WOMEN </POWER CODE>

Mini Mate Guide

Assembly and Configuration

Table of Contents

1. Introduction 2
2. Mini Mate Computer 4
2.1. Inventory 4
2.1.1. Mini Mate body 5
2.1.2. Raspberry Pi 5
2.1.3. HDMI/VGA LCD Controller Board Kit 7
2.1.4. Micro SD Card 9
2.1.5. Power Supply 9
2.1.6. Cables 10
2.1.7. Mouse 10
2.1.8. LCD Display with controller 11
2.1.9. Breadboards 11
2.1.10. Speaker 12
2.1.11. Electronic components 12
3. Assembly 12
3.1. Base Assembly 14
3.2. Drawer Assembly 18
3.3. Upper-body Assembly 22
3.4. Raspberry Pi Assembly 30
3.5. LCD Controller Assembly and Wiring 35
3.6. LCD Placeholders Assembly and LCD Attachment 49
3.7. Cupboard Assembly 58
3.8. Powerbank and Speaker 61
3.9. Electronics and Mouse 64
4. Software 65
4.1. Raspberry Pi OS (Raspbian Buster) 67
4.2. Minecraft Pi Edition 75
4.3. Scratch 2.0 76
4.4. Thonny Python 77
5. Annex 80

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1. Introduction

The Mini Mate computer is designed so as to be possible to assemble by anyone anywhere based on the instructions.

The idea is to provide a full guide on how to build the Mini Mate computer, install and configure the software and then use it for C1 to test and then provide access to buy it from anyone who would like to learn more about Raspberry Pi and assembling a DIY computer.

The specification and inventory for the Mini Mate computer, as well as custom components and kits to be created, and assembly instructions will be provided in the present guide as annexes.

The Mini Mate elegant design imitates an all-in-one desktop computer, offering ease of use as it will not be necessary to connect to an external screen to use it while it will be easier to connect external kits and electronics for physical computing and enhancement of STEM-related teaching.

The Mini Mate is a fully fledged Raspberry Pi based computer. All the necessary components and peripherals are included in one package, so the person, after assembling it, can start right away using it.

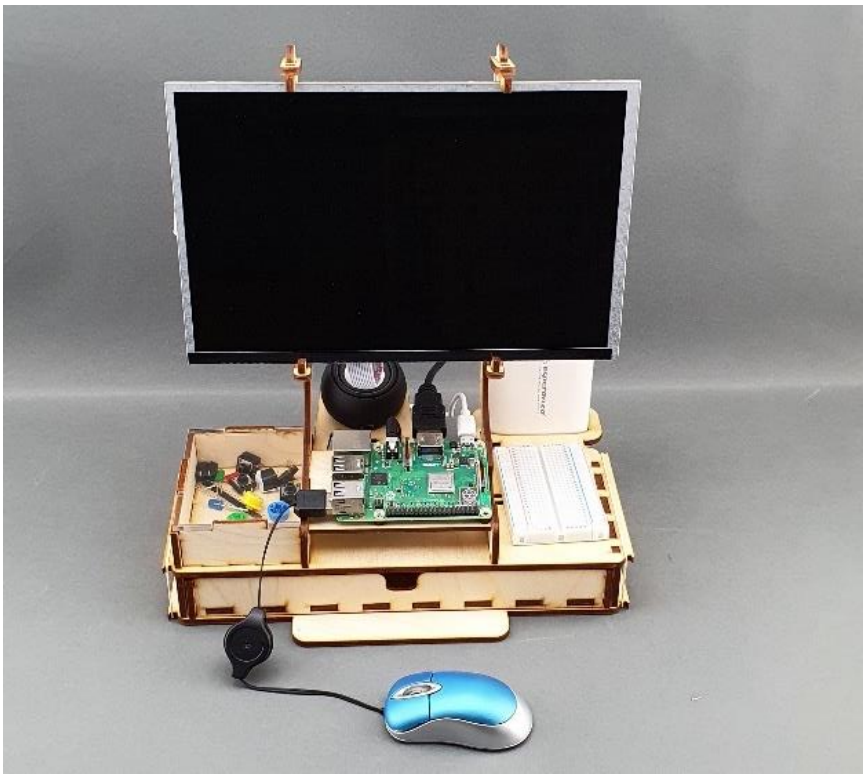

FIGURE 1 FRONT SIDE OF MINI MATE COMPUTER

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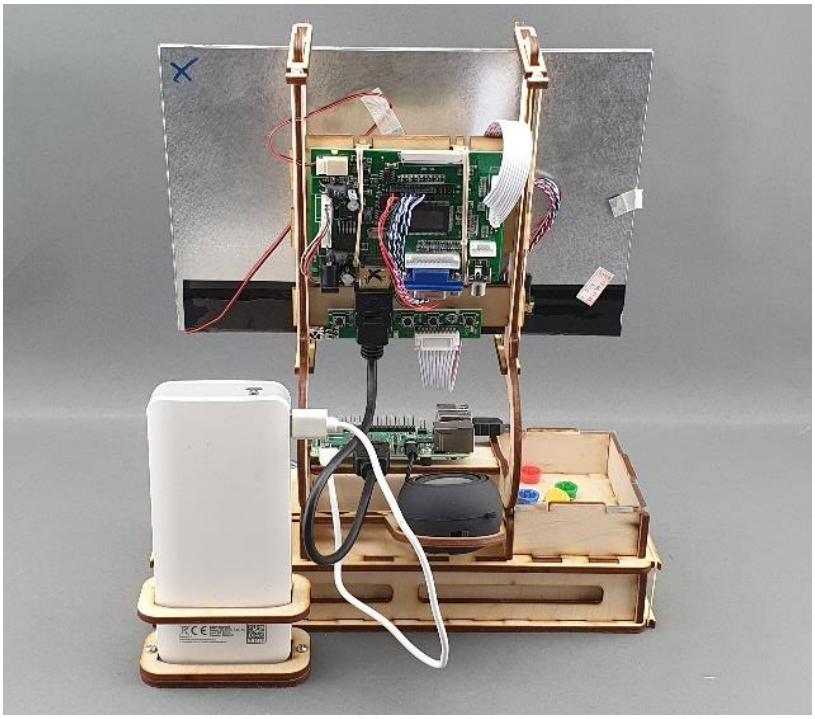

FIGURE 2 BACK SIDE OF MINI MATE COMPUTER

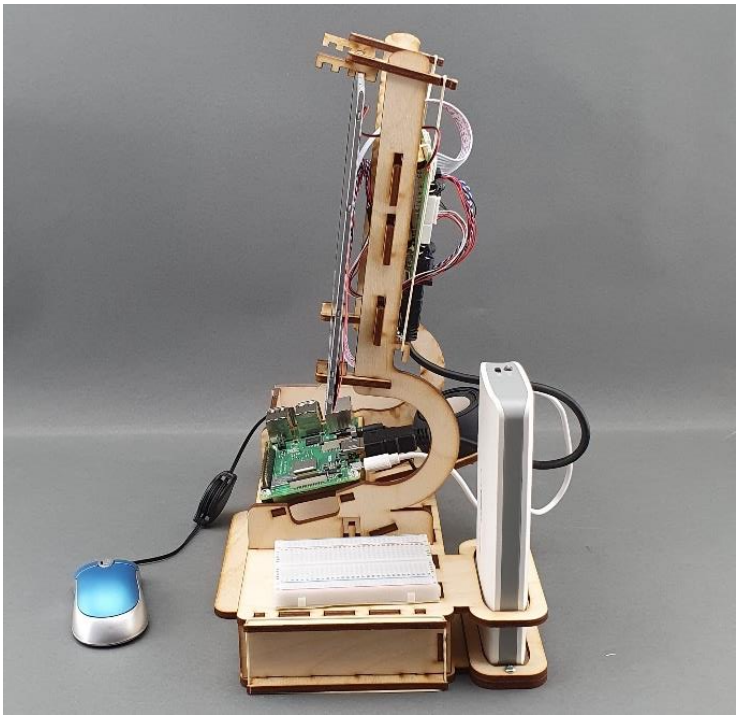

FIGURE 3 LEFT SIDE OF MINI MATE COMPUTER

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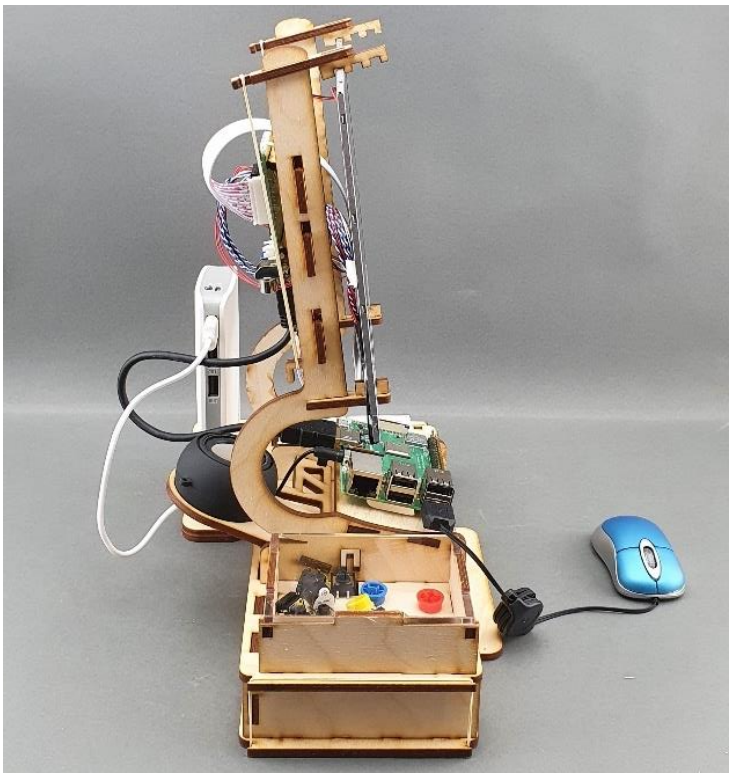

FIGURE 4 RIGHT SIDE OF MINI MATE COMPUTER

2. Mini Mate Computer

Building the Mini Mate computer comprises of the following activities:

1. Construct the Mini Mate body
2. Connect the components and the screen
3. Connect the Raspberry Pi
4. Install and configure the needed software

2.1. Inventory

The Mini Mate computer comprises the following items:

- Mini Mate body (29 plywood pieces)
- Raspberry Pi 3 Model B+
- Micro SD card (with pre-installed software)
- Power supply
- Cables
- Mouse
- LCD display with controller
- Breadboards
- Speaker
- Electronic components and cables

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2.1.1. Mini Mate body

The Mini Mate body needs 29 plywood pieces to be assembled, which are included in the package. The package also includes all necessary screws, nuts and rubber bands. You only need to supply a Philips screwdriver which is not included in the package.

2.1.2. Raspberry Pi

A Raspberry Pi is a credit card-sized computer that plugs into a computer monitor or TV and uses a standard keyboard and mouse. Originally designed for education, inspired by the 1981 BBC Micro. Creator Eben Upton's goal was to create a low-cost device that would improve programming skills and hardware understanding at the pre-university level. But thanks to its small size and accessible price, it was quickly adopted by tinkerers, makers, and electronics enthusiasts for projects that require more than a basic microcontroller (such as Arduino devices).

The Raspberry Pi is slower than a modern laptop or desktop but is still a complete Linux computer and can provide all the expected abilities that implies, at a low-power consumption level. It is a capable small device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python. It is capable of doing everything you would expect a desktop computer to do, from browsing the internet and playing high-definition video, to making spreadsheets, word-processing and playing games.

What's more, the Raspberry Pi has the ability to interact with the outside world and has been used in a wide array of digital maker projects, from music machines and parent detectors to weather stations and tweeting birdhouses with infra-red cameras. The Raspberry Pi has the capability to be used by kids from around the world to learn to program and understand how computers work.

FIGURE 5 RASPBERRY PI 3 MODEL B+

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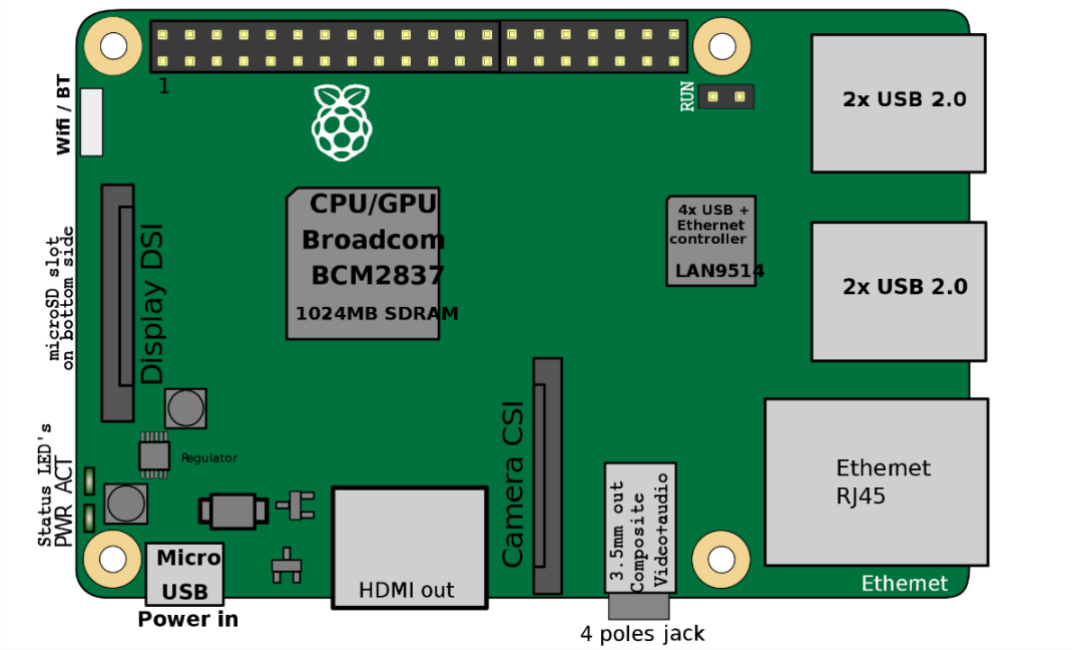

FIGURE 6 RASPBERRY PI 3 MODEL B+ SCHEMATIC

A powerful feature of the Raspberry Pi is the row of GPIO (general-purpose input/output) pins along the top edge of the board. A 40-pin GPIO header is found on all current Raspberry Pi boards (unpopulated on Pi Zero and Pi Zero W). The GPIO pins are integrated into the circuit board of the computer. Their behaviour can be controlled by the user to allow them to read data from sensors, and control components like LEDs, motors, and displays. Older models of the Pi had 26 GPIO pins, while the newer models all have 40. Using a bit of programming, like Python and C, GPIO pins are easy to be controlled.

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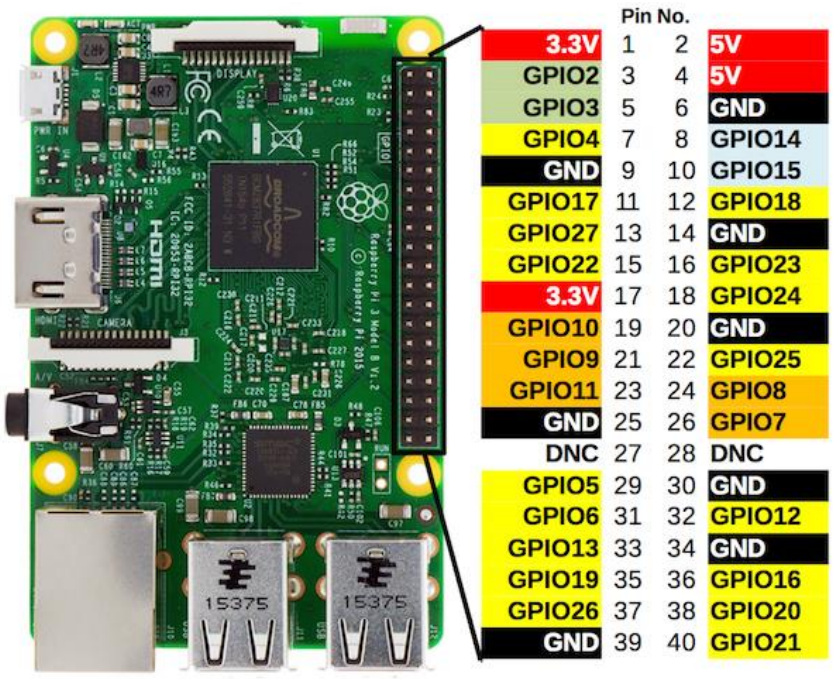

FIGURE 7 RASPBERRY PI GPIO AND PIN ASSIGNMENT

More info at: **https://www.raspberrypi.org/**

2.1.3. HDMI/VGA LCD Controller Board Kit

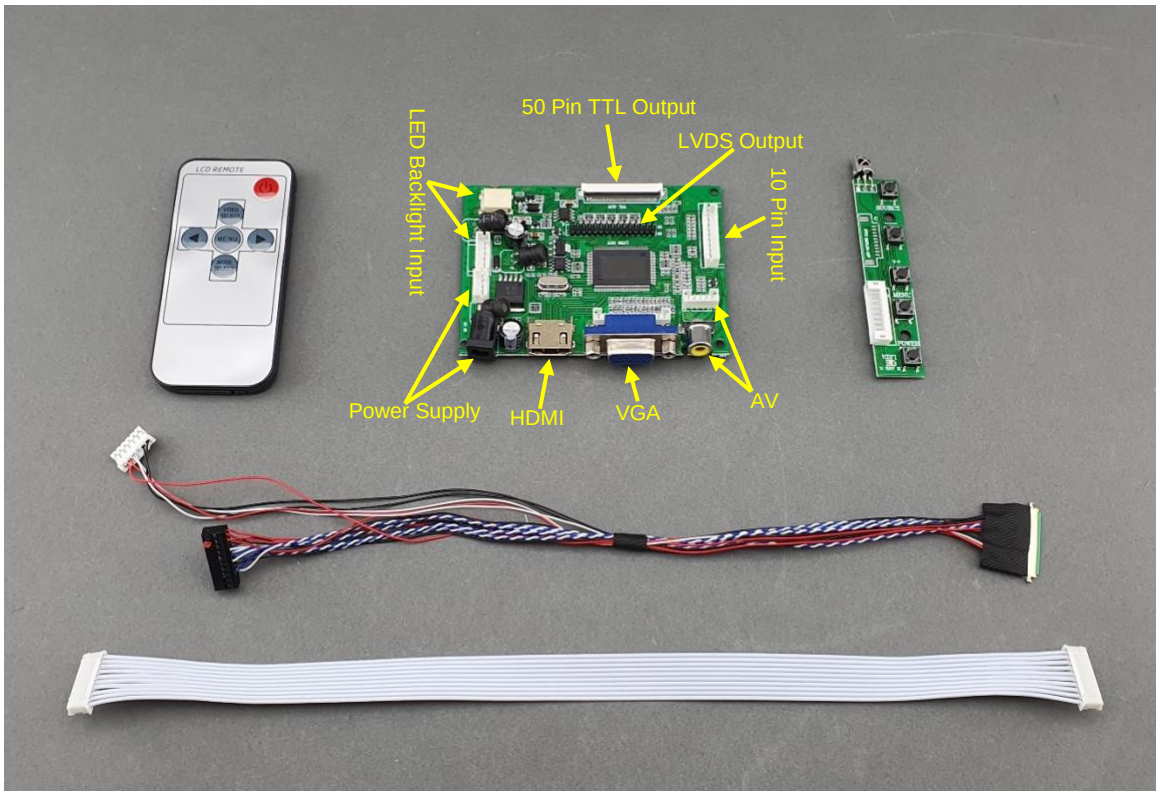

FIGURE 8 LCD MONITOR CONTROLLER BOARD

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The LCD controller Board Kit consist of:

- Video input/output board unit
- Controller board unit
- Video input cable (coloured cable)
- Controller input cable (white cable)

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2.1.4. Micro SD Card

FIGURE 9 MICRO SD CARD

The Raspberry Pi should work with any compatible micro SD card, although there are some guidelines that should be followed:

- **Micro SD card size (capacity)**: the minimum recommended card size is 8GB. Above that, there is no limitation.
- **Micro SD card class**: the card class determines the sustained write speed for the card; a class 4 card will be able to write at 4MB/s, whereas a class 10 should be able to attain 10 MB/s. however, it should be noted that this does not mean a class 10 card will outperform a class 4 card for general usage, because often this write speed is achieved at the cost of read speed and increased seek times.

2.1.5. Power Supply

FIGURE 10 POWER SUPPLY

For safety and portability reasons, a Power Bank is used to power the equipment. Portable Power Banks are comprised of a special battery in a special case with a special circuit to control power flow. They allow to store electrical energy (deposit it in the bank) and then later use it to charge up a mobile device (withdraw it from the bank). Power Banks battery life is outstripped by the amount of time we spend using them each day. By keeping a battery backup close by, you can top-up your device(s) while far from a wall outlet. They can be charged up using a USB charger when power is available.

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2.1.6. Cables

Power cable, USB to jack is included in the box. It is used to connect the Display with the Power Supply.

HDMI male-to-male cable that connects the display with Raspberry Pi.

USB to micro USB is cable needed to give power from the Power Source to the Raspberry Pi.

2.1.7. Mouse

FIGURE 11 MOUSE

Standard USB mini expandable cable mouse.

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2.1.8. LCD Display with controller

FIGURE 12 LCD DISPLAY

A 10” Anti-Glare LCD display size, with resolution of 1024x768, and active area of 218(W)×135(H) mm, is included in the box.

2.1.9. Breadboards

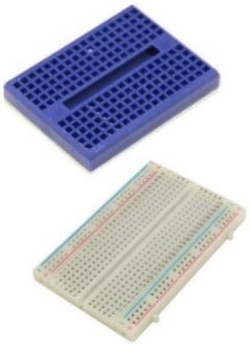

FIGURE 13 BREADBOARDS

Breadboards are one of the most fundamental pieces when learning how to build circuits. The breadboard is the bread-and-butter of DIY electronics. Breadboards allow beginners to get acquainted with circuits without the need for soldering, and even seasoned tinkerers use breadboards as starting points for large-scale projects. The first steps in the world of DIY or microcontrollers require just a breadboard.

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2.1.10. Speaker

FIGURE 14 SPEAKER

Portable / rechargeable Mini Hamburger 2.2W speaker which is compatible with all line in audio source with a 3.5mm headphone socket. The speaker has a build-in high capacity rechargeable battery, supporting long time playing. An LED indicator stands for power-on or charging status.

2.1.11. Electronic components

FIGURE 15 ELECTRONIC COMPONENTS

Several electronic components that are provided will help students creating their own labs for testing. Electronic components include:

- Jumper Cables (male-to-male and male-to-female)
- Jumper rail
- On-off switches
- LEDs
- Push-on buttons
- Button caps
- Buzzer

3. Assembly

In this section, all the steps to be followed for assembling the Mini Mate Computer are provided. Remember that the only tool you need is a Philips screwdriver. Everything else is included in the package.

The assembly process is divided into 9 sections, each one including some simple assembly steps. These sections are the following:

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1. Base assembly
2. Drawer assembly
3. Upper body assembly
4. Raspberry Pi Assembly
5. LCD Controller assembly and Wiring
6. LCD Placeholder assembly and LCD assembly
7. Cupboard assembly
8. Powerbank and speaker
9. Electronics and mouse

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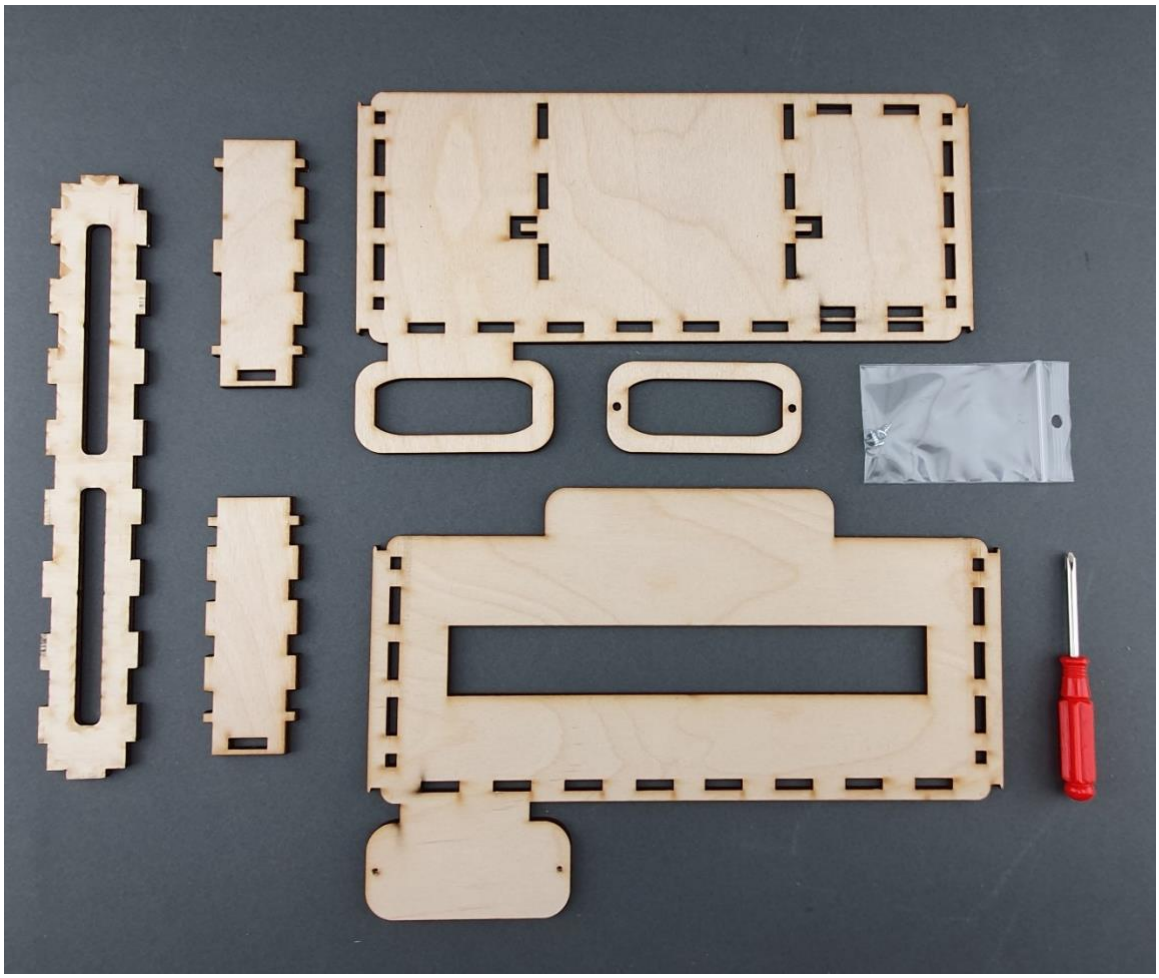
3.1. Base Assembly

Step 1 – What you will need:



