Step-by-Step Procedure

Step 1: Research Materials and References on How to Make an Air Mouse

The internet is utilized in determining the concepts, circuits, required materials, and software and hardware tools. Based on research, an air mouse has four main components. The microcontroller, sensor, input buttons, and power source. In this project, ESP32 is the microcontroller, MPU6050 Gyroscope is the sensor (uses the x, y, and z axis movement as input), push buttons are the input buttons, and four AAA batteries via battery holder that can be turned on or off with a rocker or SPST switch.

Step 2: Install KiCad and Arduino IDE Software Applications for Testing Theory

Arduino IDE and KiCad are the main software tools used in this project. Arduino IDE is used for programming the code to be embedded to the ESP32 microcontroller while KiCad is used for creating the schematic diagram, routing of the circuit in the Printed Circuit Board (PCB) or Copper Clad, and the visual on the actual air mouse final output.

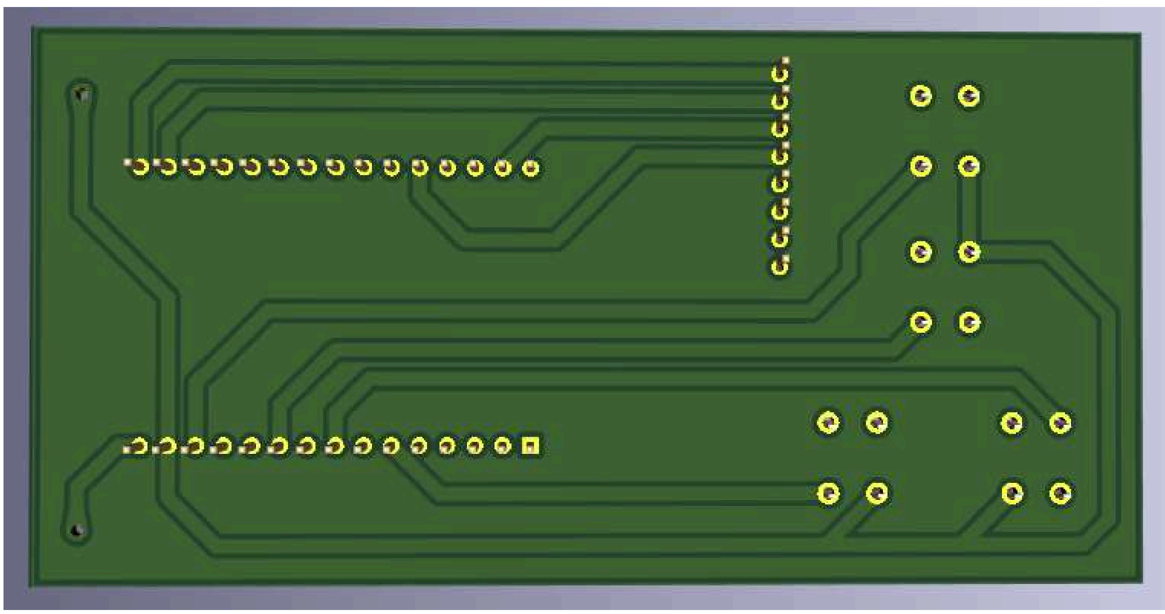

Figure 1. Bottom View of Air Mouse from KiCad.

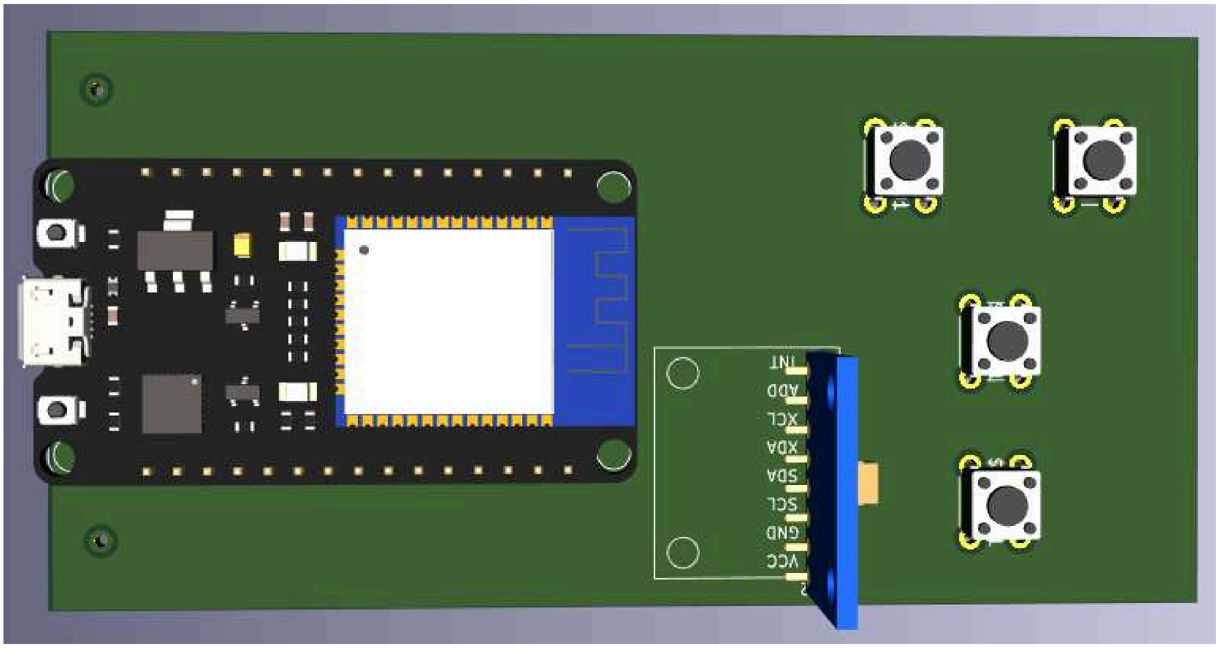

Figure 2. Top View of Air Mouse from KiCad.

