



# ARDUINO MATATU PROJECT

MAKE ANYTHING

# Assembly Document

## Introduction:

This kit features a laser-cut plywood matatu chassis, an arduino uno and other electronic components. It is meant to be your introduction to the fascinating realm of Microcontrollers and Programming.

The main features of this kit include:

1. **Arduino-Based:** The project utilizes an Arduino Uno board for central control. The Arduino is programmed to interpret signals from the Bluetooth module or ultrasonic sensor and translate them into commands for the motors, enabling precise control of the car's movements. You can also alter the code to achieve different results.
2. **Sturdy Laser-Cut Plywood Chassis:** The car's chassis is constructed from precisely laser-cut varnished plywood, providing a durable and customizable framework for mounting motors, wheels, and electronic components.
3. **Bluetooth Remote Control:** The car can be wirelessly controlled using a Bluetooth module, allowing you to command its movements from a mobile device using an Android app that you will build. Sounds Interesting?
4. **Obstacle Avoidance:** Equipped with an ultrasonic sensor, the car intelligently detects and avoids obstacles, enhancing its ability to navigate its surroundings seamlessly.
5. **4WD Motorized Movement:** The car is equipped with motors and wheels, enabling it to move forward, backward, turn, and perform other maneuvers in auto mode or based on user inputs, when in manual mode.
6. **Rechargeable Battery:** The car is powered by a rechargeable battery, providing the convenience of portable and untethered operation.
7. **Open-Source:** The project is open-source, encouraging you to modify the design, experiment with additional features, and contribute to the community.

This document will guide you to assemble your Arduino Matatu from the ground up. Before assembly, it's crucial to observe the following safety precautions to ensure a secure and risk-free environment:

1. Carefully read and understand the assembly instructions provided in this document. Familiarize yourself with the steps and components before starting the assembly process.
2. Choose a well-lit and well-ventilated workspace. Ensure the area is clean and free of clutter to prevent accidents and loss of small components.
3. Since this assembly requires some tools, ensure they are in good condition and appropriate for the task. Follow proper tool safety practices, such as using tools for their intended purposes and keeping them in good working order.
4. This Project involves electronics or wiring, making sure to work in a dry environment and avoid water exposure. Disconnect power sources before making any connections or adjustments to prevent experiencing the magic smoke from your electronic components.
5. This kit includes rechargeable Li-ion 18650 batteries. Handle them with care. Follow the manufacturer's guidelines for charging, storage, and usage to prevent damage and other safety issues.
6. If the assembly involves younger individuals or beginners, ensure they are supervised by someone experienced.
7. This kit is not suitable for children under the age of 12. The involvement of tools and electronic components may pose potential hazards for younger individuals. Always adhere to the recommended age guidelines to ensure a safe and age-appropriate experience.

## **Ensure your kit has the following components**

- Laser-cut plywood parts
- Assembly diagram
- 1 X Arduino Uno
- 4 X TT Geared motors with wheels
- 8 X M3\*30 Screws with accompanying nuts
- 1 X HC-05 Bluetooth module
- 8 X M3\*12 Screws
- 1 X 4 cell 18650 li-ion battery holder
- 1 X tp4056 18650 li-ion battery charger
- 1 X LM2596 DC-DC Buck Converter Step-down Power Module
- 4 X li-ion cells
- 2 X White LEDs
- 2 X Red LEDs
- 1 X Buzzer
- 1 X HC-SR04 Ultrasonic sensor
- 1 X SG-90 Servo motor
- 1 X switch
- 1 X Breadboard Power strip
- Jumper wires

## **Tools you should have at hand**

- Phillips screwdriver set
- Super glue\*
- Hot Glue gun and sticks
- Cup of coffee (Optional)