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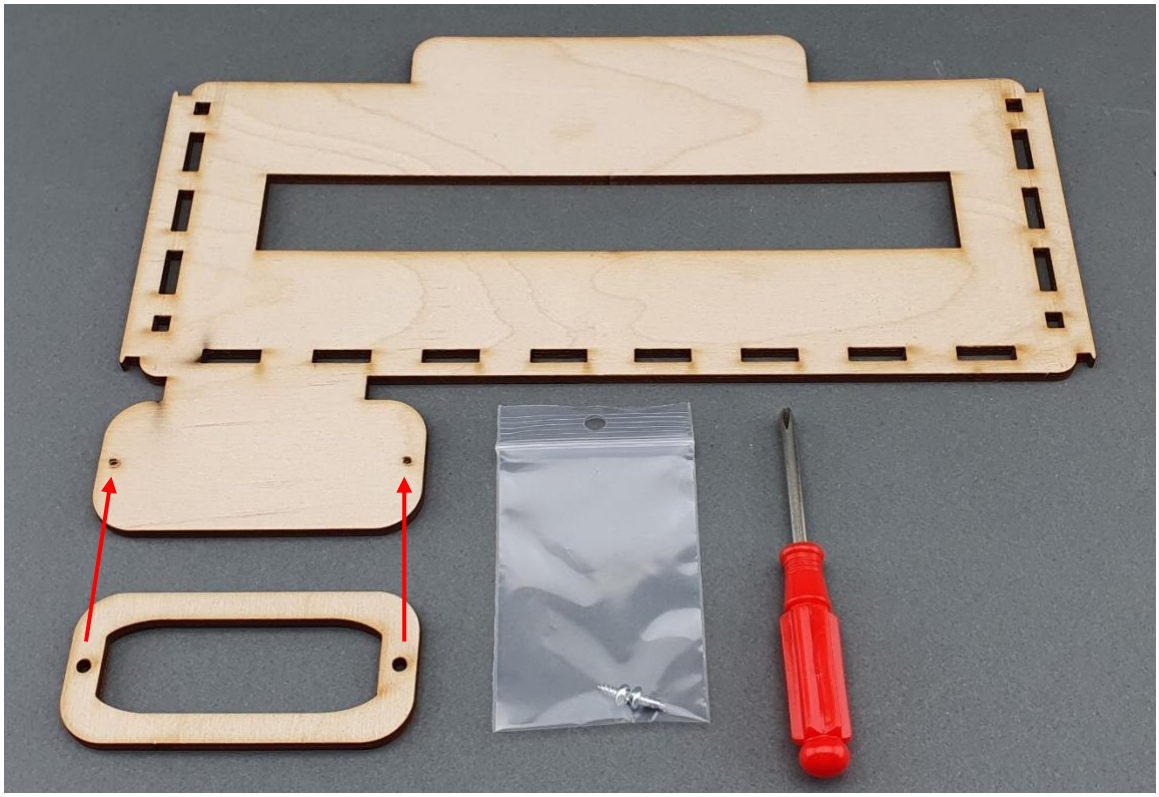
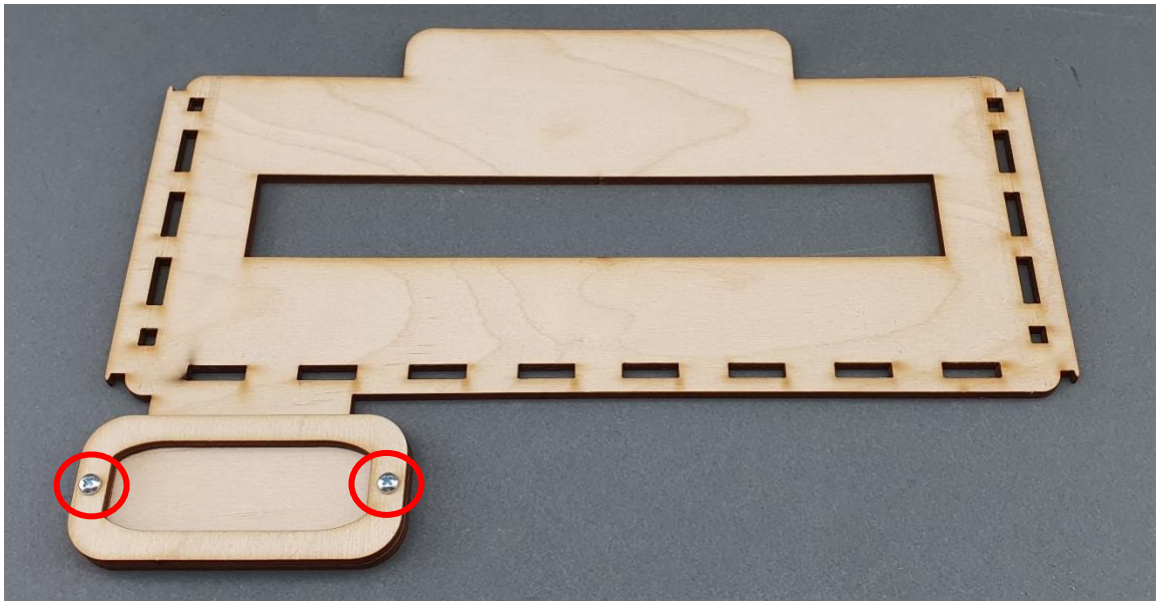
Step 2 – Screw the Power Bank base holder:





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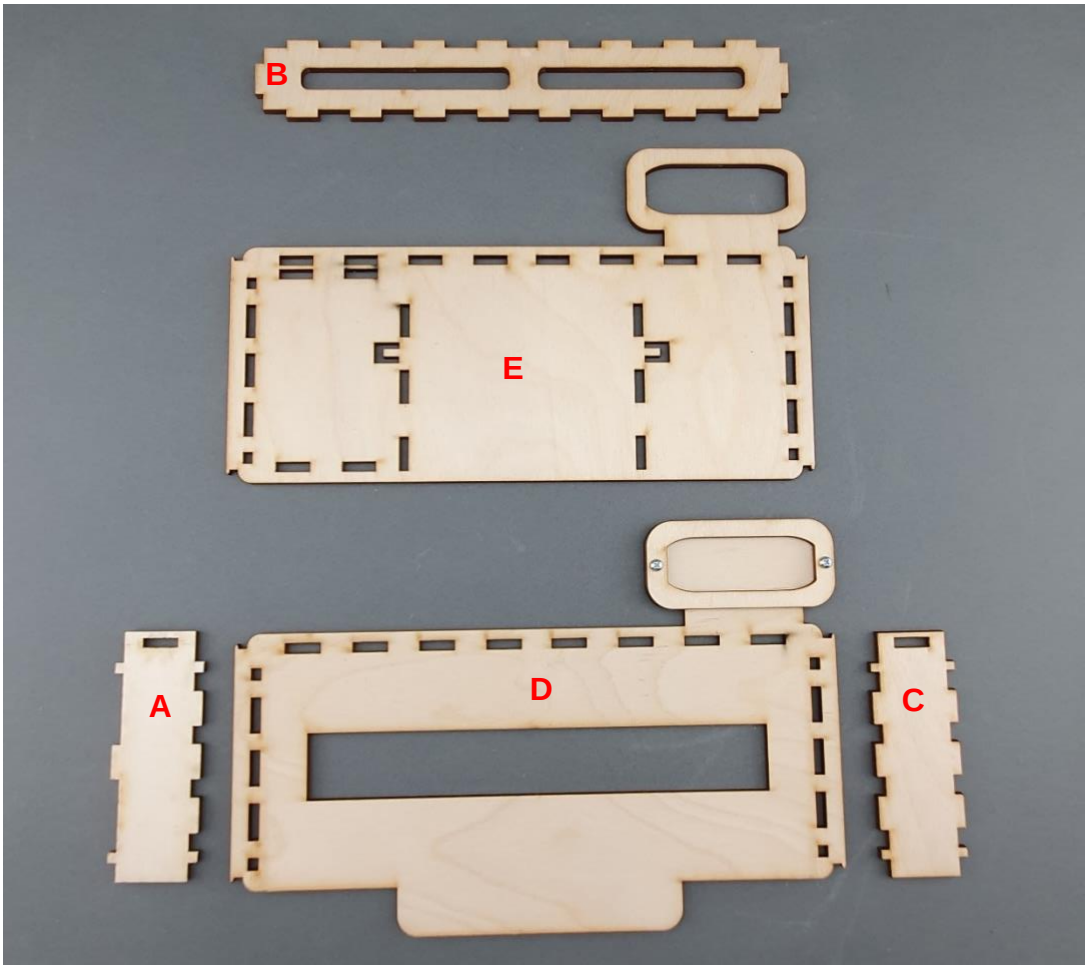
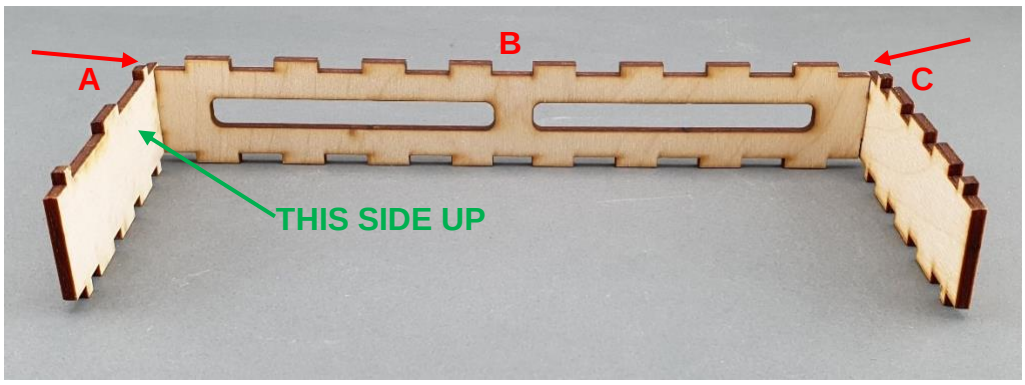
Step 3 – Align the pieces as shown in the image below:



Step 4 – Assembly together A → B → C, as shown in the images below:



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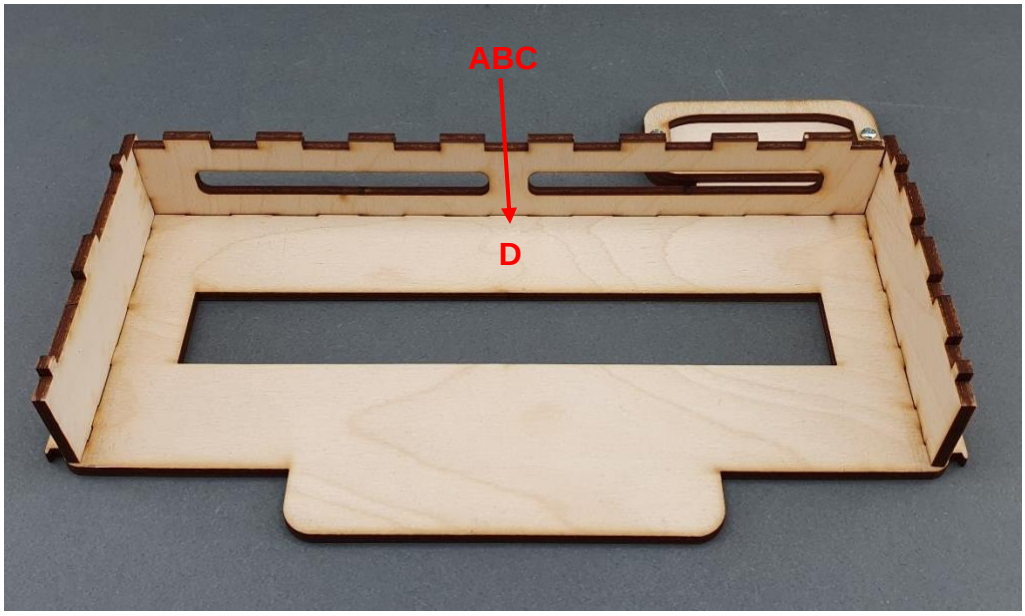
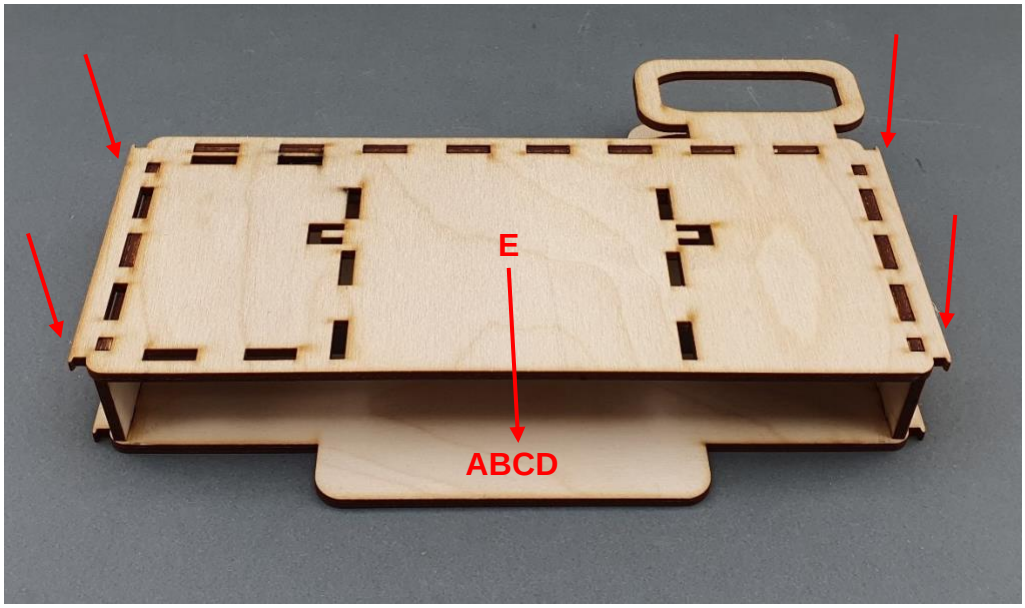
Step 5 – Assembly ABC → D, as shown in the images below:



Step 6 – Assembly E on top of ABCD, as shown in the images below:



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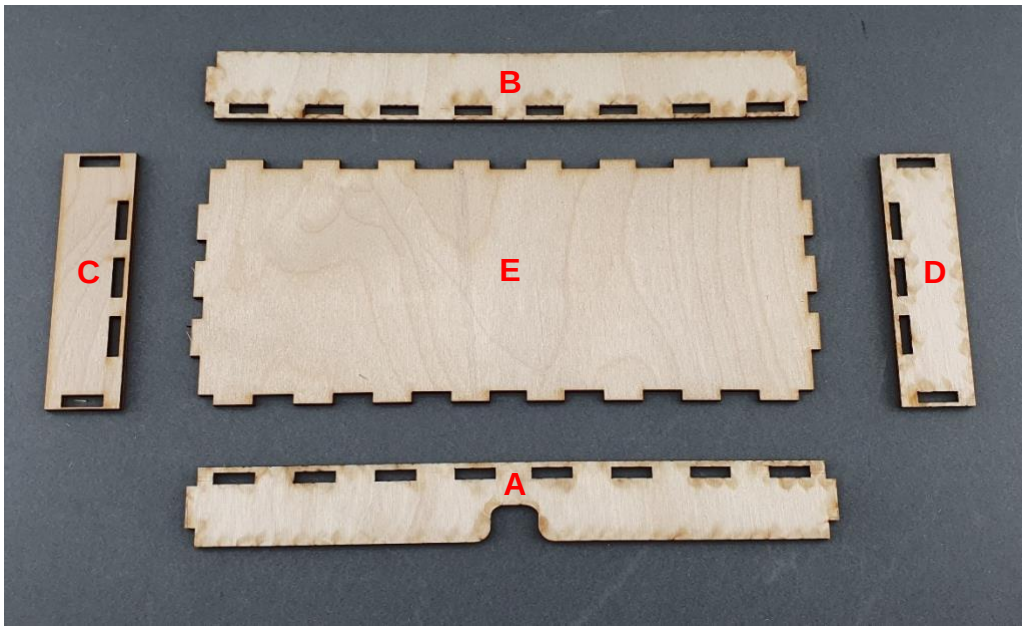
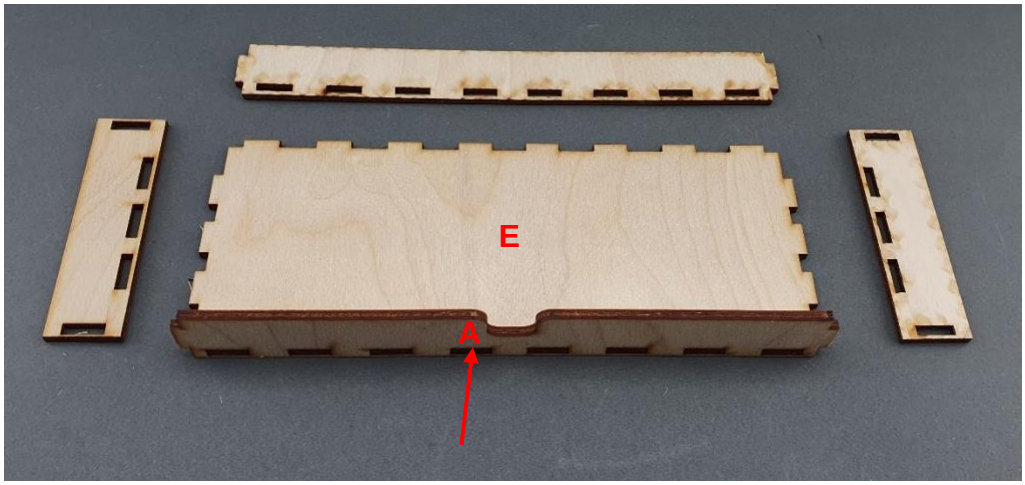
3.2. Drawer Assembly

Step 1: What you will need:



Step 2: Attach A to E, as shown in the image below:



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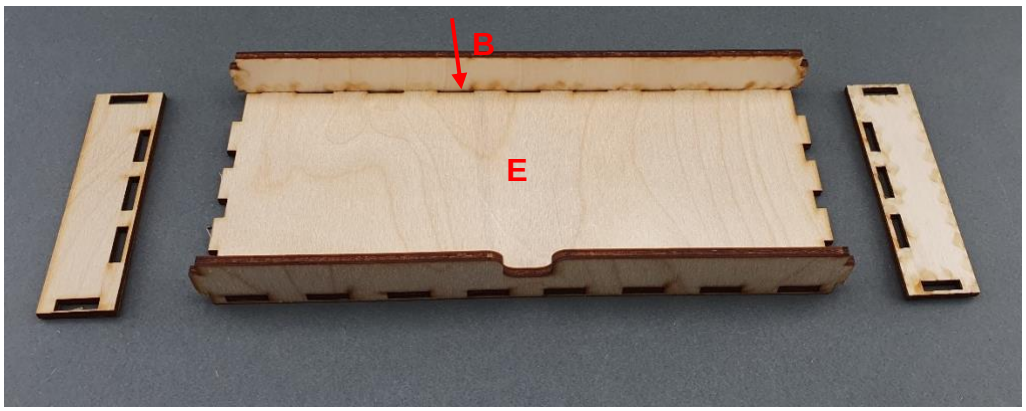
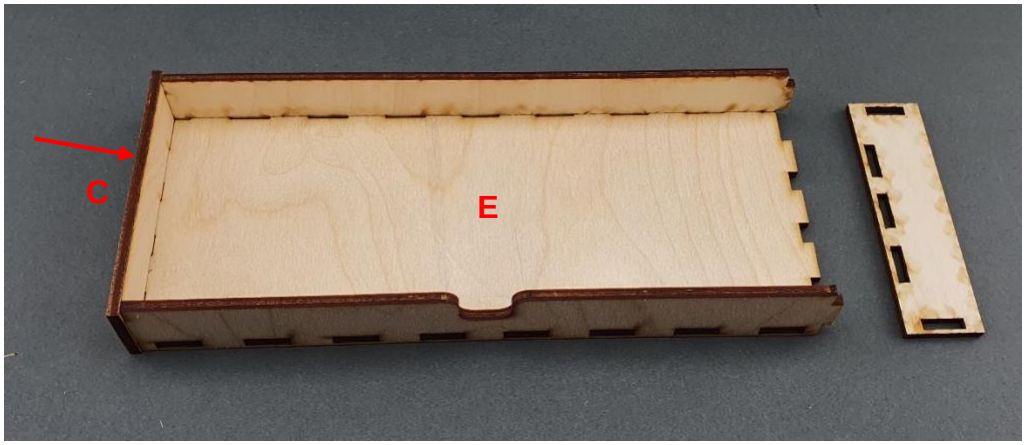
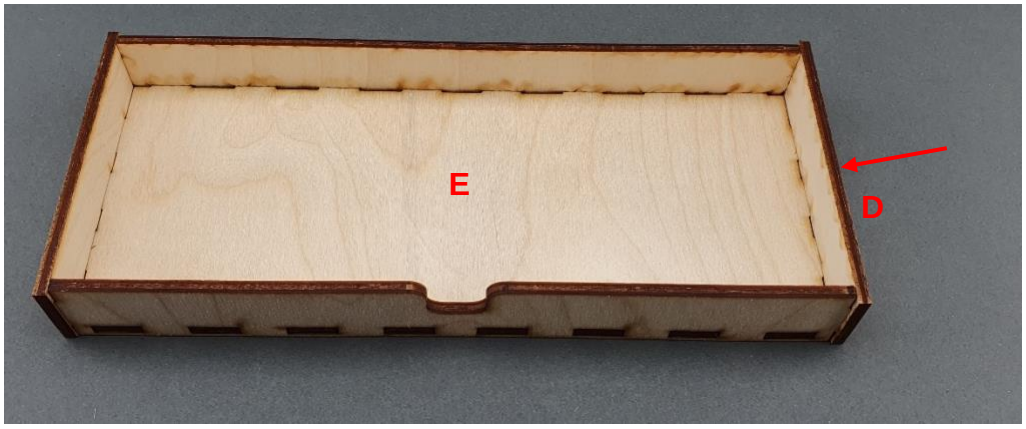
Step 3: Attach B to E, as shown in the image below:



Step 4: Attach C to E, as shown in the image below:



Step 5: Attach D to E, as shown in the image below:



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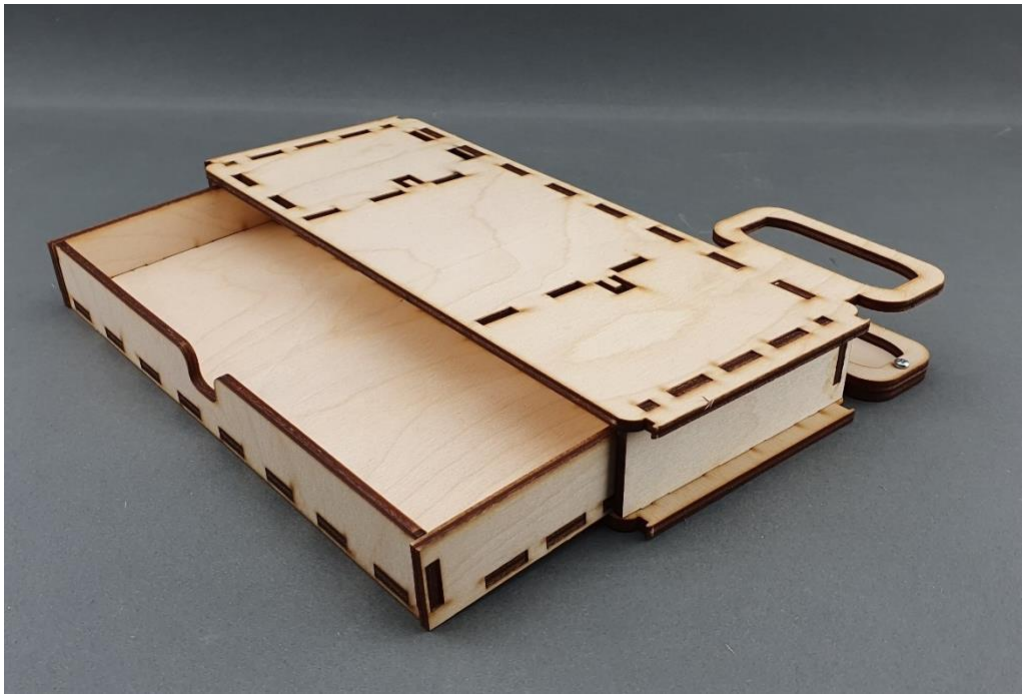
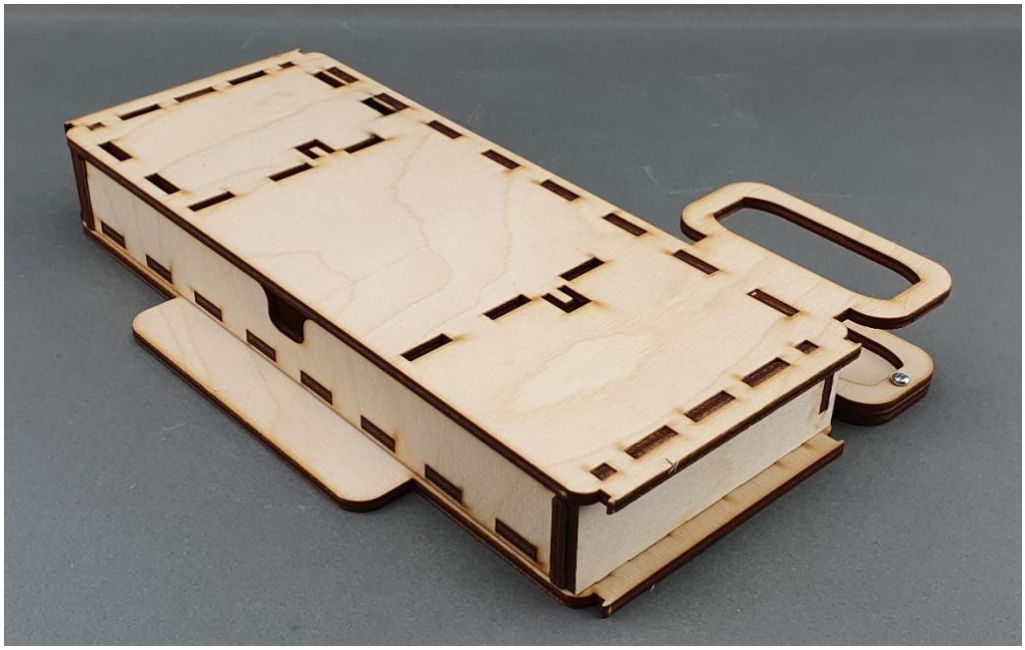
Step 6: Insert drawer to base, as shown in the images below:





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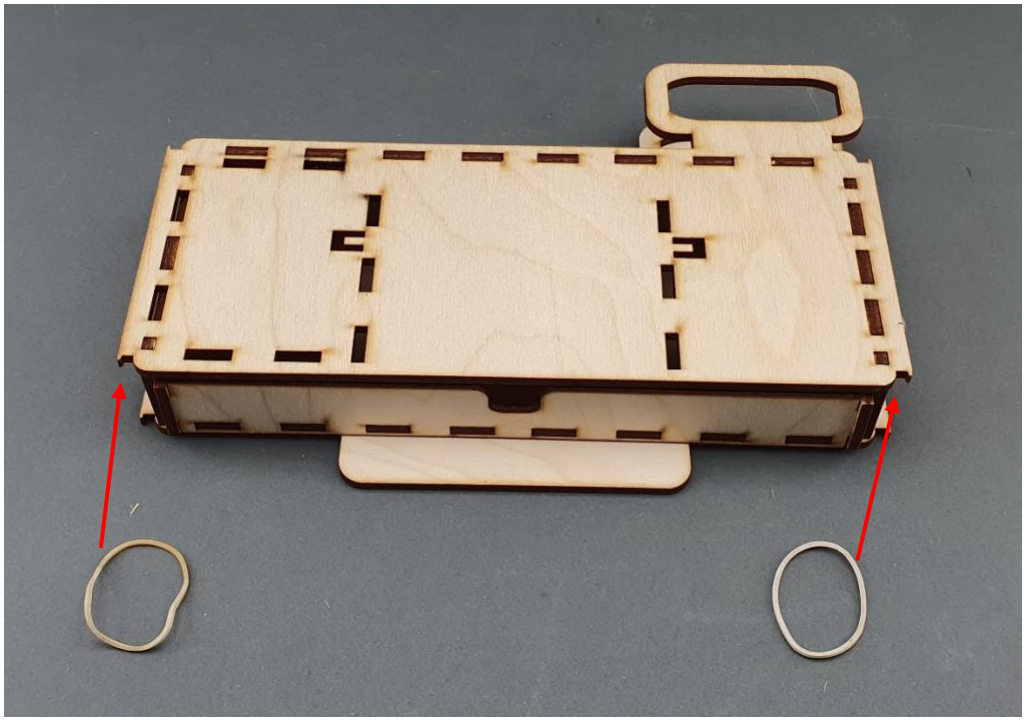
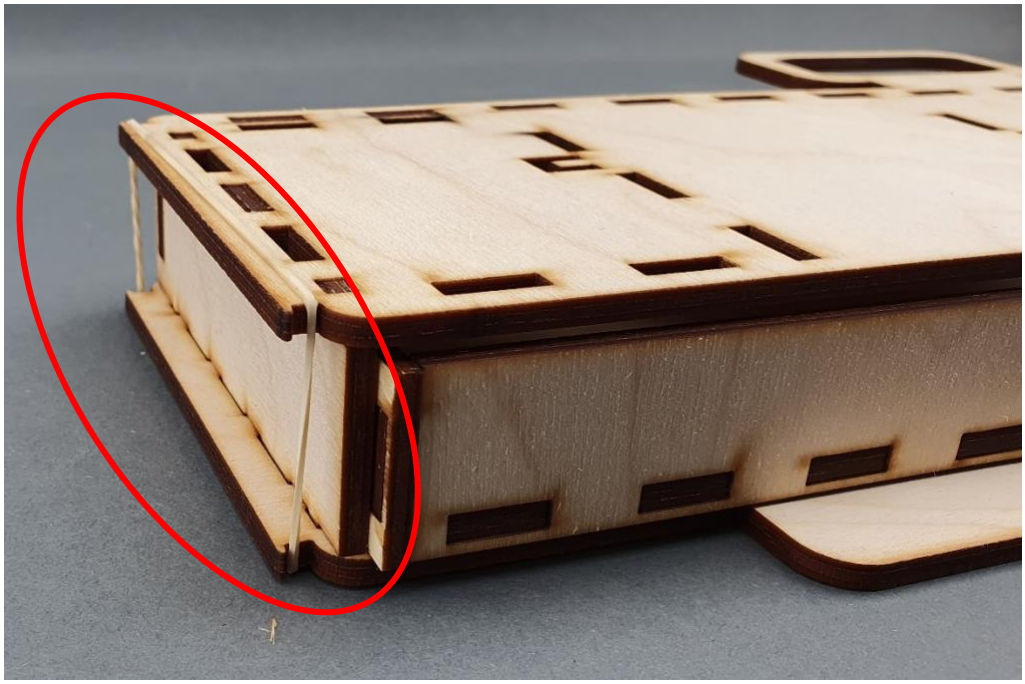
Step 7: Attach rubber bands to base and drawer, as shown in the images below:





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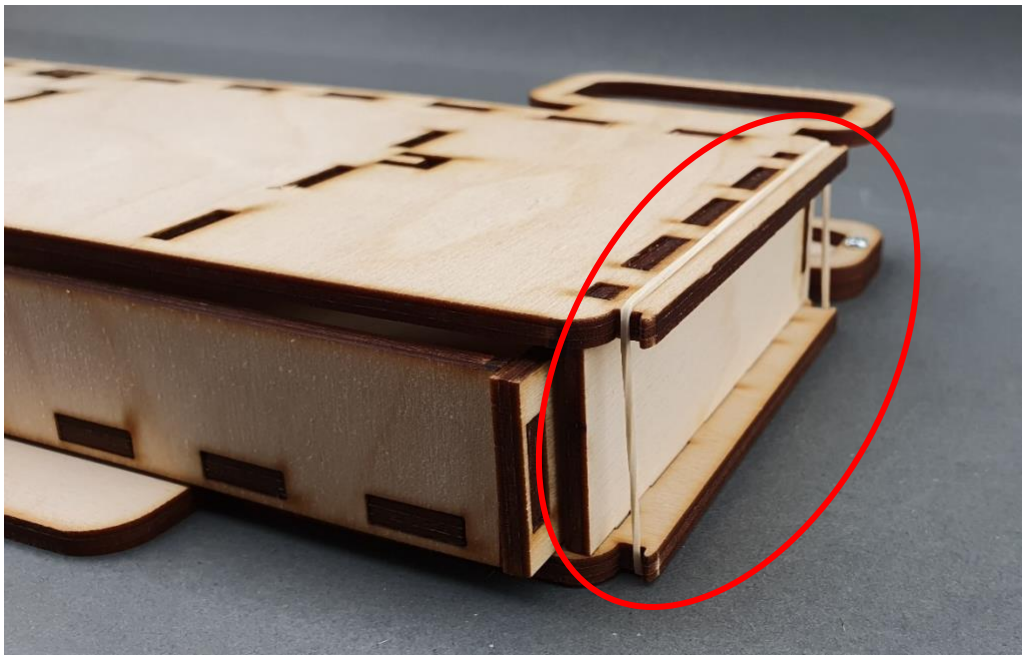
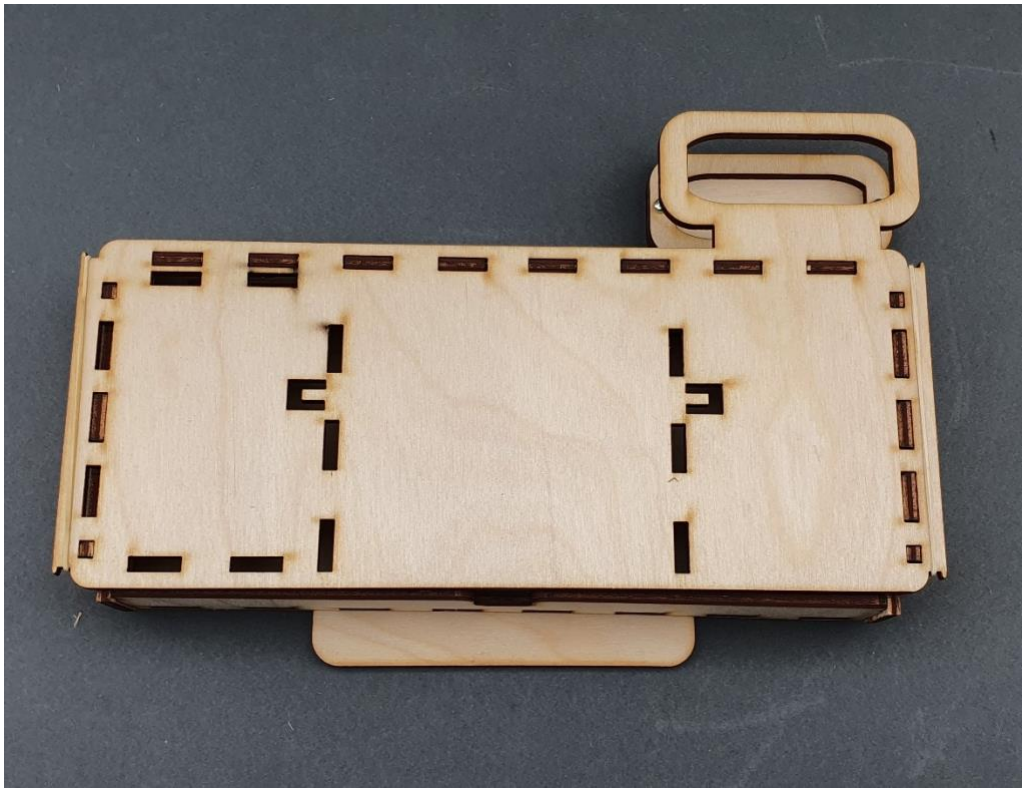


Step 8: The base and drawer assembly are completed:



3.3. Upper-body Assembly

Step 1: What you will need:

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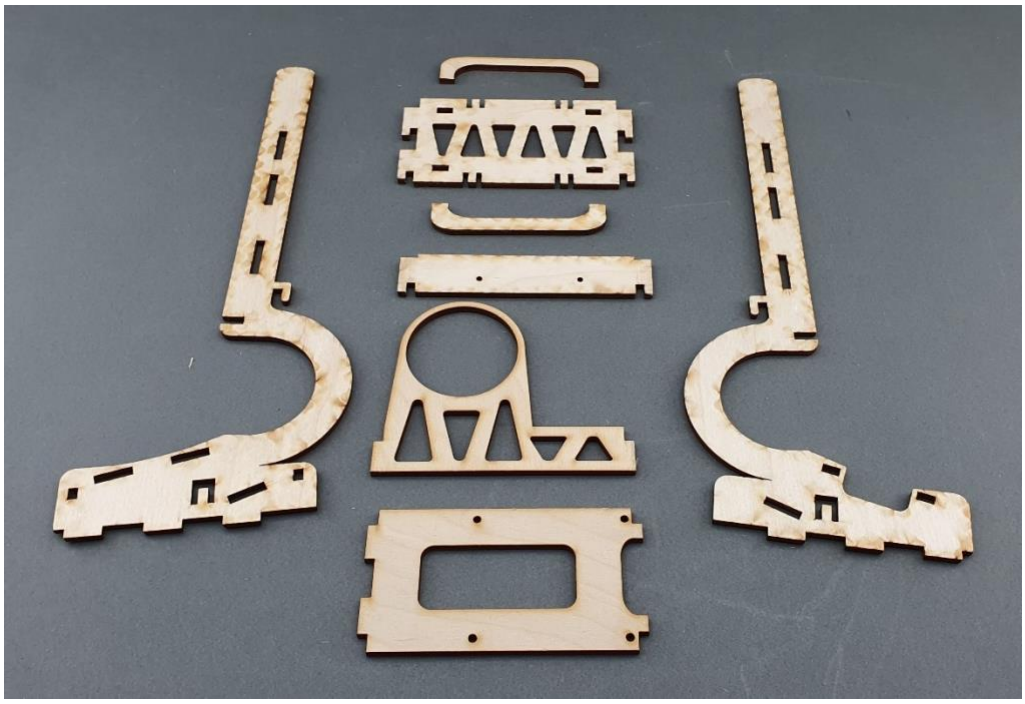

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Step 2: Attaching speaker base to left arm, as shown in the picture below:

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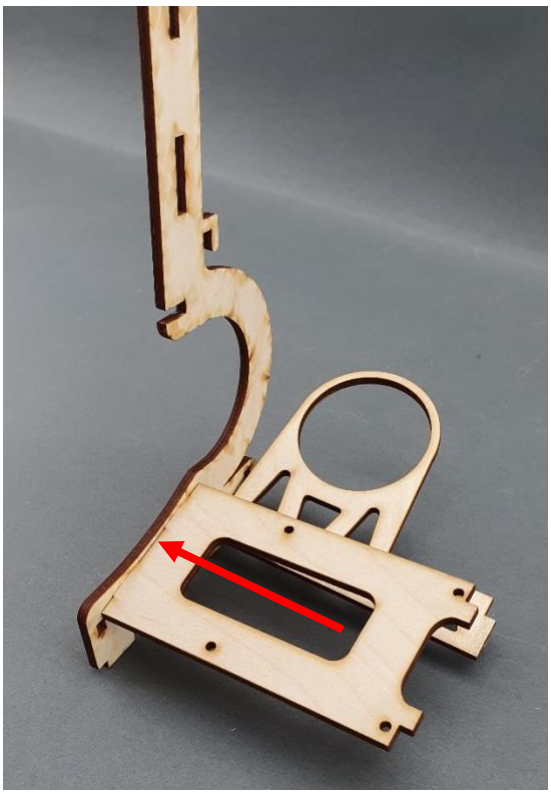
Step 3: Attaching Raspberry Pi base to left arm, as shown in the picture below:



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Step 4: Attaching right arm, as shown in the picture below:

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Step 5: Attaching LCD controller base, as shown in the picture below:

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Step 6: Attaching LCD I/O board base, as shown in the picture below:

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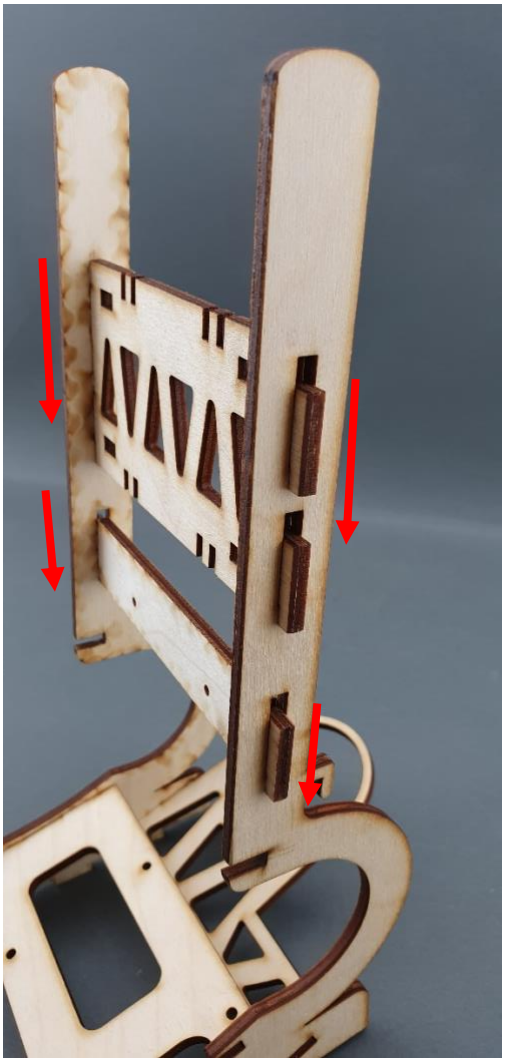
Step 7: Sliding holders to upper-body shoulders, as shown in the picture below:



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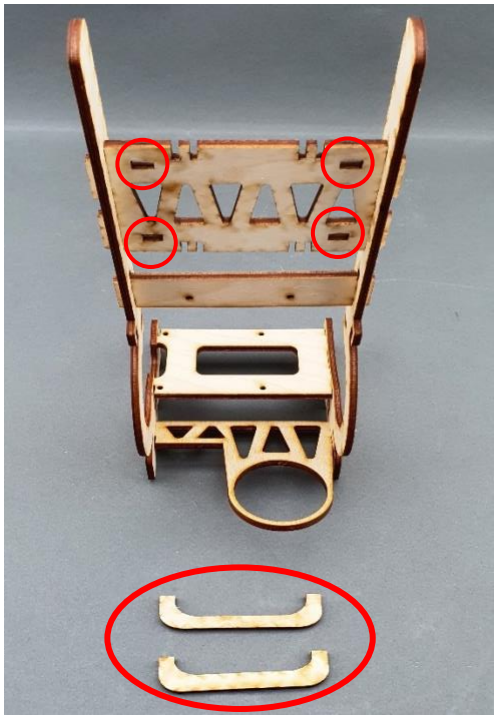
Step 7: Attaching LCD I/O board holders, , as shown in the pictures below:



3.4. Raspberry Pi Assembly

Step 1: What you will need:

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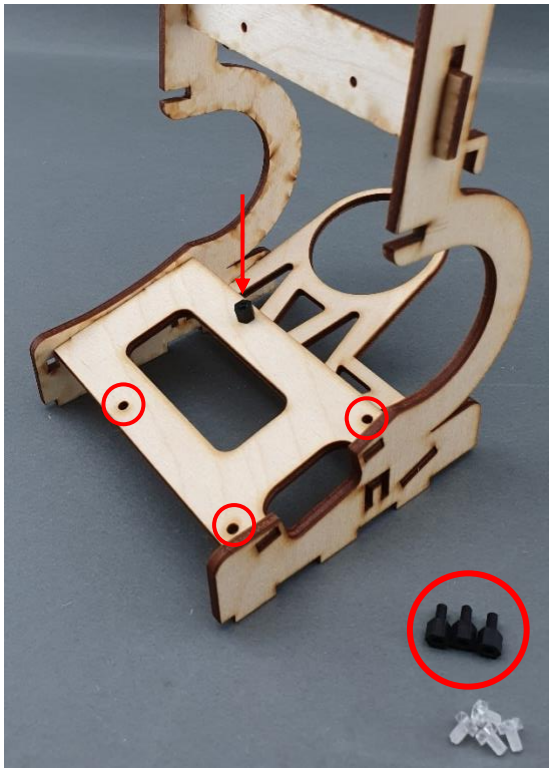
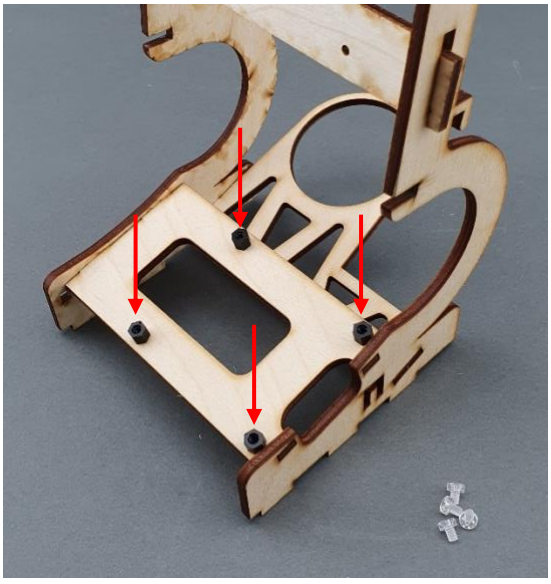
Step 2: Placing the screw fixtures on the Raspberry Pi base, as shown in the pictures below:





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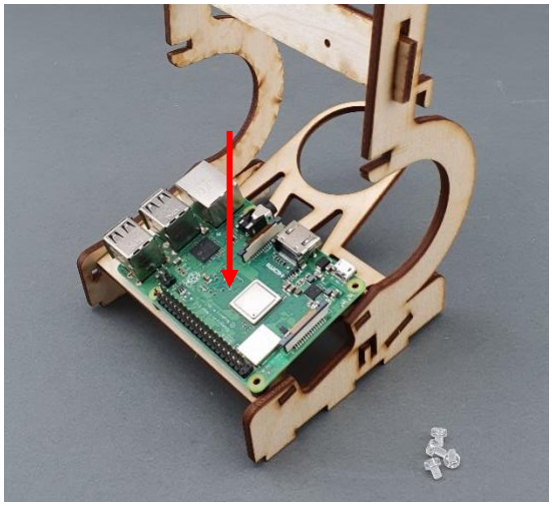
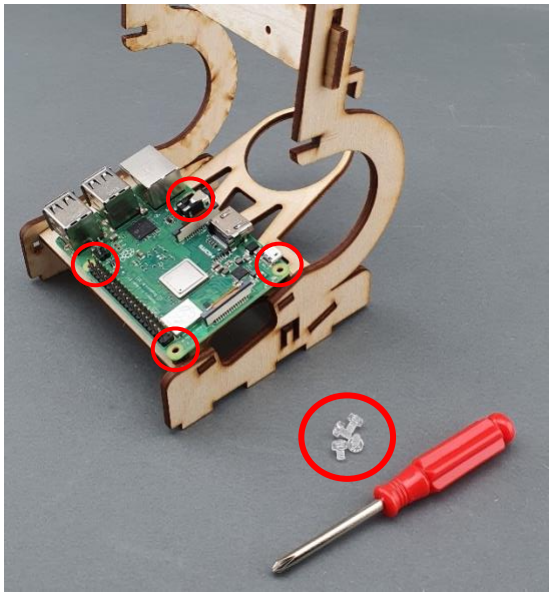
Step 3: Placing the Raspberry Pi on top of screw fixtures, as shown in the picture below:



Step 4: Screw the Raspberry Pi to the fixtures, as shown in the pictures below:



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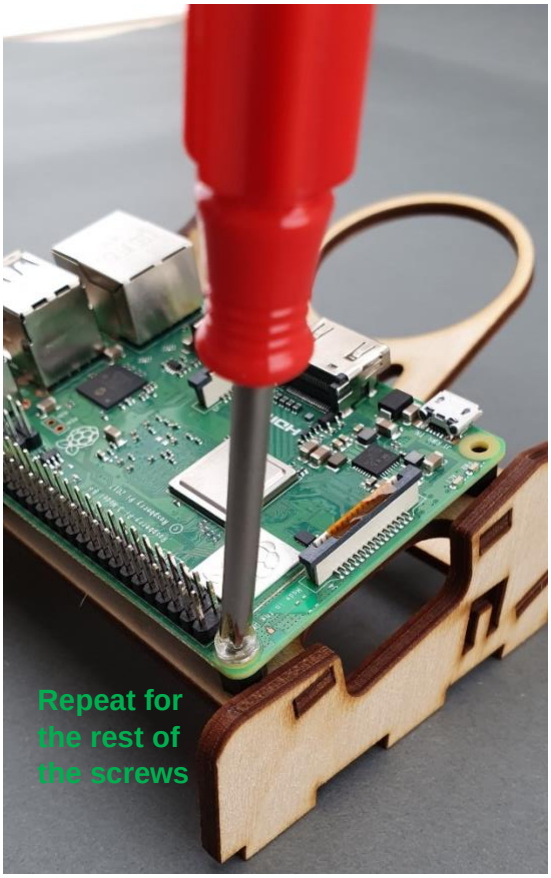

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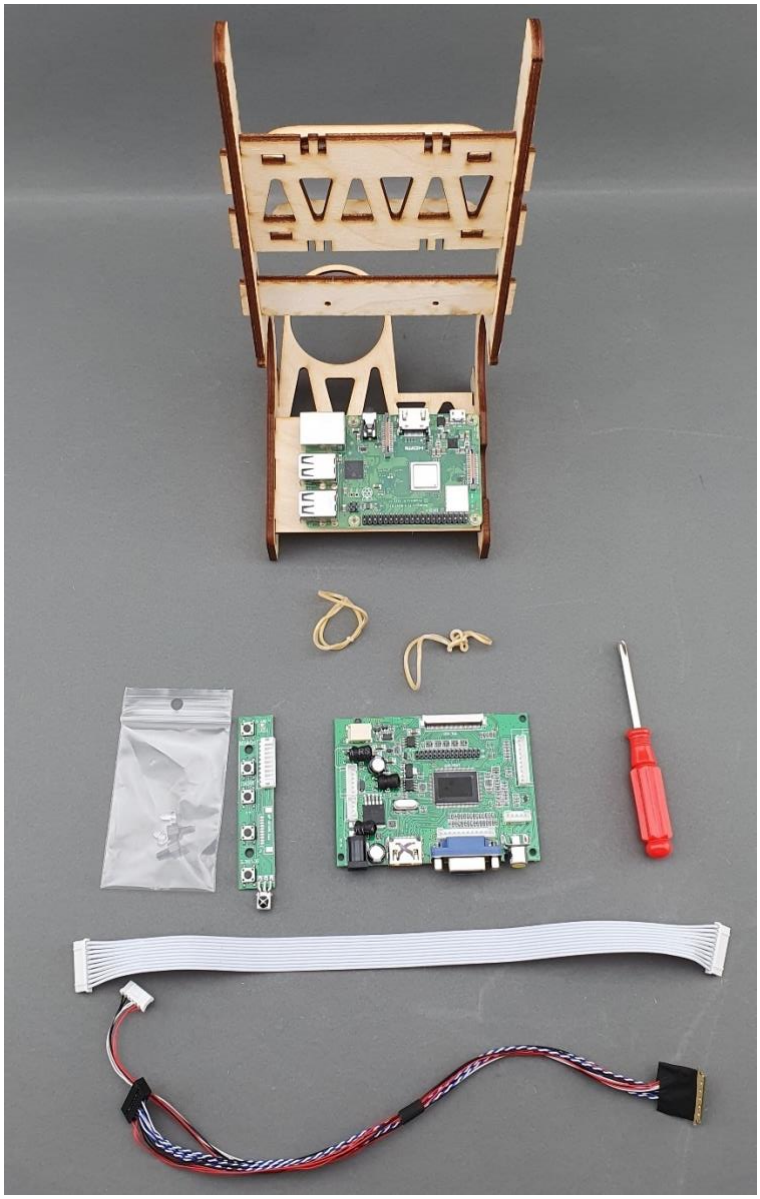
3.5. LCD Controller Assembly and Wiring

Step 1: What you will need:



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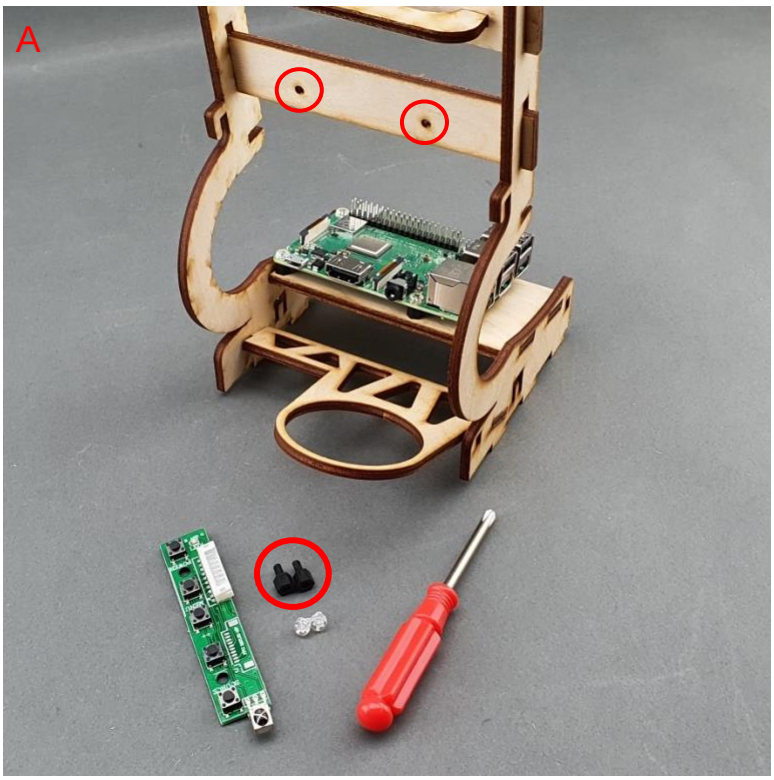
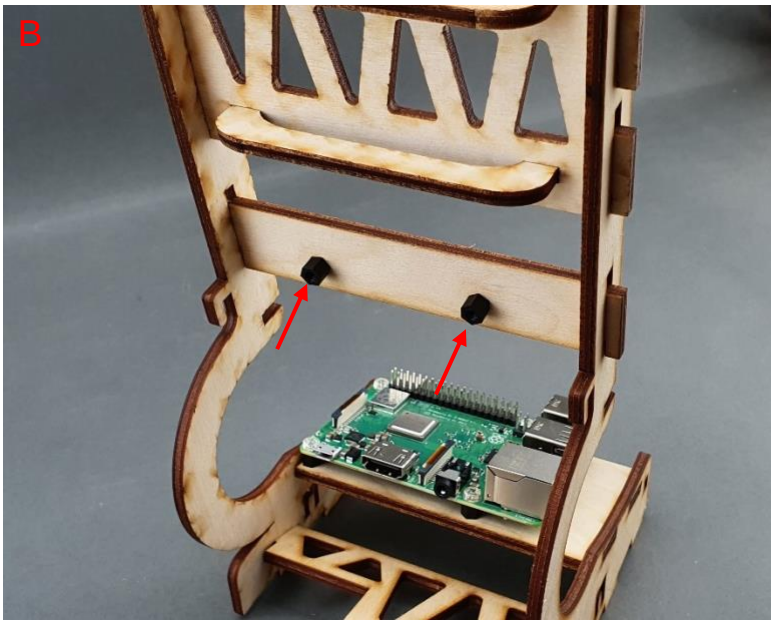
Step 2: Assembling the LCD controller, as shown in the pictures below:





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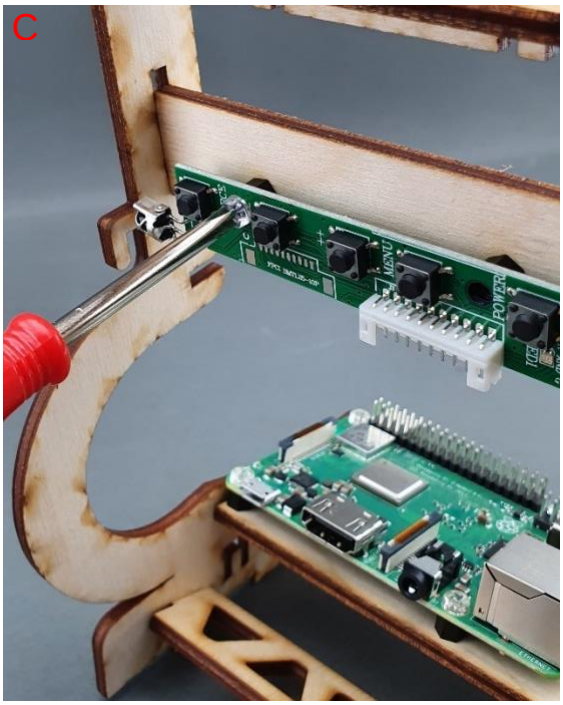
C