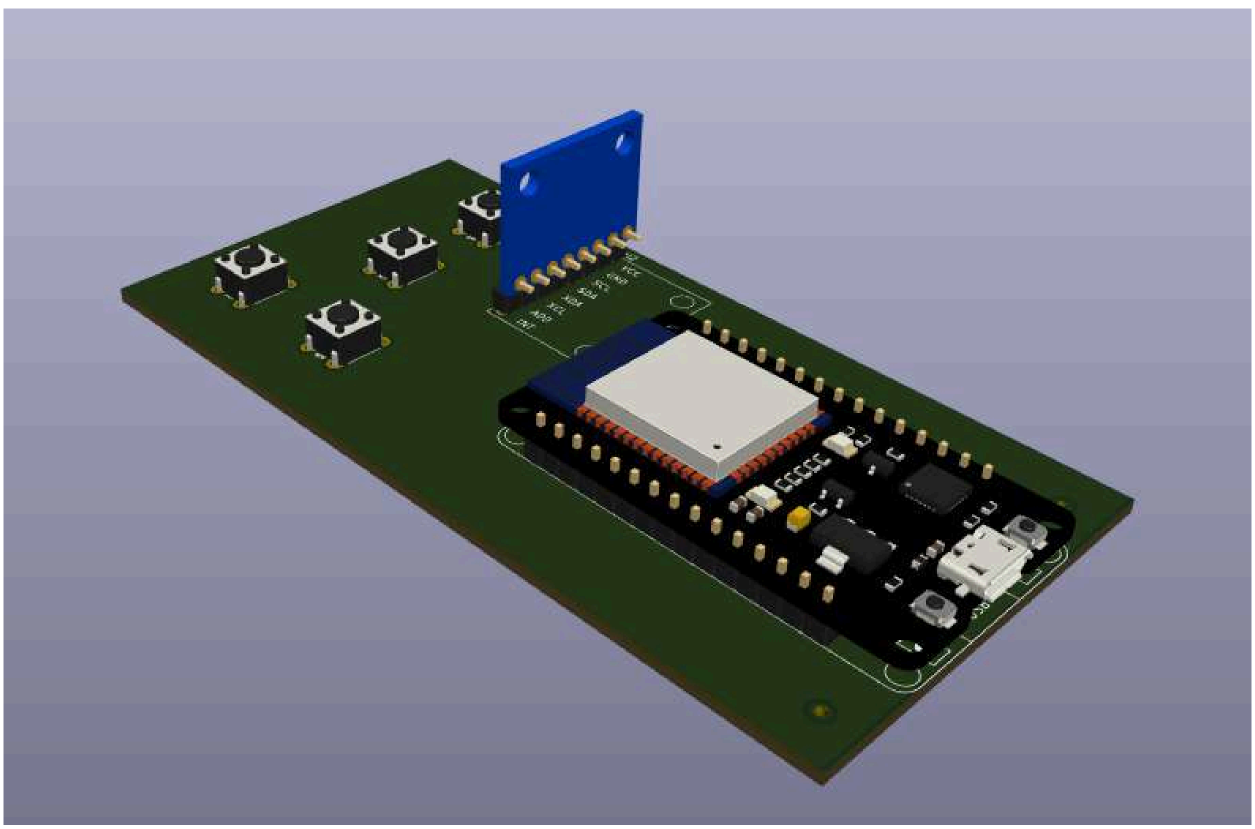
Figure 3. Back Isometric View of Air Mouse from KiCad.

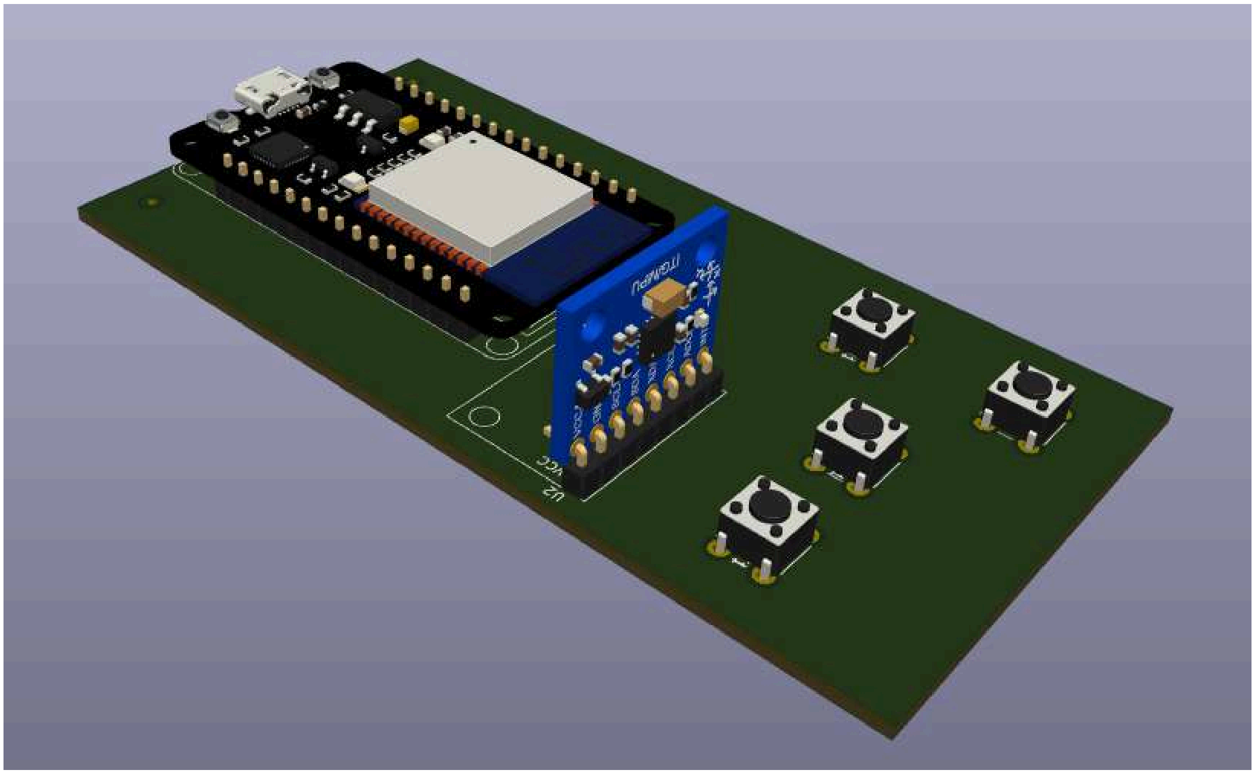

Figure 4. Front Isometric View of Air Mouse from KiCad.

Step 3: Write Arduino IDE Code for ESP32 + MPU6050 Air Mouse

Using the code found in the research materials as foundation, functions and pin buttons were added to create the air mouse. Preparation is required before writing the actual code to be embedded in the microcontroller. Libraries such as `"Ble.Mouse.h"` and `"Adafruit_MPU6050.h"` are installed as seen at the beginning of the code. Although there are some libraries that require a manual download unlike a direct download from Arduino IDE itself. Moreover, an additional board manager is used for the ESP32 microcontroller which is "https://espressif.github.io/arduino-esp32/package_esp32_index.json" to allow utilization of its functions.

Step 4: Purchase and Test Materials

Online shopping such as Shopee is used since it is less expensive compared to buying the materials and hardware tools in actual shops. Although, there are still some materials bought in Deeco and other local electronic shops for the sake of convenience. Testing the materials with a simple code is utilized to ensure that the ESP32 and MPU6050 Gyroscope work as intended.

Step 5: Test Prototype Using Schematic in Breadboard

Using the Arduino IDE code and KiCad schematic diagram as guide, the next step is implementing the proper wiring connections to try and test the air mouse prototype. Once it works after multiple attempts, the next step is to etch it to the PCB.

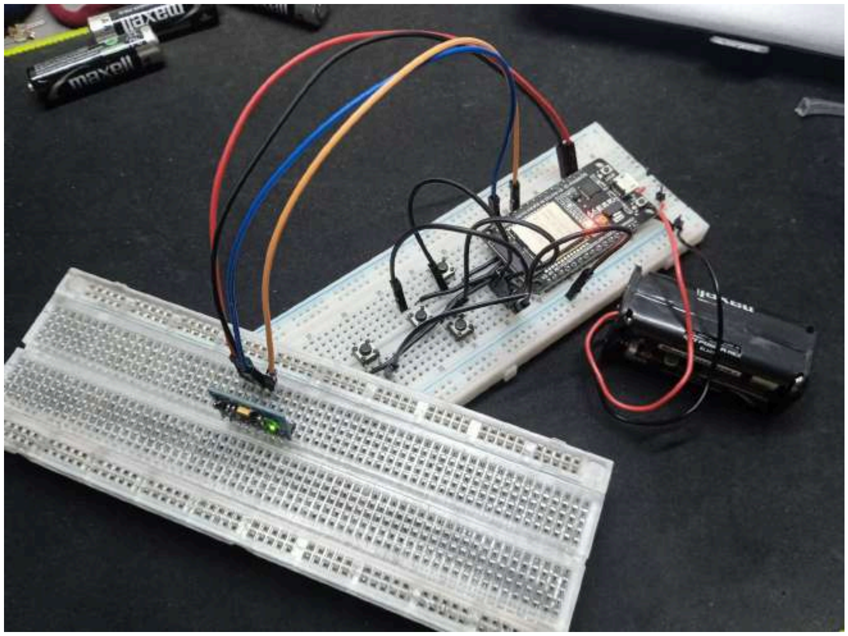

Figure 6. Air Mouse Actual Prototype.

