

Intellectual Output 1

STEM4CLIM8 Console Assembly Guide

Deliverable: IO1-A1:STEM4CLIM8 Console



STEM4CLIM8

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APPLICABLE DOCUMENTS

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| 1 | | | |
| 2 | | | |

Executive Summary

In a recent OECD survey (OECD- Education and Skills Today 2018), covering 25 European countries, almost all countries report shortfalls of skills that teachers need to meet school needs, combined with difficulties in updating teachers' skills. However, digitisation is expected to profoundly change the way we learn and work. Many children entering school today are likely to end up working in jobs that do not yet exist. Preparing students for these uncharted territories means that we not only have to make sure that they have the right technical capabilities but that we have to strengthen their emotional and social skills. Resilience, the individual capacity to overcome adverse circumstances and use them as sources for personal development, lies at the core of being able to successfully adapt to change and thus actively engage with our digital world. At the same time, we need to acknowledge Internet addiction and behaviours at risk of IAB (Internet Addiction Behaviour) as emerging problems for our youth. A STEM approach bridging physical computing with environmental consciousness while focusing on off-screen collaborative activities is an excellent way of improving technical capabilities while strengthening emotional and social skills.

STEM4CLIM8 has as primary objective to produce approaches and tools to help those working with children reach out to them with a view to help them engage with programming and develop STEM related skills. It aims to achieve this not by increasing screen time but by encouraging hands on play through the creation of a custom virtual world using Minecraft modding and the execution of missions dealing with natural disasters and using physical computing blocks which will be programmed to interact with the virtual world through the Raspberry GPIO. The missions will reveal the science behind natural phenomena frequently associated to climate change and inspire environmental consciousness while at the same time enhance STEM skills.

Reference:

*OECD- Education and Skills Today, Succeeding with resilience-Lessons for schools, January 29, 2018, Retrieved February 18 2021 from: <https://oecdeditoday.com/succeeding-with-resilience-lessons-for-schools/>

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1. Introduction

1.1 Scope of the project

The proposed project is about enhancing the understanding of school children in relation to climate change, physical and geological phenomena through a STEM compliant approach which promotes hands on educational play rather than increased screen time. The direct target group are teachers of the last two years of primary school and lower secondary education (focus on those teaching ages between 10 and 14).

Equipping young Europeans with the right skills has been reaffirmed by the 2016 Council Resolution on 'A New Skills Agenda for an Inclusive and Competitive' Europe which stated that skills are a pathway to employability and prosperity. However, skills gaps and mismatches are striking, 40% of employers cannot find people with the skills they need, whereas students leave E&T without being sufficiently prepared to enter the labour market. The advent of Industry 4.0 will only make things worse in this regard unless the educational system reacts. Teachers play a crucial role in supporting the learning experience of young learners, while their teaching quality is the most important within-school aspect explaining student performance. In a recent OECD survey, covering 25 European countries, almost all countries report shortfalls of skills that teachers need to meet school needs, combined with difficulties in updating teachers' skills. (OECD-Education and Skills Today 2018) However, digitisation is expected to profoundly change the way we learn and work – at a faster pace than previous major drivers of transformation. Many children entering school today are likely to end up working in jobs that do not yet exist. Preparing students for these uncharted territories means that we not only have to make sure that they have the right technical capabilities but that we must strengthen their emotional and social skills. Resilience, the individual capacity to overcome adverse circumstances and use them as sources for personal development, lies at the core of being able to successfully adapt to change and thus actively engage with our digital world. At the same time, we need to acknowledge Internet addiction and behaviours at risk of IAB (Internet Addiction Behaviour) as emerging problems for our youth.

A STEM approach bridging physical computing with environmental consciousness while focusing on off-screen collaborative activities is an excellent way of improving technical capabilities while strengthening emotional and social skills. Educators need turnkey approaches for teaching STEM with an all-inclusive curriculum and for professional development. Most of today's approaches lack engaging lesson plans suitable for all types of learners to develop 21st Century Skills. This is very important because our society's long-term capacity to innovate depends on youth's interest in following science, technology, engineering, and mathematics (STEM) related studies and careers. According to Eurostat data, there was a total of 4,2 million primary and secondary schools' teachers in EU countries, for whom "the introduction of computational thinking into the curriculum at all educational levels is creating demand for large-scale in-service continuous professional development" [Developing CT in Compulsory Education, 2016]. So, ways to help teachers teach more effectively programming and STEM in general are in critical need. At the same time, it is important to achieve this without encouraging additional screen time and in relation to issues which are important to our societies such as climate change. We must not forget that children today are born into technology and using it comes natural

to them, but touchscreens, computer/online games, puzzles, and apps are still a substitute to other, more physical offline activities which are more fun, healthier and many times more educational.

1.2 Project Objectives

In STEM4CLIM8 we aim to combine the best practices of both “worlds”, online and offline. We do not want to encourage children to take up more screen time, but we want them to build things while playing especially learning to build and program electronics. At the same time, we want to turn this to an educational activity which is engaging for the teachers and parents alike.

The need for a transnational project emerges from the added value of being in position to interact with teachers from different countries, serving different STEM related curricula and viewpoints and discuss how to improve the present situation at schools through making STEM related education more hands on and effective. Identifying good practices among participant countries and considering natural disasters of specific interest (e.g., earthquakes for Greece, floods for the UK) and piloting conclusions from the partner countries will help deliver more efficient curriculum and tools.

1.3 Project's target groups

In the life of the project: professionals working with children (mainly 10 - 14 years). Apart from these direct target groups, the beneficiaries comprise also indirect target groups such as schools, children's/parents' associations and organisations, policy makers and educational stakeholders deciding about subjects covered by school curricula, parents, content developers, etc. After the life of the project and subject to the delivery of concrete results, more target groups become relevant, such as companies active in educational technology, universities with pedagogical/engineering departments, educational bodies, STEM toys manufacturers.

2. The STEM4CLIM8 DIY Console

The STEM4CLIM8 Console is designed so as to be possible to assemble in the classroom by the students under the supervision of the teacher. It is expected that kids from the age of 8 will be able to assemble the STEM4CLIM8 Console themselves based on the instructions.

The idea is to provide a full guide on how to build the STEM4CLIM8 Console, install and configure the software and then use it for all the envisaged project activities.

The specification and inventory for the STEM4CLIM8 Console, as well as custom components and kits to be created, and assembly instructions will be provided in the present guide as annexes.

The STEM4CLIM8 Console's elegant design imitates an all-in-one desktop computer, offering ease of use in the classroom 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 STEM4CLIM8 Console is a fully fledged Raspberry Pi based computer. All the necessary components and peripherals are included in one package, so the student, after assembling it, can start right away using it.

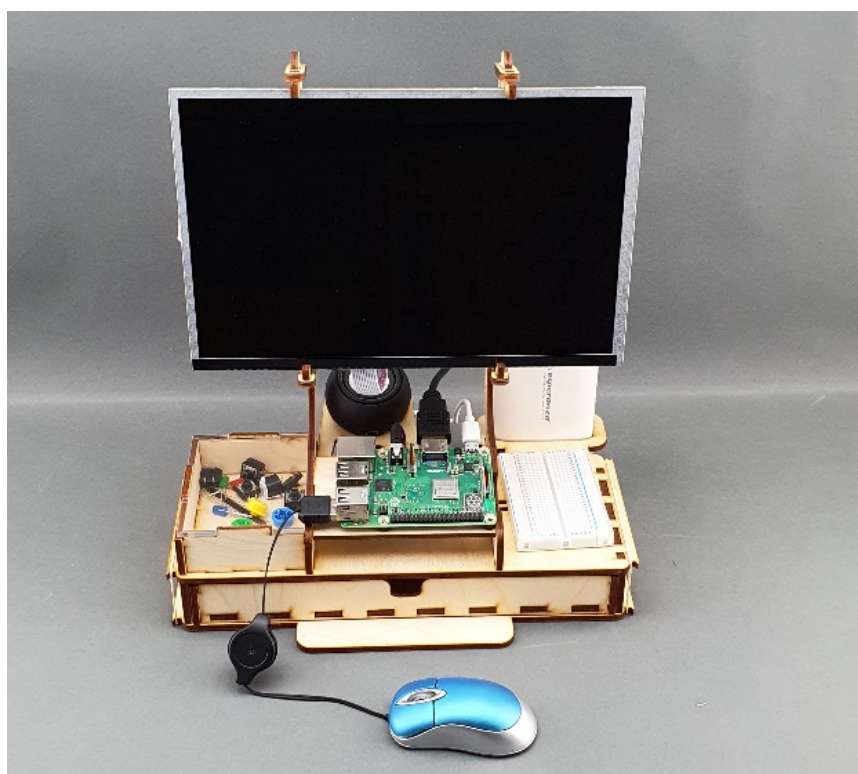


Figure 1 Front Side of STEM4CLIM8 Console

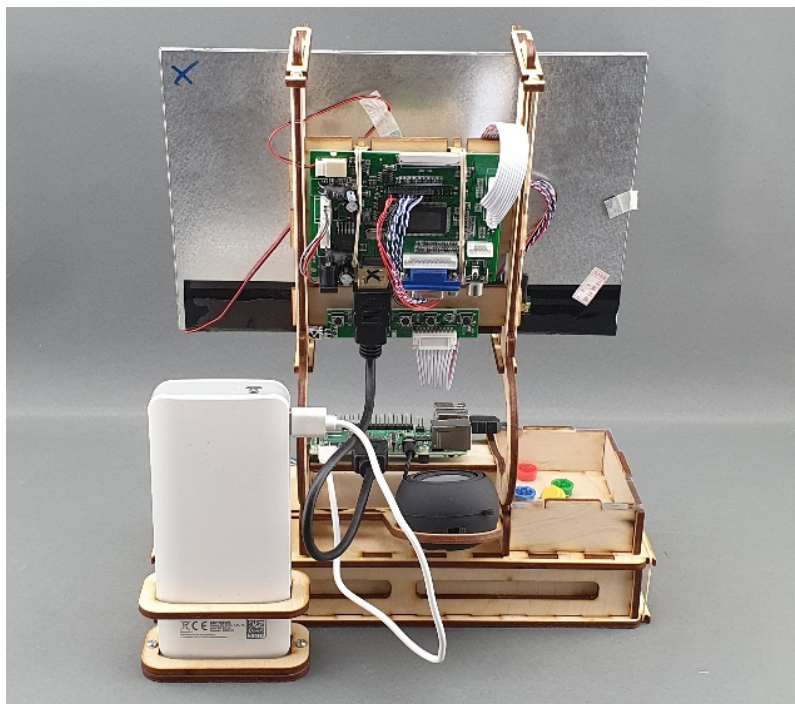


Figure 2 Back side of STEM4CLIM8 Console

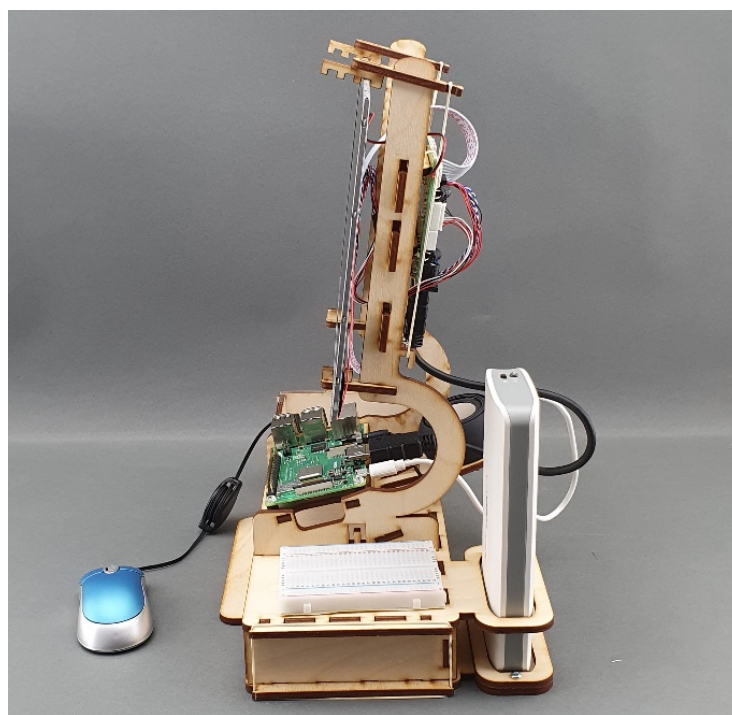


Figure 3 Left side of STEM4CLIM8 Console.

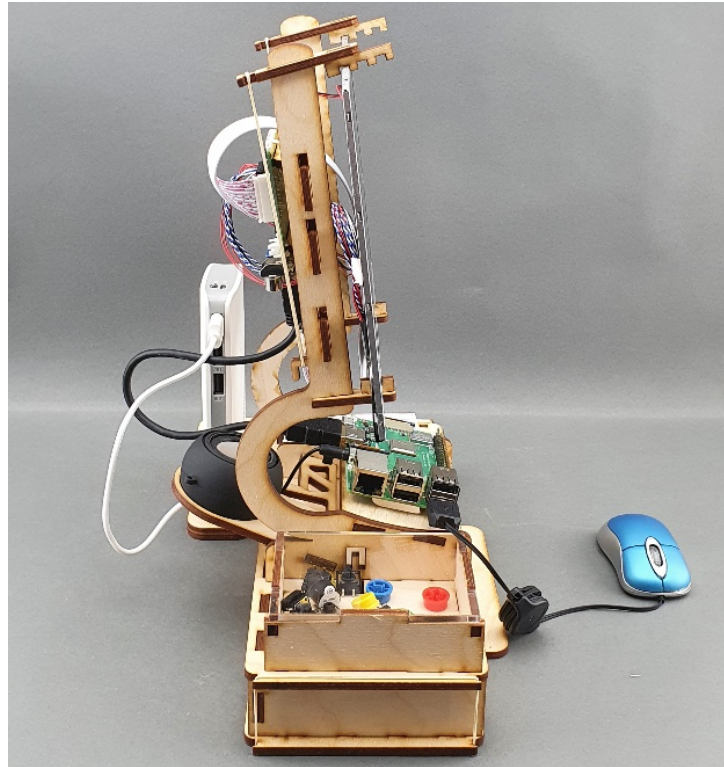


Figure 4 Right side of STEM4CLIM8 Console

3. The Console

Building the STEM4CLIM8 Console comprises of the following activities:

1. Construct the STE4CLIM8 Console body
2. Connect the components and the screen.
3. Connect the Raspberry Pi
4. Install and configure the needed software.