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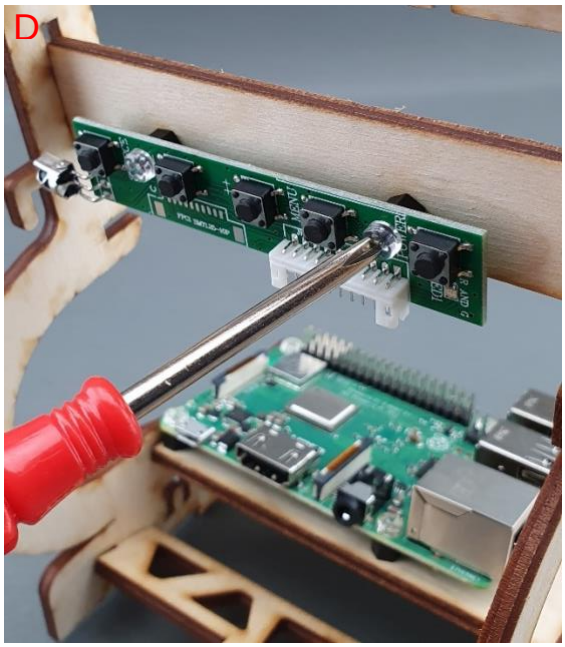

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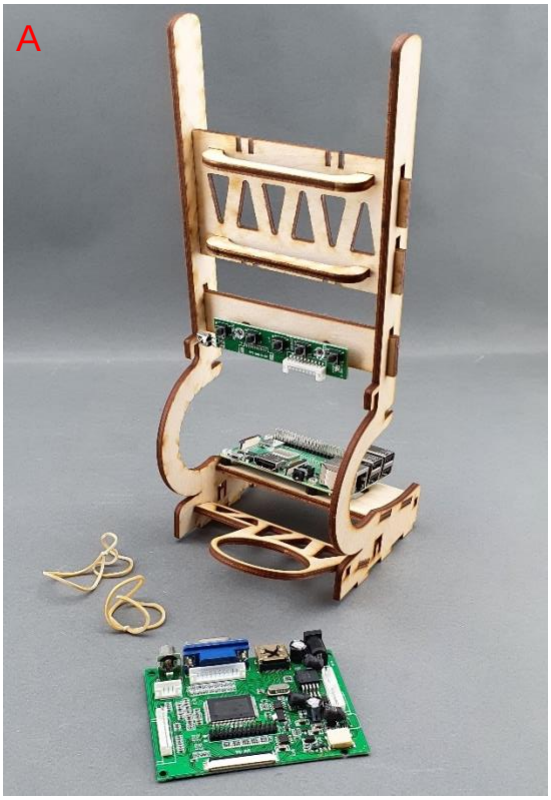
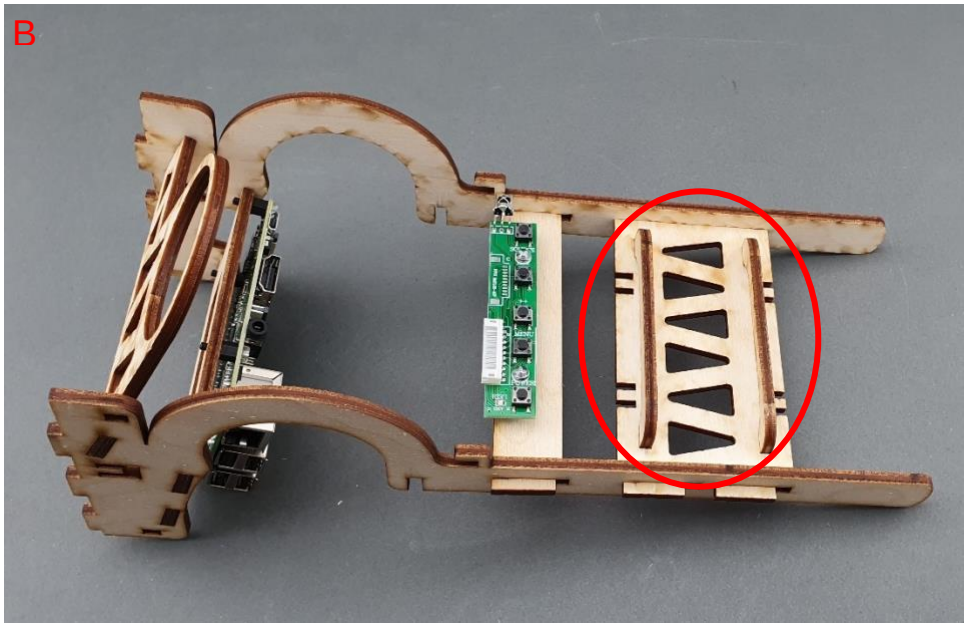
Step 3: Placing the LCD I/O board, as shown in the pictures below:





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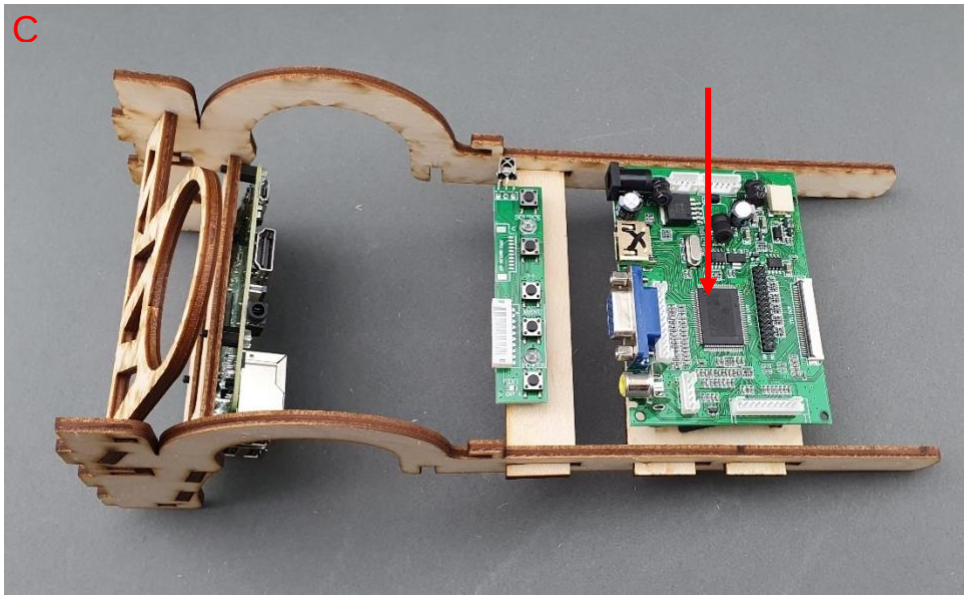
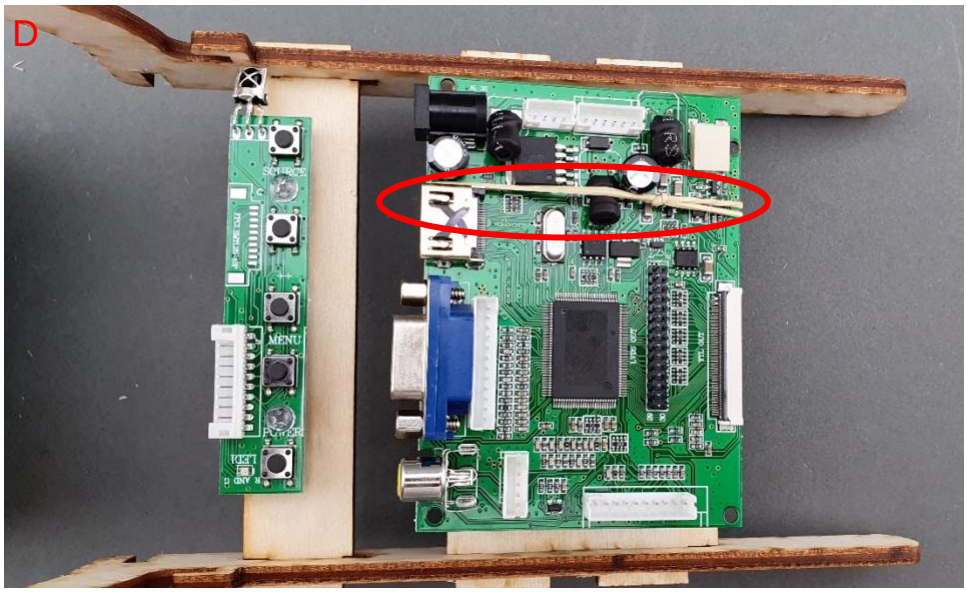
C



D



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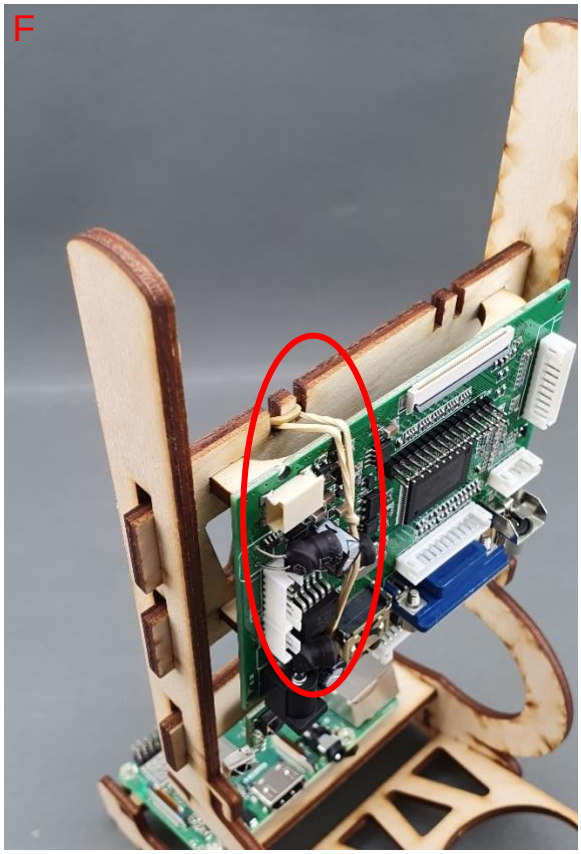

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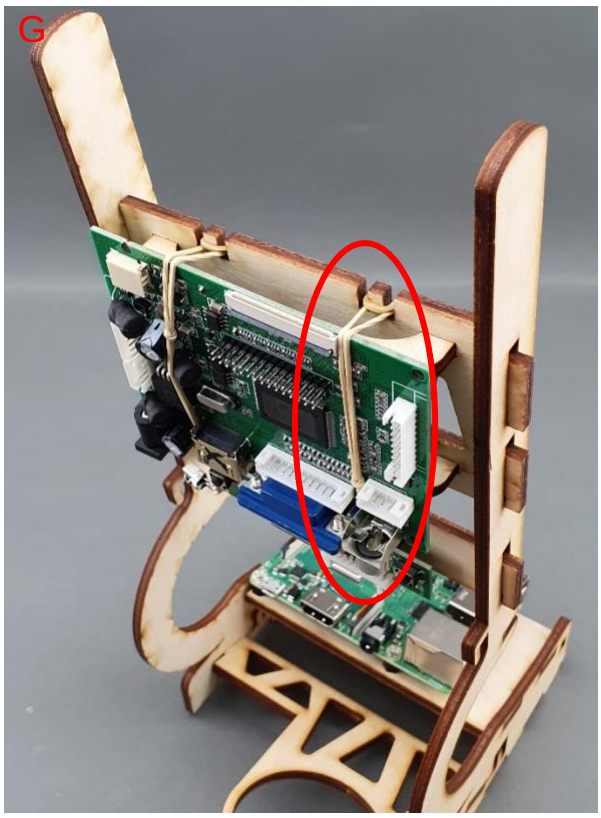

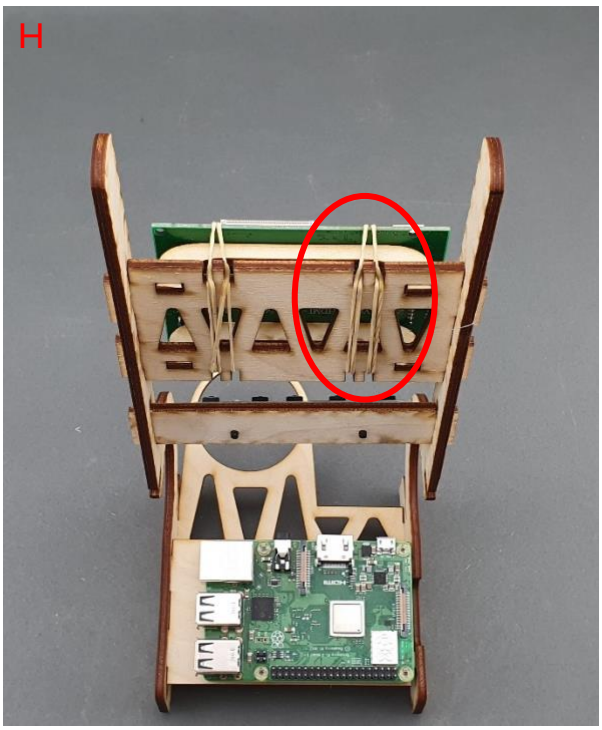

Step 4: Wiring of LCD Display Controller – Controller unit to I/O board:

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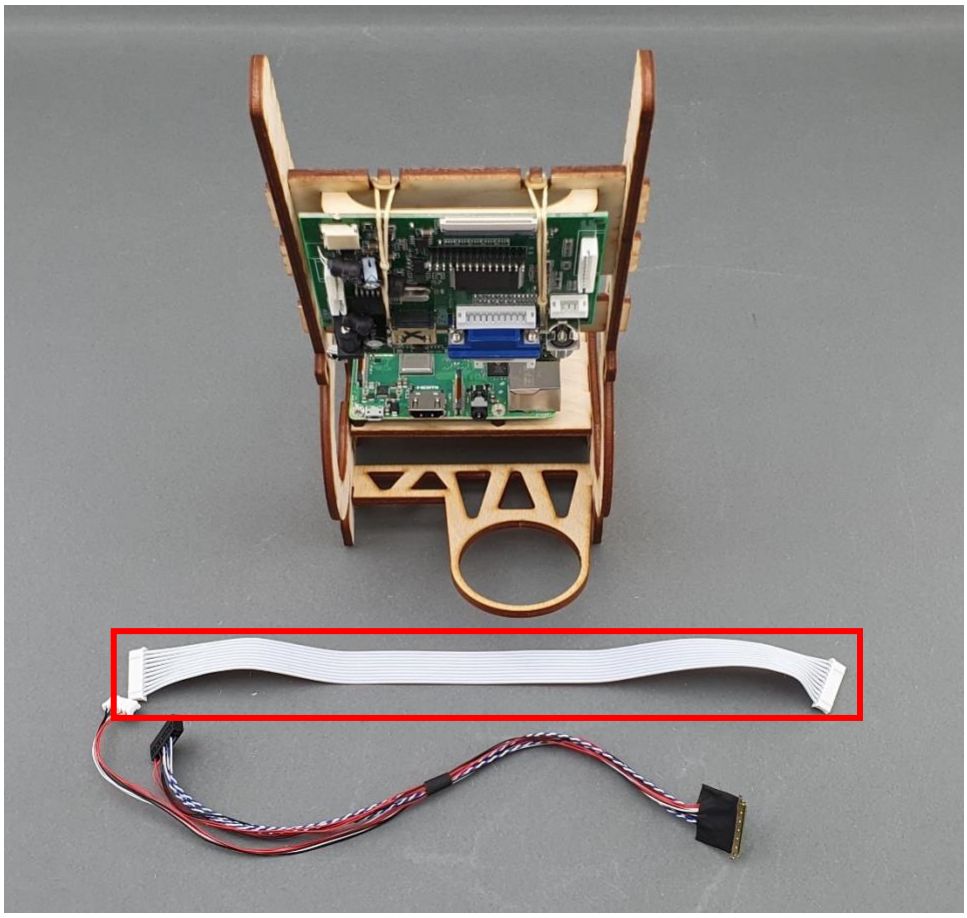

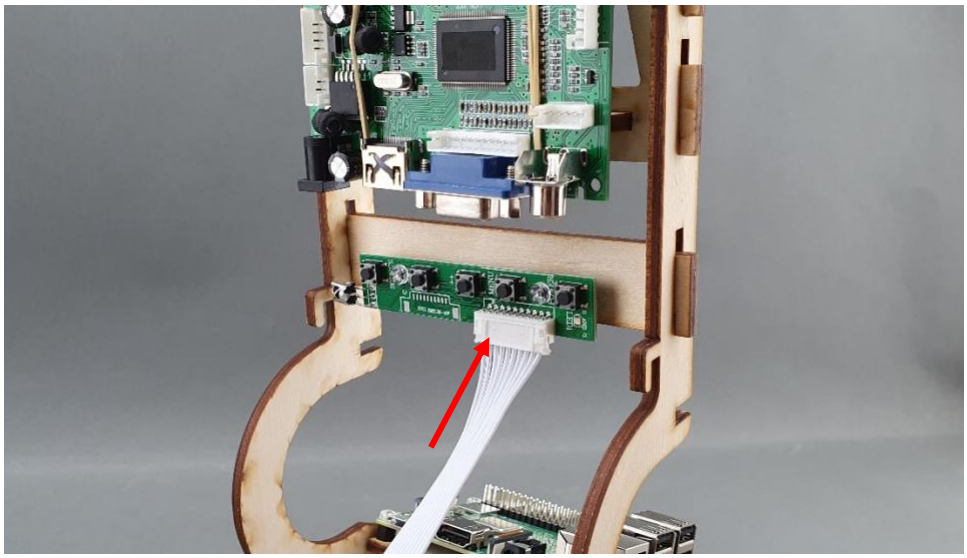

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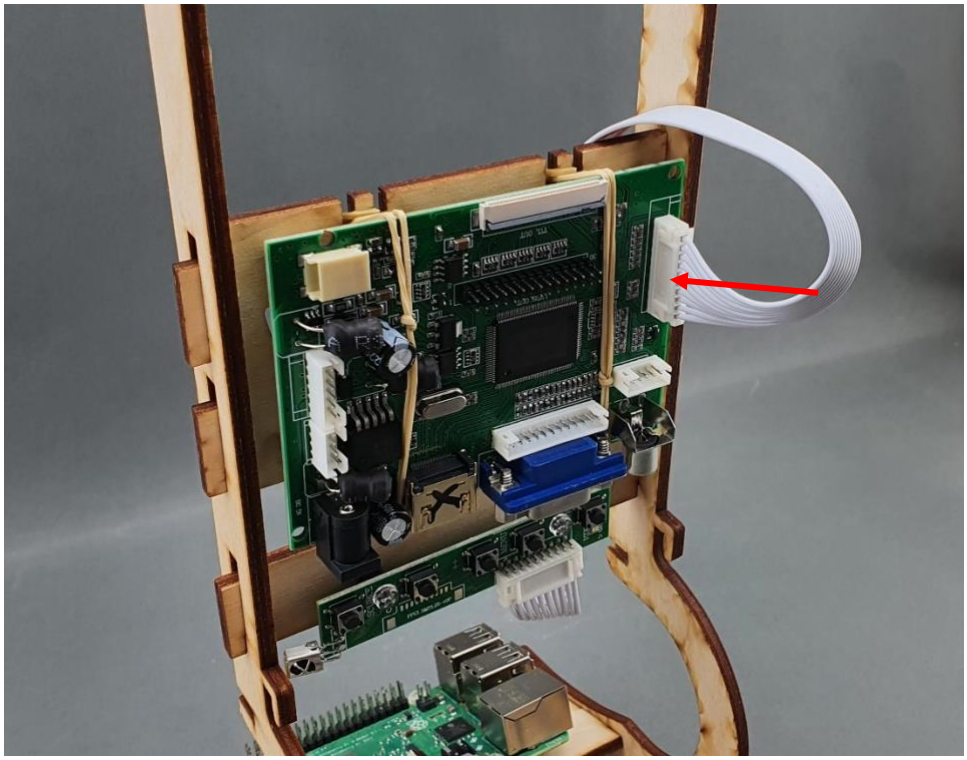

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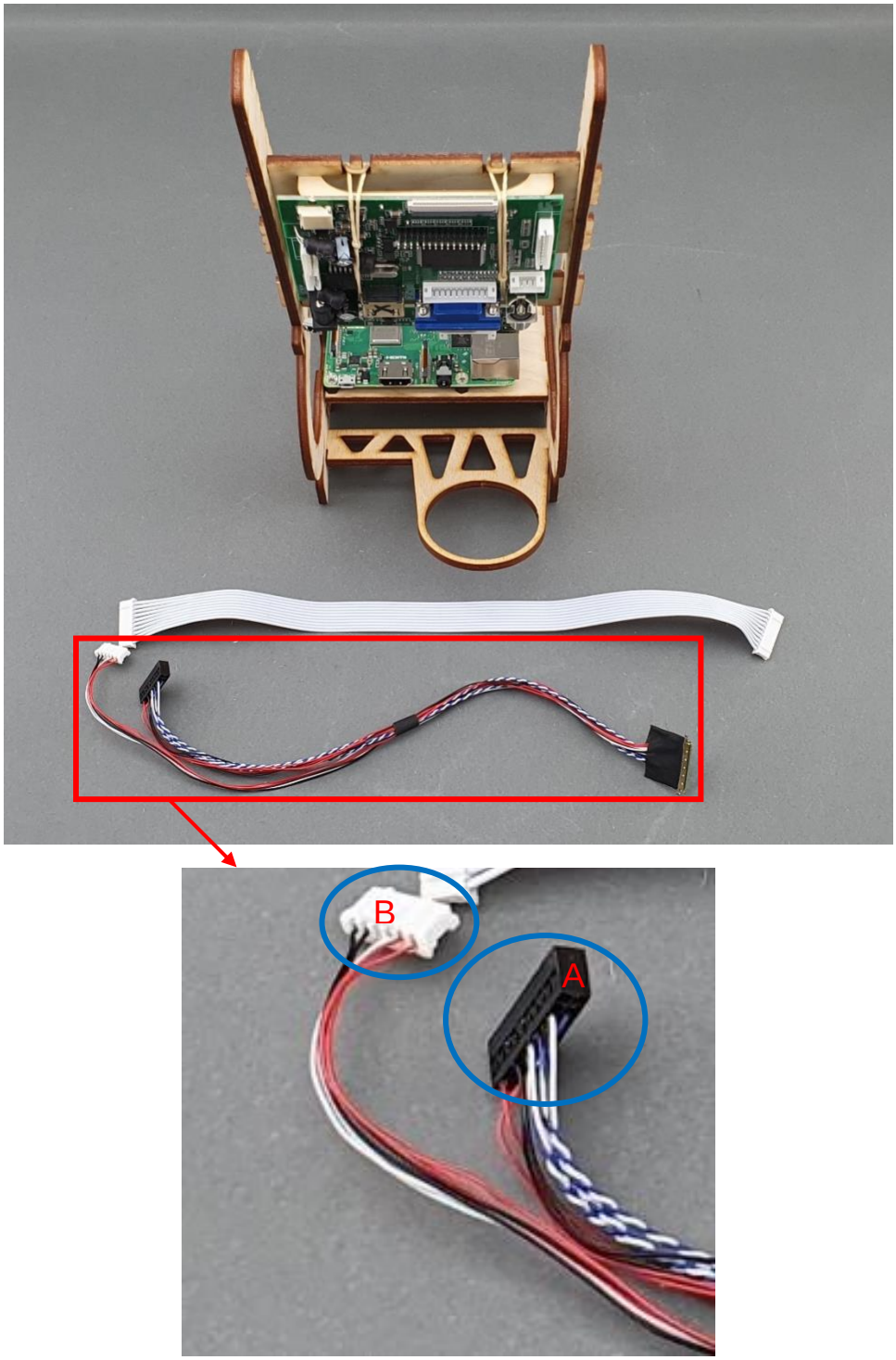
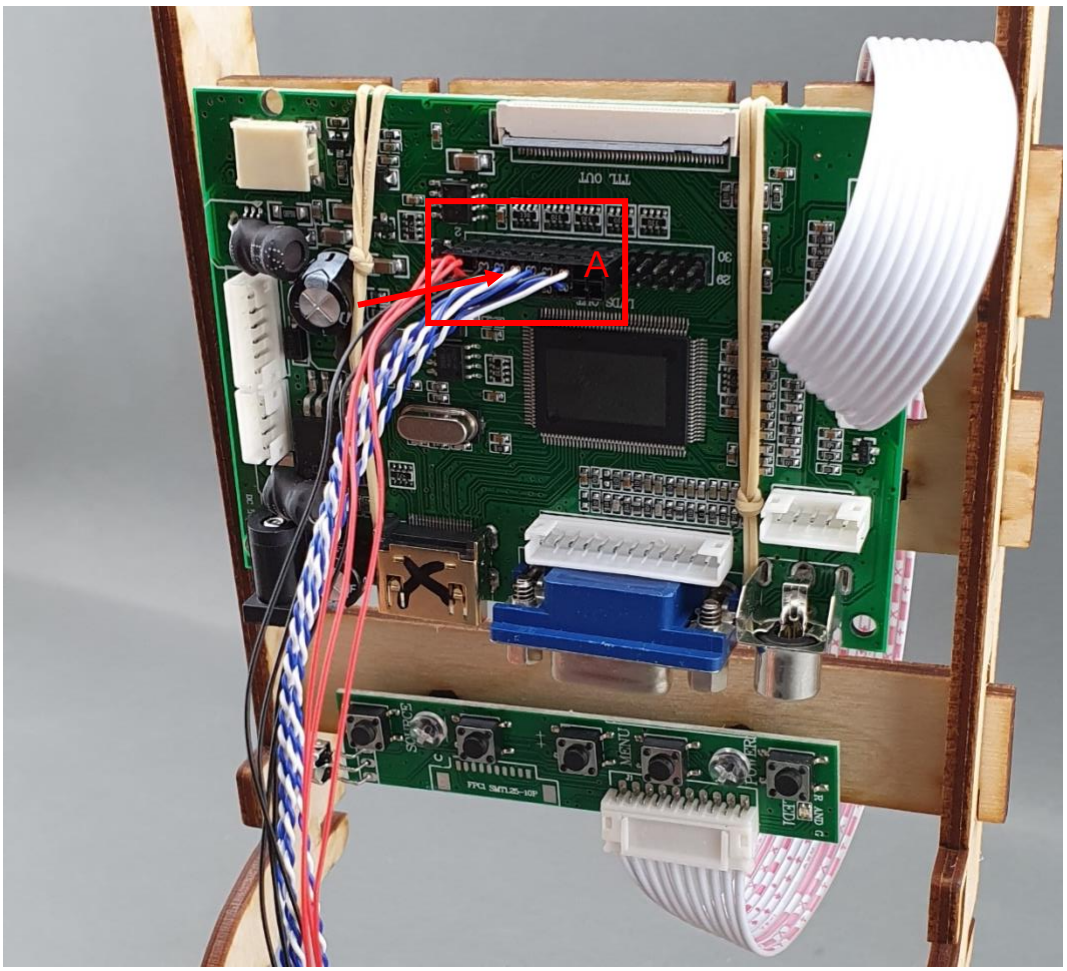
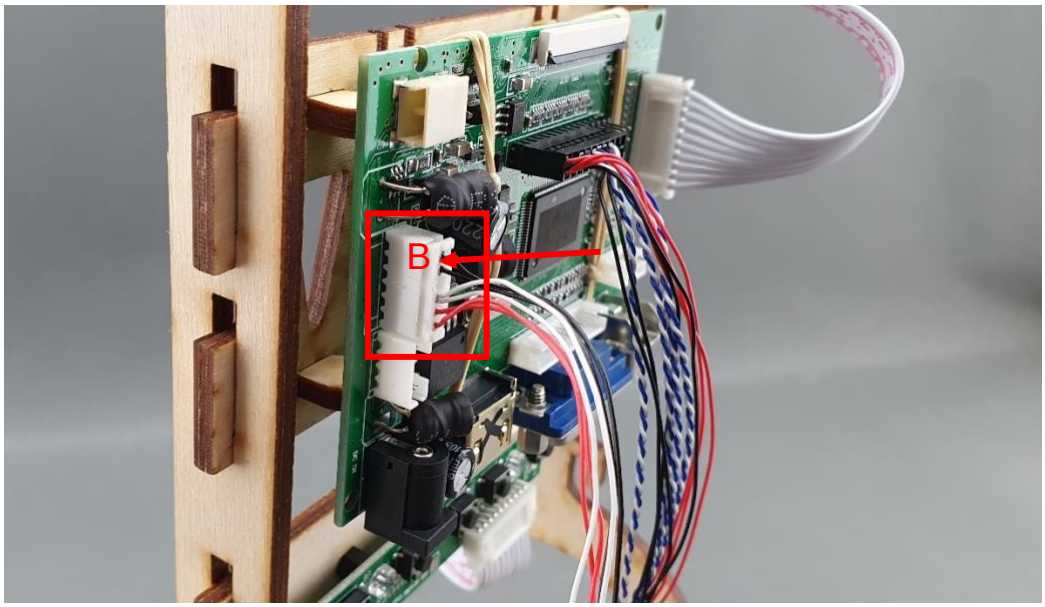
Step 5: Wiring of LCD Display Controller – I/O Board to LCD Display:







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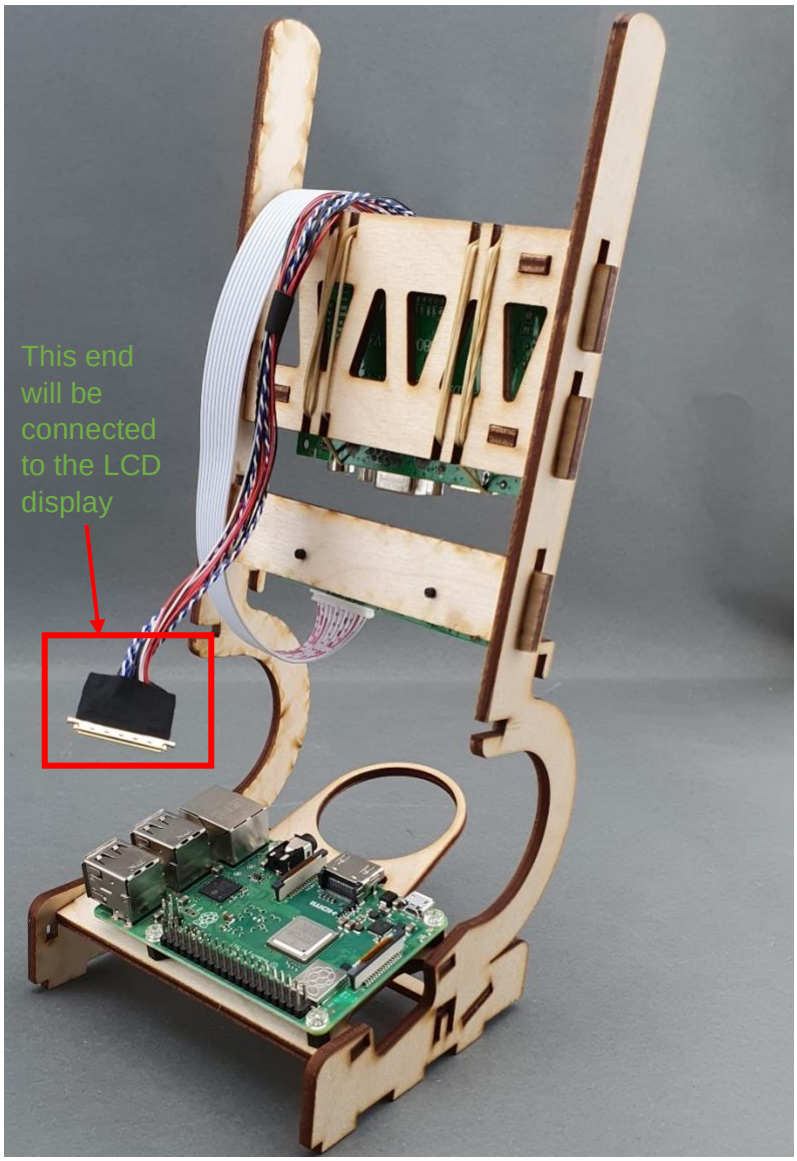

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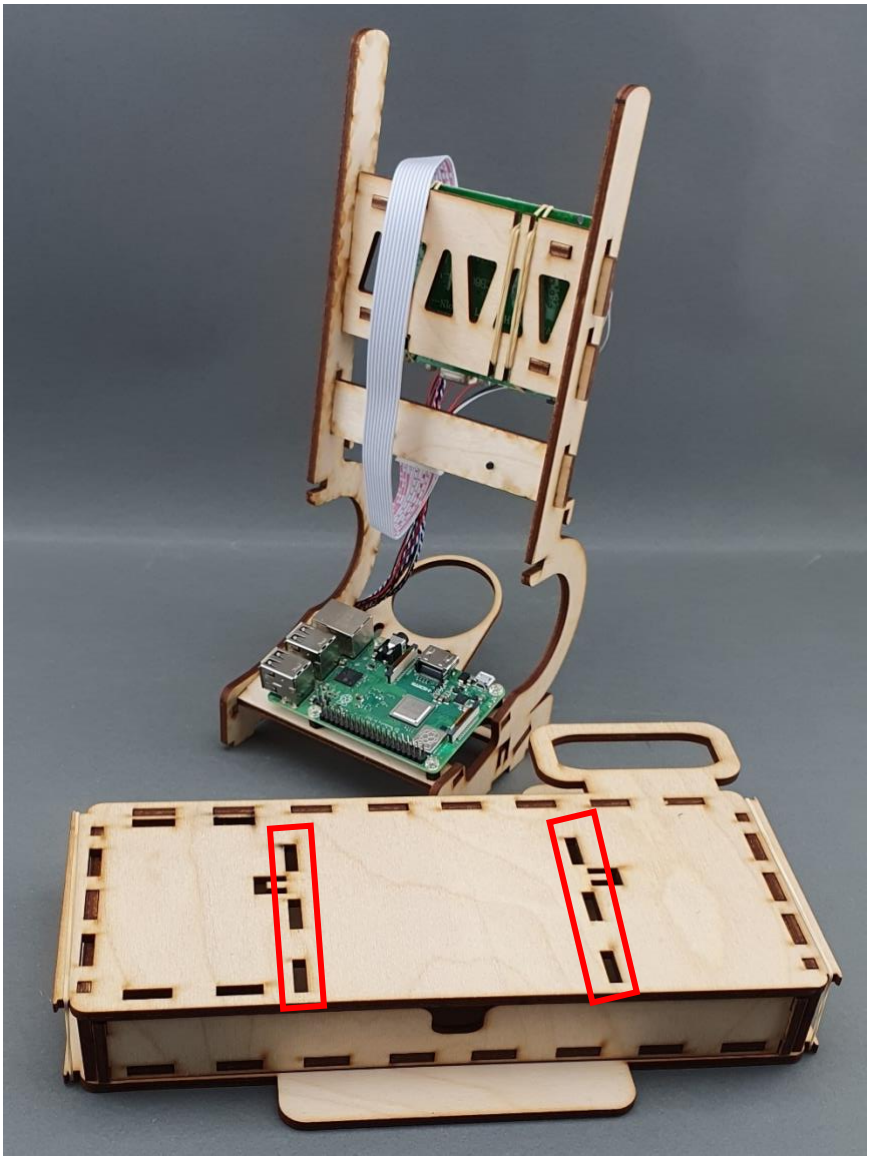
Step 6: Assembling upper body with base, as shown in the pictures below:



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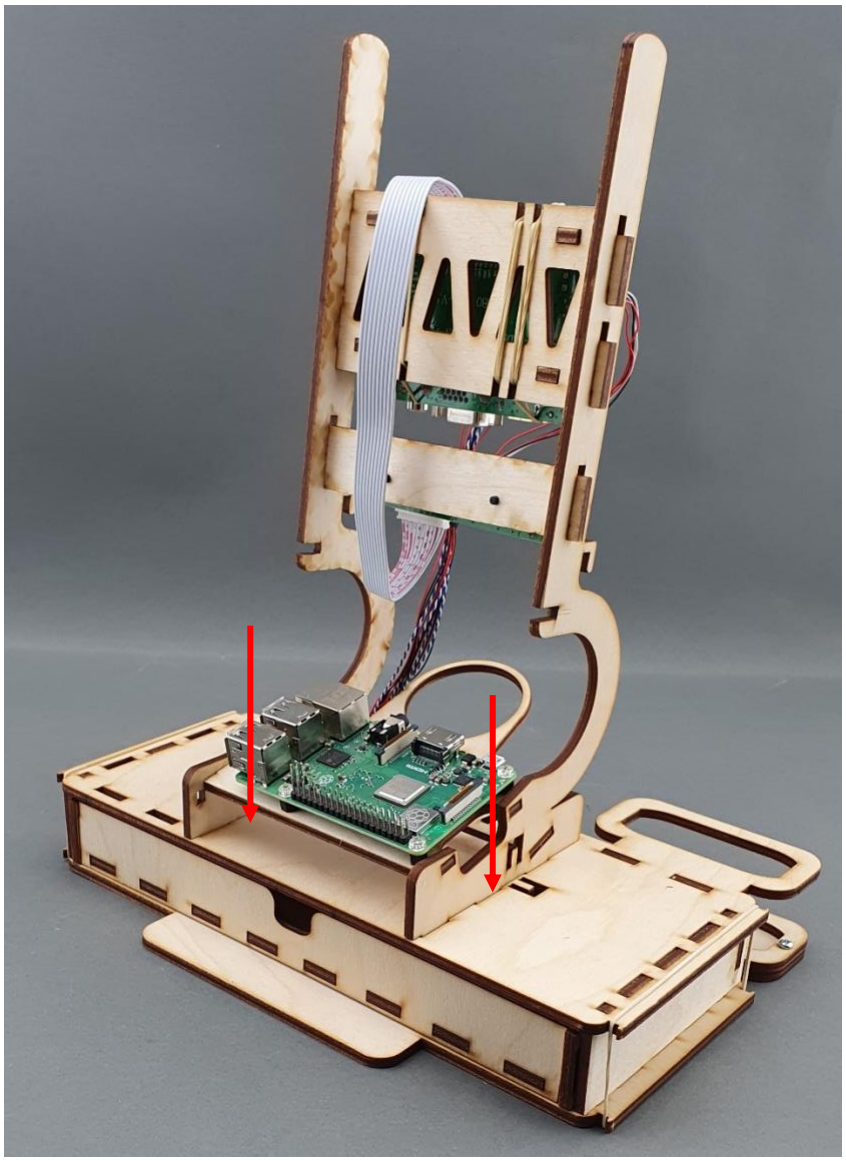

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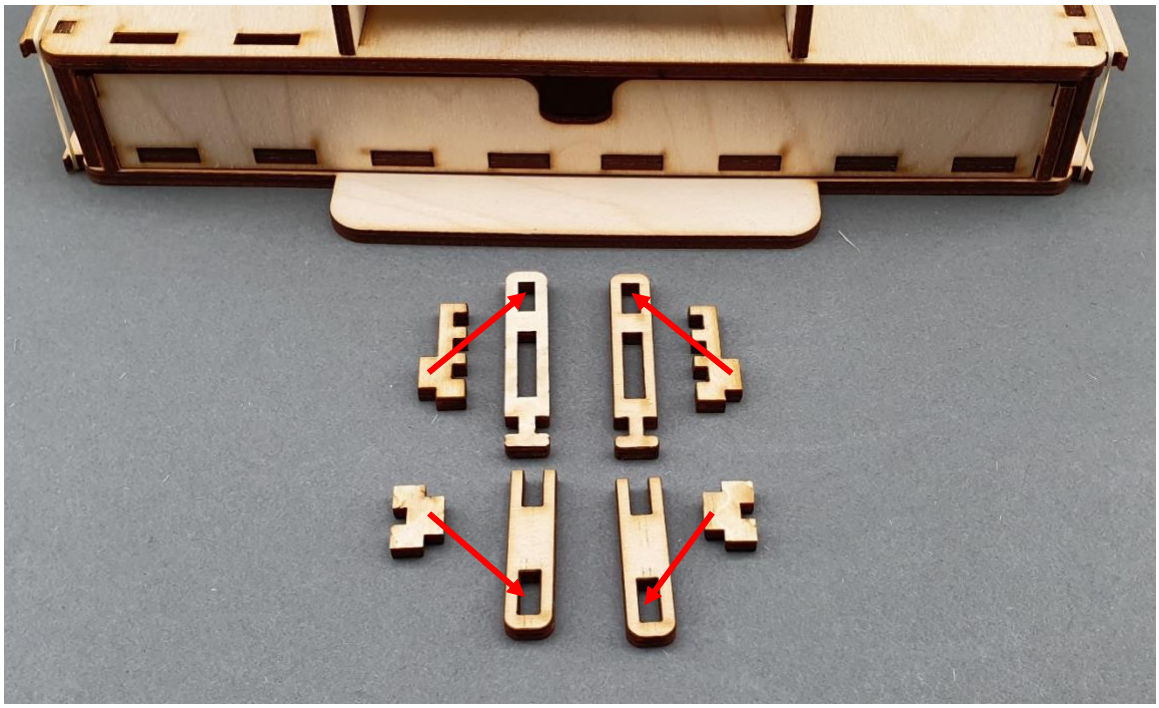
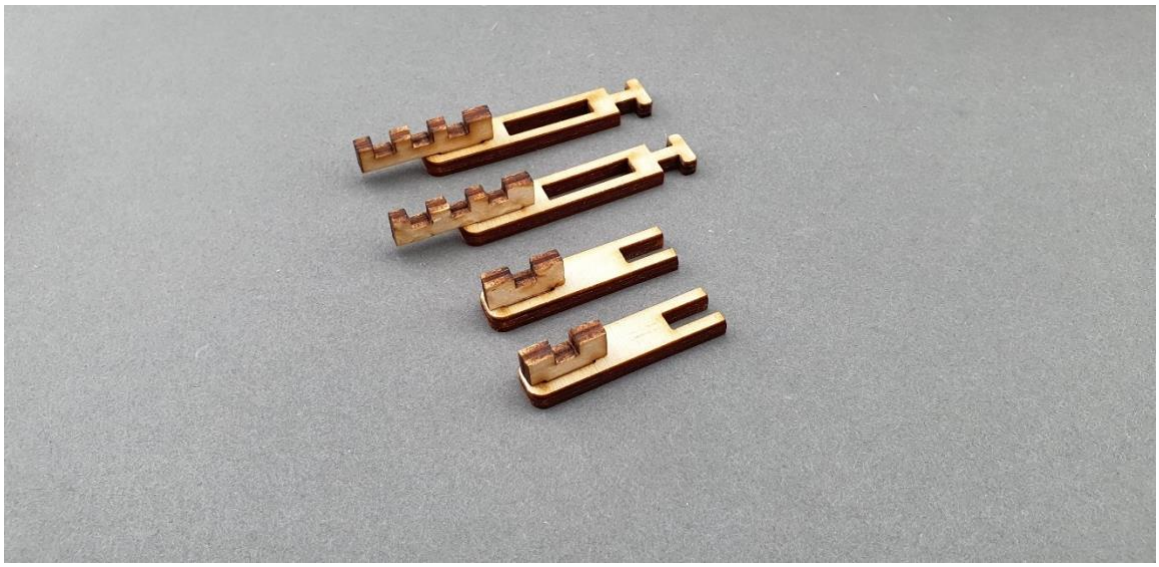
3.6. LCD Placeholders Assembly and LCD Attachment

Step 1: Assembling the LCD display placeholders, as shown in the pictures below:





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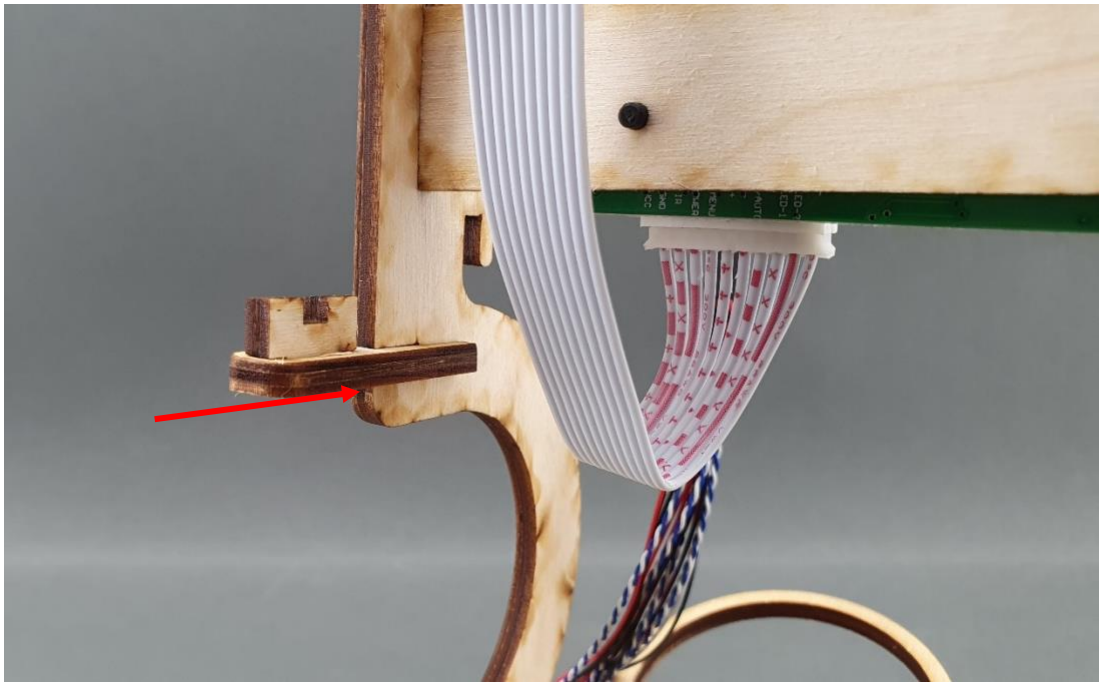
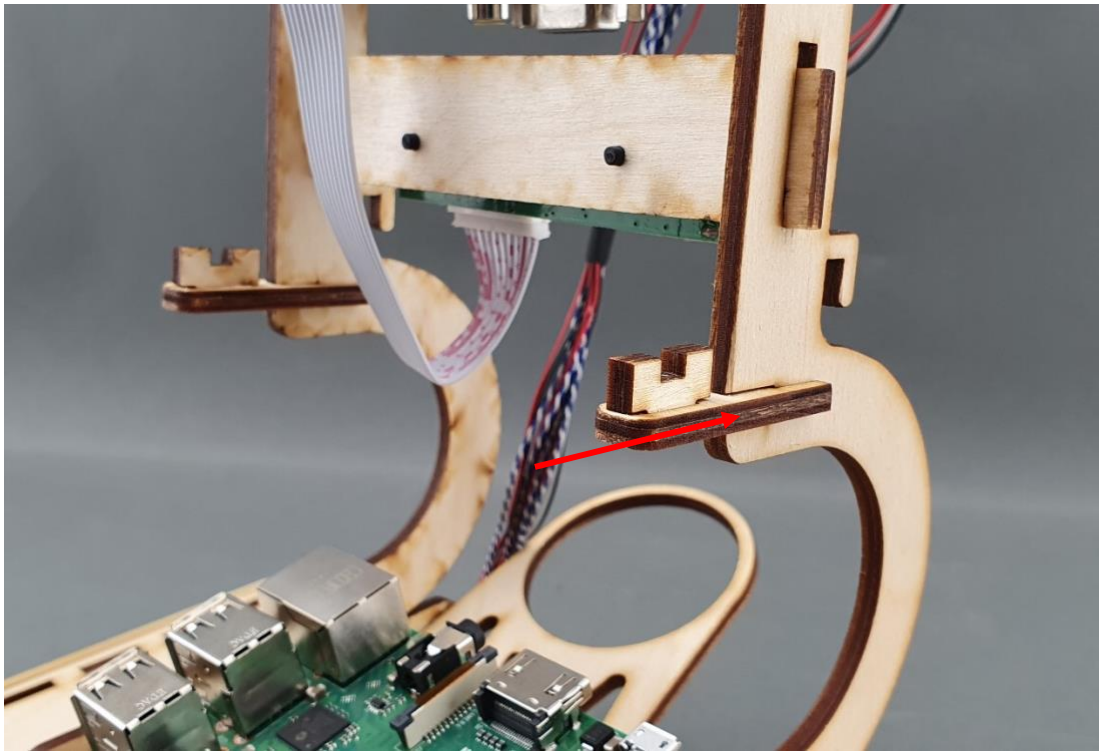
Step 2: Placing the LCD display placeholders to upper-body, as shown in the pictures below:





Step 3: Assembling the LCD display to the upper body, as shown in the pictures below:

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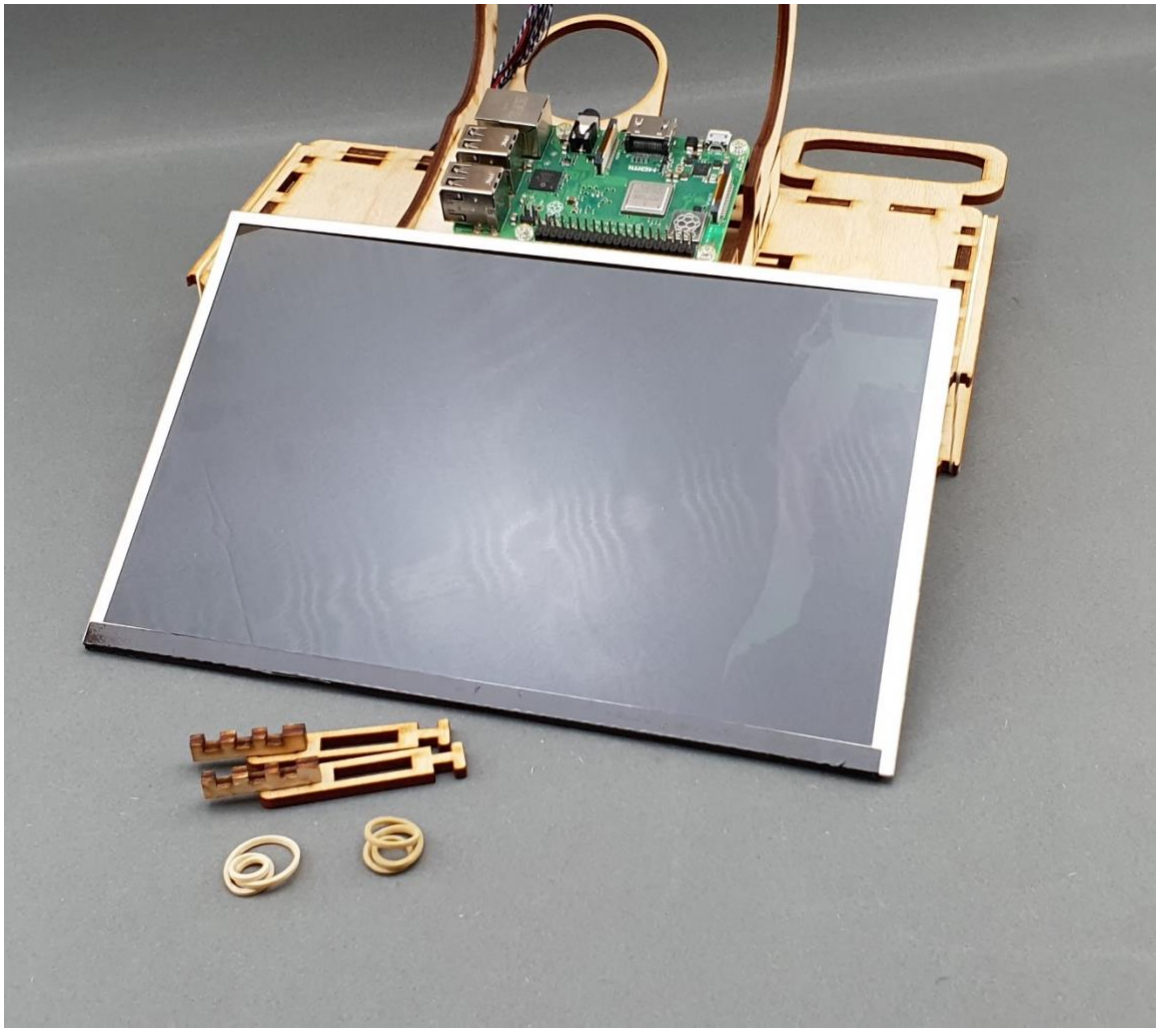

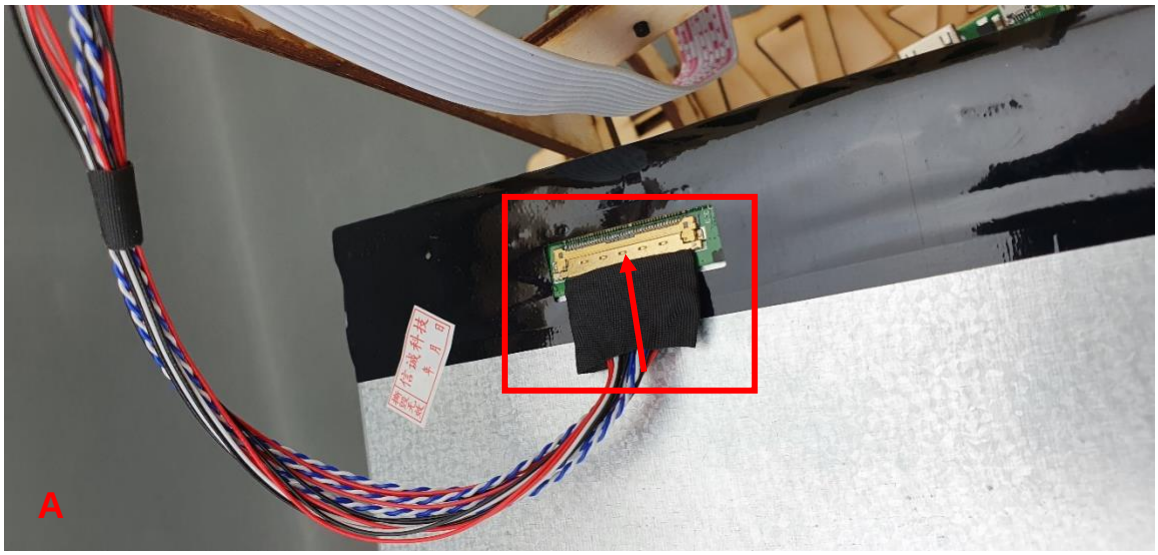

B

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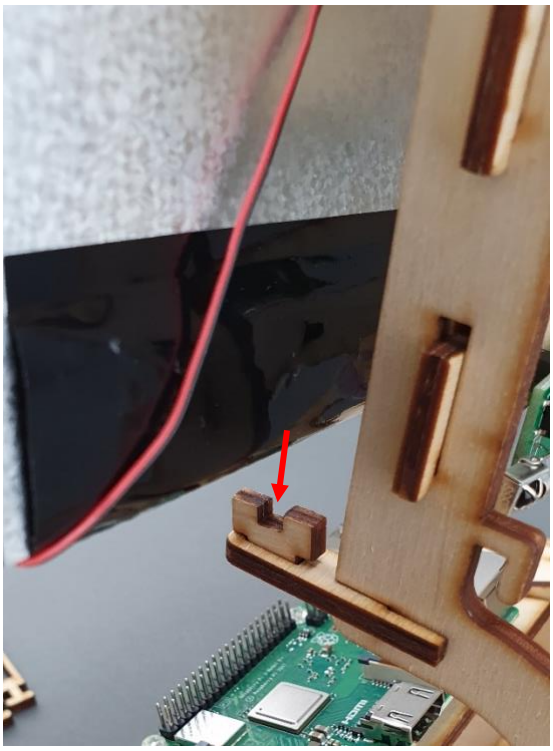

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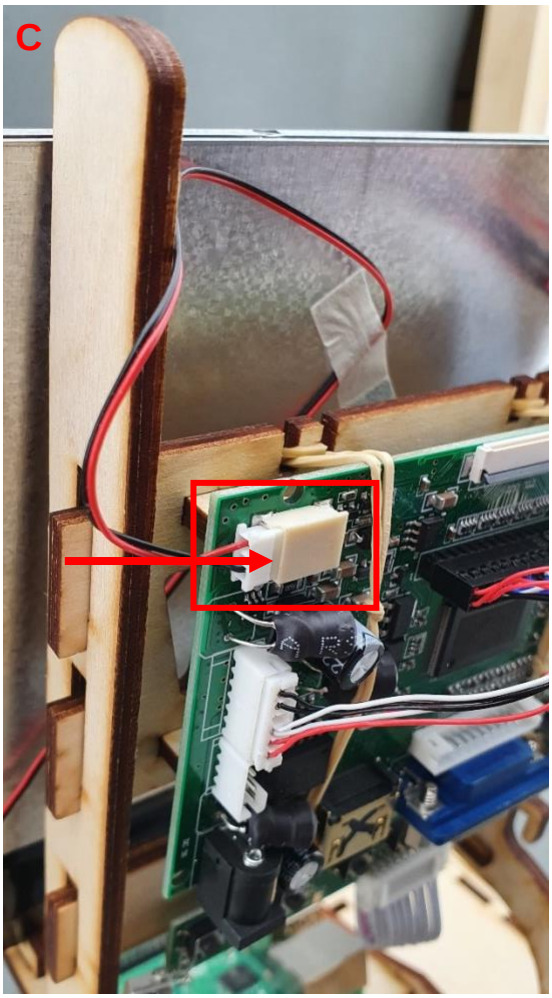