Step 6: Etching the Routing Circuit on the Copper Clad

This step includes printing the routing circuit on sticker paper, cutting it and sticking it into the copper clad, drilling holes for the components and checking if it fits, cutting out so only the circuit remains, and etching the circuit using the ferric chloride solution. The [sticker paper technique] used in the etching process can be seen in the references. After that, check for possible short circuits by testing continuity using a multitester and using a flashlight against the copper clad side to see copper remnants and using a cutter to remove them. Next is inserting the components and soldering them while once again making sure there are no short circuits. A visual on these steps are as follows.

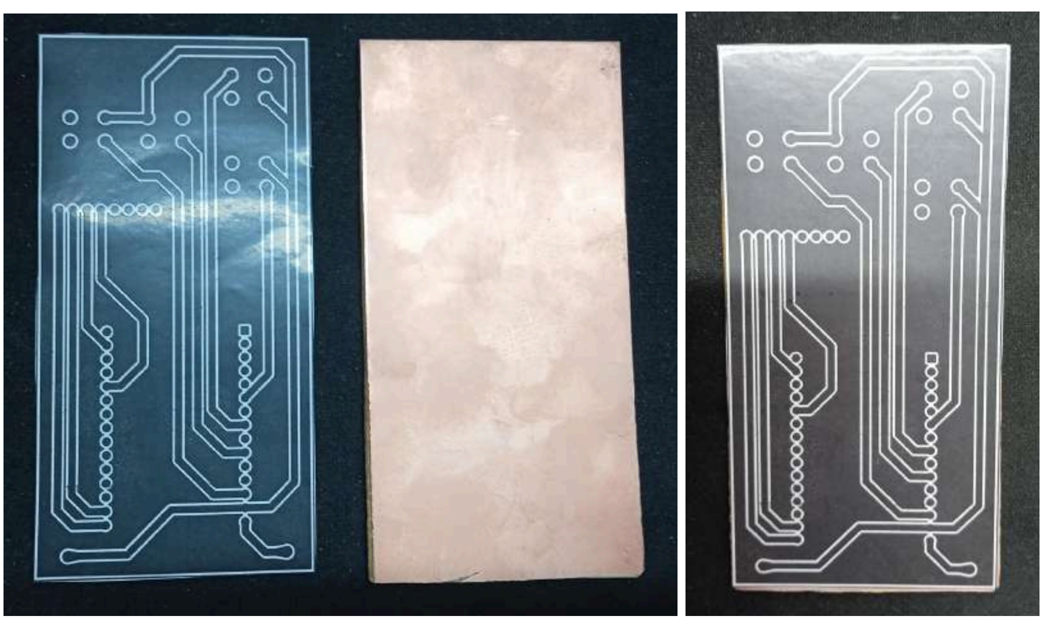

Figure 7. Printed Routing Circuit on Sticker Paper and Stick to Copper Clad.

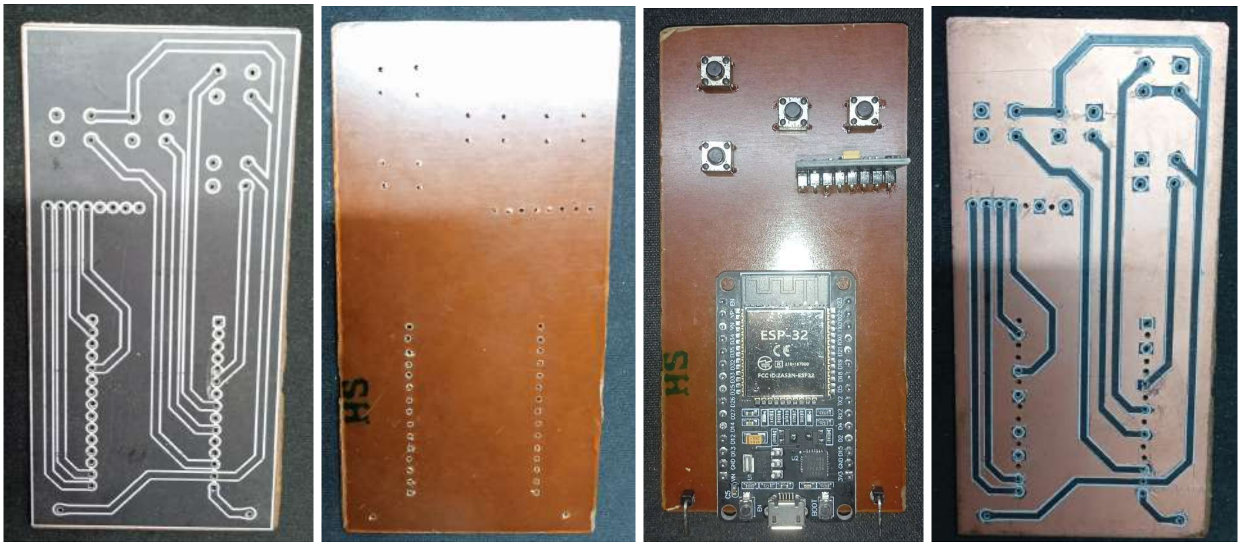

Figure 8. Drilled Copper Clad, Component Fit Test, and Cut-out Circuit.

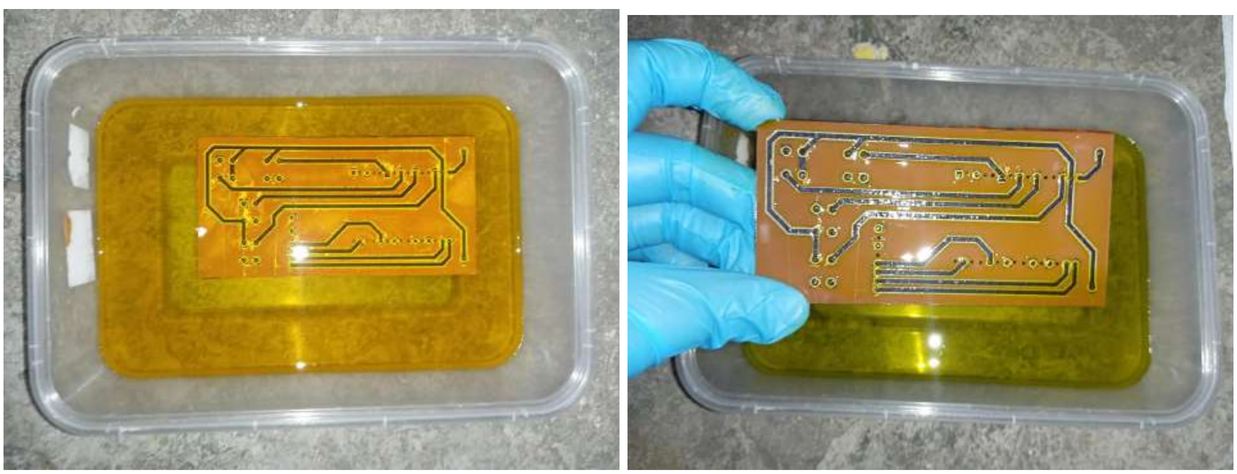
Figure 9. Etching the Copper Clad with Ferric Chloride.