3.1 Inventory

The STEM4CLIM8 Console comprises the following items:

- STEM4CLIM8 Console body (30 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

3.1.1 STEM4CLIM8 Console body

The console's body needs 30 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.

3.1.2 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 is 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+

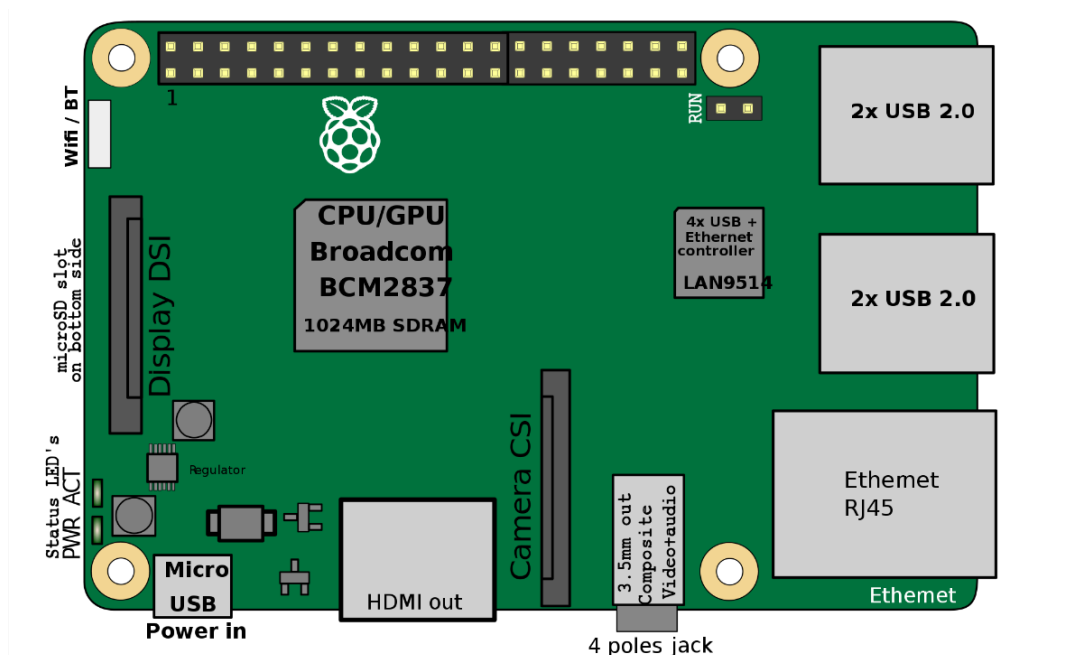


Figure 6 Raspberry Pi 3 Model B+ Schematic

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.

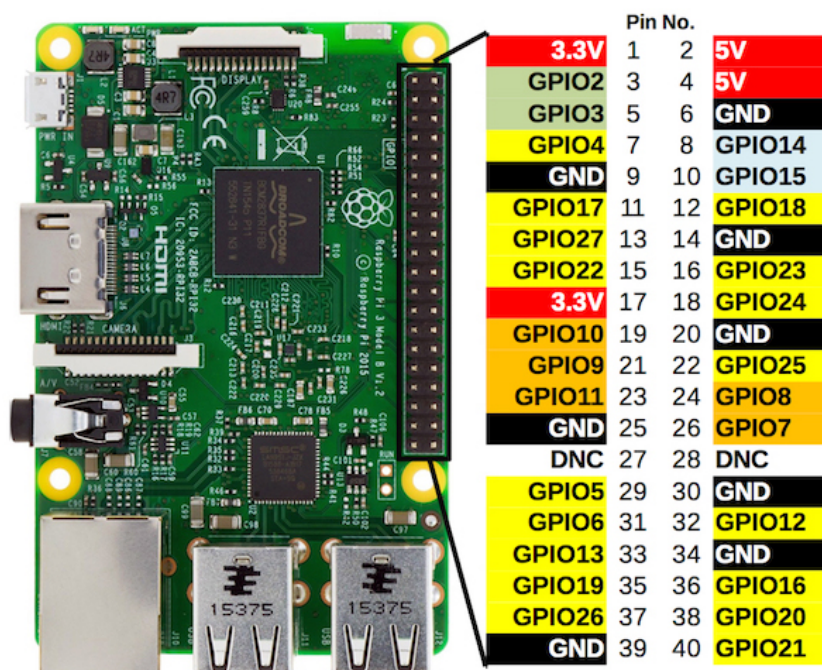


Figure 7 Raspberry Pi GPIO and Pin Assignment

More info at: <https://www.raspberrypi.org/>

3.1.3. HDMI/VGA LCD Controller Board Kit

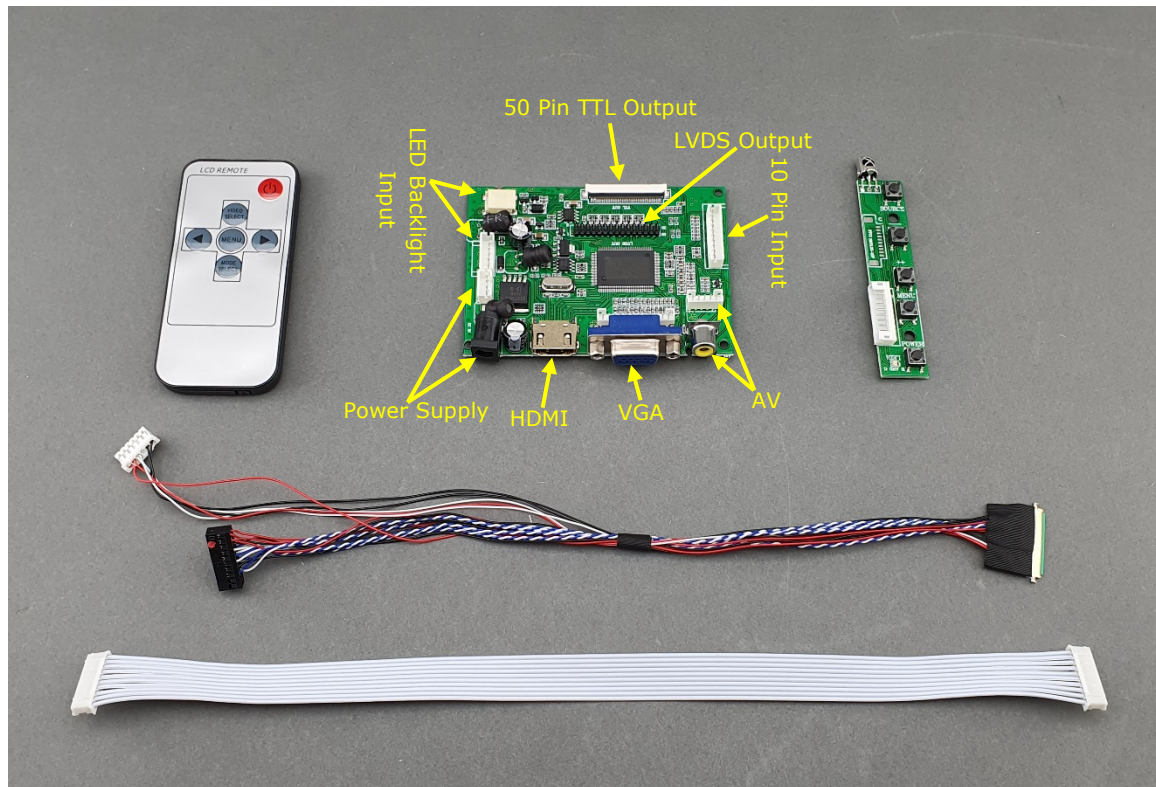


Figure 8 LCD Monitor Controller Board

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)

3.1.4. 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.

3.1.5. 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.

3.1.6. 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.

3.1.7. Mouse



Figure 11 Mouse

Standard USB mini expandable cable mouse.

3.1.8. LCD Display with controller

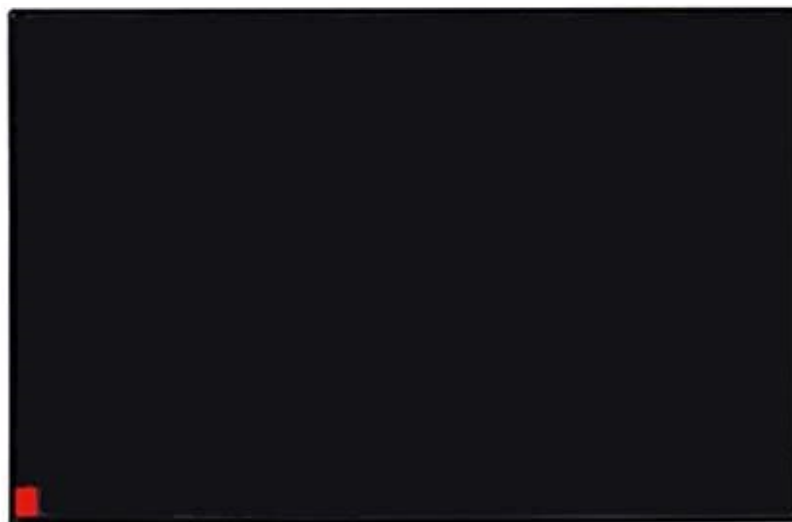


Figure 12 LCD Display

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.

3.1.9. Breadboards

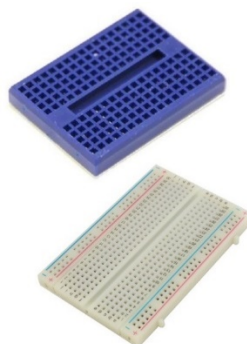


Figure 13 Breadboards

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.

3.1.10. 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.

3.1.11. 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

4. Assembly

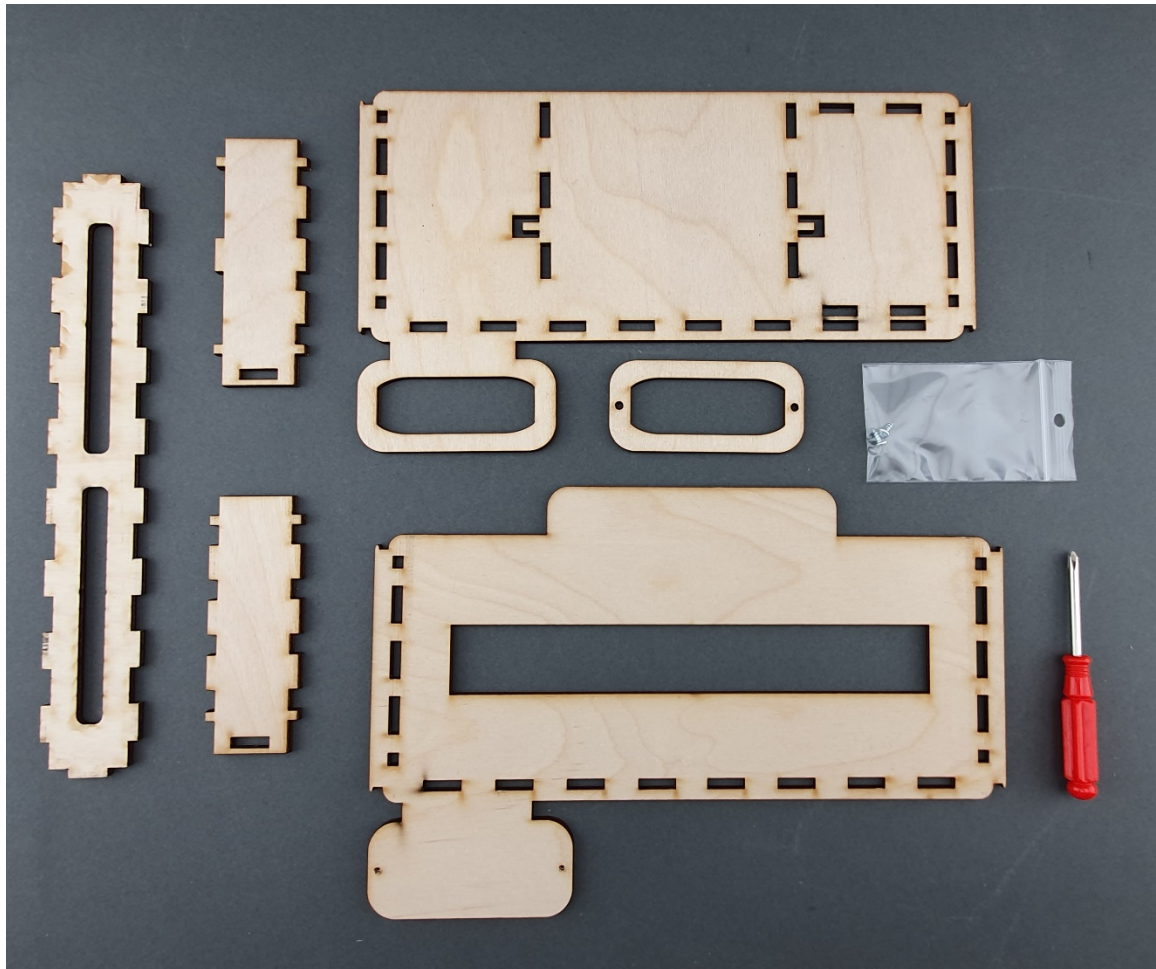
In this section, all the steps to be followed for assembling the STEM4CLIM8 Console are provided. Remember that the only tool you need is a Philips screwdriver. Everything else is included in the package.