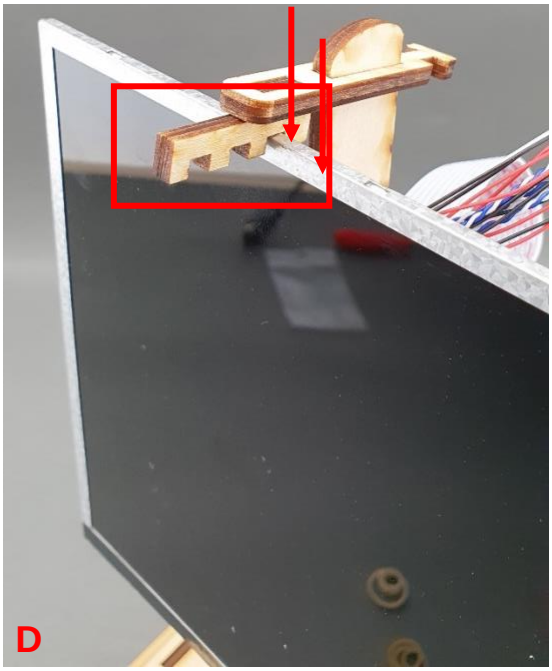

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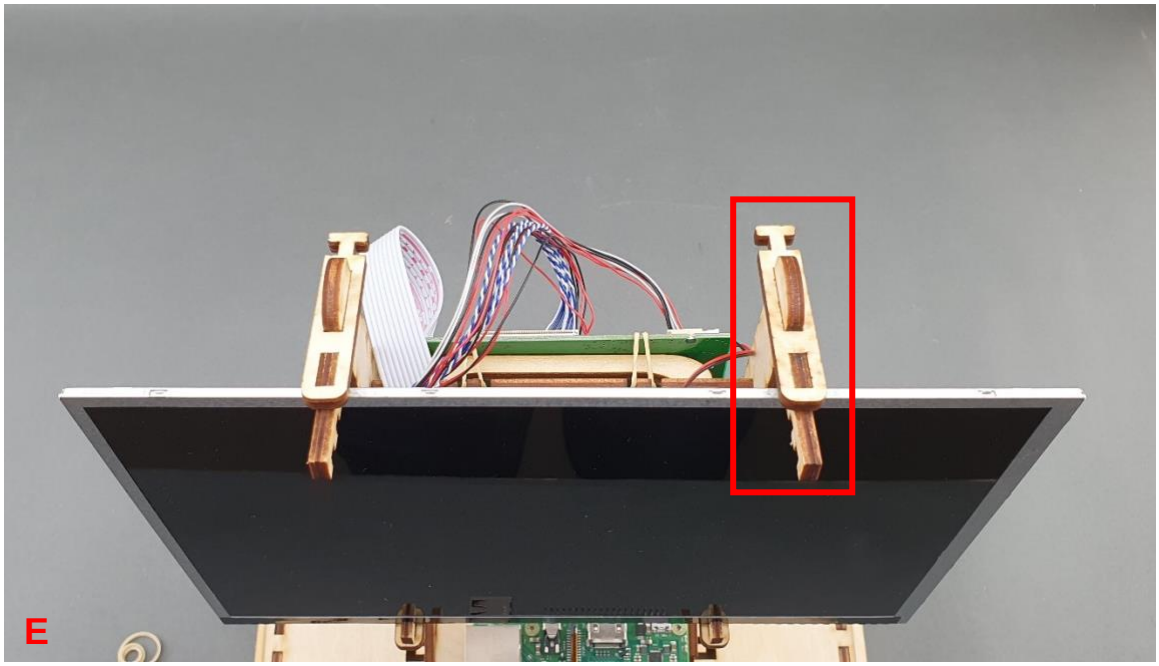

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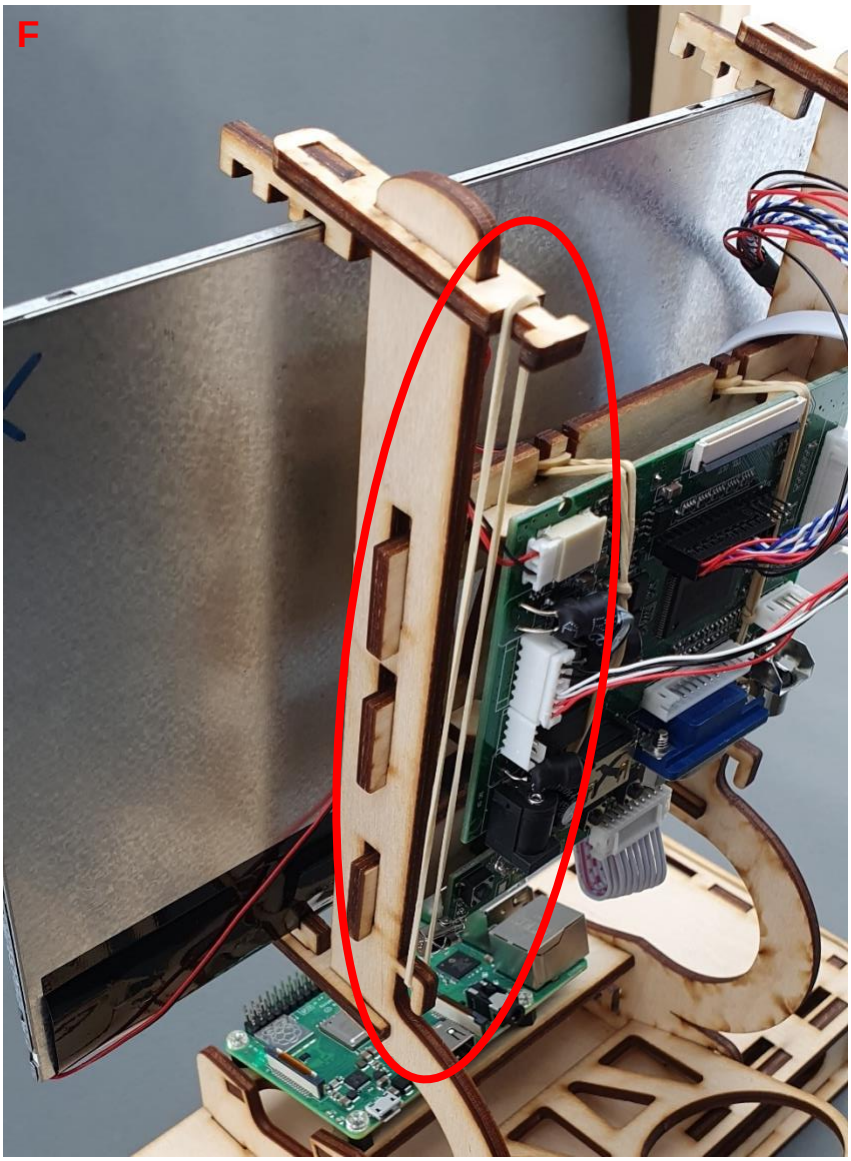

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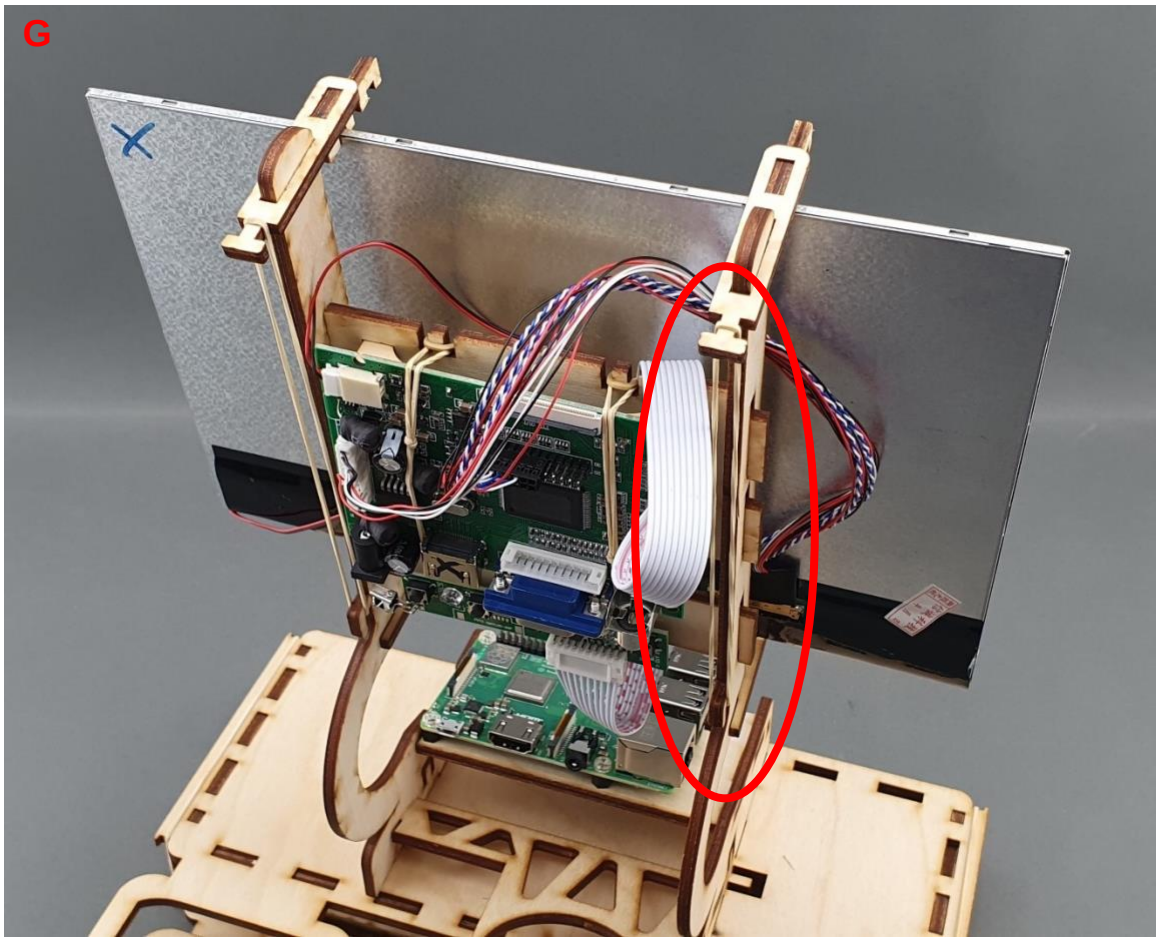

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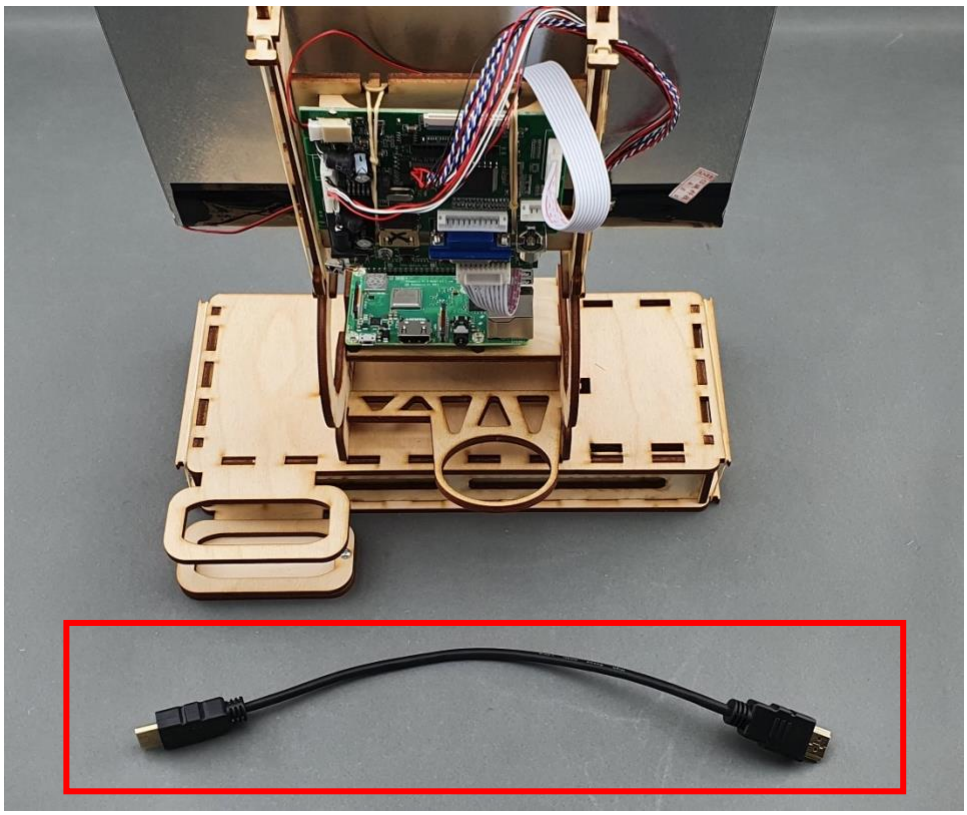
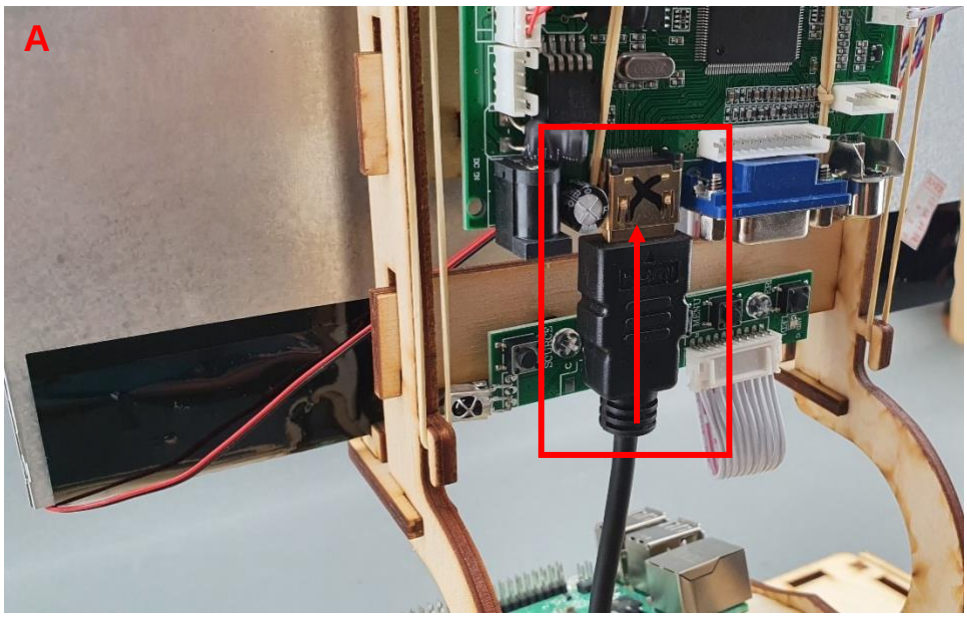
Step 4: Connecting the HDMI cable, as shown in the pictures below:





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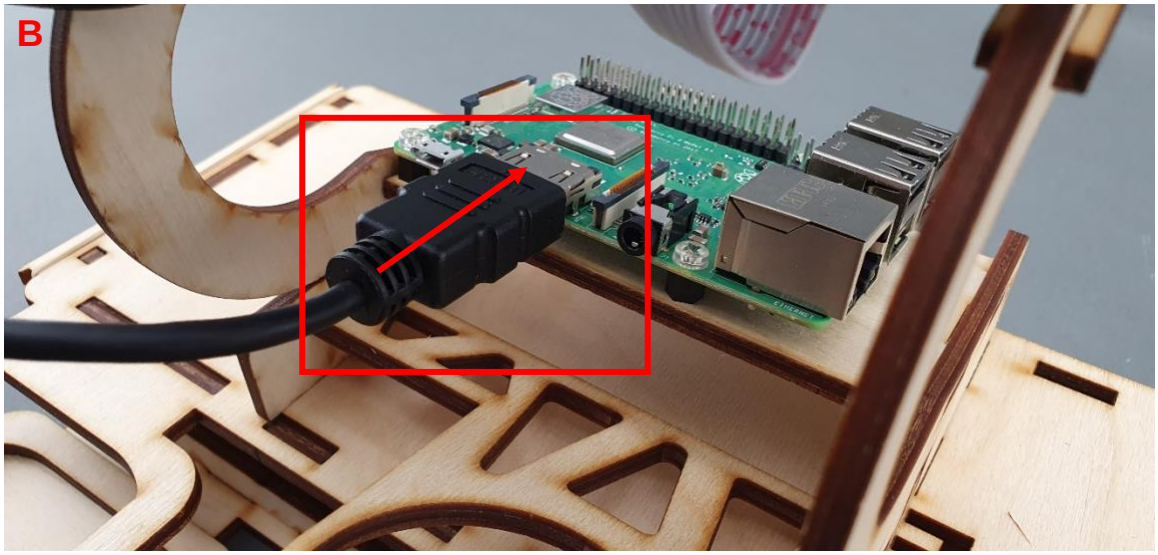
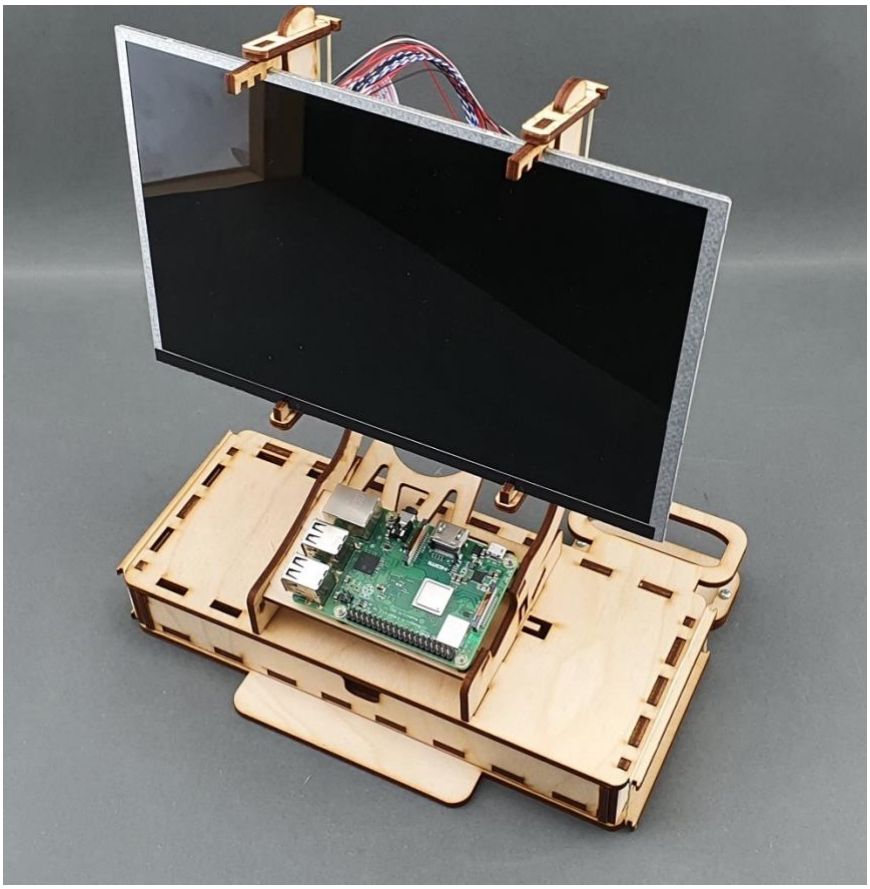


Step 5: The assembly process of the upper body is completed:



3.7. Cupboard Assembly

Step 1: What you will need:

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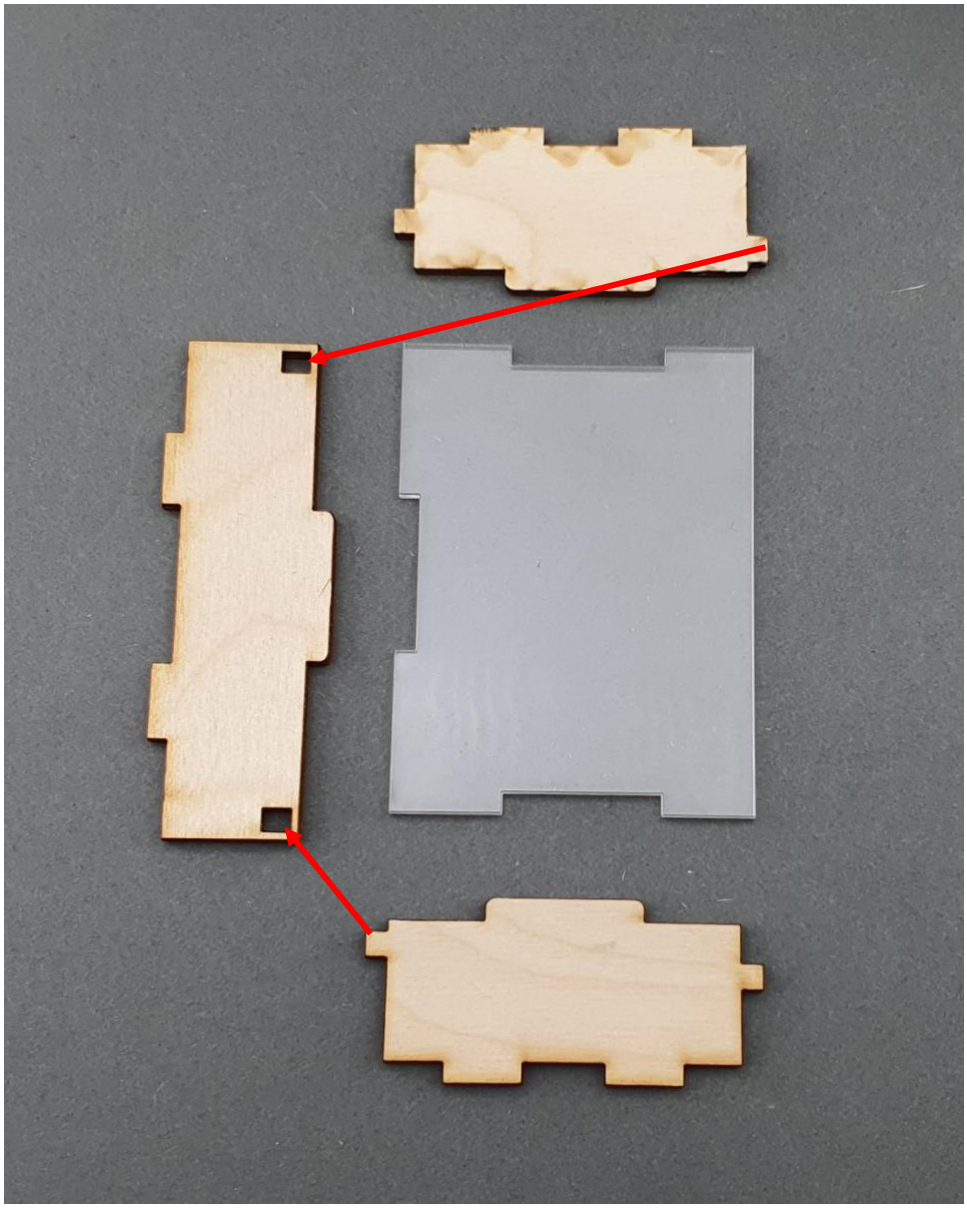

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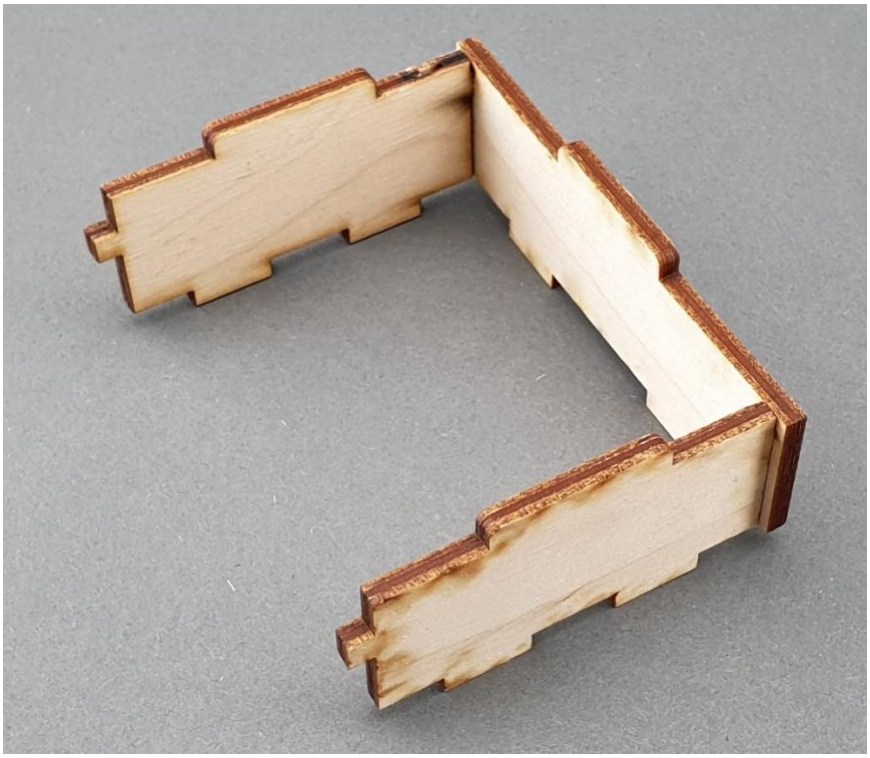
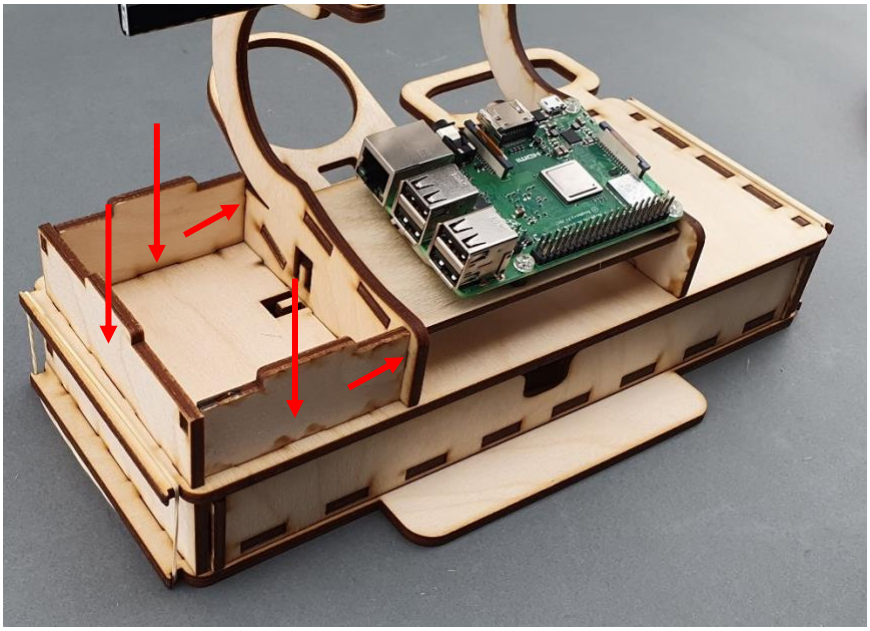
Step 2: Assembling the cupboard body:



Step 3: Placing the cupboard body to the Mini Mate **base:**



Step 3: Placing the cupboard body to the Mini Mate **base:**

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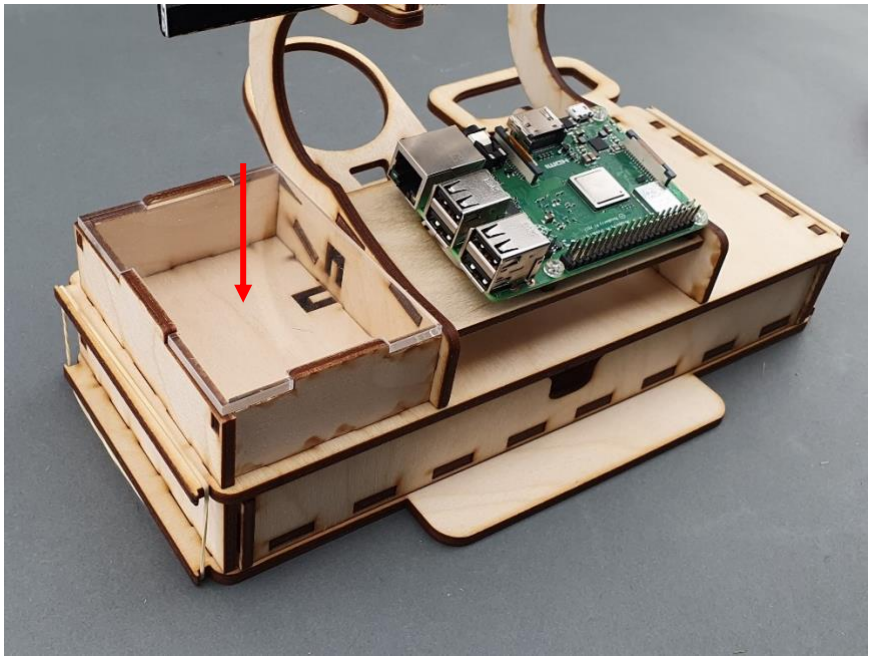

3.8. Powerbank and Speaker

Step 1: What you will need:

Step 2: Placing the power bank to the power bank holder, as shown in the picture below:

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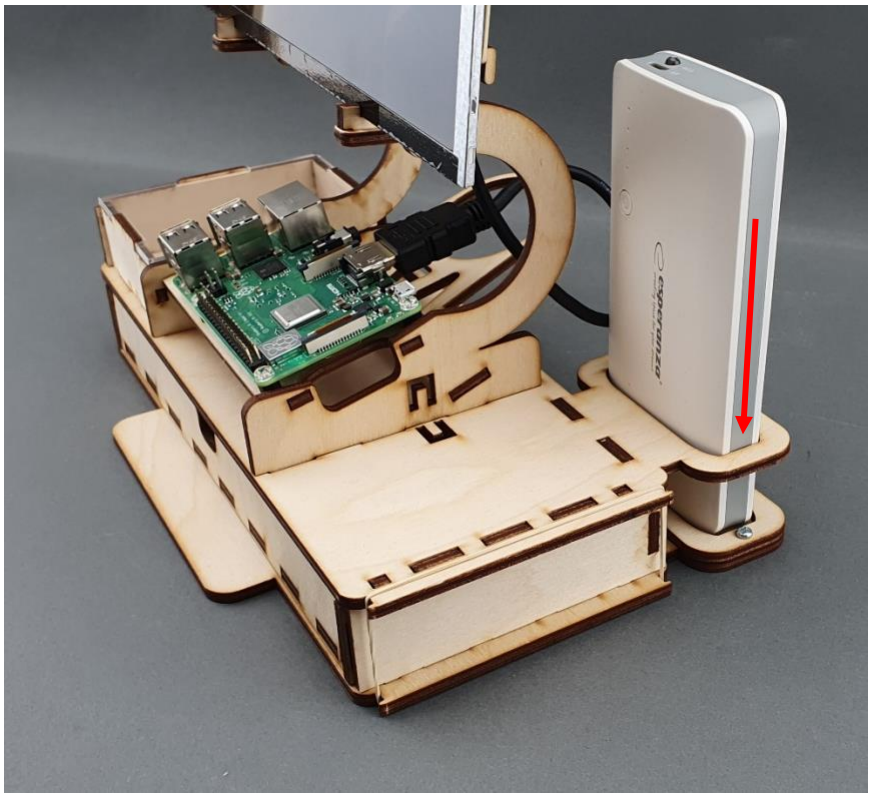
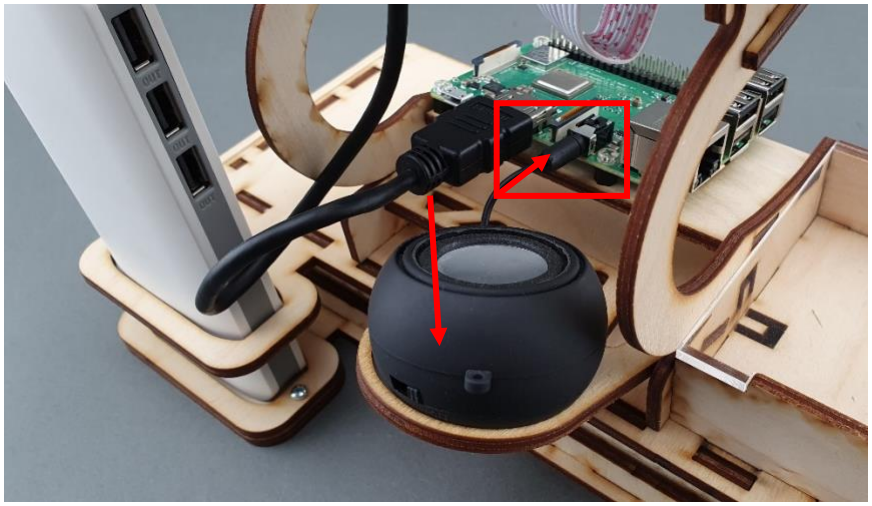


Step 3: Placing the speaker to the speaker holder, as shown in the picture below:



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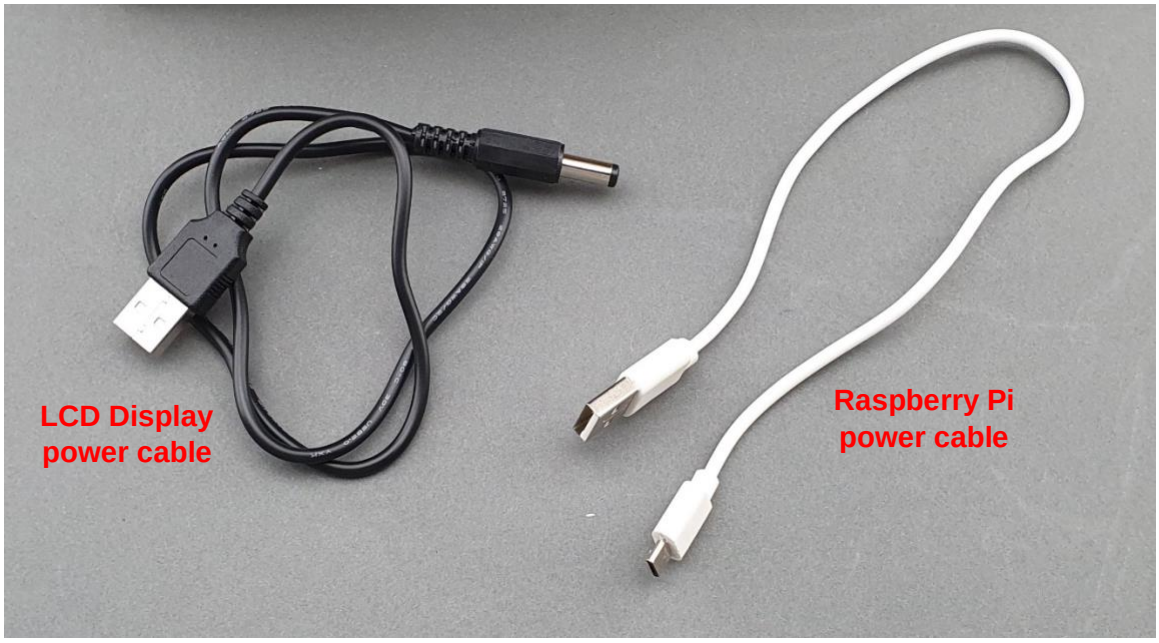
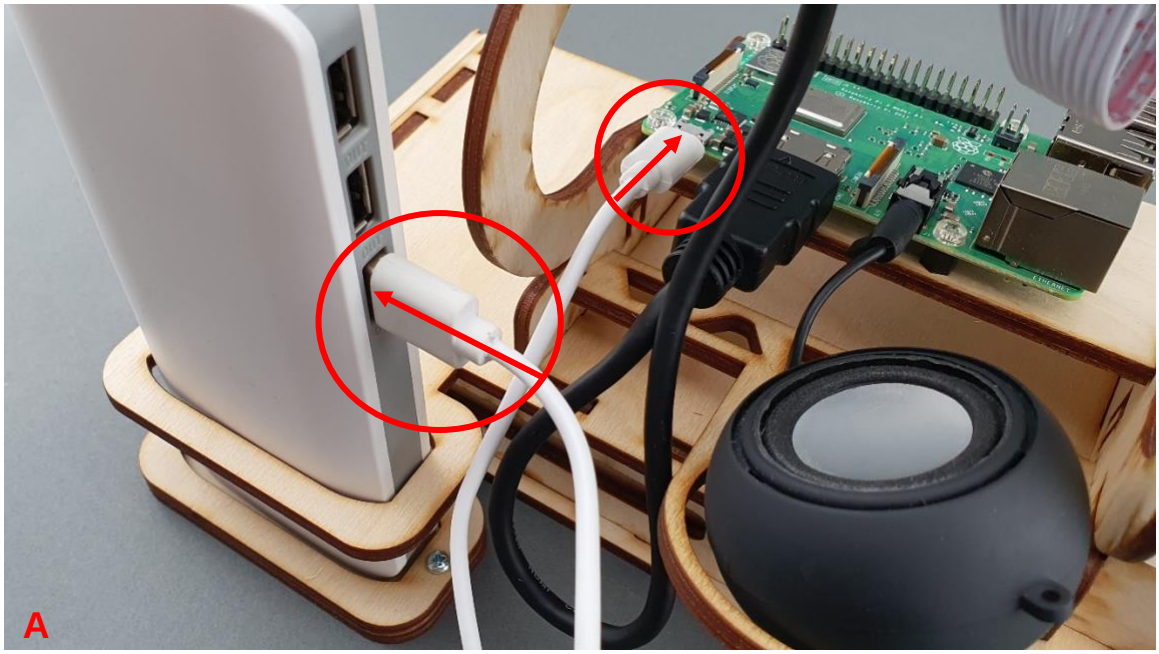
Step 4: Connecting the power cables, as shown in the pictures below:





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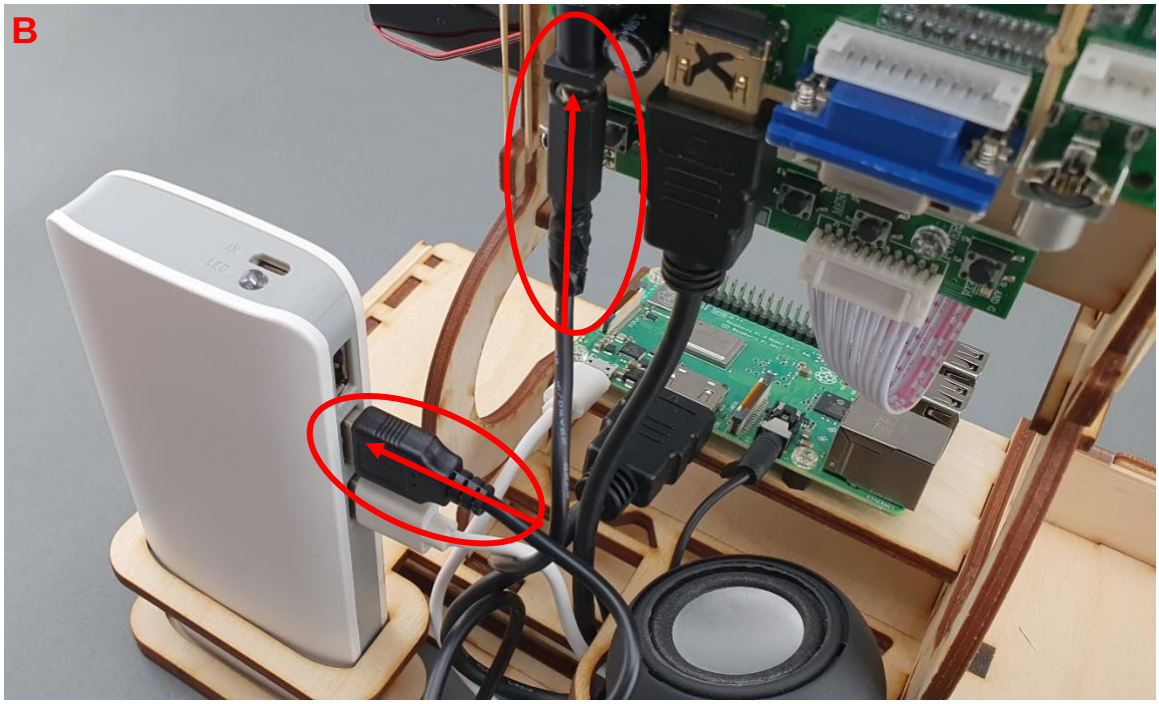

3.9. Electronics and Mouse

Step 1: What is included in the Mini Mate package:

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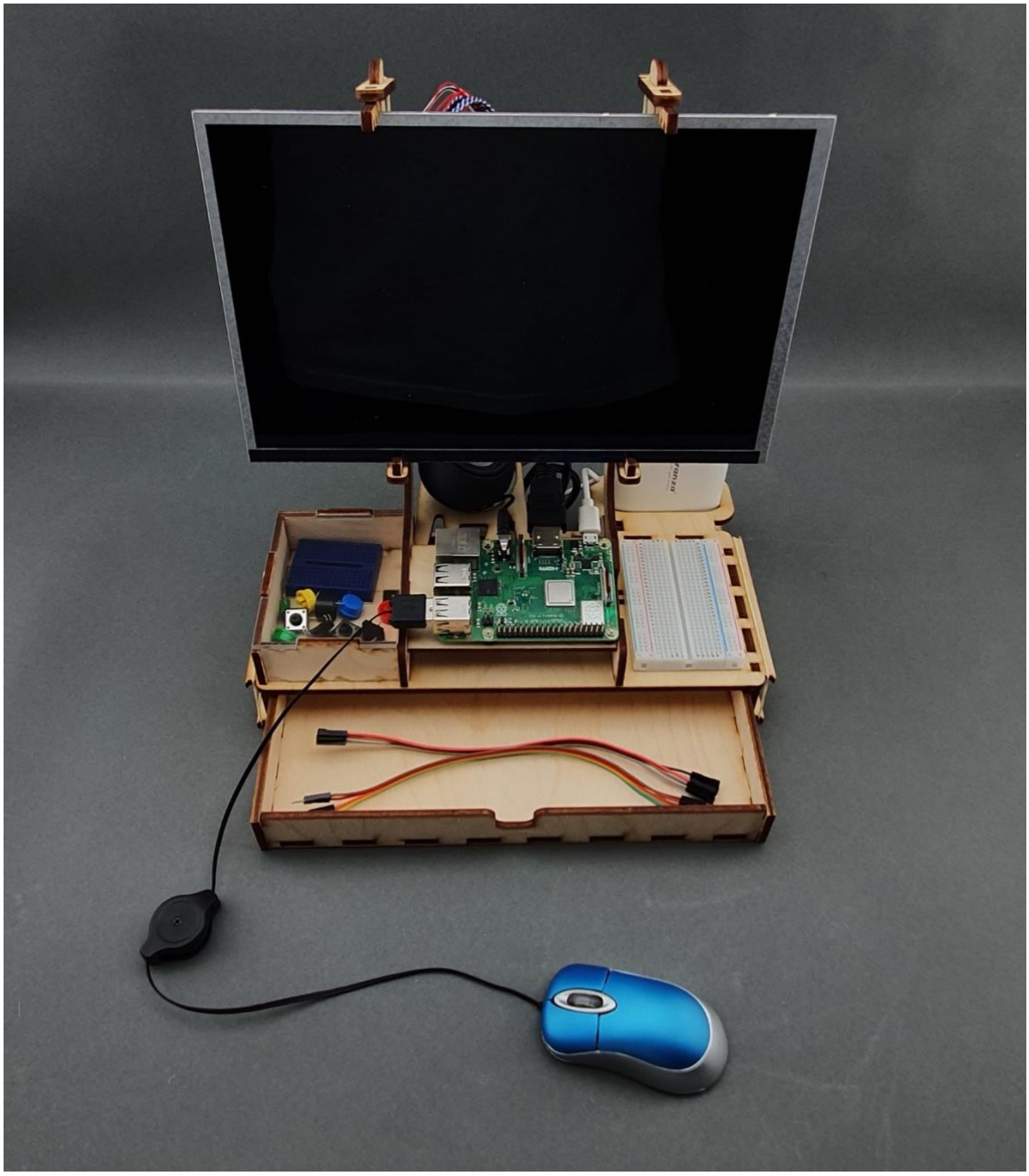
Step 2: Placing the electronic components and mouse:



4. Software

Mini Mate runs on Raspbian Buster, which is a free operating system based on Debian optimized for the Raspberry Pi hardware. Raspbian provides more than a pure OS: it comes with over 35 000 packages, pre-compiled and pre-installed with plenty of software for education, programming and general use bundled in a nice format for easy installation for the Raspberry Pi. It has Python, Scratch, Sonic Pi, Java and more.

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The initial build of over 35,000 Raspbian packages, optimized for best performance on the Raspberry Pi, was completed in June of 2012. However, Raspbian is still under active development with an emphasis on improving the stability and performance of as many Debian packages as possible.

Raspbian uses PIXEL, **P**i **I**mproved **X**-Window **E**nvironment, **L**ightweight as its main desktop environment as of the latest update. It is composed of a modified LXDE desktop environment and the Openbox stacking window manager with a new theme and a few other changes. The distribution is shipped with a copy of computer algebra program Mathematica and a version of Minecraft called Minecraft Pi as well as a lightweight version of Chromium, Thonny Python, Scratch and many more.

Note: Raspbian is not affiliated with the Raspberry Pi Foundation. Raspbian was created by a small, dedicated team of developers that are fans of the Raspberry Pi hardware, the educational goals of the Raspberry Pi Foundation and, of course, the Debian Project.

As of May 2020, the Raspbian Buster OS is renamed to Raspberry Pi OS.

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4.1. Raspberry Pi OS (Raspbian Buster)

All we need is to download the desired software version from rasbperrypi.org https://www.raspberrypi.org/downloads/raspberry-pi-os/ (Raspberry Pi OS with desktop and recommended software is the full version)

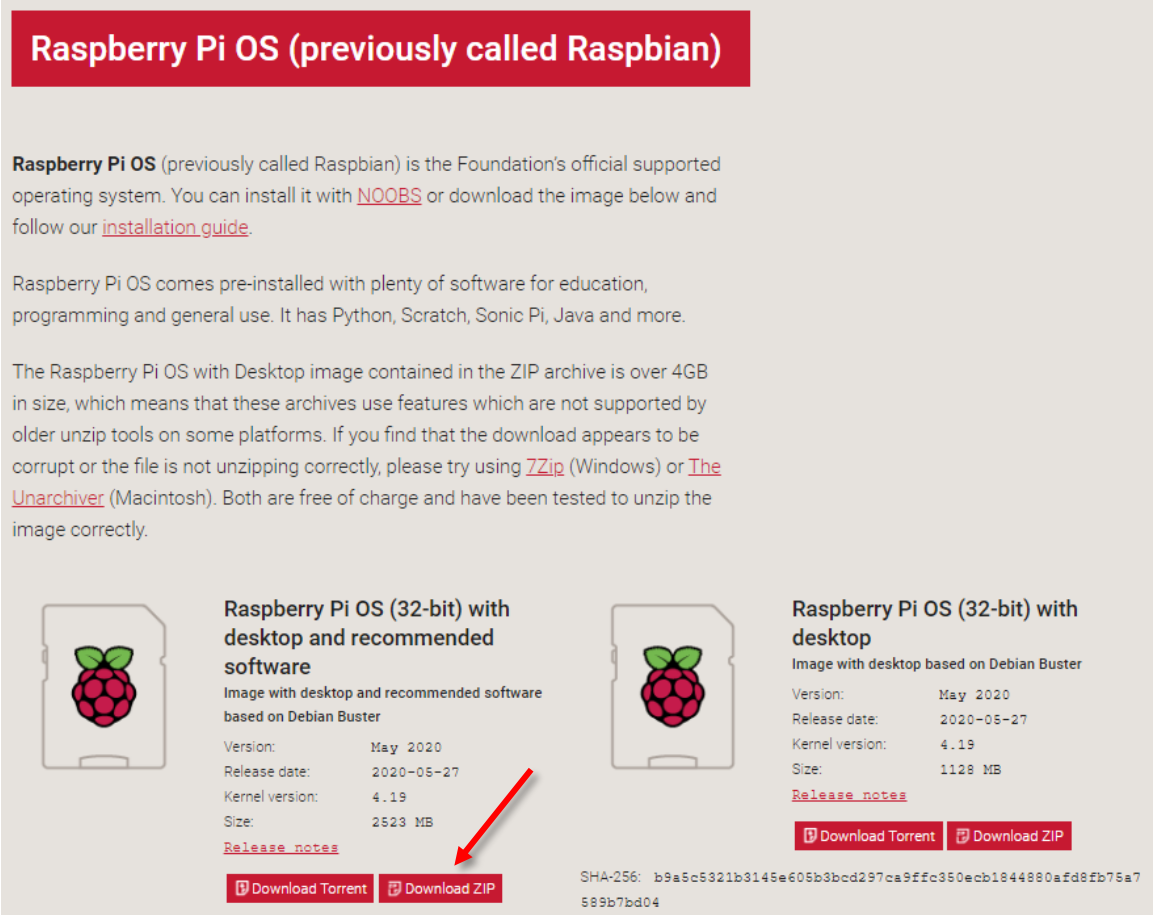

FIGURE 16 DOWNLOADING RASPBERRY OS

and Etcher https://www.balena.io/etcher/,

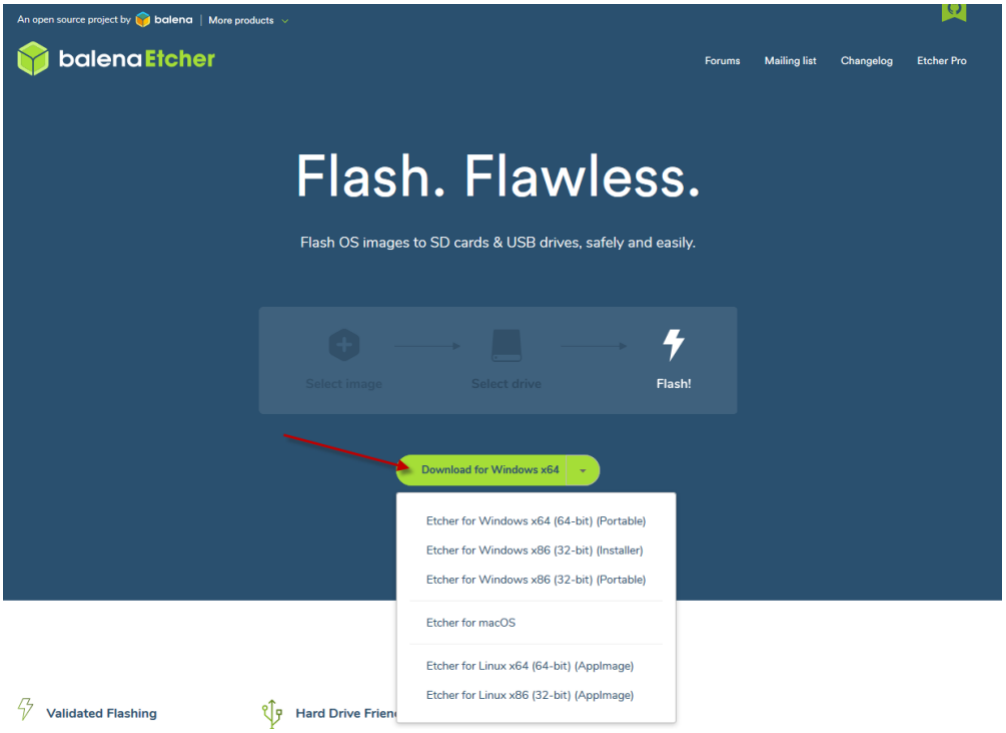

FIGURE 17 DOWNLOADING ETCHER

which will be used to write Raspberry Pi OS image file we downloaded, to Raspberry Pi micro SD Card.

After Etcher download is complete, run the installation and wait for completion.

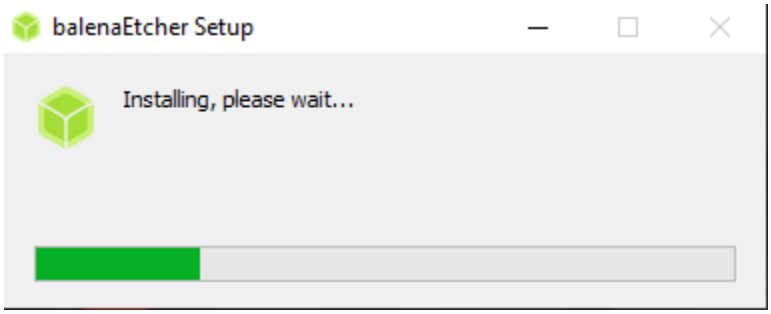

FIGURE 18 ETCHER INSTALLATION WINDOW

When it is completed, run Etcher.

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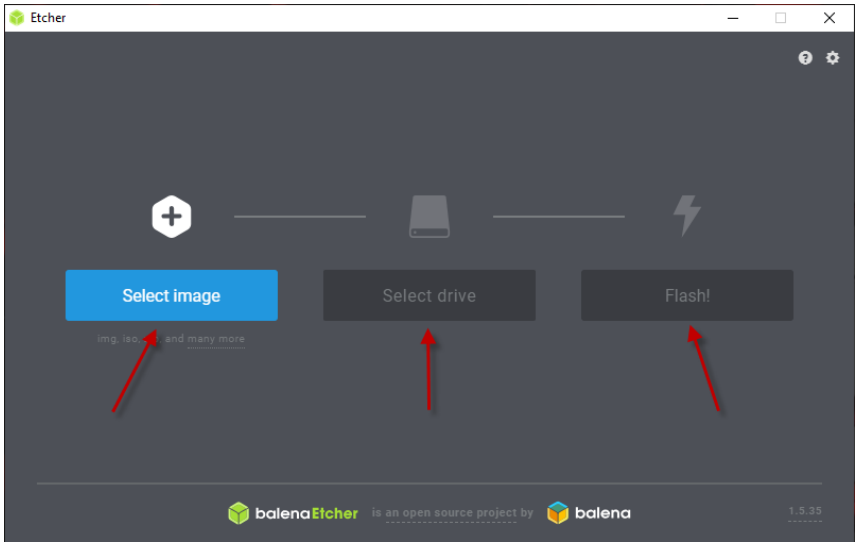

FIGURE 19 ETCHER APPLICATION WINDOW

The first step is to select the Raspberry Pi OS Image. The *.img* file is in the *.zip* file that was previously downloaded from Raspberrypi.org. The second step is to select drive. At this step, the drive of the micro SD Card is chosen (the micro SD card should be inserted in the card slot of the computer). The third step is to flash the OS to the micro SD Card. When this operation is completed, remove the micro SD Card from the computer, insert it to the Raspberry Pi, and power it on.