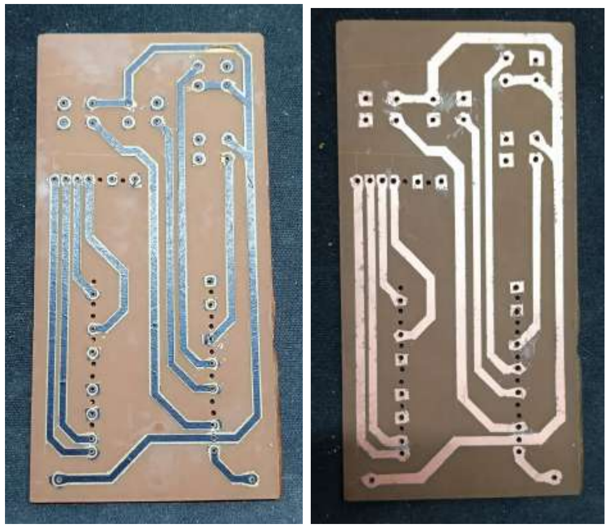

Figure 10. Cleaning and Removing the Sticker Paper.

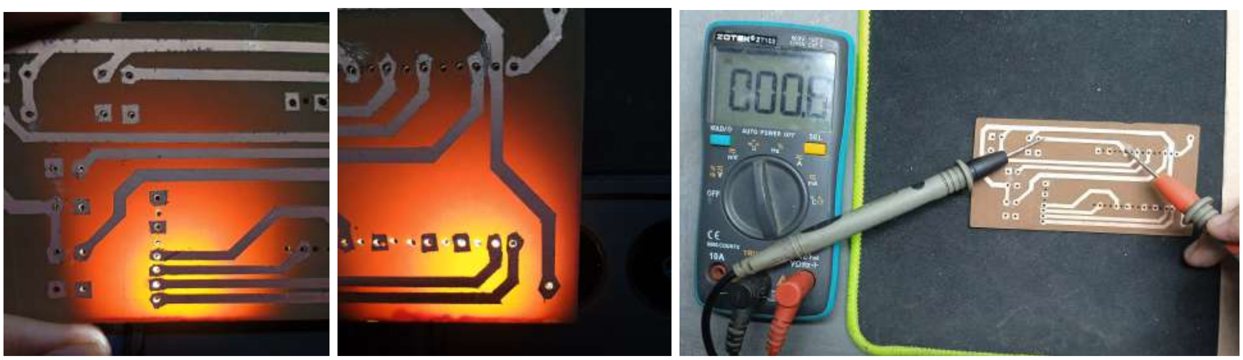

Figure 11. Checking for Shorted Circuits Using Flashlight and Multitester.

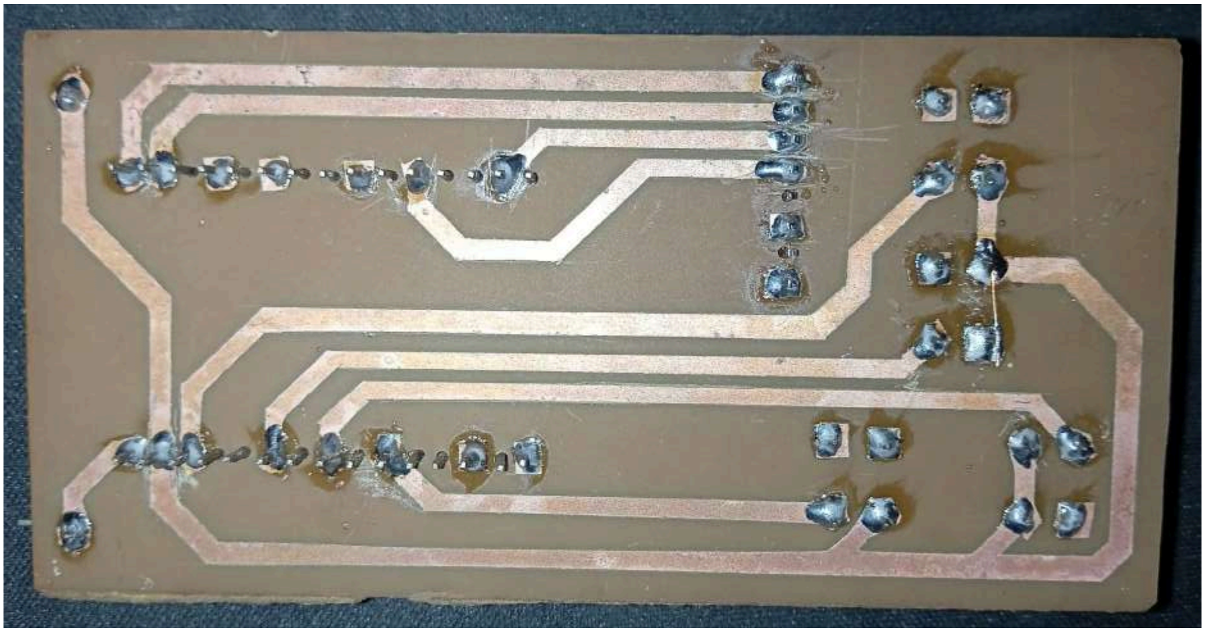

Figure 12. Bottom View of Air Mouse.

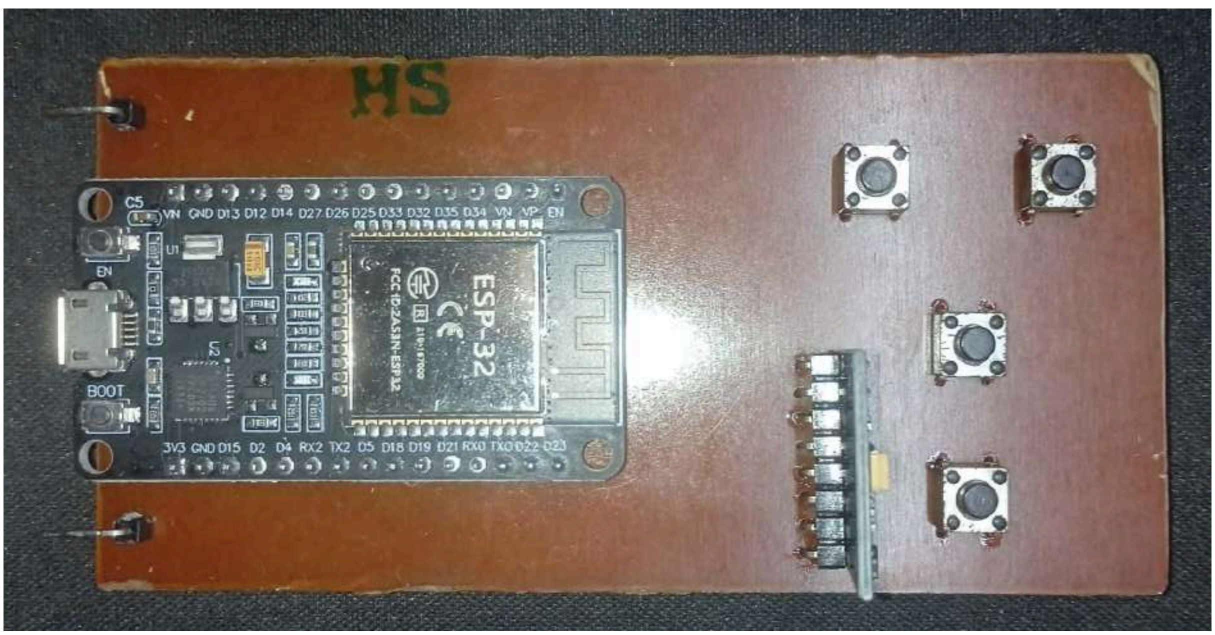

Figure 13. Top View of Air Mouse.