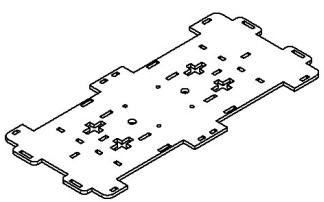
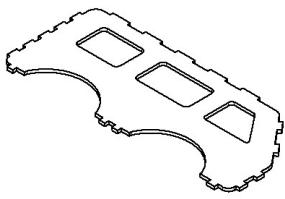
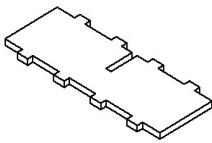
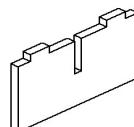
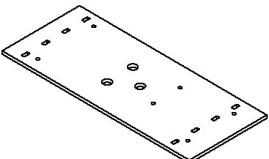
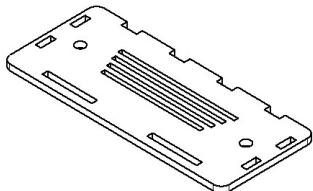
## **RC Matatu Parameters:**

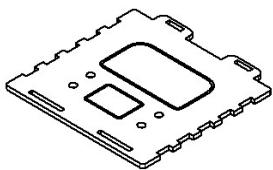
- Programming Software: Arduino IDE, MIT App Inventor
- Inputs: Bluetooth sensor, Ultrasonic Sensor
- Outputs: 4 Geared Motors, Servo motor, LEDs
- Voltage: ~16v (4 18650 Lithium cells), Regulated to 12V
- Battery Life: Use for ~2 hours then charge with provided Charger
- Distance Measuring Method: Ultrasonic Ranging Sensor
- Motor Driver: L298N
- Communication: Bluetooth
- Multi-purpose function: Obstacle avoidance, Obstacle following, Bluetooth Remote control

# Step-by-Step Assembly Instructions:

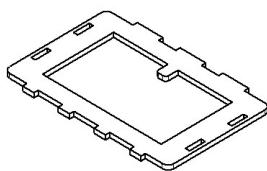
## Assembling the RC car

Your kit should have the following laser cut plywood parts

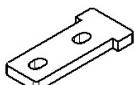
 A large rectangular base plate with a complex, multi-layered slot track pattern along its edges.	 Two smaller, curved rectangular plates, one for the right side and one for the left side, each featuring a central rectangular cutout.
 Two rectangular stand plates, each with a central rectangular cutout and a small protrusion at the top center.	 Two rectangular stand locking plates, each with a central rectangular cutout and a small protrusion at the top center.
 A long, narrow rectangular mid-plate with several circular holes along its length.	 A rectangular front plate featuring a vertical ribbed pattern in the center and two circular holes at the bottom corners.
Base plate. 1 Piece	Right & Left plates. 2 Pieces
Stand plate. 2 Pieces	Stand locking plate. 2 Pieces
Mid-plate. 1 Piece	Front Plate. 1 Piece