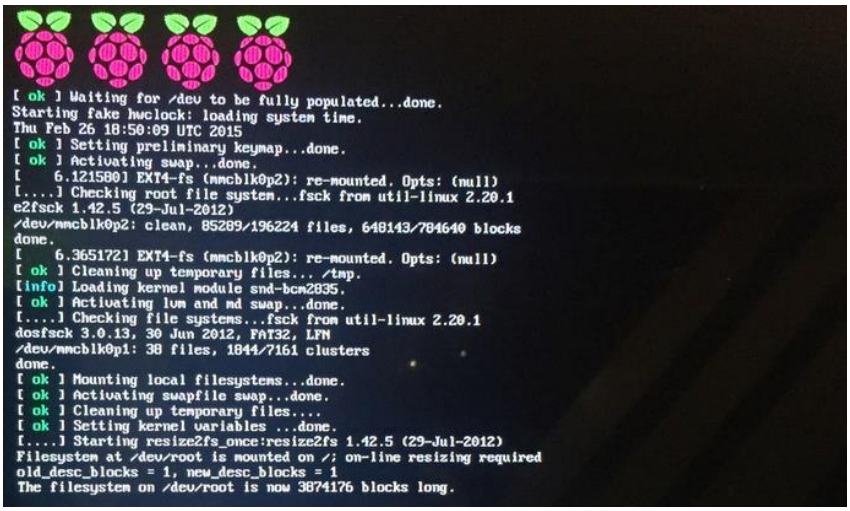

FIGURE 20 RASPBERRY PI BOOTING SCREEN

All you have to so is follow the simple installation steps, (Country, Language, time zone etc.).

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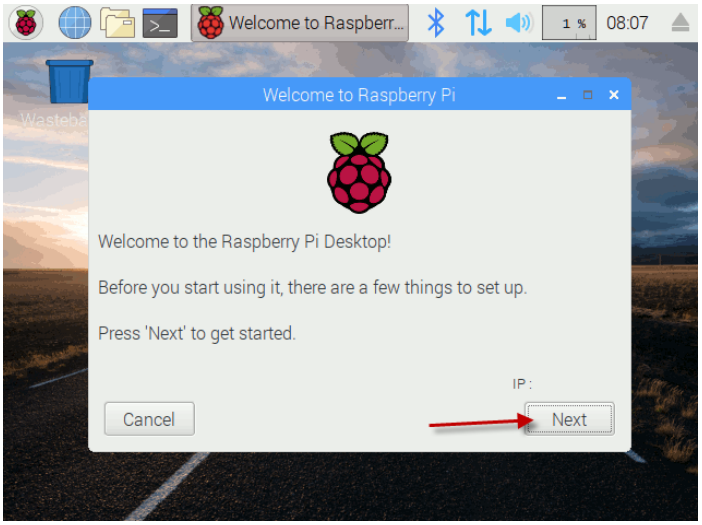

FIGURE 21 RASPBERRY INSTALLATION PROCEDURE

Choose Country, Language and Time zone.

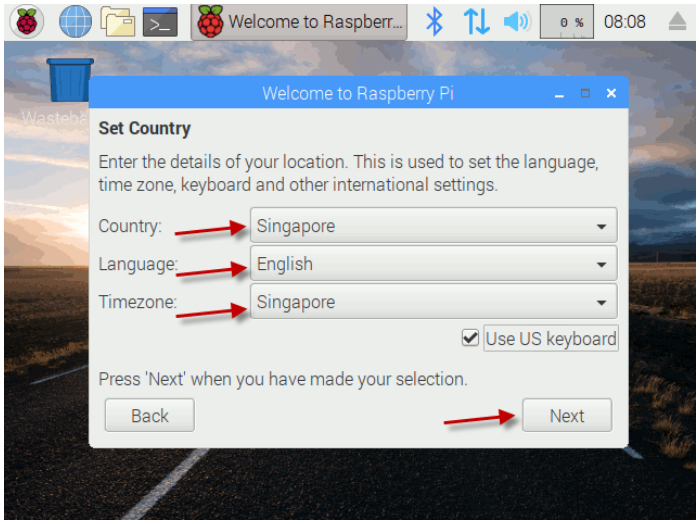

FIGURE 22 SETTING-UP RASPBERRY PI

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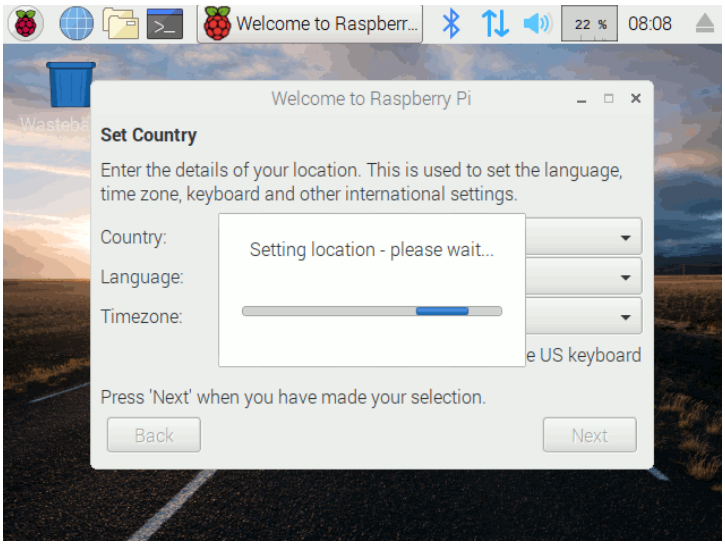

FIGURE 23 SETTING LOCATION

Set a password to login. You can also leave this blank and create one later.

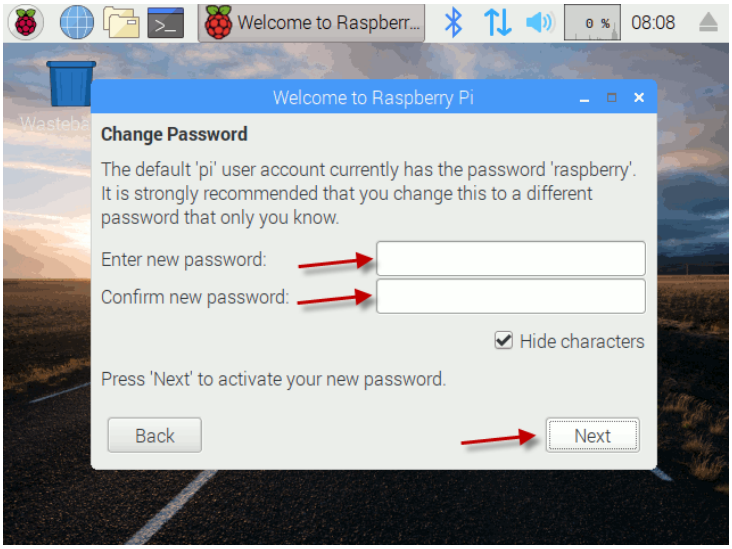

FIGURE 24 CREATING A PASSWORD FOR THE RASPBERRY PI

Choose your Wi-Fi Network or connect the Raspberry to the Internet via Ethernet cable. The Internet is needed for Raspberry Pi OS to check for updates.

Click Next to check for available updates

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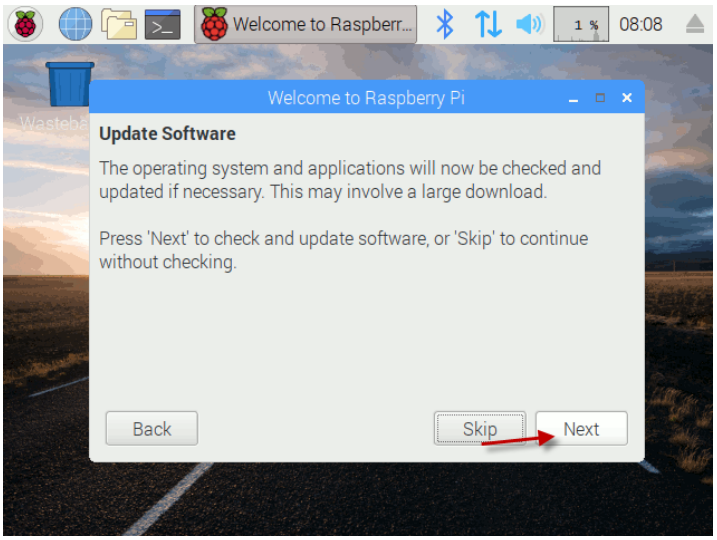

FIGURE 25 SOFTWARE UPDATE PROCESS

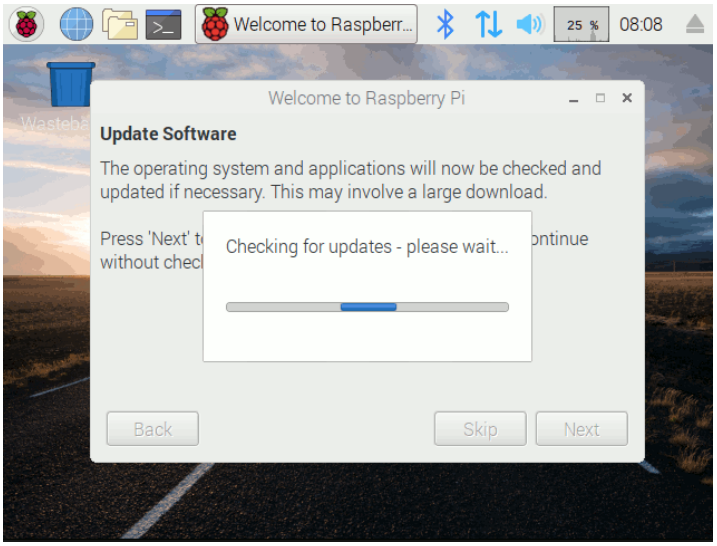

FIGURE 26 CHECKING FOR UPDATES

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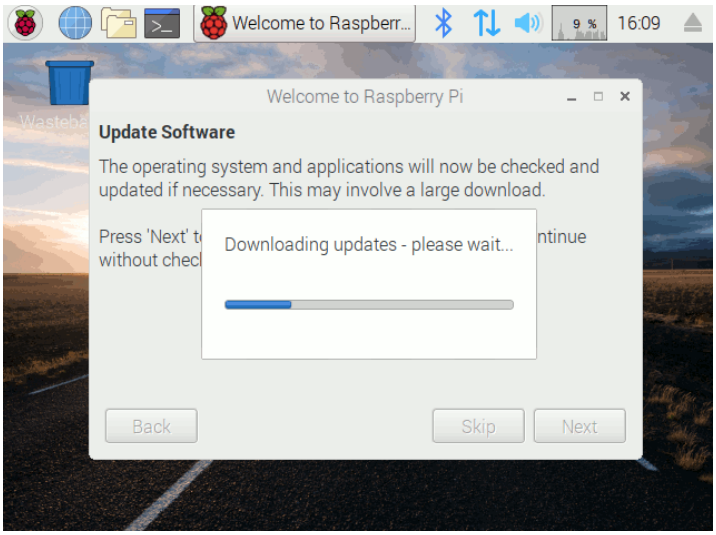

FIGURE 27 DOWNLOADING UPDATES

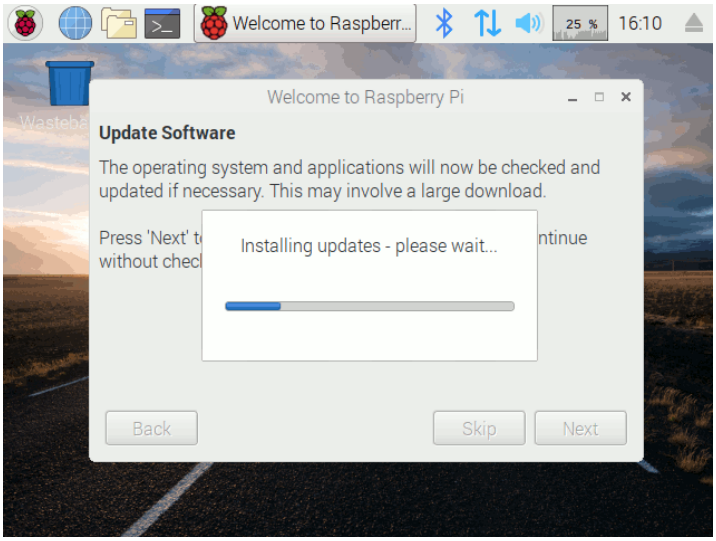

FIGURE 28 INSTALLING UPDATES

When updates are completed, click ok

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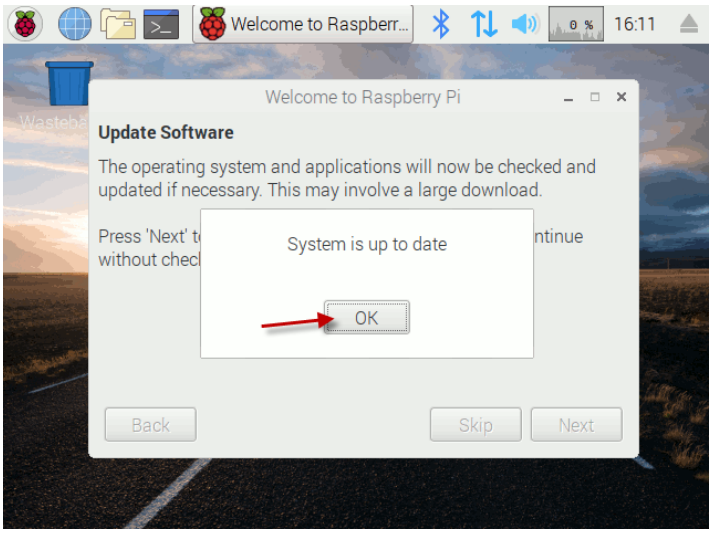

FIGURE 29 FINISHING WITH UPDATES

Reboot for updates to take effect.

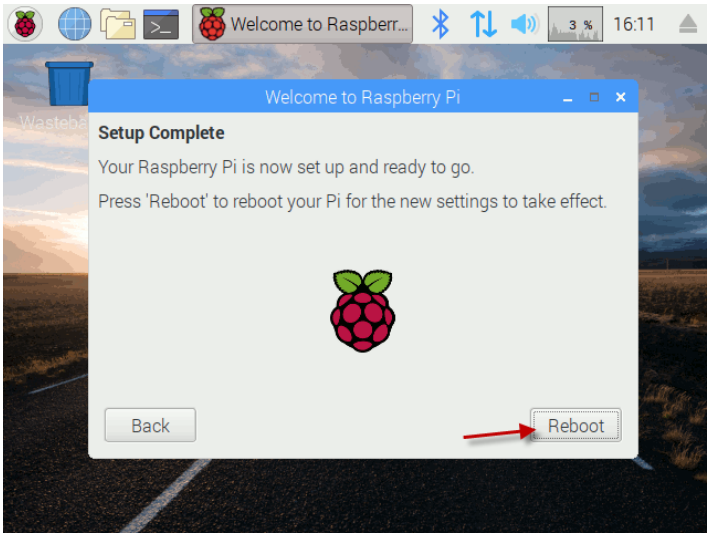

FIGURE 30 REBOOT SCREEN

and everything is ready for use.

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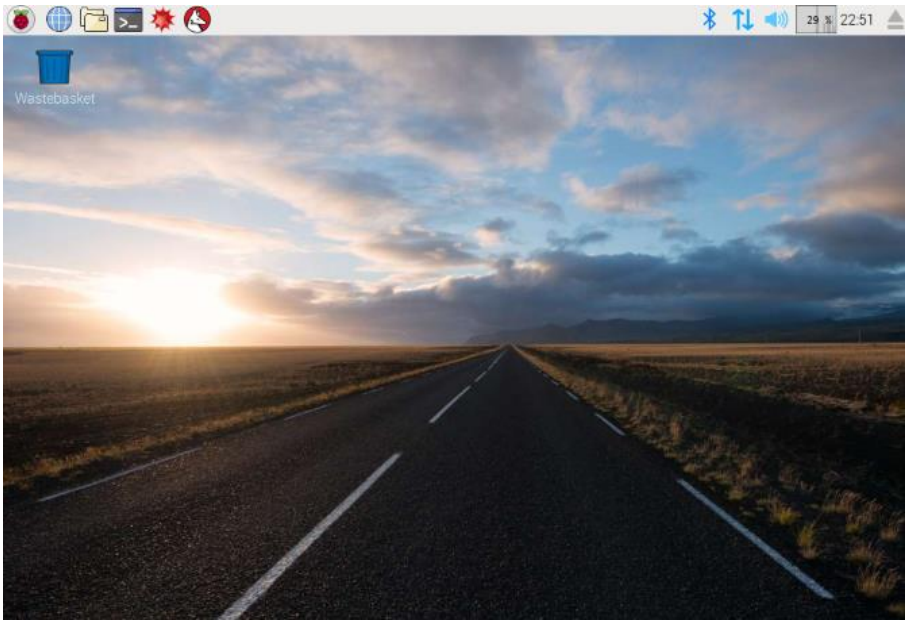

FIGURE 31 RASPBERRY PI OS USER DESKTOP

4.2. Minecraft Pi Edition

Raspberry Pi OS comes with Minecraft Pi edition preinstalled. It is a sandbox video game created by Swedish game developer Markus Persson and released by Mojang in 2011. The game allows players to build with a variety of different blocks in a 3D procedurally generated world, requiring creativity from players. Other activities in the game include exploration, resource gathering, crafting, and combat.

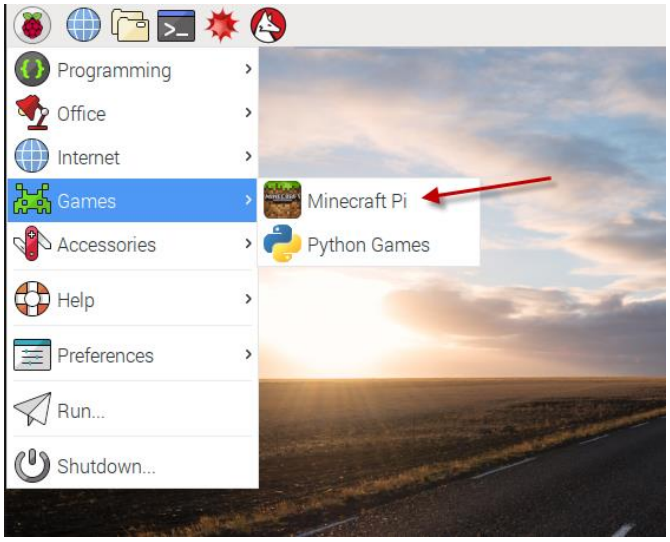

FIGURE 32 LOCATING MINECRAFT PI

Multiple gameplay modes are available. These include survival mode, in which the player must acquire resources to build the world and maintain health; creative mode, where players have unlimited resources to build with and the ability to fly; adventure mode, where players can play custom maps created by other players with certain restrictions and spectator mode, where players can freely move throughout a world without being affected

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by gravity and collisions, or without being allowed to destroy or build anything. There is also hardcore mode, which is similar to survival mode, but the player is given only one life, and the game difficulty is locked on hard. If the player dies on hardcore, the player does not respawn, and the world is locked to spectator mode (as of 1.9). The *Java Edition* of the game allows players to create mods with new gameplay mechanics, items, textures, and assets.

Minecraft received critical acclaim and has won numerous awards and accolades. Social media, parodies, adaptations, merchandise, and the MineCon convention played large roles in popularizing the game. It has also been used in **educational environments** (Minecraft Education Edition), especially in the realm of computing systems, as virtual computers and hardware devices have been built in it.

4.3. Scratch 2.0

Scratch is a visual programming tool which allows the user to create animations and games with a drag-and-drop interface. It allows you to create your own computer games, interactive stories, and animations using some programming techniques without having to write code. It is a great way to get started programming on the Raspberry Pi with young people.

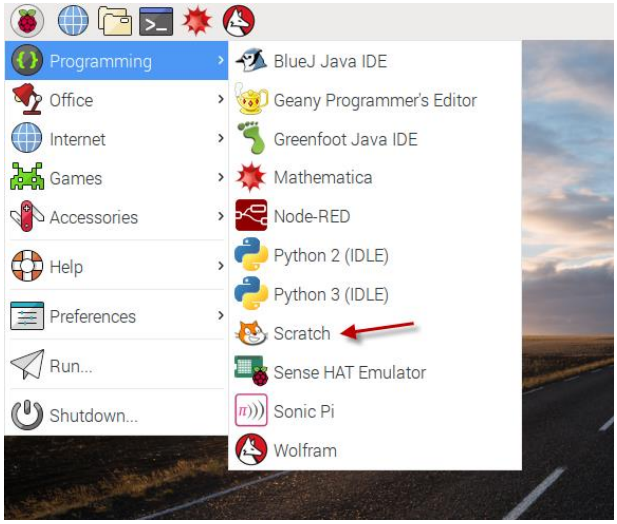

FIGURE 33 LOCATING SCRATCH

The Raspberry Pi is a great way to learn both DIY tech and programming on a budget. They are also great cheap computers for kids, with plenty of great learning resources included to help young minds grasp useful concepts for the future.

There are many great beginner projects out there which use the Pi's GPIO (general-purpose input/output) pins. It's great for coding too, since the Raspberry Pi OS comes with Python built-in. As mentioned, there is even a version of Minecraft for the Pi which can help you learn both beginner electronics and Python!

While this is great for people with some coding experience, what if someone wanted to use the Pi's GPIO pins without having to learn a programming language?

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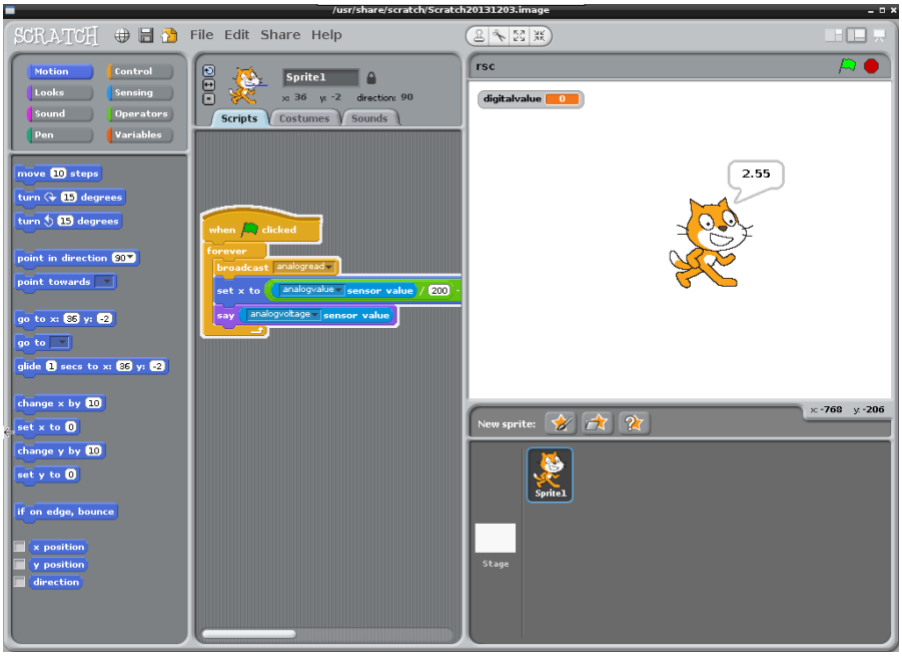

FIGURE 34 SCRATCH ENVIRONMENT

With Scratch, it is possible.

4.4. Thonny Python

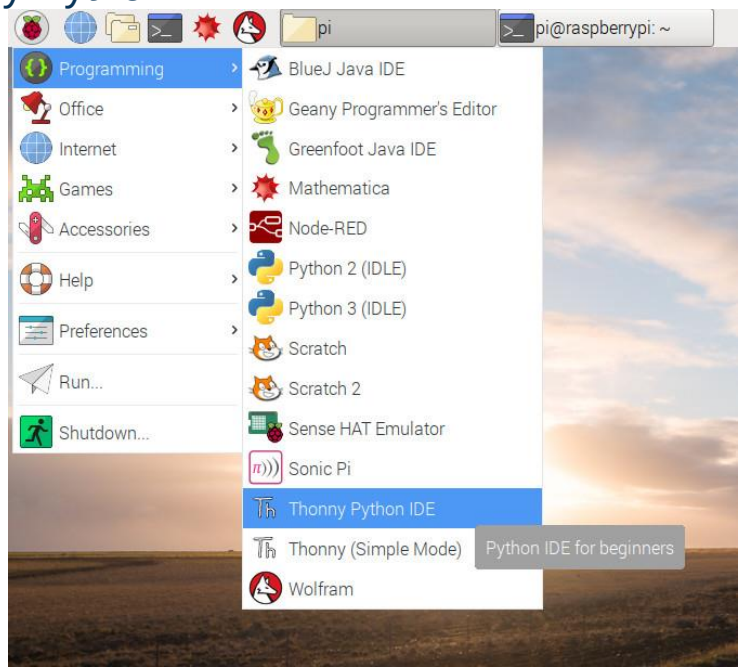

FIGURE 35 LOCATING THONNY PYTHON

Python is an interpreter, object-oriented, high-level programming language with dynamic semantics. Its high-level, built-in data structures, combined with dynamic typing and dynamic binding, make it very attractive for Rapid Application Development, as well as for use as a scripting or glue language to connect existing components together. Python's

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simple, easy to learn syntax emphasizes readability and therefore reduces the cost of program maintenance. Python supports modules and packages, which encourages program modularity and code reuse. The Python interpreter and the extensive standard library are available in source or binary form without charge for all major platforms and can be freely distributed.

```
# Python 3: Fibonacci series up to n
>>> def fib(n):
>>>     a, b = 0, 1
>>>     while a < n:
>>>         print(a, end=' ')
>>>         a, b = b, a+b
>>>     print()
>>> fib(1000)
0 1 1 2 3 5 8 13 21 34 55 89 144 233 377 610 987
```

FIGURE 36 FIBONACCI SERIES IN PYTHON

Python 3.0 is pre-installed on Raspbian and automatic updates run through Rasbian OS. In case a manual update is needed, use a terminal window,

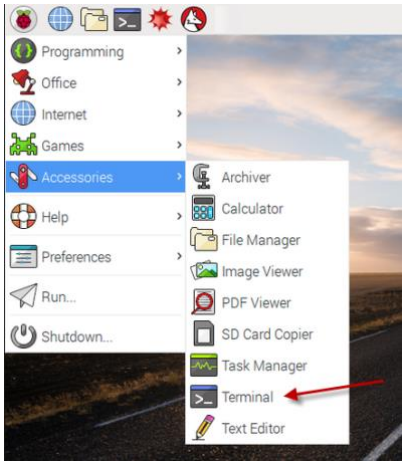

FIGURE 37 LOCATING THE TERMINAL WINDOW

and run the following command: sudo apt-get install python3

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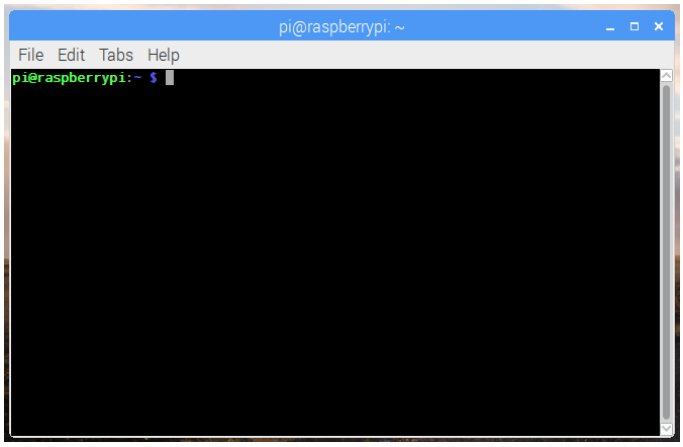

FIGURE 38 TERMINAL WINDOW IN RASPBERRY OS

5. Annex

Bill of Material for Mini Mate Computer		
No.	**Item**	**Quantity**
1	Plywood pieces	29
2	Screws (metal)	2
3	Screws (plastic)	4
4	Screw locks (plastic)	4
5	Nuts (plastic)	4
6	Rubber bands	6
7	Raspberry Pi Model B+	1
8	10" Screen	1
9	Screen I/O PCB	1
10	Screen controller PCB	1
11	Screen remote control	1
12	CR Lithium battery	1
13	Screen controller white cable	1
14	HDMI cable	1
15	Screen power cable	1
16	USB to micro-USB cable	1
17	Powerbank	1
18	Mouse	1
19	Speaker	1
20	Speaker charging cable	1
21	White breadboard	1
22	Small green breadboard	1
23	Jumper cables (Male-to-Female)	5
24	Jumper cables (Male-to-Male)	5
25	Buttons	4
26	Button caps	4
27	Buzzer	1
28	LEDs	4
29	Resistors 220 Ohm	5
30	Resistos 1k Ohm	5

Erasmus+
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