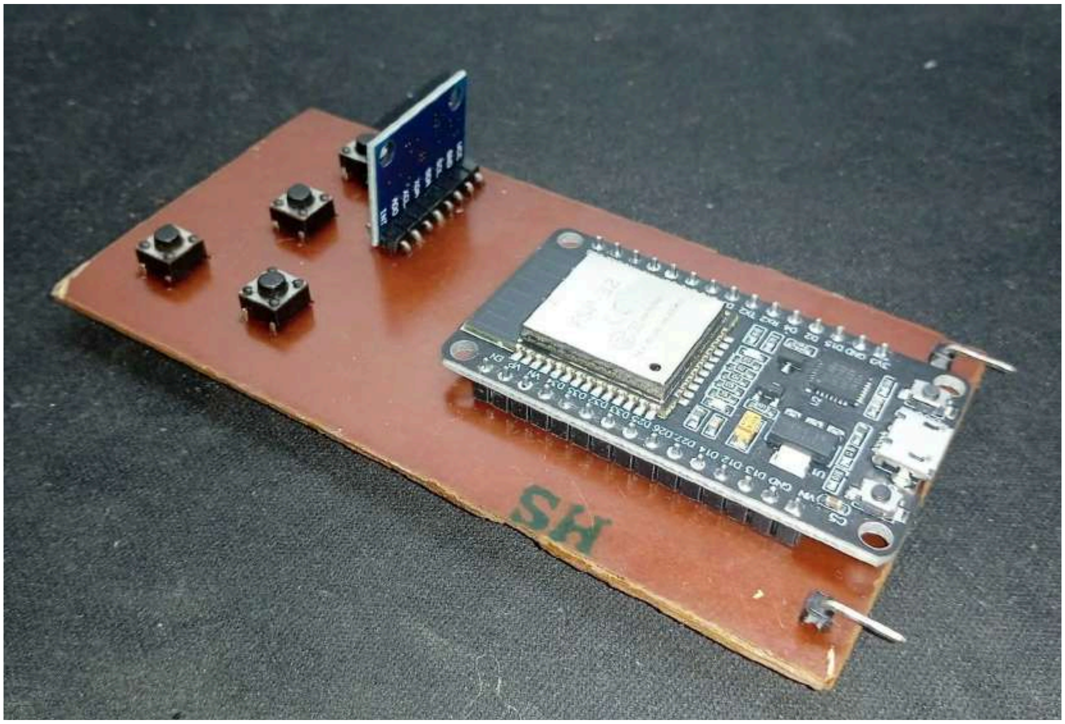

Figure 14. Back Isometric View of Air Mouse.

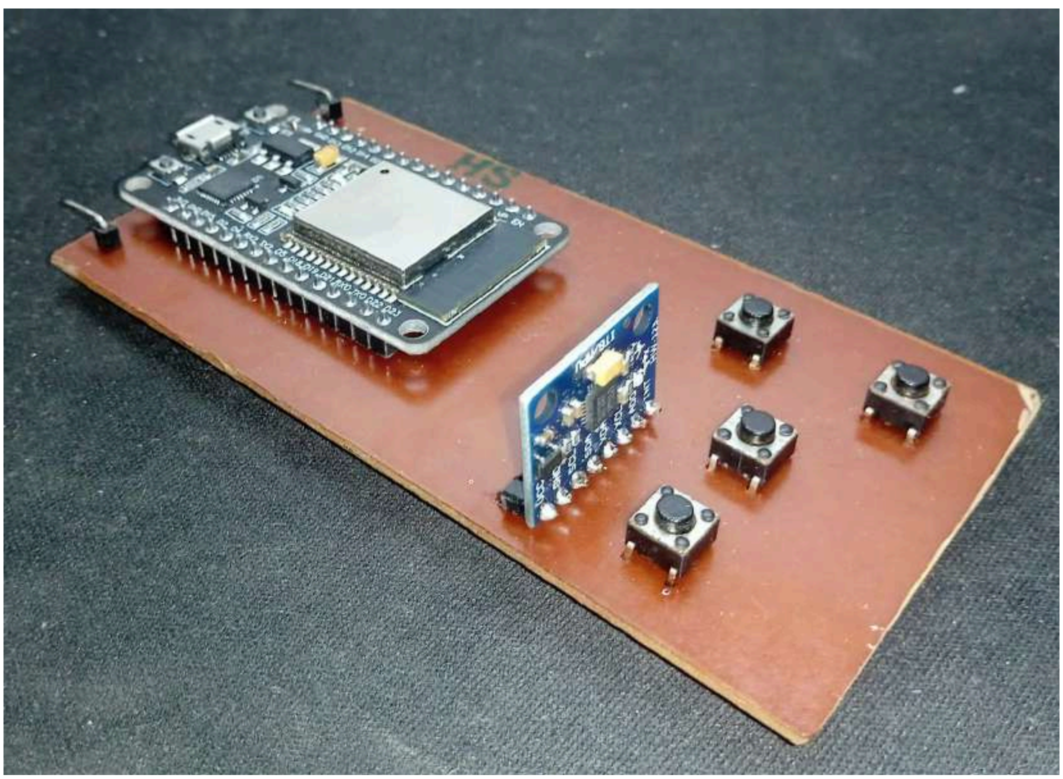

Figure 15. Front Isometric View of Air Mouse from KiCad.

Step 7: Test BLE Air Mouse and Battery Holder as Power Source

After double checking possible short circuits after soldering the components, testing the BLE Air Mouse via power bank (capable of 5-volt output) and the AAA battery power supply.

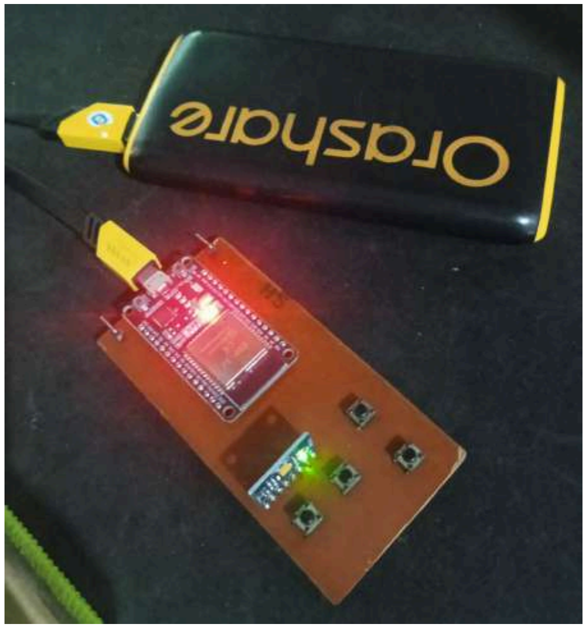

Figure 16. 5V Output Power Bank Connected to Air Mouse.

