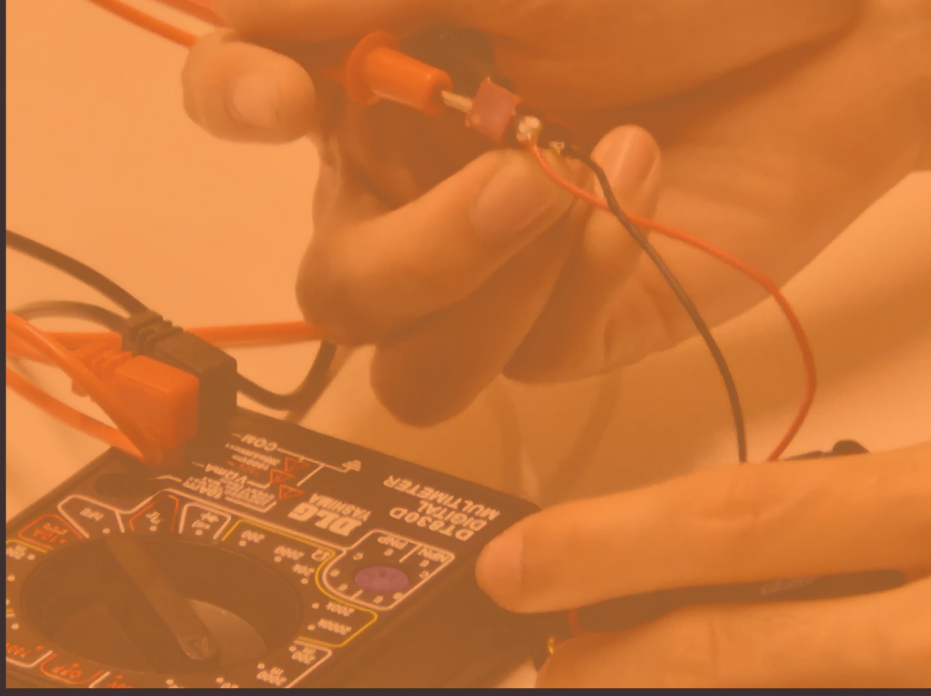


Autonomous Soccer Robot Kit

ASSEMBLY MANUAL

Table of Contents

1. Introduction

1.1 Brief Overview of the [Organization Name]

The [Organization Name]is an innovative 3-wheeled autonomous soccer robot designed for education, experimentation, and competitive robotics. Equipped with a full suite of sensors, including 3 line sensors, 8 ball sensors, and a 9-D compass, the [Organization Name] delivers high-performance navigation and ball-tracking capabilities. Its three omni-directional wheels, powered by precision 15:1 gear motors, enable smooth and agile movement in all directions, making it ideal for dynamic robotics applications like robot soccer.

Built around the Arduino-compatible Teensy 4.1 microcontroller board, the [Organization Name] can be extended by adding a camera or other additional sensors, actuators, and communication modules. Such additional components can easily be connected to the UART and I2C serial communication ports, and to several open digital and analog in-out pins on the [Organization Name] circuit board. The board also includes two programmable push buttons (labeled Pin 9 and Pin 10), which can be used for initiating test programs or triggering user-defined functions during development.

The system uses 3.3V/5V logic and offers flexible power options with a 6–8.4V DC battery input (4–6 AA or 2S LiPo). Once assembled, the [Organization Name] can be programmed in C or C++, and is compatible with Windows, Mac, and Linux systems.

1.2 Purpose of the Assembly Manual

This assembly manual serves as a comprehensive guide to help users construct their [Organization Name] from the kit components. It provides step-by-step instructions, ensuring that even users with limited prior experience can successfully assemble the robot.

1.3 Recommended Audience

This assembly manual is recommended for users with a basic understanding of electronics and mechanics. The instructions are written to be beginner-friendly, but some familiarity with tools such as a soldering iron, wire strippers, screwdrivers, and pliers will be beneficial.