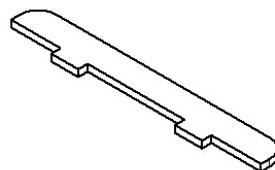
Rear Plate. 1 Piece



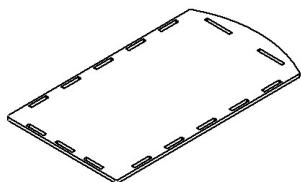
Dashboard. 1 Piece



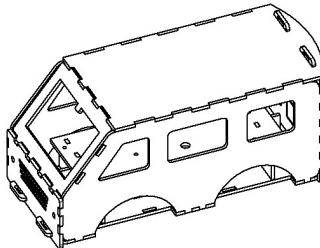
Motor mounts. 8 Pieces



Bumpers. 2 Pieces



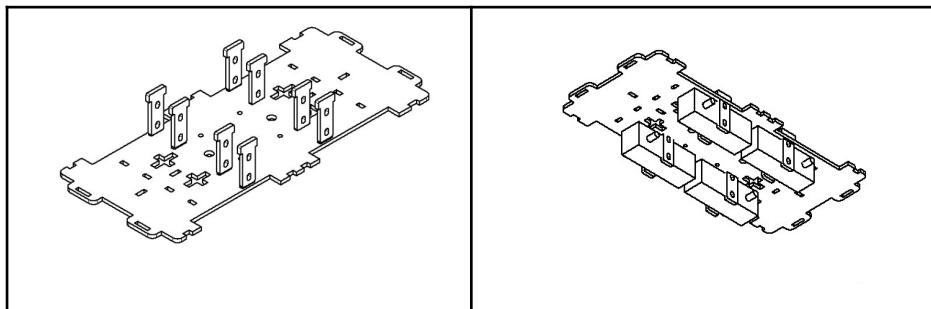
Top plate. 1 Piece



Fully Assembled RC car

## Assembly Steps

### Step 1: Assembling the Base



Place the provided motor mounts onto the designated spots on the base plate. Then, position the TT geared motors beneath the base plate, aligning it between a pair of motor mounts. Next, insert the supplied M3 screws through the holes in one motor mount, and a nut on the other side. Tighten the screw with a screwdriver. Pay attention to proper orientation and alignment and avoid over tightening.

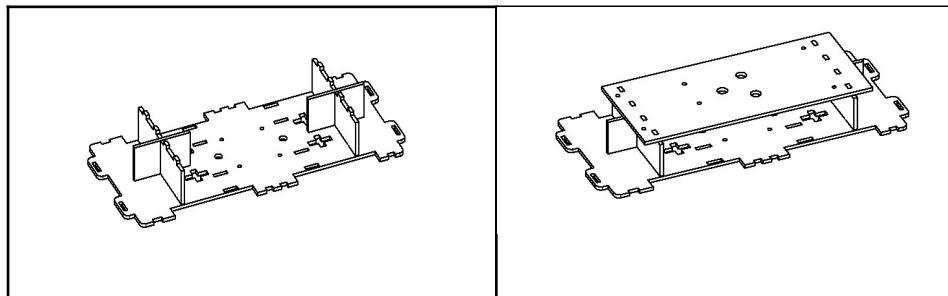
Attach the provided wheels to the motors.

### Step 2: L298n and wiring the motors

Using m3\*12 screws attach the L298n motor driver on the holes provided in the middle of the base plate. Connect the left motors together in a parallel connection and screw in the red and black wires on the screw terminals Out1 and Out2 of the L298n motor driver, respectively. Do the same for the right motors and connect it to the Out3 and Out4.

### **Step 3: Adding the stand and mid plate to the base**

Before this step, connect all wires to the L298n motor driver as shown in the circuit provided.

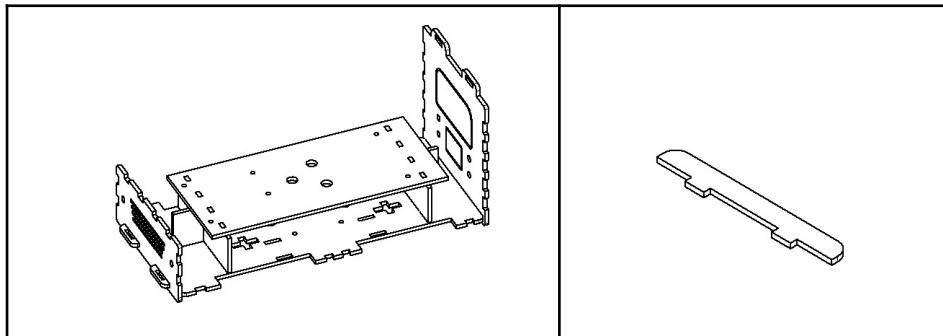


Place the stand plate on the base plate. Attach the locking plate for a tight fit. Place the mid plate and lock on the protruding teeth.