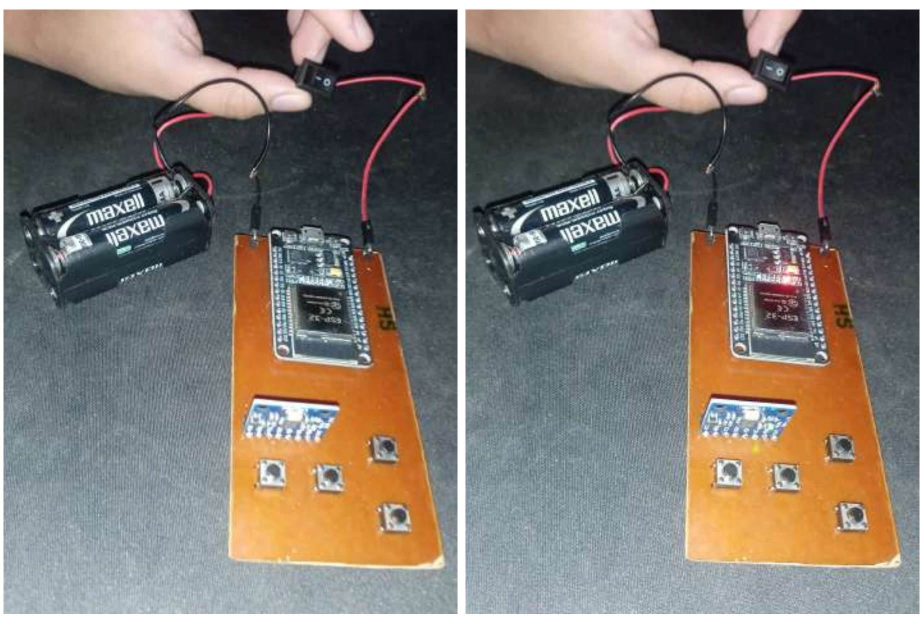

Figure 17. Battery Holder Connected to Air Mouse when Turned Off and On.

Step 8: Create Case for Air Mouse using the Pencil Case

A plastic pencil case found in the local market was used. Testing the components on the pencil case, reducing its size using the electric drill and putting it back together with tape and glue stick was necessary to fit the PCB of the air mouse and battery holder. Once everything is in place, the barbecue sticks or screws are used as direct connections from the case to the circuit inside with the help of plastic straws as tunnels to guide them to the inside buttons. Old remote control rubber buttons were used to serve as the outside buttons. An additional button was added which is for the reset or EN button on the ESP32 for instances that it is unable to connect to the device.

Figure 18. Size of Pencil Case with the Components.

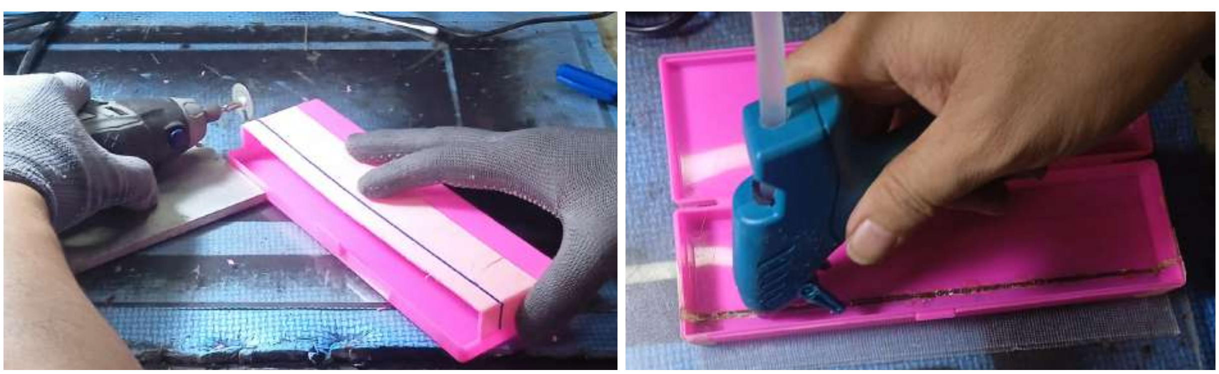

Figure 19. Cutting and Gluing of Reduced Pencil Case.

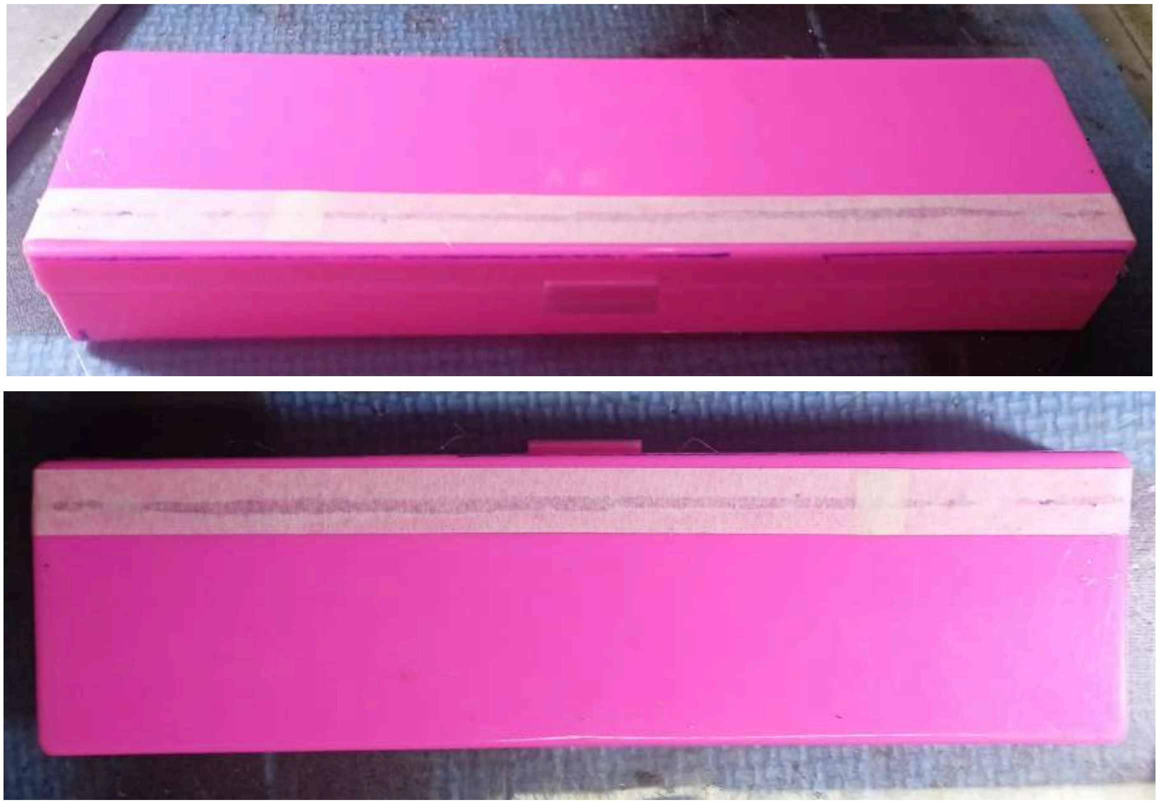

Figure 20. Reduced Pencil Case for the Air Mouse Case.