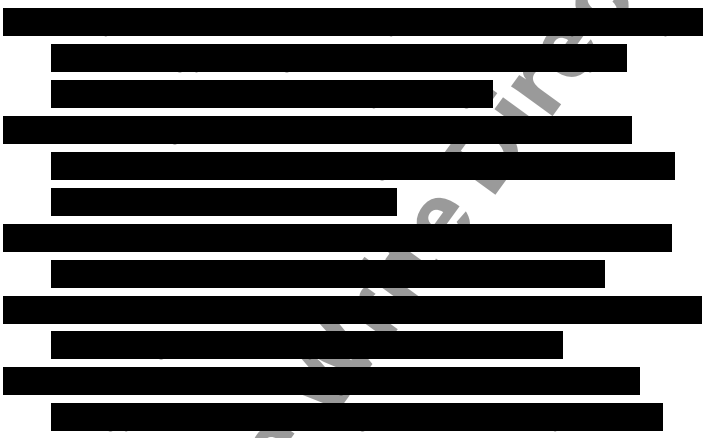
The robot's programming in C++ and its modifiable nature makes it suitable for hobbyists, students, and educators interested in robotics, programming, and autonomous systems. Familiarity with C or C++ and using Arduino IDE or VS Code with PlatformIO are beneficial but not required for assembling the [Organization Name]. The complexity suggests it is appropriate for teenagers and adults.

[Organization Name] is designed to teach real robotics: The hard and software feature state of the art embedded systems programming (ARM Cortex-M7) that can directly be applied to university and industry applications in robotics and microelectronics.

2. Safety Warnings

2.1 General Precautions

Building robotic kits involves working with various tools and electronic components. Safety is paramount. Please read and adhere to all safety warnings and precautions before, during, and after the assembly process.



2.2 Specific Warnings

2.2.1 Soldering Iron Safety

The soldering iron operates at high temperatures and can cause severe burns.

The biggest source of accidents is the soldering iron not being in the holder. It can melt the power cable and cause a 110V short circuit, or ignite paper or wood and cause a fire.

[redacted]

2.2.2 Wire Clipping Hazards

Trimming wires can cause small pieces of metal to become airborne.

[redacted]

2.2.3 Battery Handling

Improper battery handling can lead to leaks, fire, or explosion.

[redacted]

[redacted]