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

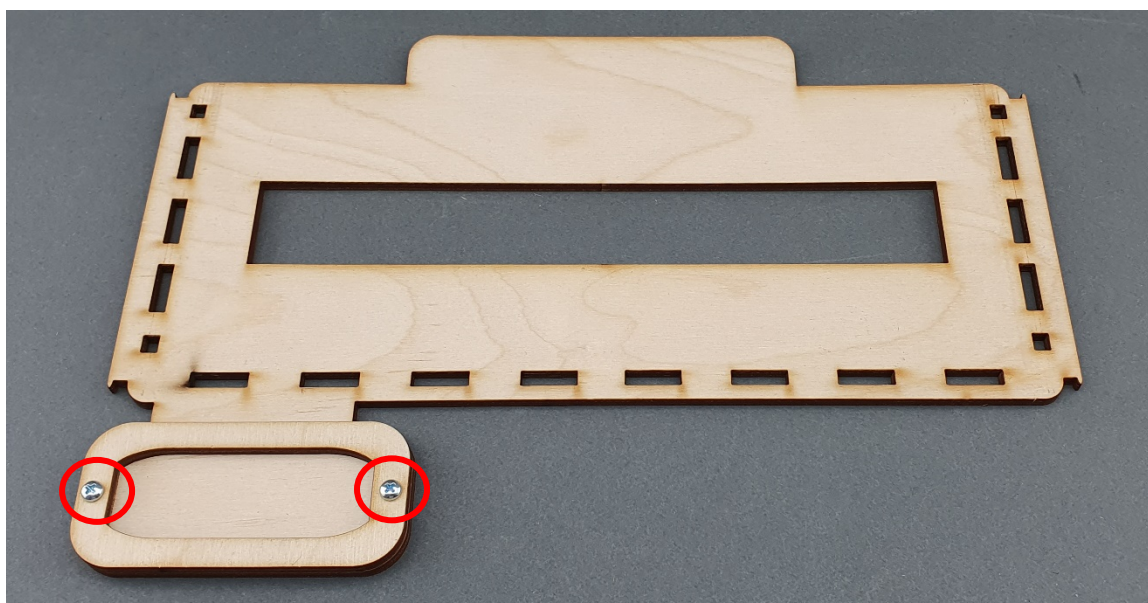
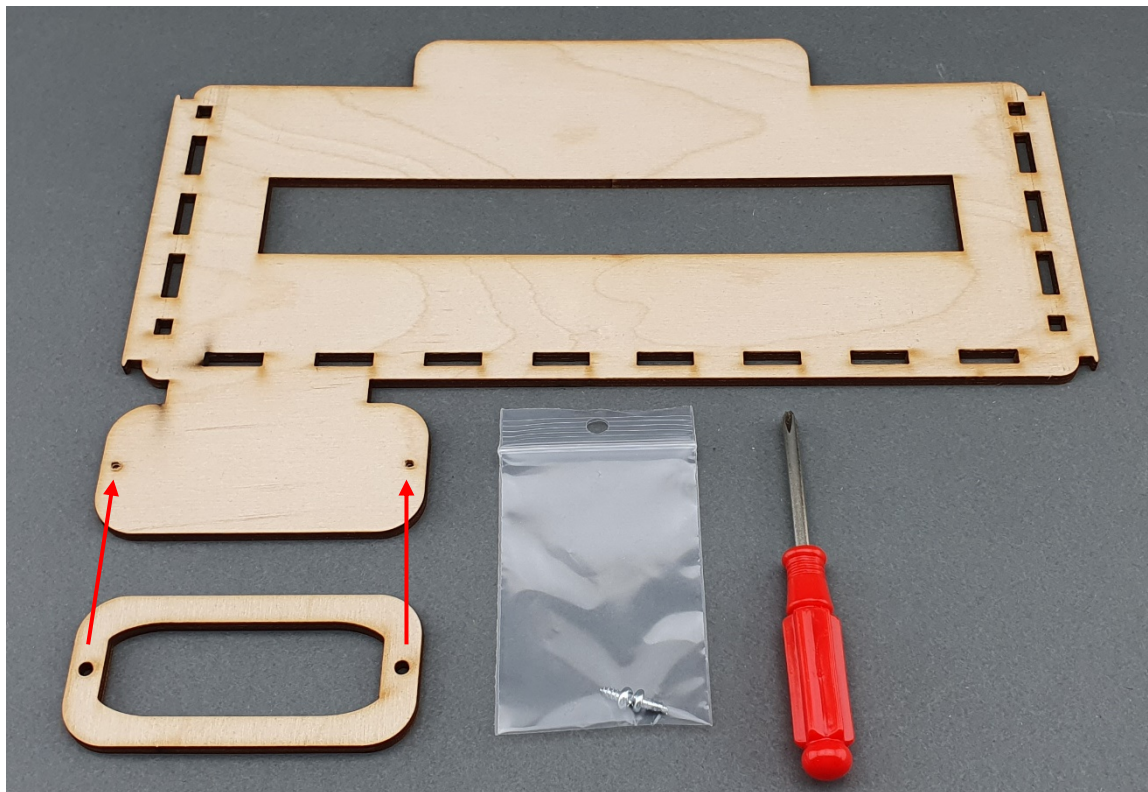
1. Base assembly
2. Drawer assembly
3. Upper body assembly
4. Raspberry Pi Assembly
5. LCD Controller assembly and Wiring
6. LCD Placeholder assembly and LCD assembly
7. Cupboard assembly
8. Powerbank and speaker
9. Electronics and mouse

4.1 Base Assembly

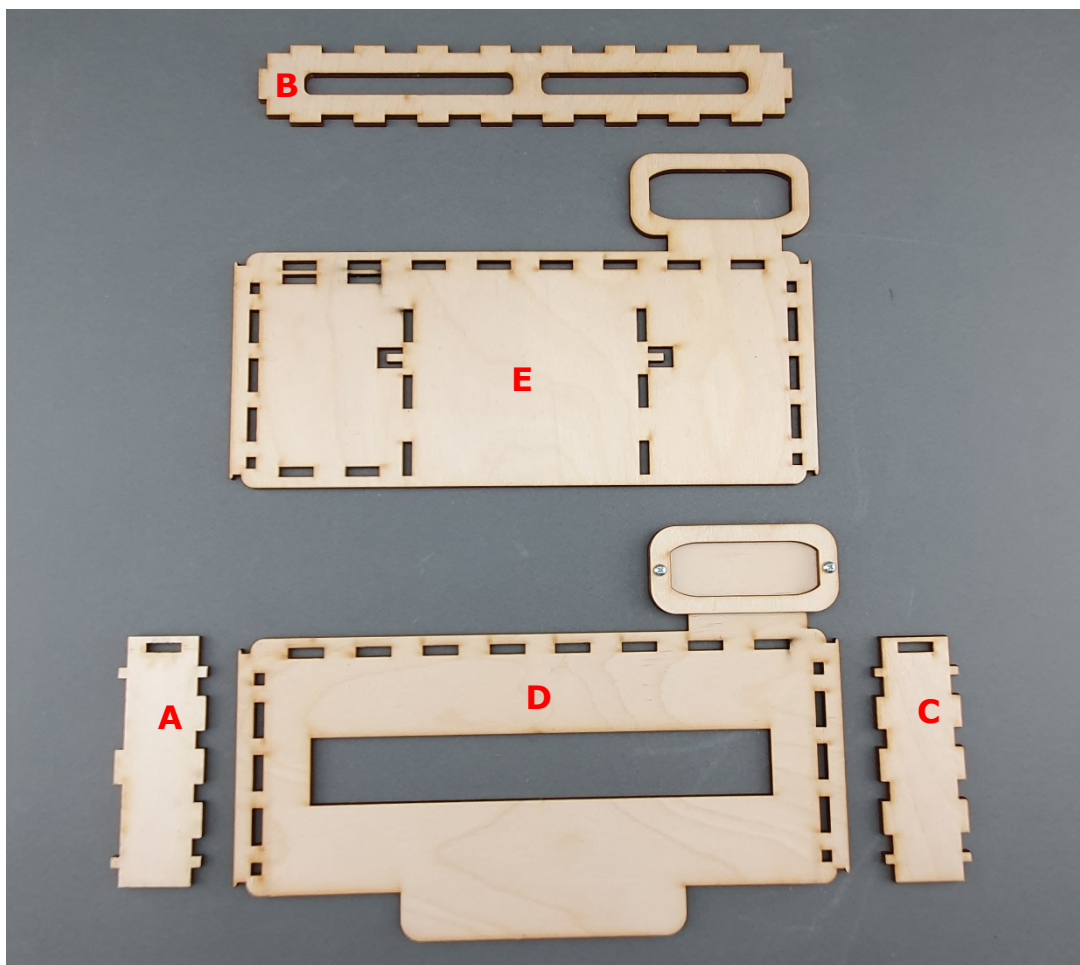
Step 1 – What you will need:



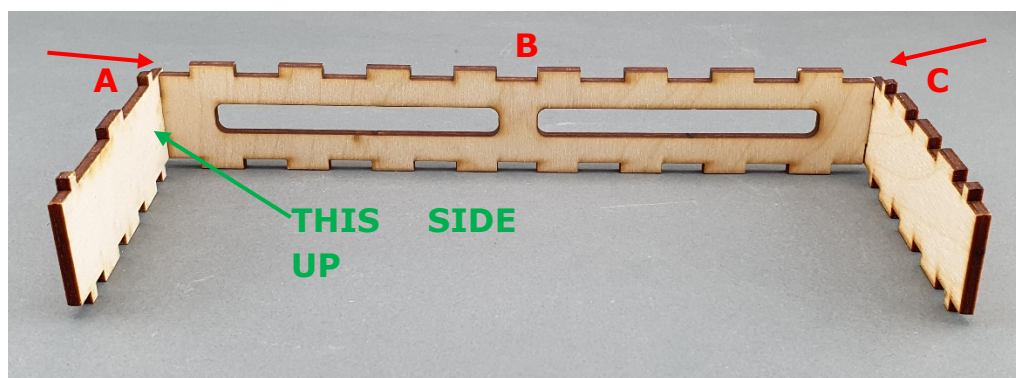
Step 2 – Screw the Power Bank base holder:



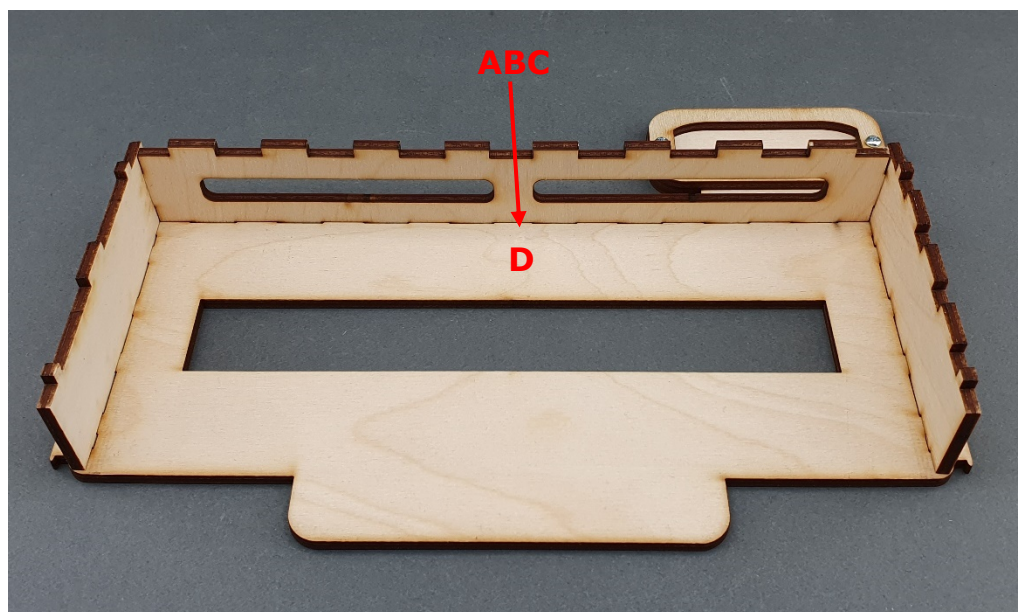
Step 3 – Align the pieces as shown in the image below:



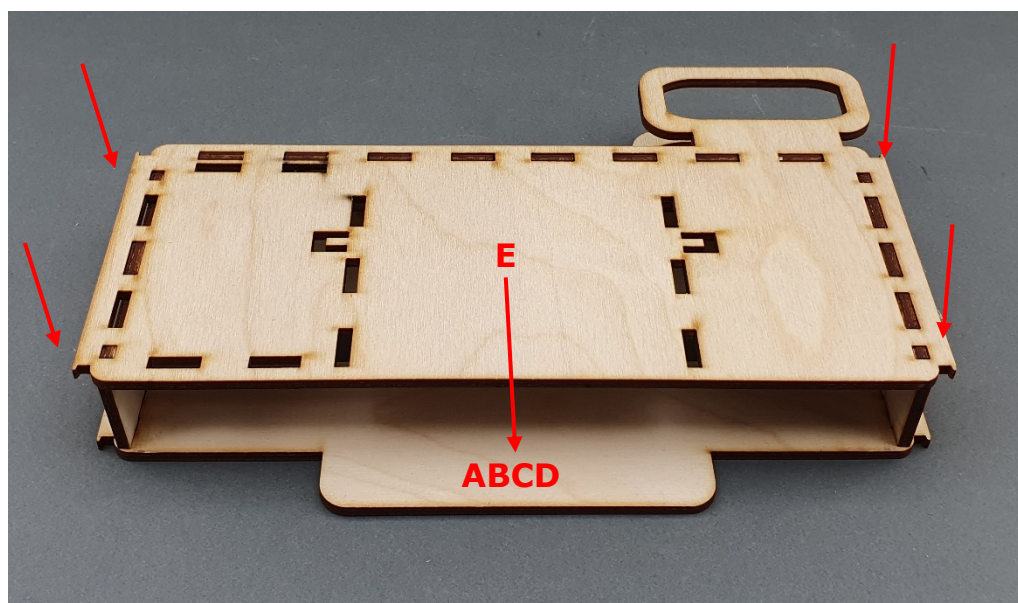
Step 4 – Assembly together A → B → C, as shown in the images below:



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

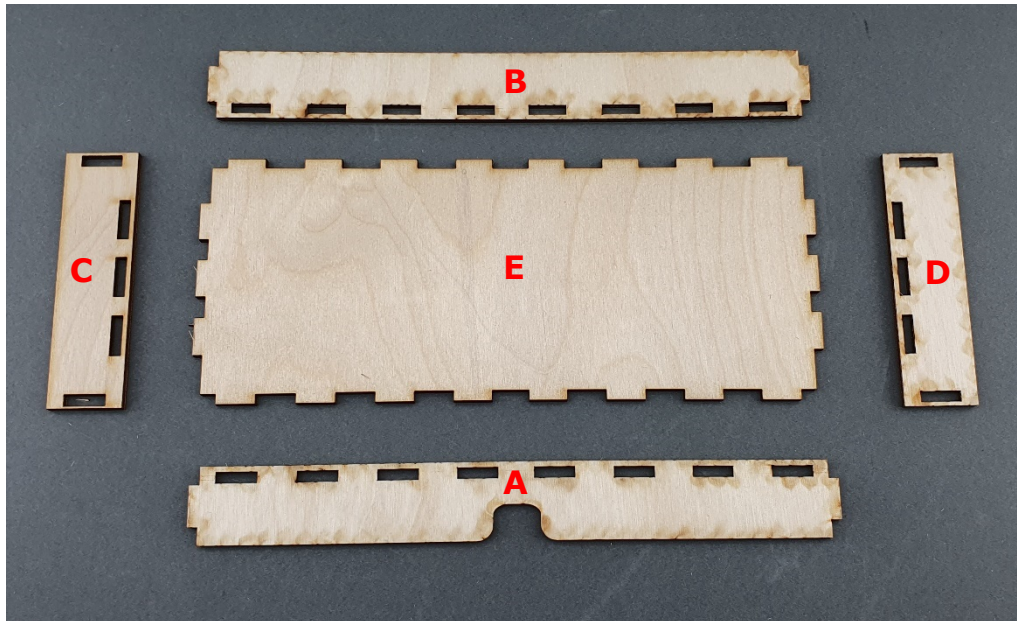


Step 6 – Assembly E on top of ABCD, as shown in the images below:

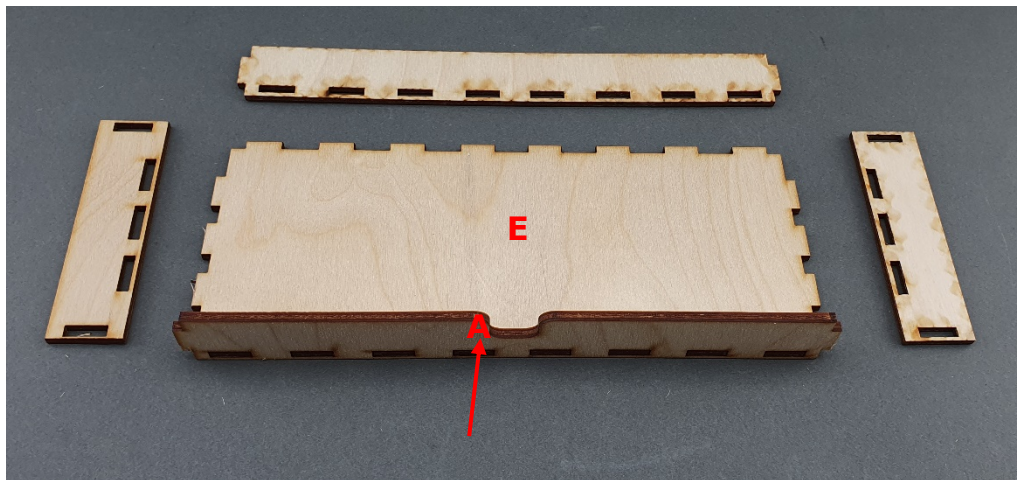


4.2 Drawer Assembly

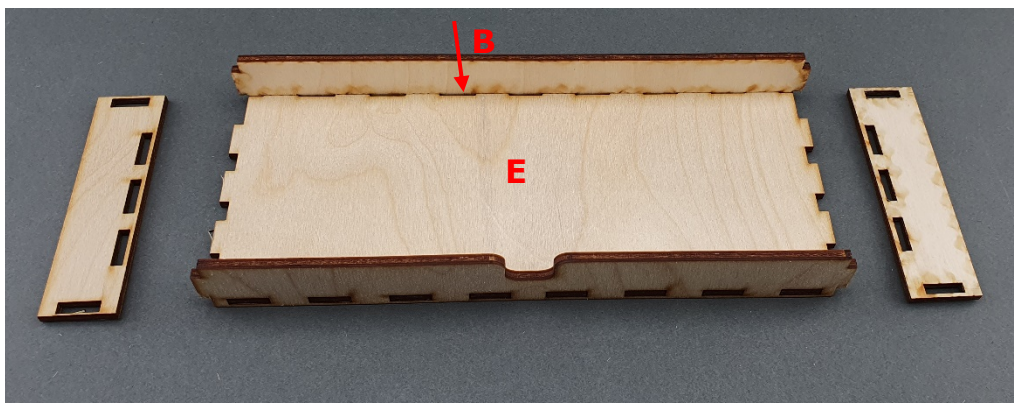
Step 1: What you will need:



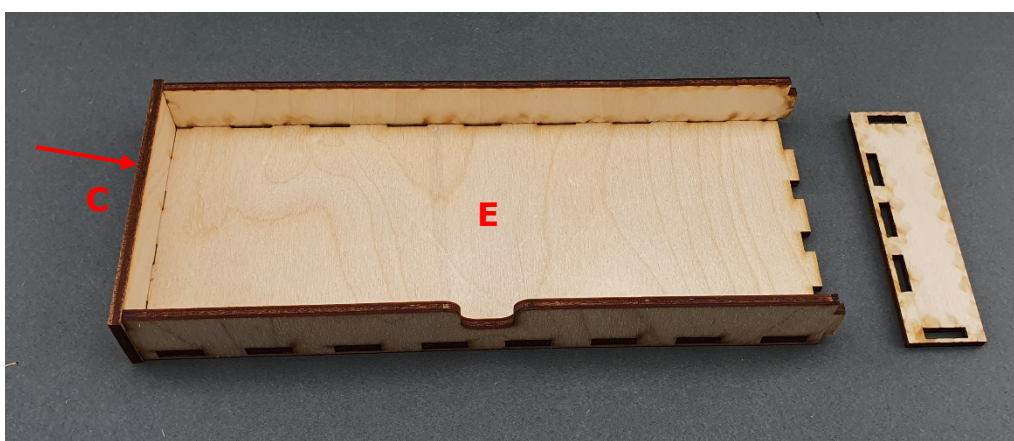
Step 2: Attach A to E, as shown in the image below:



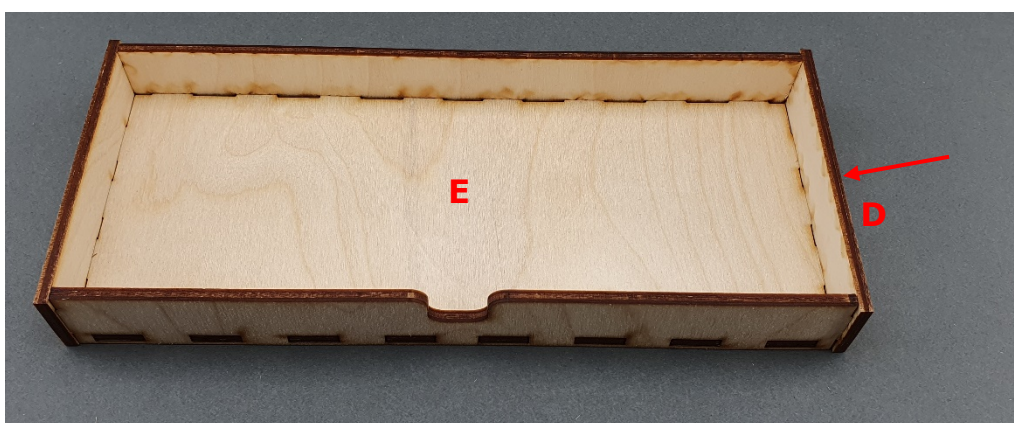
Step 3: Attach B to E, as shown in the image below:



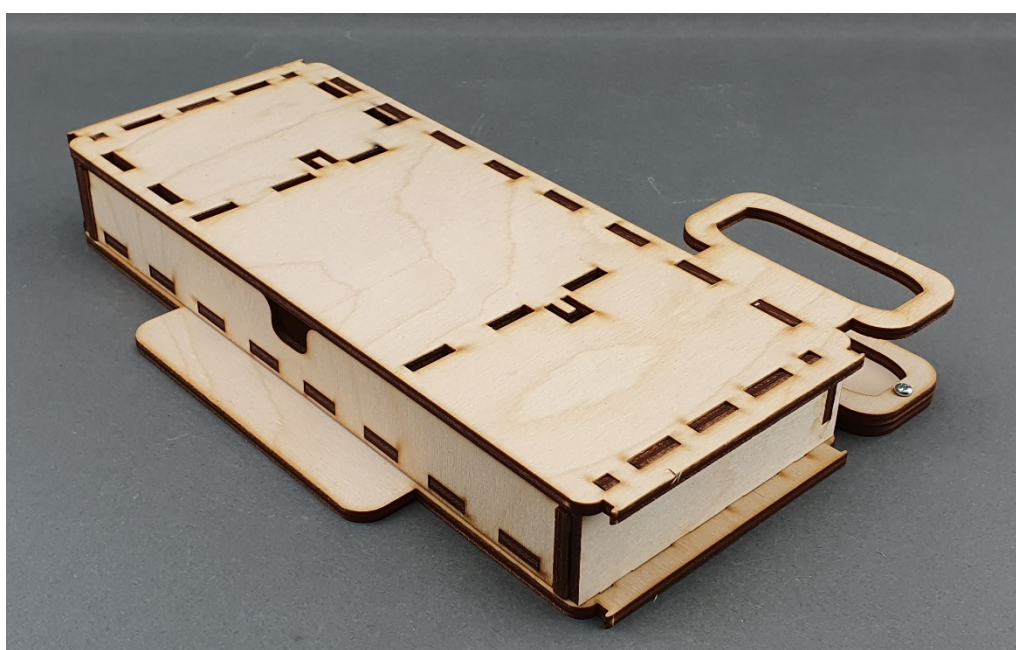
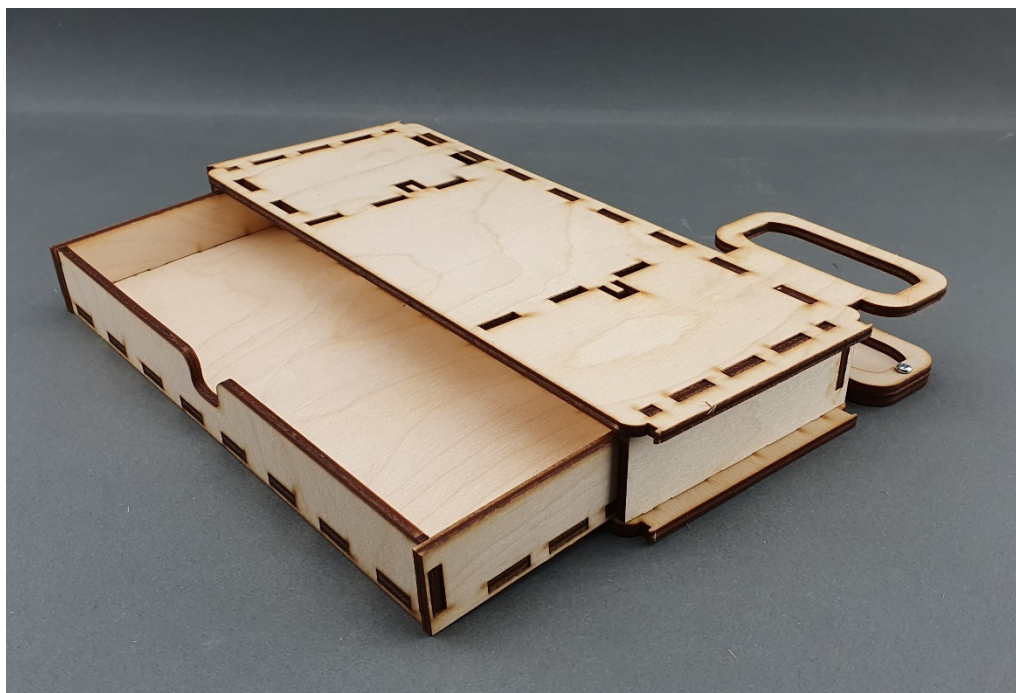
Step 4: Attach C to E, as shown in the image below:



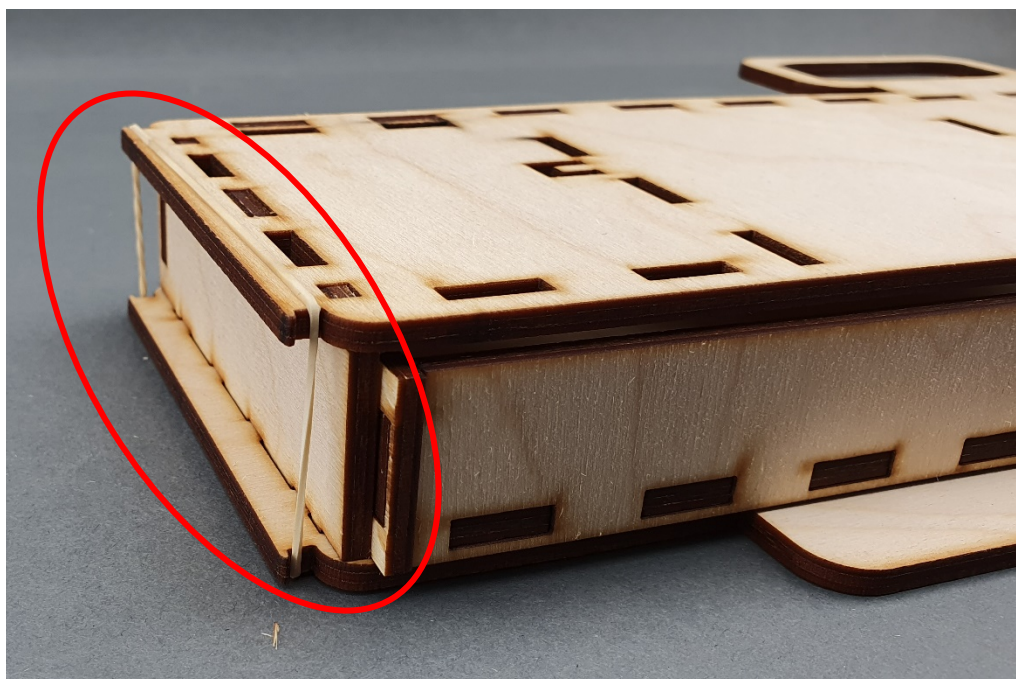
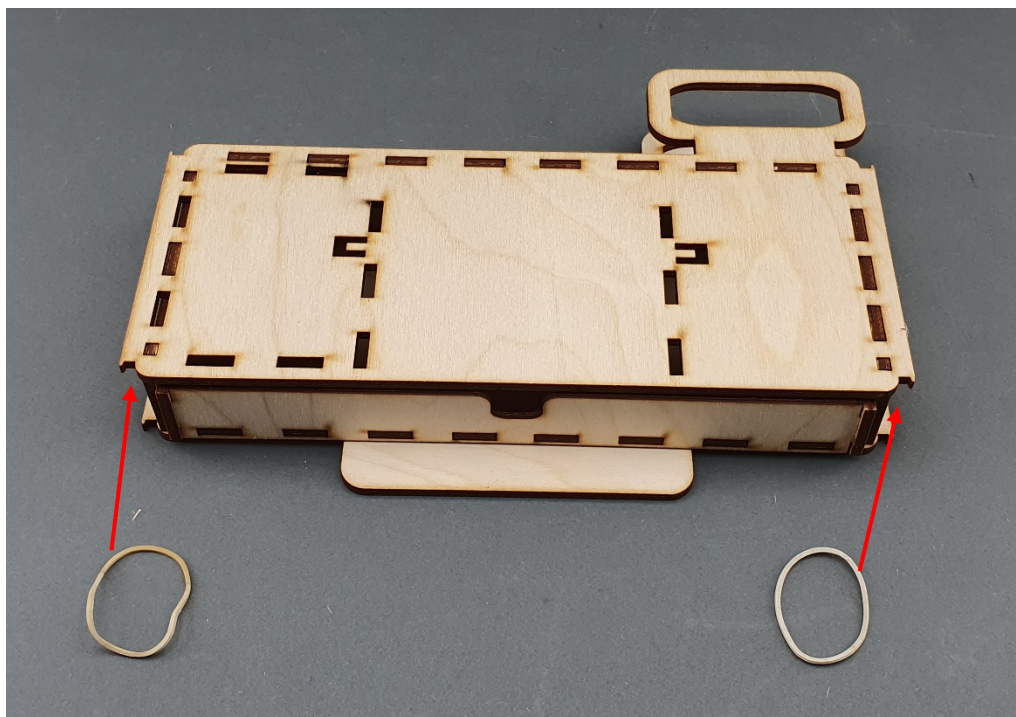
Step 5: Attach D to E, as shown in the image below:

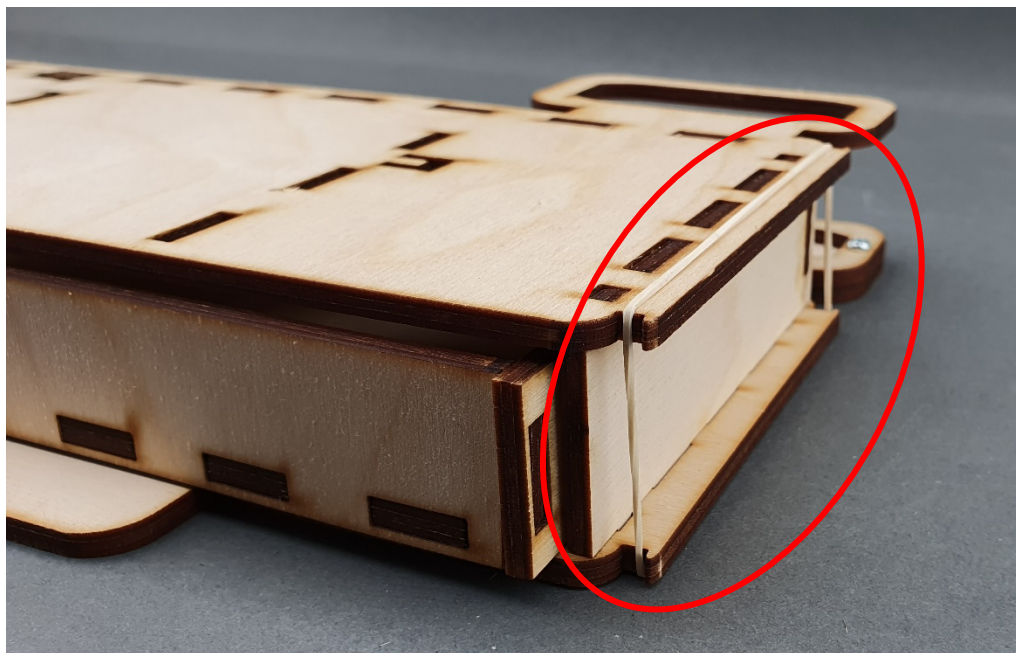


Step 6: Insert drawer to base, as shown in the images below:



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



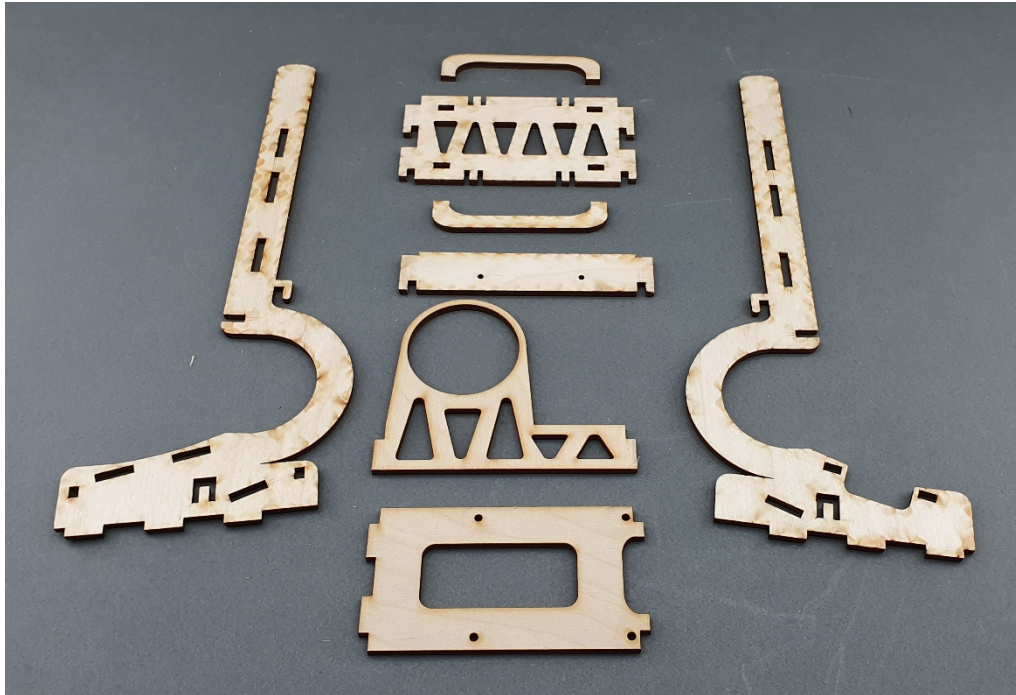


Step 8: The base and drawer assembly are completed:



4.3 Upper-body Assembly

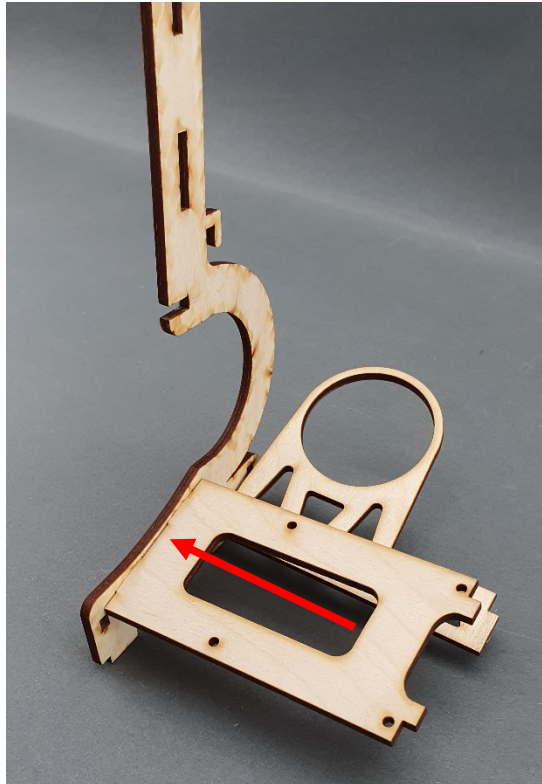
Step 1: What you will need:



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



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



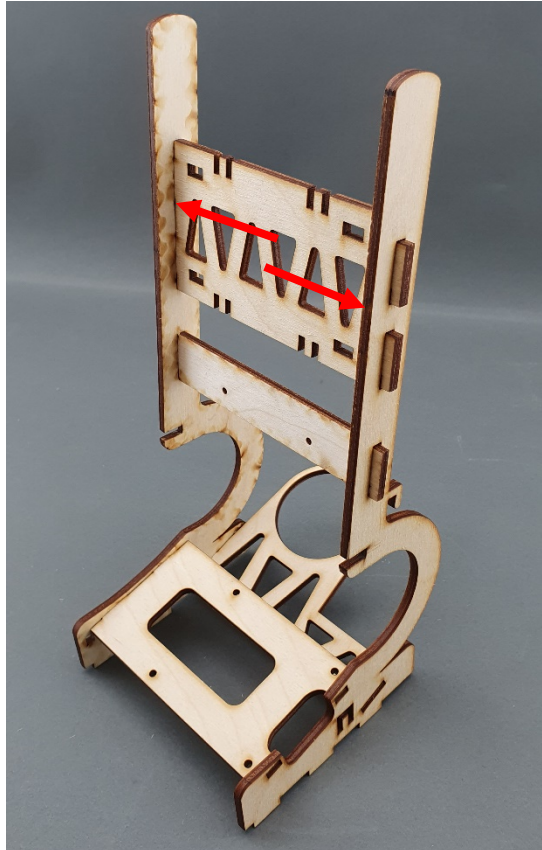
Step 4: Attaching right arm, as shown in the picture below:



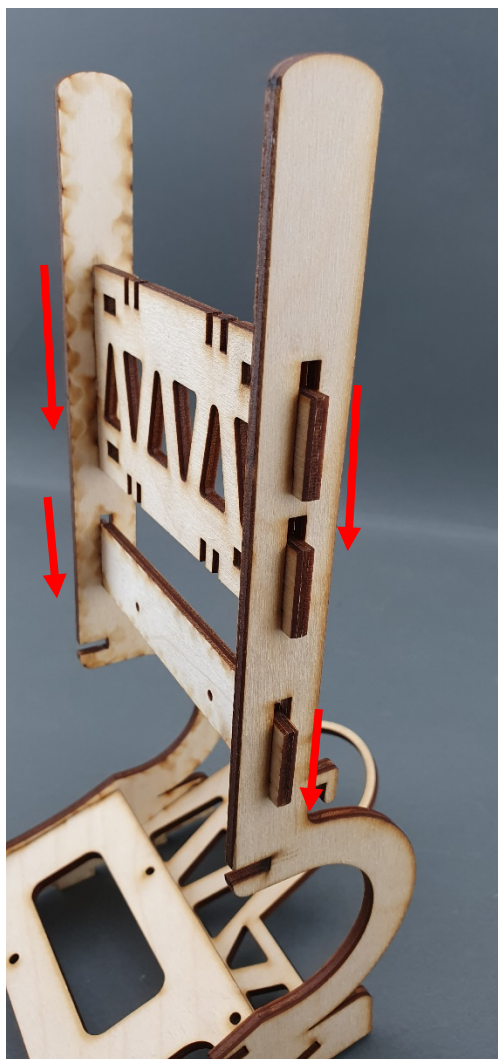
Step 5: Attaching LCD controller base, as shown in the picture below:



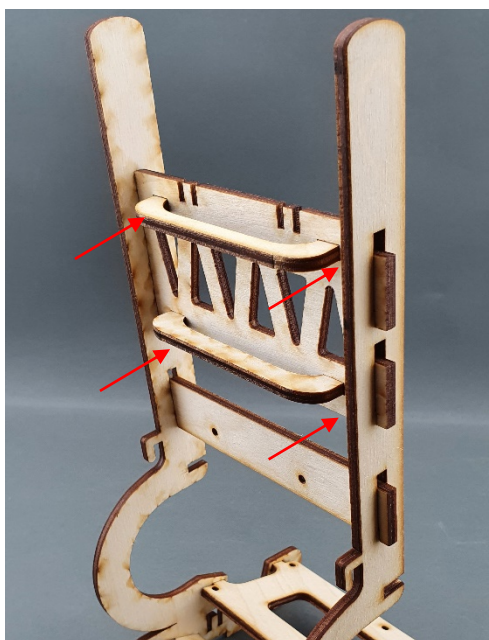
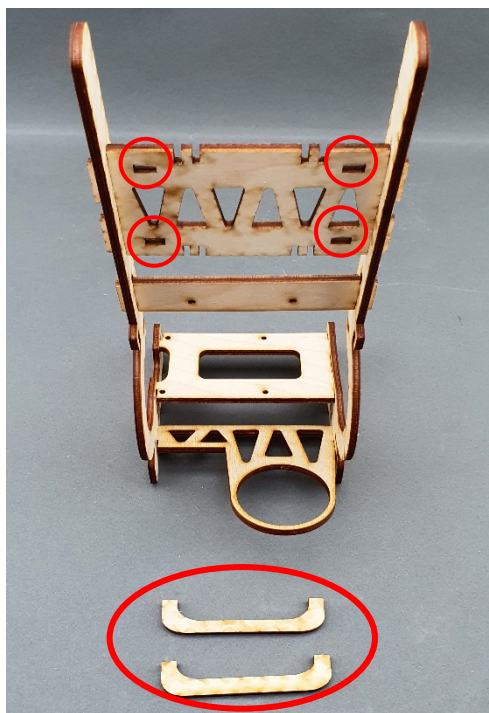
Step 6: Attaching LCD I/O board base, as shown in the picture below:



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



Step 8: Attaching LCD I/O board holders, as shown in the pictures below:

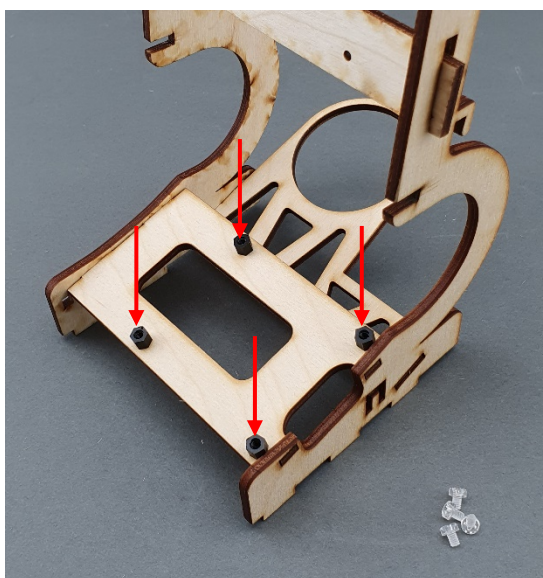
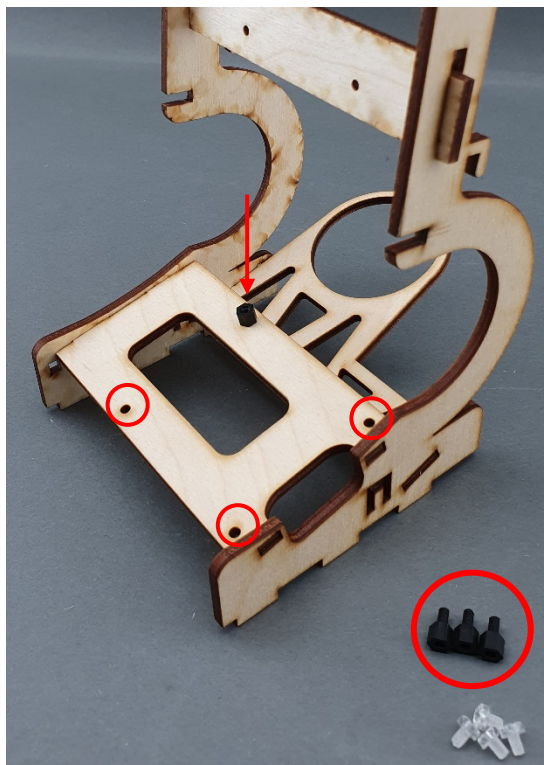


4.4 Raspberry Pi Assembly

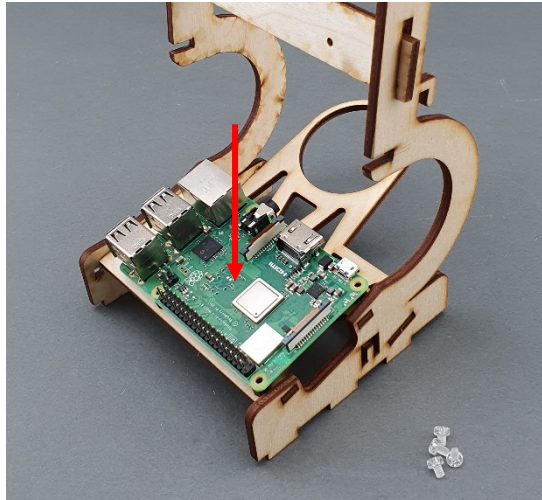
Step 1: What you will need:



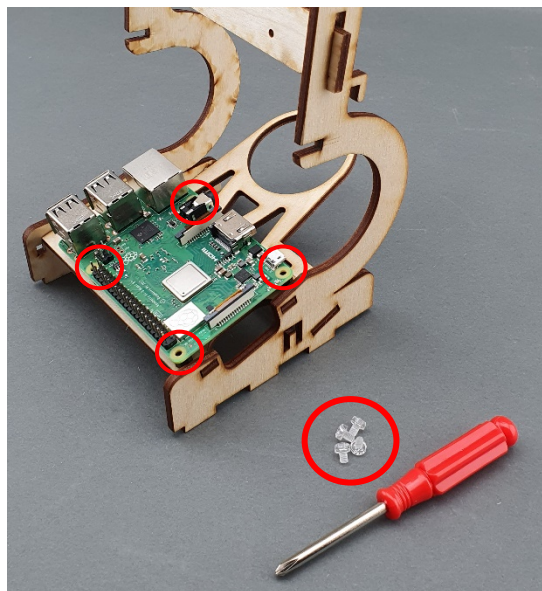
Step 2: Placing the screw fixtures on the Raspberry Pi base, as shown in the pictures below:

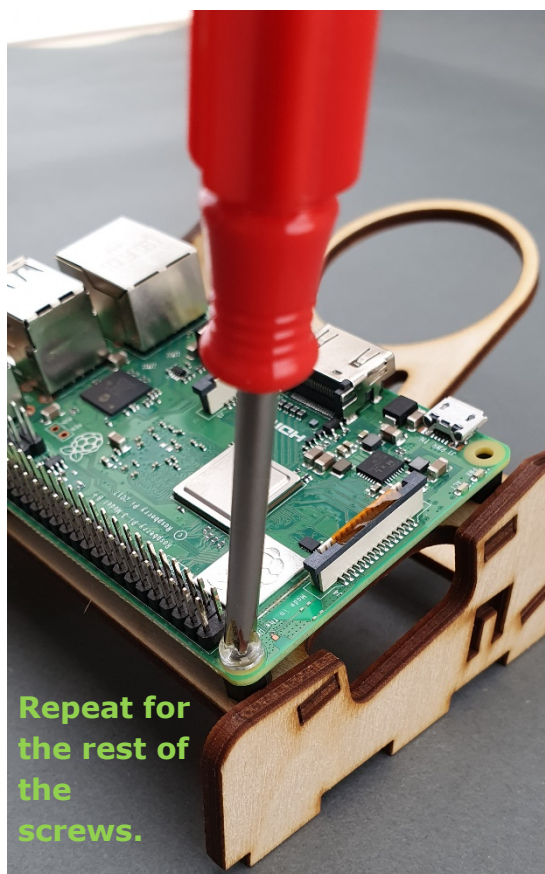


Step 3: Placing the Raspberry Pi on top of screw fixtures, as shown in the picture below:



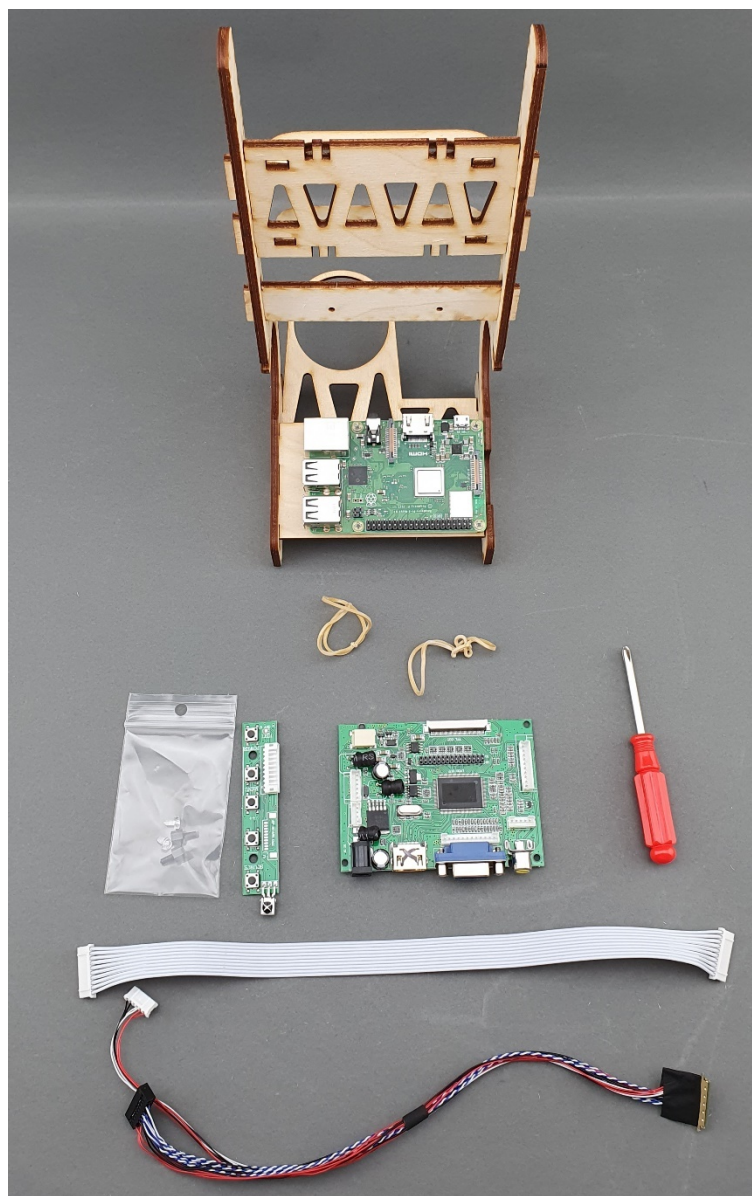
Step 4: Screw the Raspberry Pi to the fixtures, as shown in the pictures below:



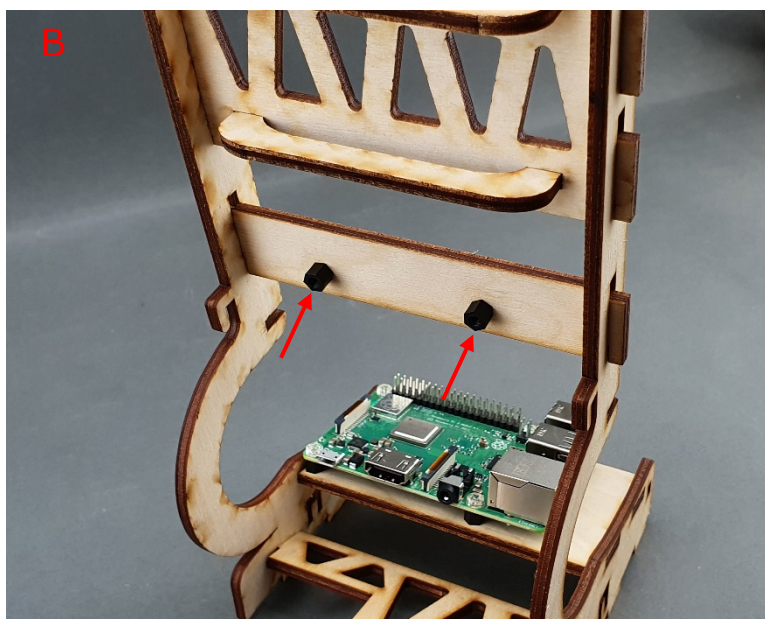
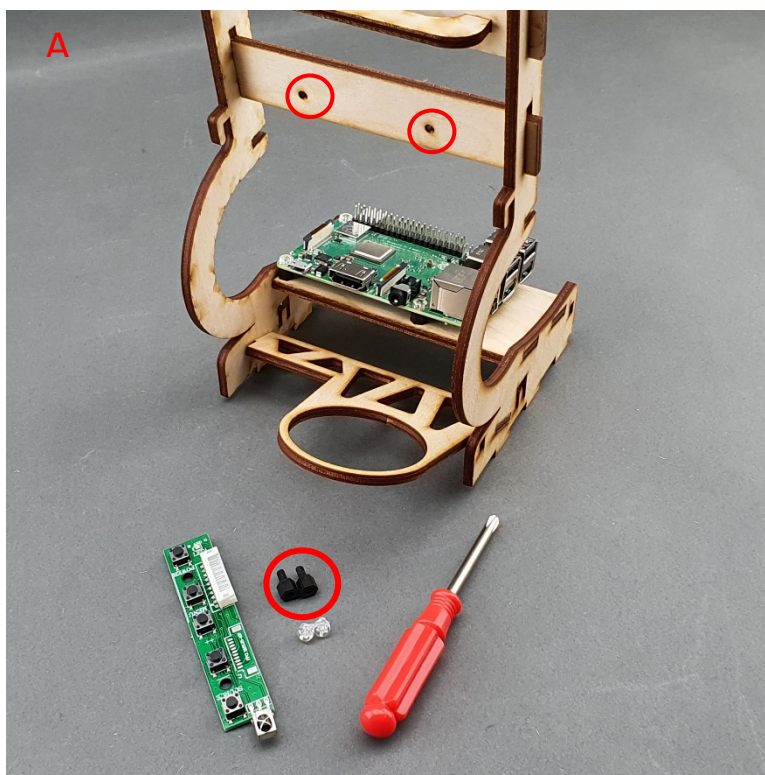