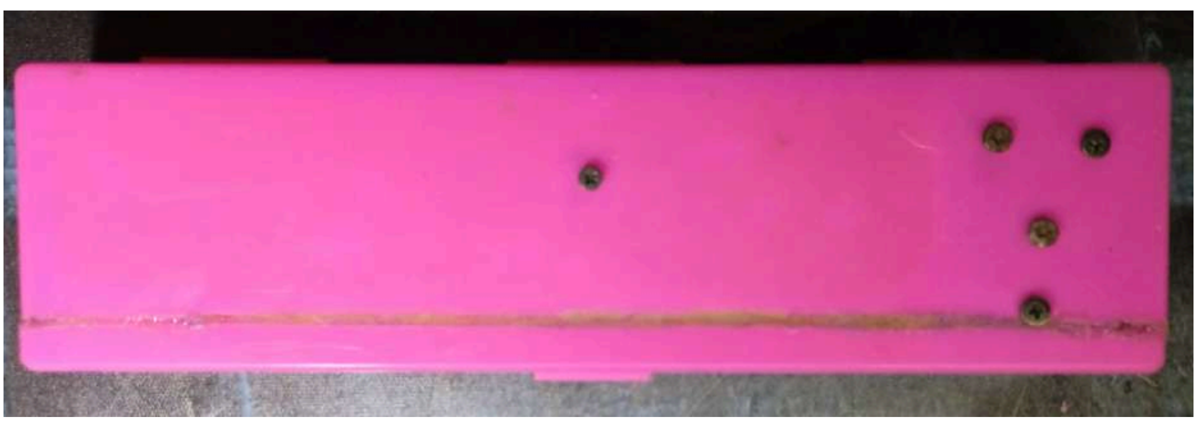

Figure 21. Adding Screws as Buttons Connected Inside the Air Mouse Case.

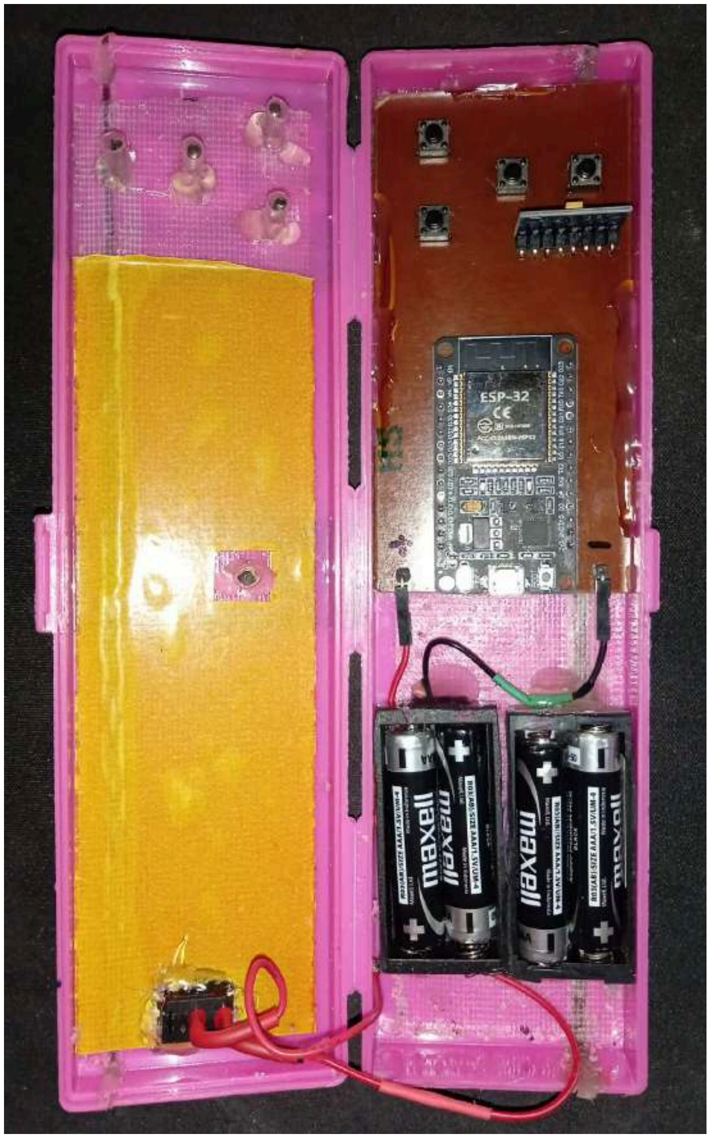

Figure 22. Inside the Air Mouse Case.

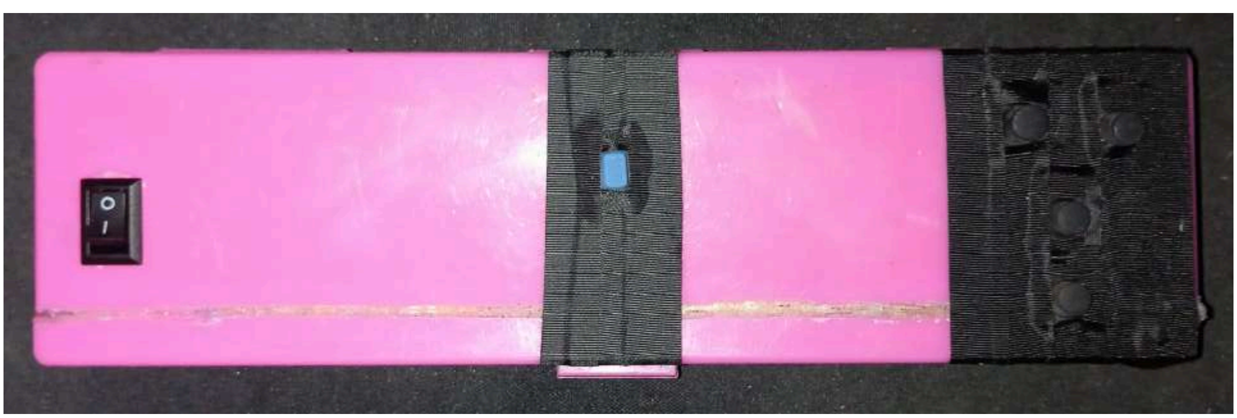
Figure 23. Placing the Recycled Remote Control Buttons to the Air Mouse Case.