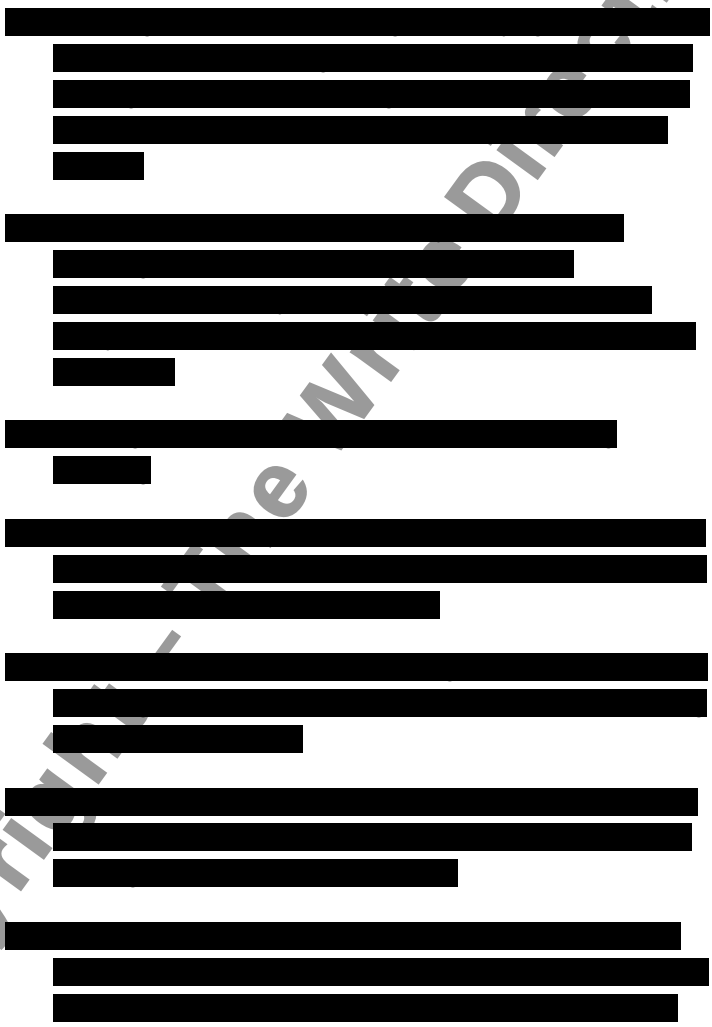
2.2.4 General Tools

[redacted]

3. Tools and Materials Required

3.1 List of Tools

A successful assembly of the [Organization Name] requires a few essential tools. Having these readily available before you begin will enable a smooth and efficient building process.

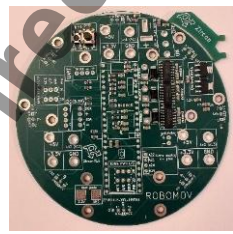
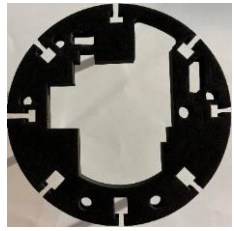


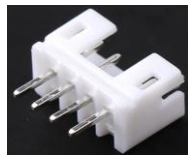
Robomov's all-in-one toolkit comes in a single pouch with everything needed to assemble, maintain, troubleshoot, and upgrade your [Organization Name].

4. Parts Inventory

4.1 Illustrated Parts List

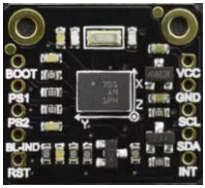
The following is an inventory of all components included in the [Organization Name]kit.

	Image
[redacted]	
	
	

ZC202	Electrical Parts	Switch	1	An on/off switch to control the battery power supply to the [Organization Name] Board. (The	
					
					
					

[redacted]

ZC207	Electrical Parts	Ball sensors (infrared pulse sensor TSSP4038)	8-9	Infrared pulse sensors to be positioned around the [Organization Name] board's perimeter to detect the soccer ball	
[redacted]					
					
					
					



[redacted]

[redacted]

5. Assembly Instructions

A video tutorial is available at [https://robomov.net/blogs/[Organization Name]-tutorial](https://robomov.net/blogs/[Organization Name]-tutorial)

Note that the order of steps might be different in the video tutorial. In this manual, we will solder the motor and compass sensor first, in order to gain practice soldering before working on the [Organization Name] Board directly.

5.1 Step-by-Step Process

Before you begin, ensure you have all the parts listed in the "Parts Inventory" and the tools outlined in "Tools Required" readily available.

Step 1. Assembling the motor casings and Soldering cables to the motor leads

In this step, you will prepare your motors

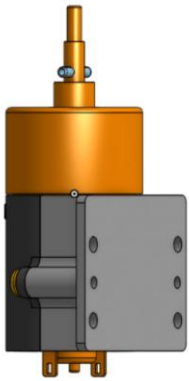
1.1 Assemble motors with motor holders and spring

[redacted]

2. Screw the motor holder tight around the motor with two screws (Do not use excess force with the screwdriver, or the motor holders' plastic might be damaged).
3. Insert the spring into the hole in the motor shaft.

[redacted]

[redacted]



1.2 Solder wires to motor tabs

[redacted]

1. For each of the three motors, take one pair of the provided wires
2. Use the wire stripper to strip about 3/8 inch (10 mm) of the red and black plastic coating off each wire end to expose the small copper wires

[redacted]

3. Carefully solder one wire to each of the two metal tabs on the motor. The polarity determines which directions the motors will move. Make sure to attach the red wire to the tab near the + sign.