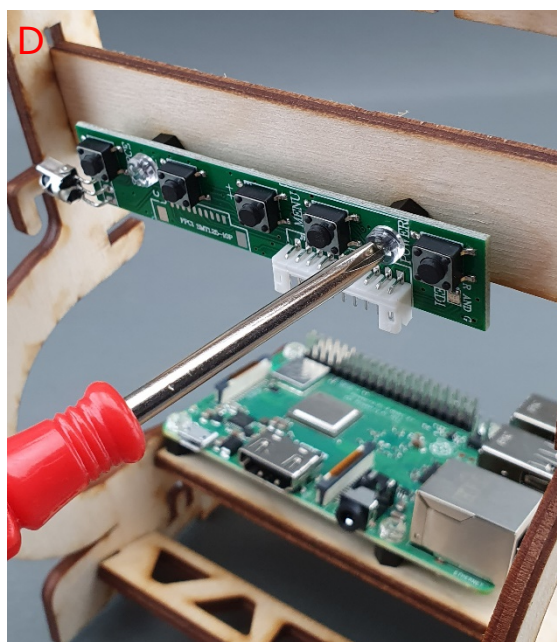
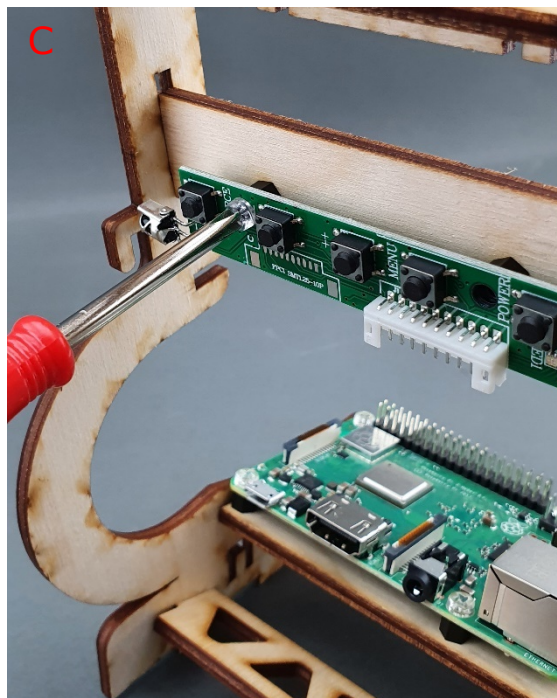
4.5 LCD Controller Assembly and Wiring

Step 1: What you will need:

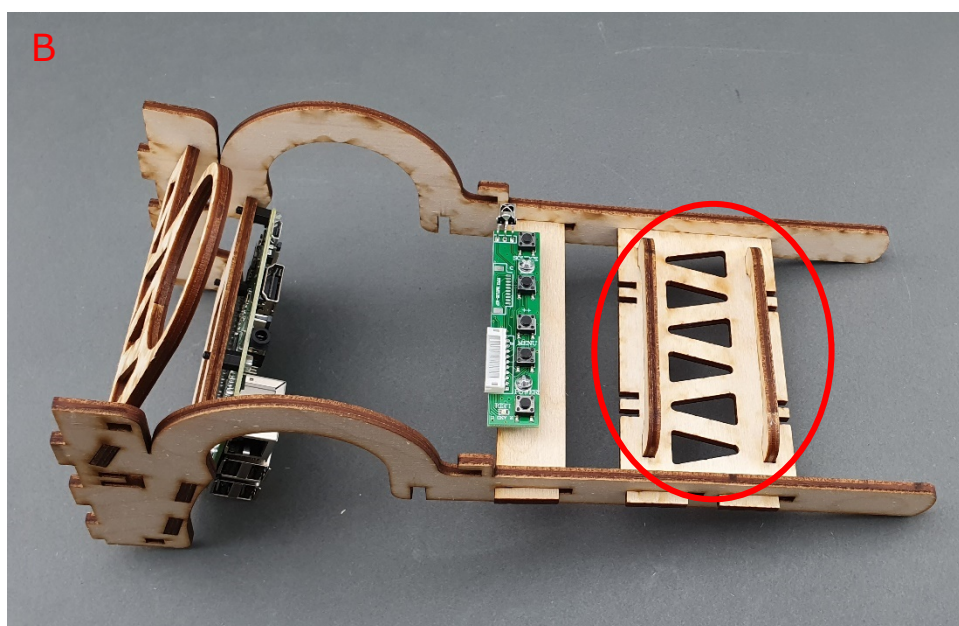
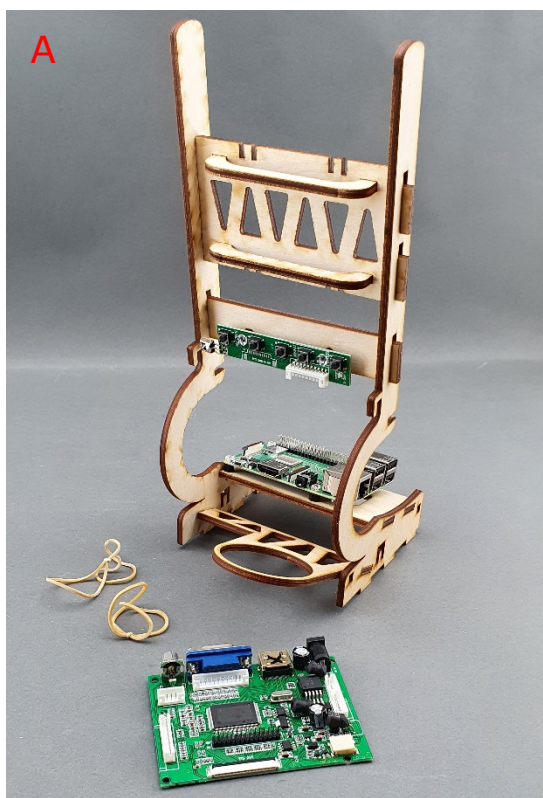


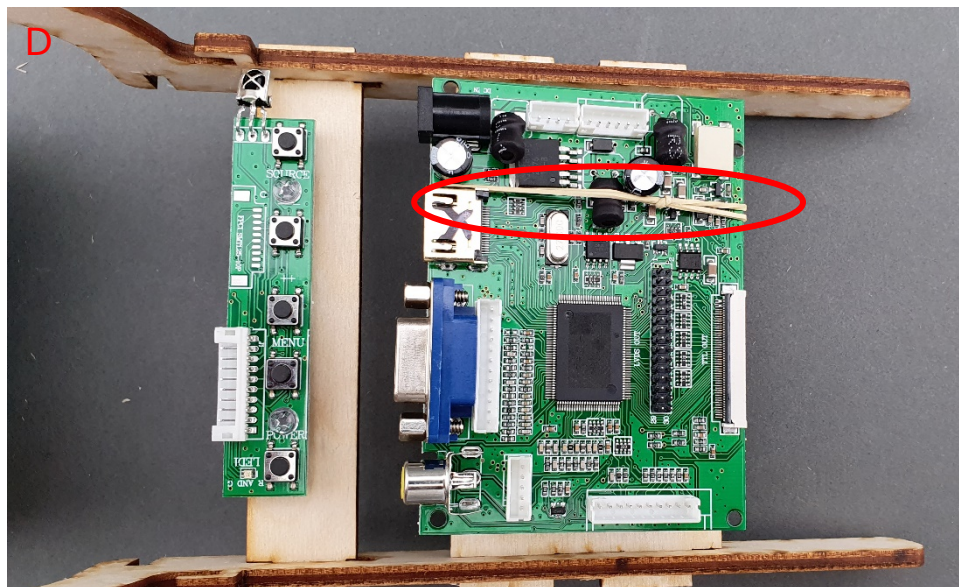
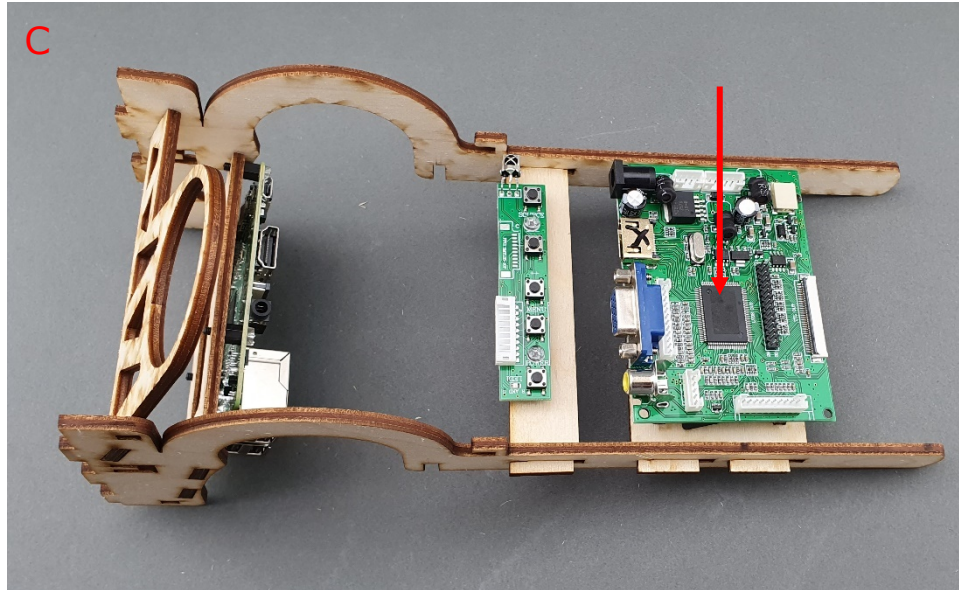
Step 2: Assembling the LCD controller, as shown in the pictures below:

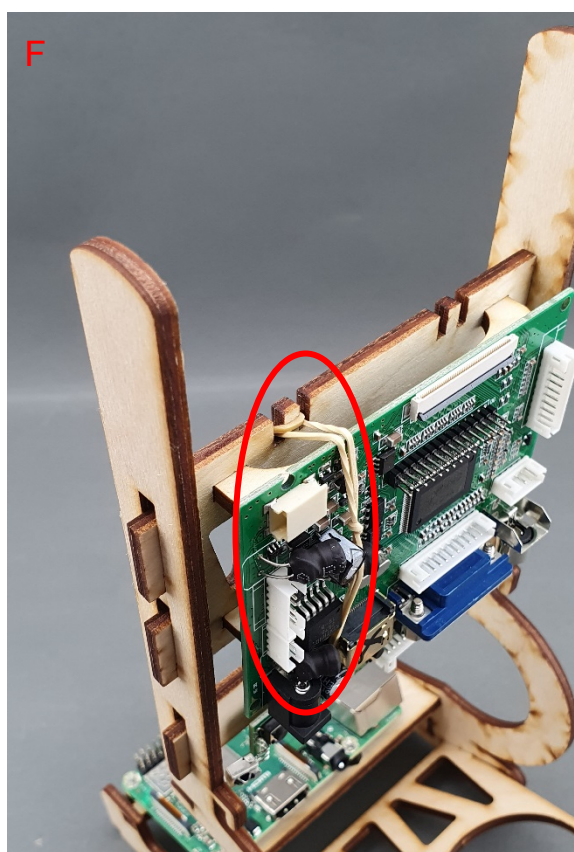
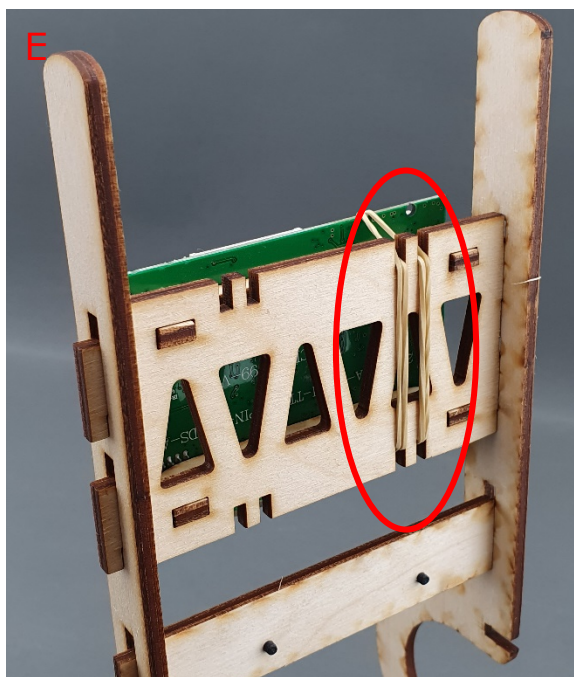