### **Step 4: Connecting the other components**

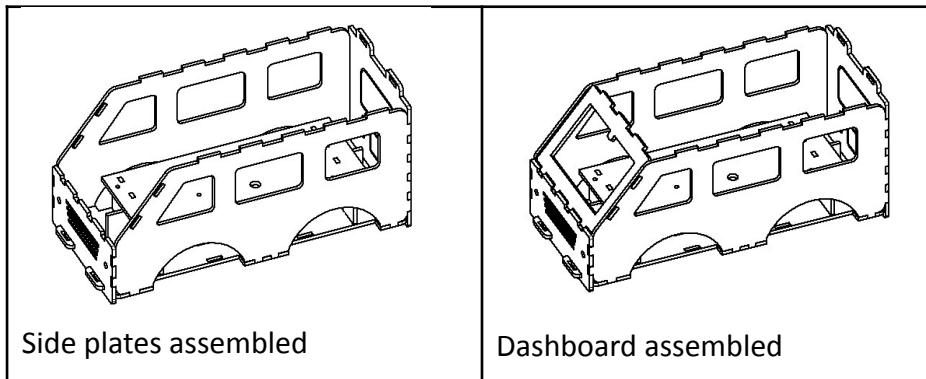
Attach the 4 cell 18650 li-ion battery holder, breadboard power strip, Arduino, and the servo motor on the mid plate. Connect them as shown on the circuit layout.

## Step 5: Assembling the Front and Rear plates



The front lip on the base is longer than the rear lip. Be keen to identify the front and rear part of the base plate. Attach the front and rear plates to the base plate. The protruding finger joints should go in the designated sockets. The bumper plates will fit into the slots on the finger joints. Looks cool!

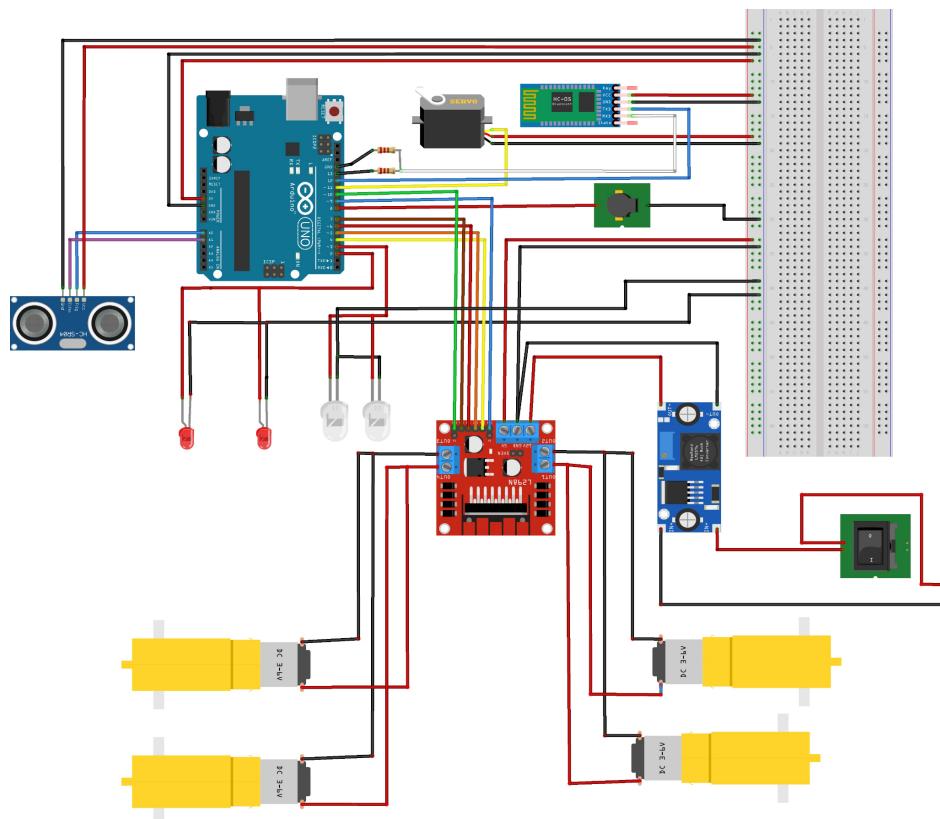
## Step 5: Side, Dashboard and Top plates



Side plates assembled

Dashboard assembled

## Circuit Diagram



fritzing

## Key Components Theory

- L298N DC Motor Driver
- 1 X HC-05 Bluetooth module
- 1 X HC-SR04 Ultrasonic sensor
- 1 X SG-90 Servo motor

Before jumping into the exciting world of programming our Arduino BT RC car, let's take a moment to get acquainted with each component. Understanding their functions and how they seamlessly link up with the Arduino Uno is key. Check out the following links for a fantastic introduction. I highly suggest going through these resources before we dive deeper into the project.