4. Repeat this process for all three motors.

- In case a lot of wire is exposed at the motor terminals, it is a good idea to add a piece of electrical tape or duct tape to cover it, to prevent any short circuit.

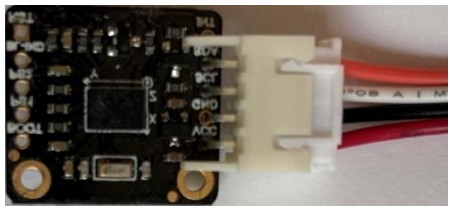
Put the assembled motors aside for later.

Step 2. Soldering and connecting the compass sensor

2.1 Solder the I2C connector to the compass sensor

- Materials: Compass sensor (x1), 4 pin I2C connector
- Tools: Soldering iron, solder, wire clipper
- Instructions

[redacted]



2. Turn the sensor with the mounted JST socket bottom up, so expose the four leads of the socket protruding to the bottom side of the circuit board. Feel free to use a piece of masking tape to hold the socket tightly in place

3. Soder only one pin at first

4. Turn around the sensor and make sure everything sits correctly (with any masking tape removed)

5. Solder in the remaining 3 leads just like under step 3 above

6. Use the wire clipper to clip off the small protrusions of the soldered leads on the bottom side of the sensor

2.2 Connect the compass sensor

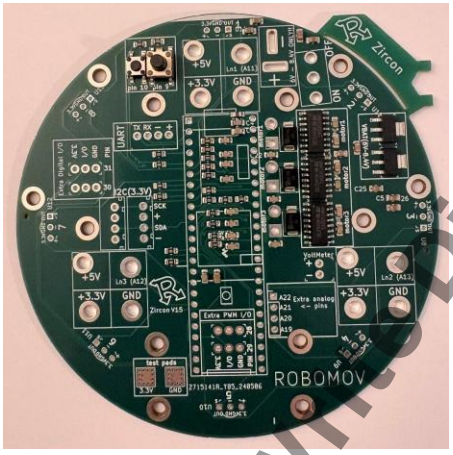
- Materials: Compass sensor with attached JST connector from previous step, 4 pin compass cable
- Tools: None (connection is plug-and-play after soldering the 4-pin JST port)
- Instructions

The robot can function without the compass sensor, so you may put aside the sensor and wait to plug it into your [Organization Name] after you are familiar with the basics of programming and using it.

Step 3. Soldering through-hole components to the main circuit board

In this step, you will solder the foundational electronic components to the [Organization Name] circuit board. Precision is crucial for the

robot's functionality. Solder should flow into each hole to tightly connect components, but be careful not to give too much solder and risk forming solder bridges between separate connections. Excess solder needs to be removed as described in the trouble shooting chapter.



Orientation of the PCB: top = front, bottom = back, left and right as are

3.1 Remove the hex nut driver

- Materials: [Organization Name] PCB (x1)
- Hands, or wire cutter
- Instructions

[redacted]

3.1 Solder female header pins, 4-pin JST port, and ball sensors

- Materials: 24 pin Female header pins (x2), 4-pin JST port (x1), ball sensors (x8), [Organization Name] circuit board (x1)
- Tools: Soldering iron, solder, wire cutter

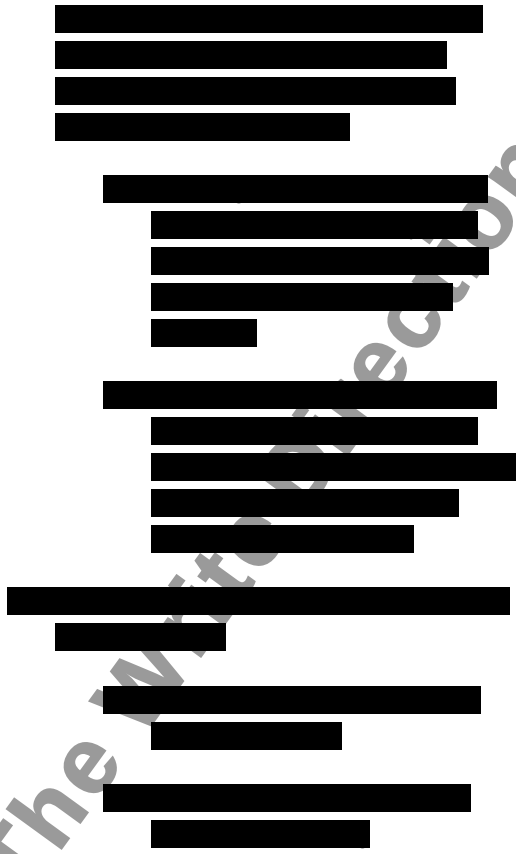
[redacted]

