerbot

```
GOTO,1,1,0,0.1
```

Upon successful execution of the commands, the robot will advance slightly to the position (1, 1) in the coordinate system, oriented straight ahead with a heading angle of 0 radians. It will reach this position at a velocity of 0.1 units, which serves as an optimal initial speed for verifying proper functionality and system responsiveness.



Programming Your Hackerbot

A wealth of resources is available online to help you learn how to program your Hackerbot effectively. The primary repository of information can be found on **GitHub**. This comprehensive resource includes **source code, example projects, CAD models,** and **URDF files** for simulation purposes, providing all the tools you need to get started and expand your capabilities.

https://github.com/hackerbotindustries

Sending Commands Over the Serial Port

If you would like to test out some simple commands, the following can all be accessed the same way as the tutorial above. All commands use a **, comma** as the separator between command and parameters. Send commands via the Serial Port **/dev/ttyAMA0** at **230400** BAUD.

PING	
INIT	
GETML	
ENTER	
GOTO	`float: x, float: y, float: angle, float: speed`
DOCK	
BUMP	`bool: left, bool: right`
MOTOR	`int16_t: linear_velocity, int16_t:`

Example Command

```
GOTO,1,1,0,0.1
```

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