1. **HC-SR04 Ultrasonic Sensor** - [How HC-SR04 Ultrasonic Sensor Works & How to Interface It With Arduino](#)
2. **Servo motor** - [How Servo Motor Works & Interface It With Arduino - Last Minute Engineers](#)
3. **L298N DC Motor Driver** - [In-Depth: Interface L298N DC Motor Driver Module with Arduino](#)
4. **HC-05 Bluetooth** - [In-Depth: Interfacing HC05 Bluetooth Module with Arduino](#)

Now that you have practiced using each individual component in this project, let us fetch the Arduino Code and upload it to our Arduino Uno. We have two Arduino codes for our system.

## **Arduino Codes**

1. Remote control with Bluetooth
  - a. You will use your Android phone with an App that we shall build in MIT App Inventor.
  - b. You can design a user-friendly interface with directional buttons for control.
2. Obstacle Avoidance
  - a. Uses an ultrasonic sensor to respond autonomously when obstacles are detected.
3. With the Components available, you can experiment and modify the code to add more functionality and features to your RC Car. This is the most important and fun part. We encourage you to modify the provided codes, try various codes from the internet, or write new code from scratch.

**Scan the QR Code to get Access to the Codes & files on Github:**



**No Smartphone? Use this Link:**

<https://github.com/nakagwamaragia/Arduino-Matatu-Project>

## **Troubleshooting Tips:**

### **Issue 1: How do I connect my motor pairs**

The left motors (front and rear) are connected together, and likewise, the right motors (front and rear) too. They operate in synchrony to ensure coordinated movement and stability, allowing the RC car to take smooth turns without having to use steering or differential systems.

### **Issue 2: Car moves in the wrong direction**

Solution: Check the wiring connection of your motor. The negative and positive position should alternate for the right motor pair, and likewise to the left pair. Change this and check if the problem is fixed.

### **Issue 3: How do I fit in the components without screw mounts**

Solution: Use hot glue to fix all components that do not have mounting positions. If you do not have access to hot glue, then you can use super glue.

### **Issue 4: Intermittent Connections**

Solution: Jumper wires are convenient for rapid prototyping, but their use can result in loose connections, potentially causing the circuit to behave unpredictably or fail entirely. To prevent such issues, it is crucial to secure every jumper wire firmly in place to ensure a stable and reliable connection throughout the project.

## **Conclusion:**

Embarking on this Arduino learning project kit involving Bluetooth controls, an ultrasonic sensor, LEDs, a servo motor, and more is an exciting journey for beginners. We applaud you for this step. Through this project, you've gained hands-on experience in microcontroller hardware connections, coding, and mobile app development.

As a beginner, it's important to reflect on the key takeaways from this project:

### **1. Hands-On Learning:**

You've engaged in practical, hands-on learning by connecting various electronic components to an Arduino Uno board. This experience is invaluable for understanding how hardware and software work together.

### **2. Coding Proficiency:**

You've written and experimented with Arduino code to control LEDs, a servo motor, and communicate with a Bluetooth module. This coding experience lays a foundation for more complex projects and improves your programming proficiency.

### **3. Mobile App Development:**

Through MIT App Inventor, you've delved into the world of quick mobile app development. This opens doors to endless possibilities for creating user interfaces and integrating them with Arduino projects.

**Next Steps:** As you conclude this project, consider the next steps in your learning journey. Explore more complex projects, delve into additional sensors and actuators, and try to integrate them into the Matatu. Gradually take on more challenging concepts and remember that every project is a stepping stone in your learning path. Embrace the mistakes and challenges as opportunities to grow. The skills you've acquired in this beginner-level project provide a solid foundation for more advanced and innovative projects in the future. Continue to explore, experiment, and most importantly, enjoy the learning process. Arduino opens the door to a world of creativity and innovation, and you're just getting started!