3. Solder all pins onto the circuit board from the underside.

[redacted]

4. Use a wire clipper to cut all the leads flush on the underside of the [Organization Name] board.
5. Solder the 4-pin I2C port

[redacted]



6. Ball sensors

[redacted]

3.2 Install the battery port (Male T connector)

- Materials: Male T connector (x1), [Organization Name] circuit board (x1)
- Tools: Soldering iron, solder, wire cutters
- Instructions
    1. Locate the Male T connector
    2. Position your [Organization Name] circuit board with the component side facing upwards
    3. Insert the Male T connector into its designated slot on the circuit board
    4. Carefully turn the board over and solder the two pins of the connector to the pads on the underside of the board

[redacted]

[redacted]

5. Clip flush the leads on the underside of the circuit board. Considerable hand power is required to clip thick leads of the T connector.

3.3 Attach the On/Off Switch

- Materials: Switch (x1), [Organization Name] circuit board (x1)
- Tools: Soldering iron, solder, wire cutters
- Instructions

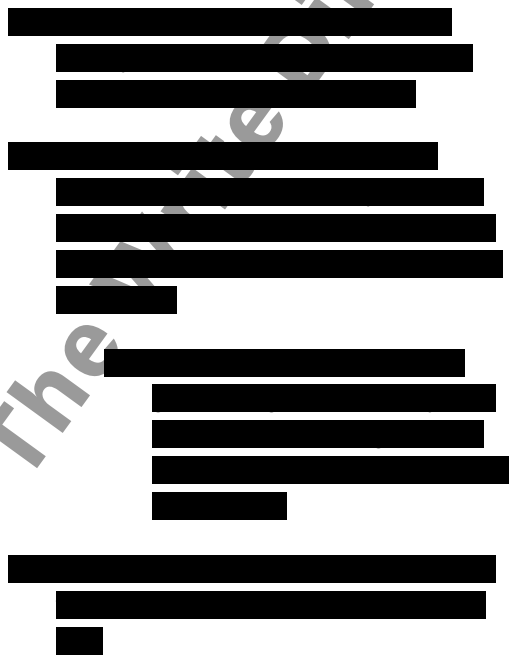
[redacted]

    - The switch lead has a thickness that is particularly prone to flying away at high speed when trimmed. Be careful to aim away, don't aim at your or someone else's eyes!

3.3 Solder the Motor Wires and attach Motors

- Materials: Assembled motors from step 1.2 (x3), [Organization Name] circuit board (x1), M3 machine screws (x12), spring washers (x12), hex nuts (x12)
- Tools: Soldering iron, wire, wire cutters, Phillips screw driver, pliers
- Instructions:

1. Insert the motor wires into the circuit board



2. Turn around the circuit board, component side up, and solder in the motor wires

Step 4. Assembling and Attaching the Omniwheels

In this step, you will construct the Omniwheels and their attachment to the prepared motors.