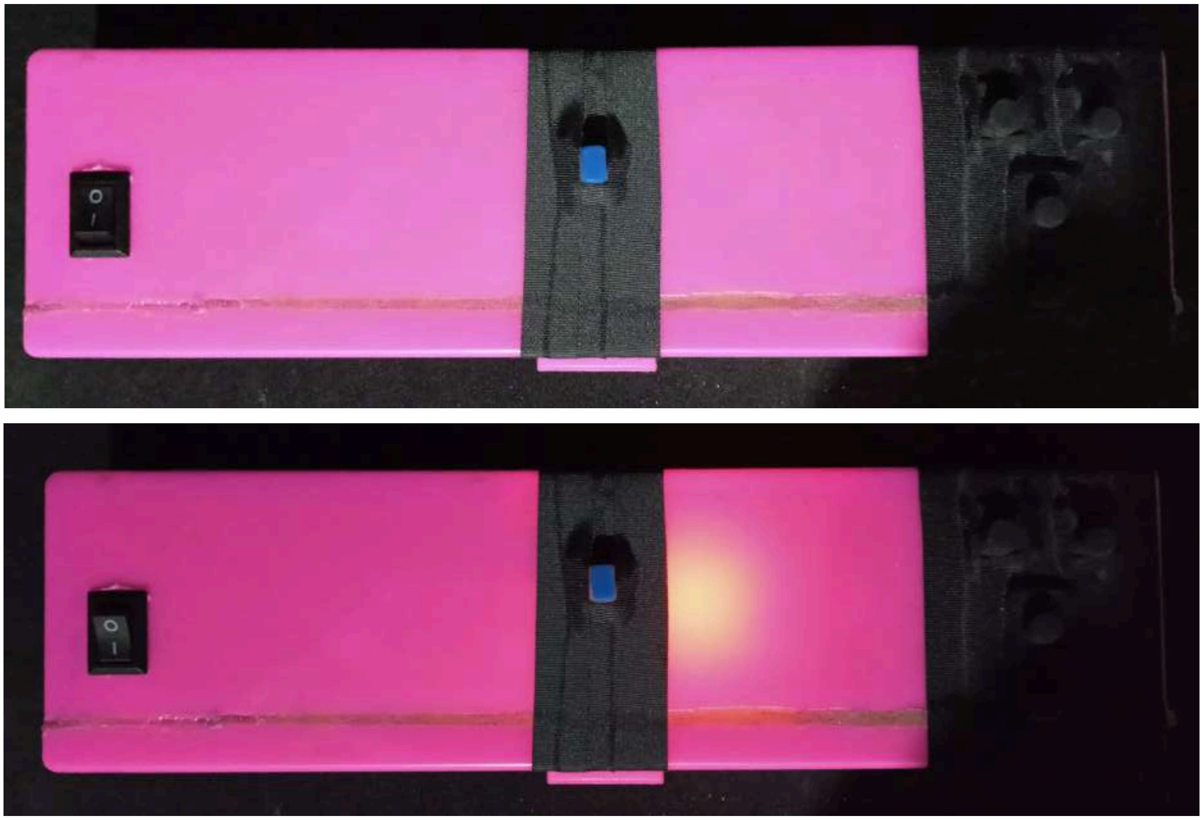

Figure 24. Air Mouse when Turned Off and On.

Step 9: Finalizing the Air Mouse

After a successful test of the air mouse while inside the case, the components are then glued to the case using a glue stick. Necessary details and descriptions of the air mouse are noted inside the case.

Figure 25. Inside the Finalized Air Mouse Case.

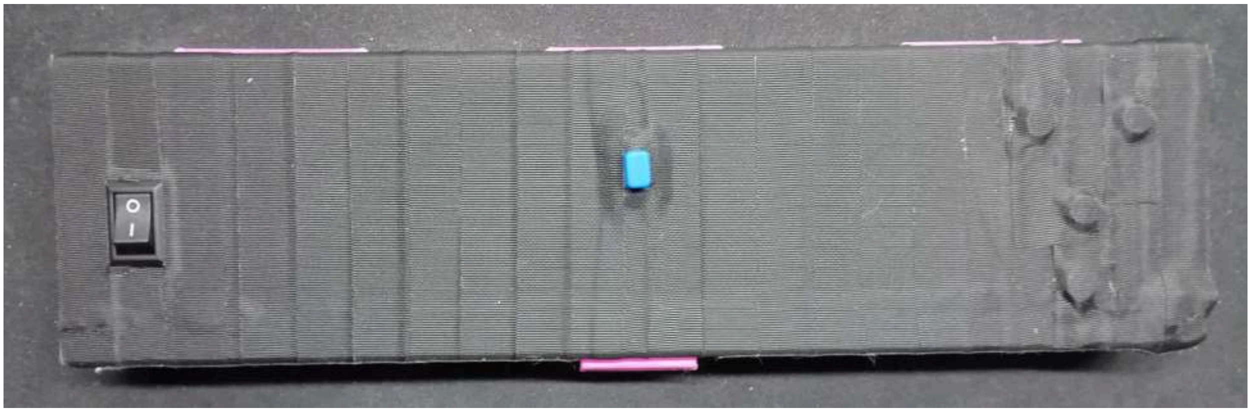

Figure 26. Finalized Top View of the Air Mouse.

Figure 27. Finalized Bottom View of the Air Mouse.

Figure 28. Finalized Front Isometric View of the Air Mouse.

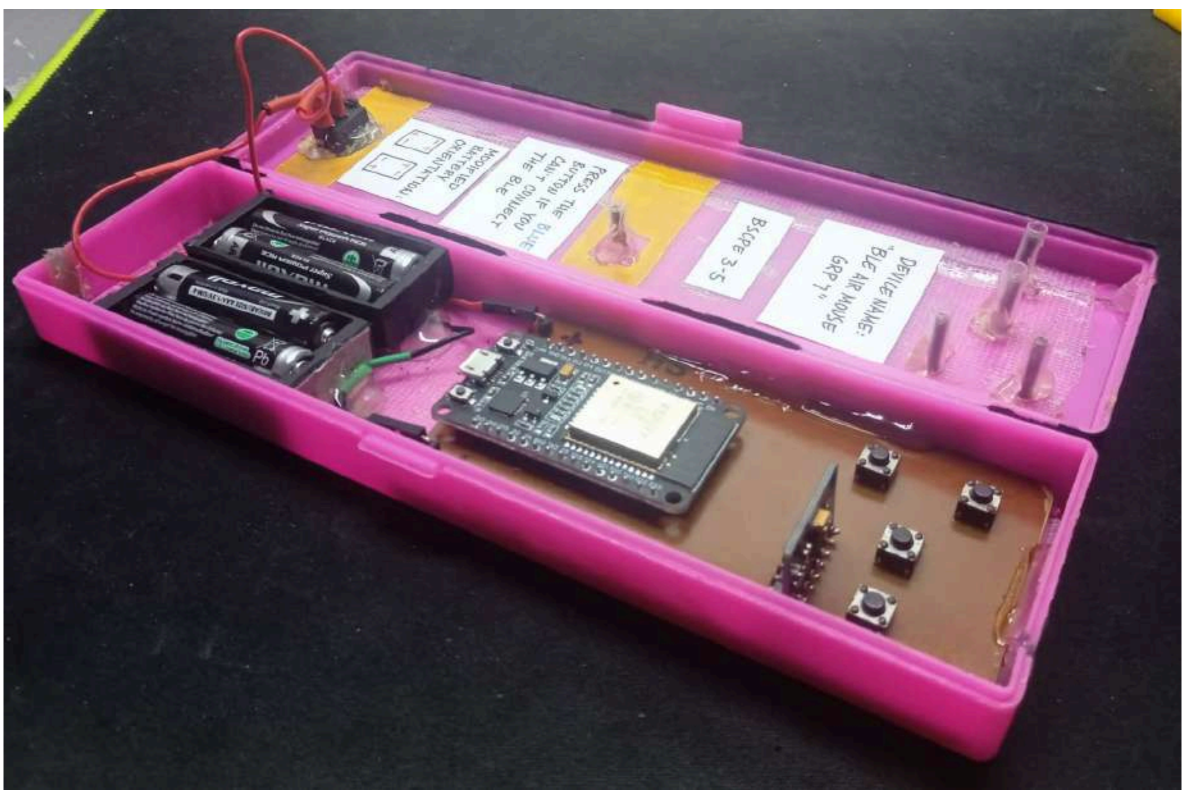

Figure 29. Finalized Front Isometric (Inside) View of the Air Mouse.