4.1 Mount motors to [Organization Name] board

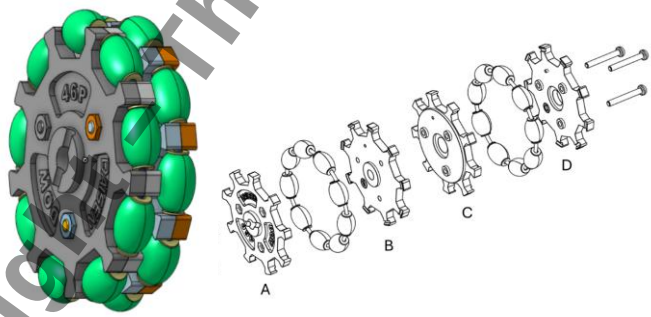
- Materials: Assembled motors with wires)(x3), M3 screws (x12), M3 nuts (x12), [Organization Name] circuit board (x1)
- Tools: Phillips head screwdriver, pliers, wire cutters (for pre-cleaning pins)
- Instructions

2. Mount each motor (repeat for all three motors)

[redacted]

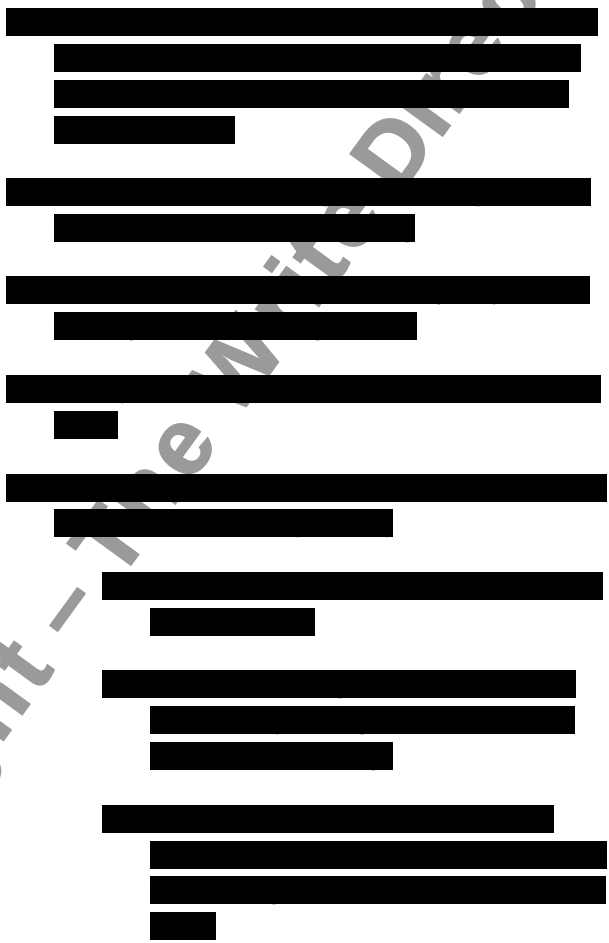
3. Tighten the hardware

[redacted]



4.2 Assemble Omniwheel beads and halves

- Materials: Omniwheel Set (x3 - includes green silicone beads, golden beads, metal rings, black center molds A, B, C, D, small bolts and nuts)
- Tools: Pliers, small Phillips screw driver
- Instructions (for one Omniwheel)



4.3 Attach Omniwheel to motor shaft

- Materials: Motors with shaft pins (from Section 3, as mounted on [Organization Name] board), assembled Omniwheels (x3), 10 mm aluminum standoffs (x3, part of the Omniwheel sets)
- Tools: Pliers
- Instructions

[redacted]

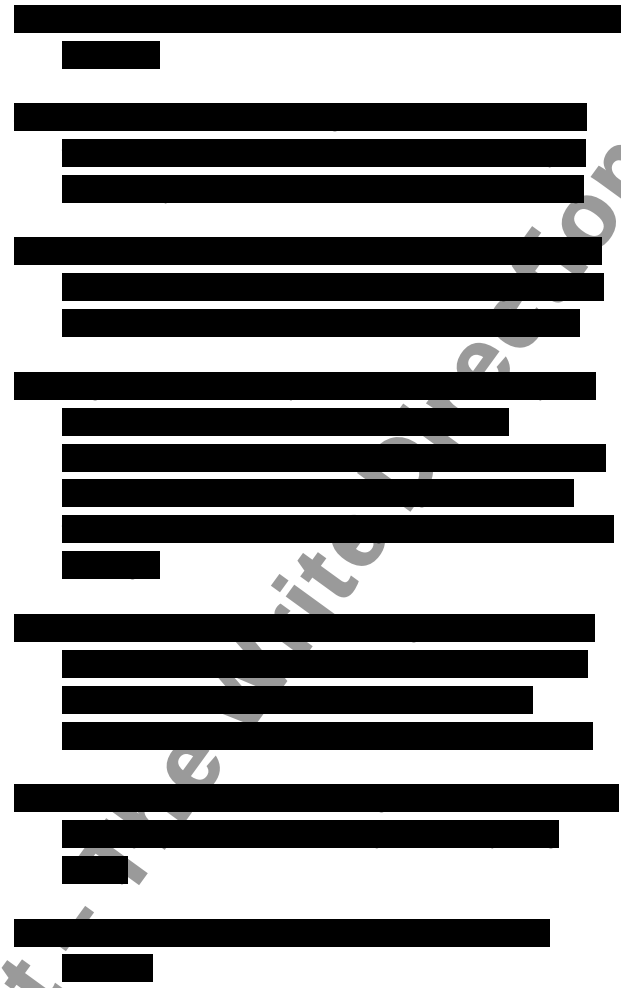
Repeat this process for the remaining two motors and Omniwheels.

Step 5. Attaching Line Sensors

In this step, you will mount the line sensors to the [Organization Name] board.

- Materials: Line sensor (x3), M3 Metal female-female standoffs (x12), M3 bolts (x24)
- Tools: Phillips head screwdriver
- Instructions (for one line sensor)

[redacted]



Step 6. Mounting the Teensy controller board

In this step, you will connect the Teensy microcontroller. Pay extremely close attention to the orientation.

- Materials: Teensy 4.1 (x1), [Organization Name] circuit board (x1)
- Tools: None
- Instructions

[redacted]Take your [redacted]

[redacted]

[redacted]

Step 7. Mounting the Foam Shield

Place the foam shield on the top side of the [Organization Name] board, and gently push it down over the components. Carefully fit the foam shield snuggly around the IR ball sensors and other components. Be careful not to bend any of the line sensors.

The foam shield serves several purposes:

[redacted]

[redacted]

Step 8. Adding the Compass Sensor

Plug the correct end of the 4 wire compass sensor cable into the JST connector on the [Organization Name] circuit board. The directionality of the cable was explained in Section 5.2.2.2.3, “Connect the compass sensor”

When using the [Organization Name] with the standard software library, the software will check whether the compass sensor is present, and if it is, it will wait to hear from the compass that it is calibrated. Calibration requires the sensor to move around. Therefore, for programs that do not use orientation, it is easier to not plug in the compass sensor.

This concludes the hardware installation of the ROBOMOV [Organization Name], making it ready for programming and further experimentation.

5.3 Verification Tips

To confirm proper assembly of our new [Organization Name] before proceeding with programming or advanced functionality, perform the following verification steps:

Verification Tips: How to confirm proper assembly

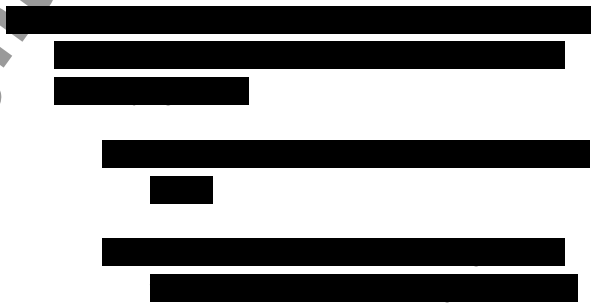
1. Visual inspection before applying power

Thoroughly inspect your assembled robot, focusing on the following areas:

- Solder joints

- Component orientation

- Mechanical fasteners



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Thank you,

The Write Direction Team