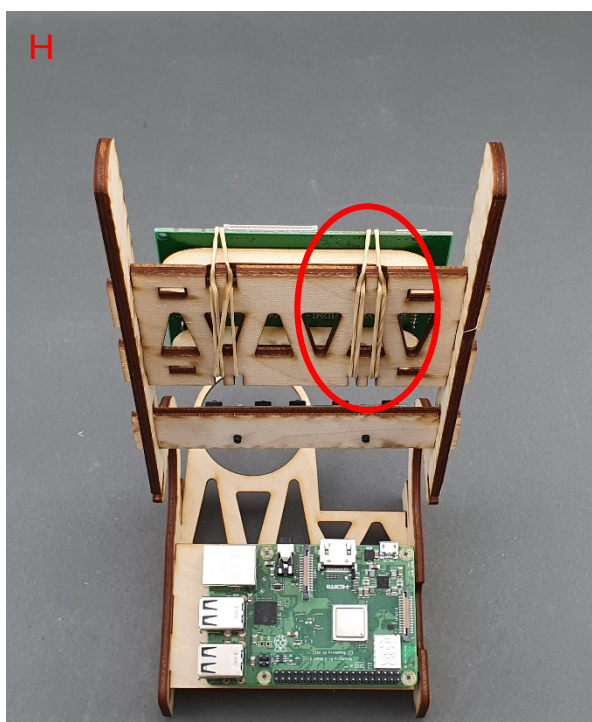
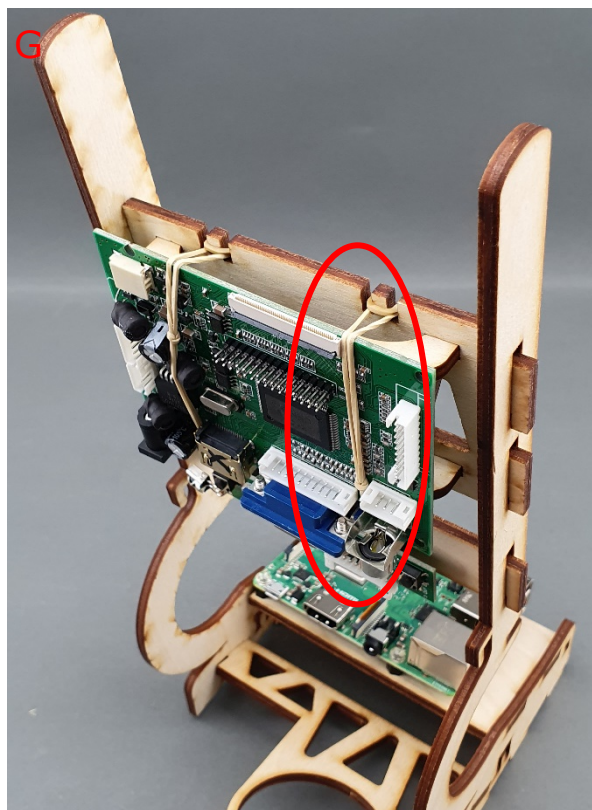


Step 3: Placing the LCD I/O board, as shown in the pictures below:

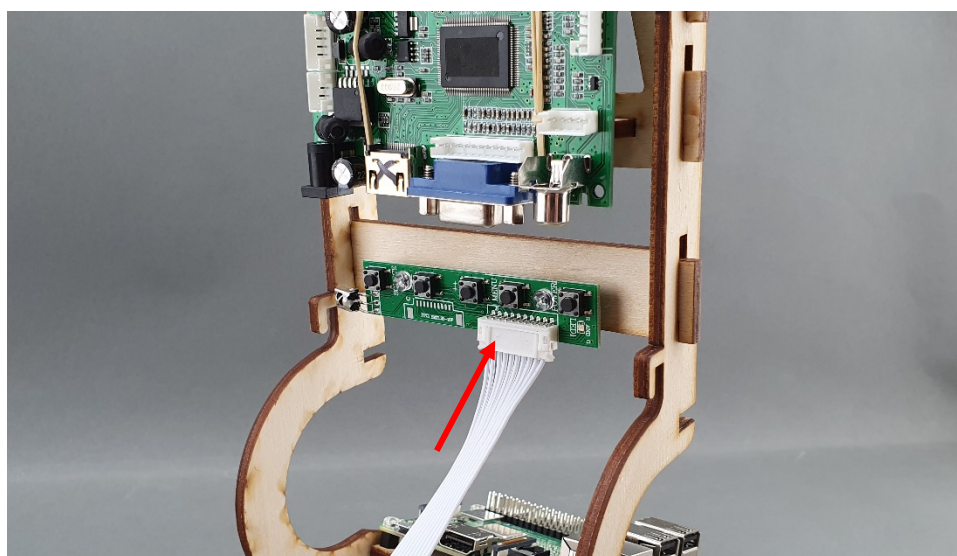
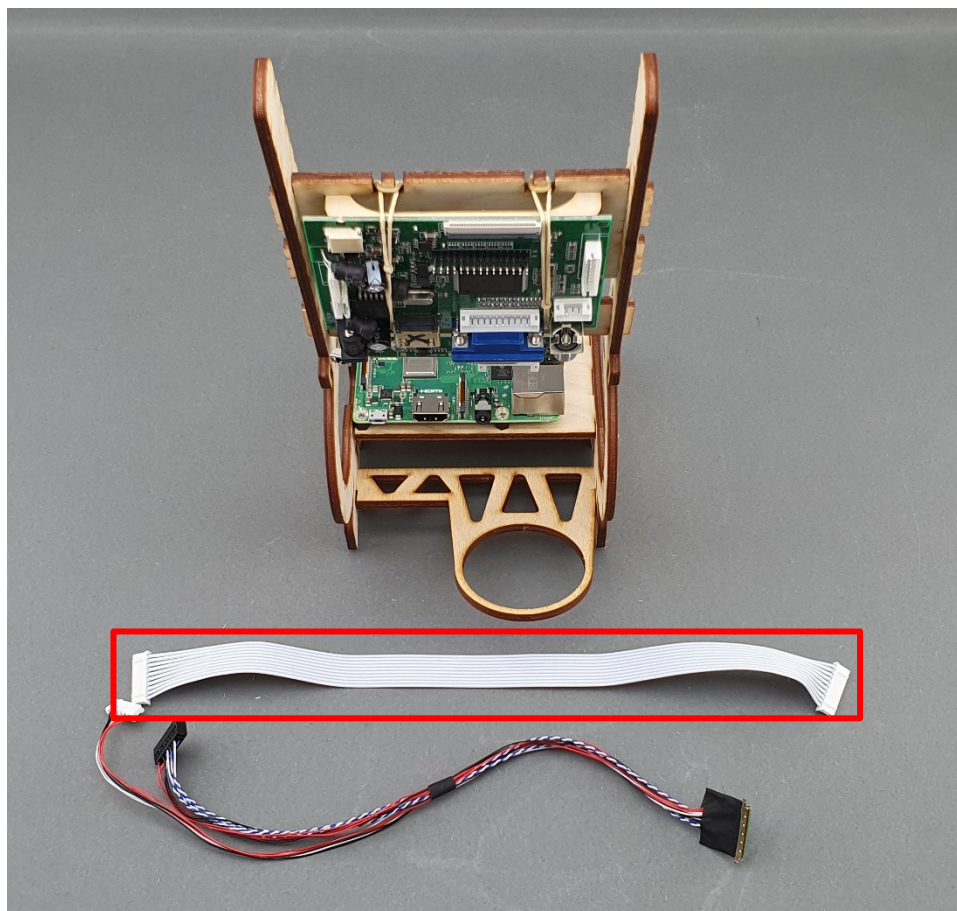


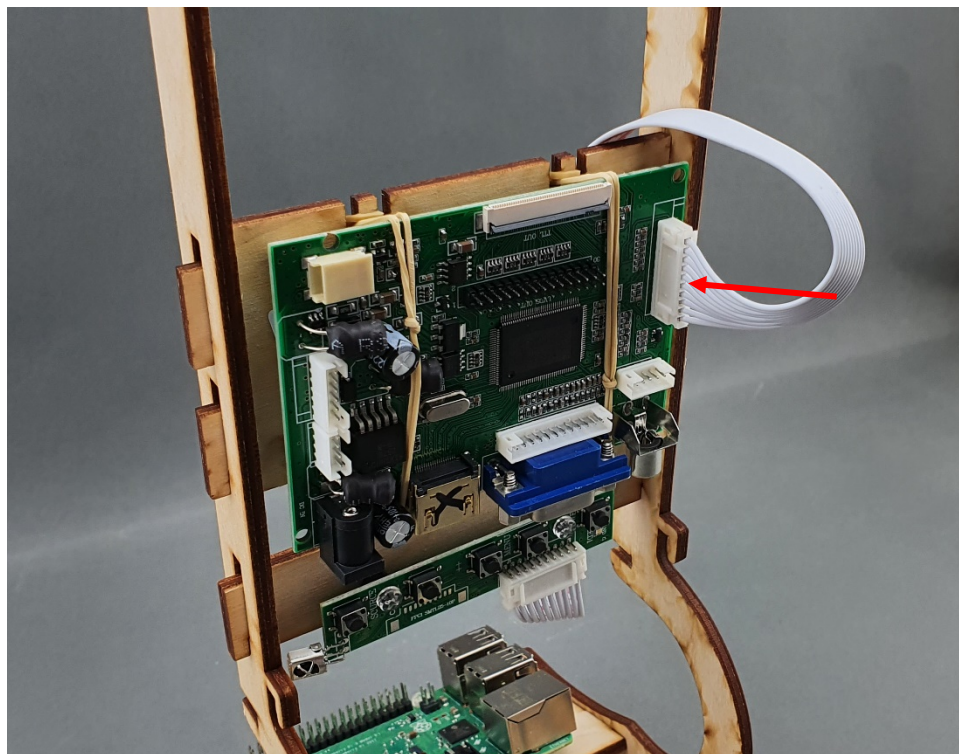




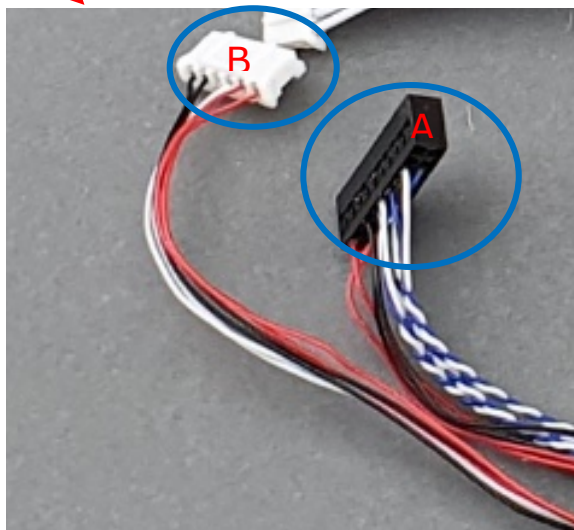
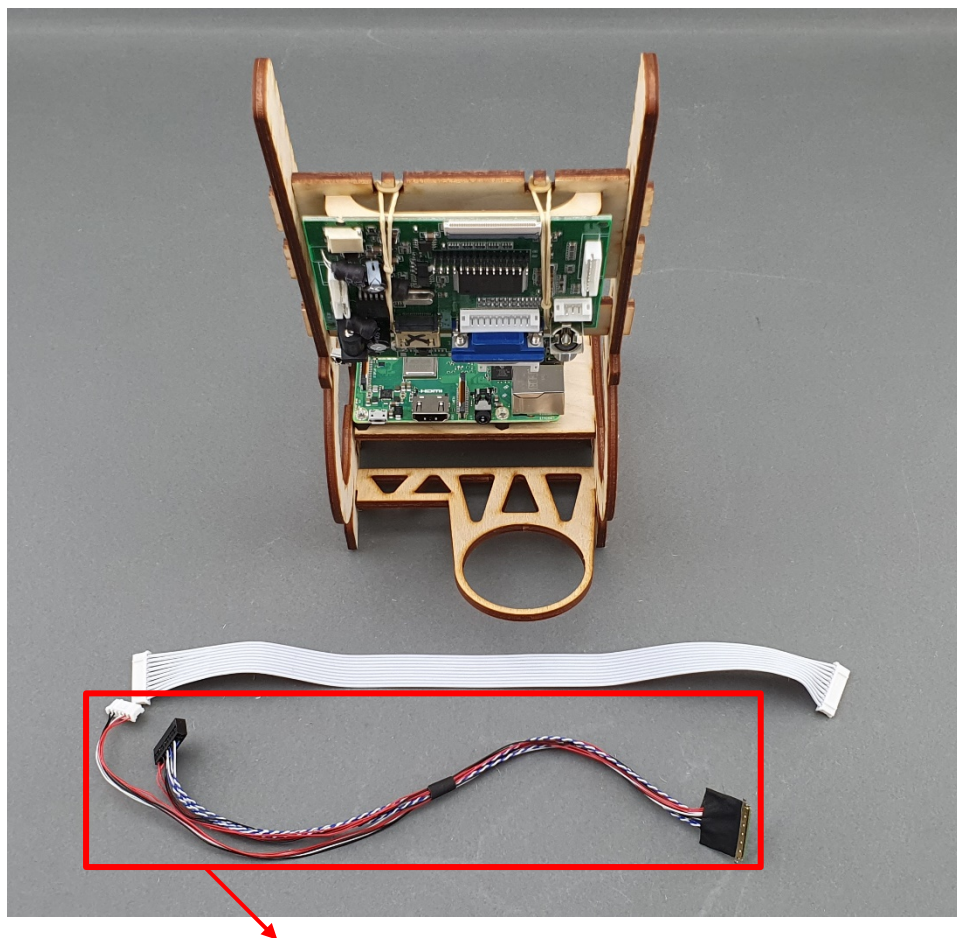


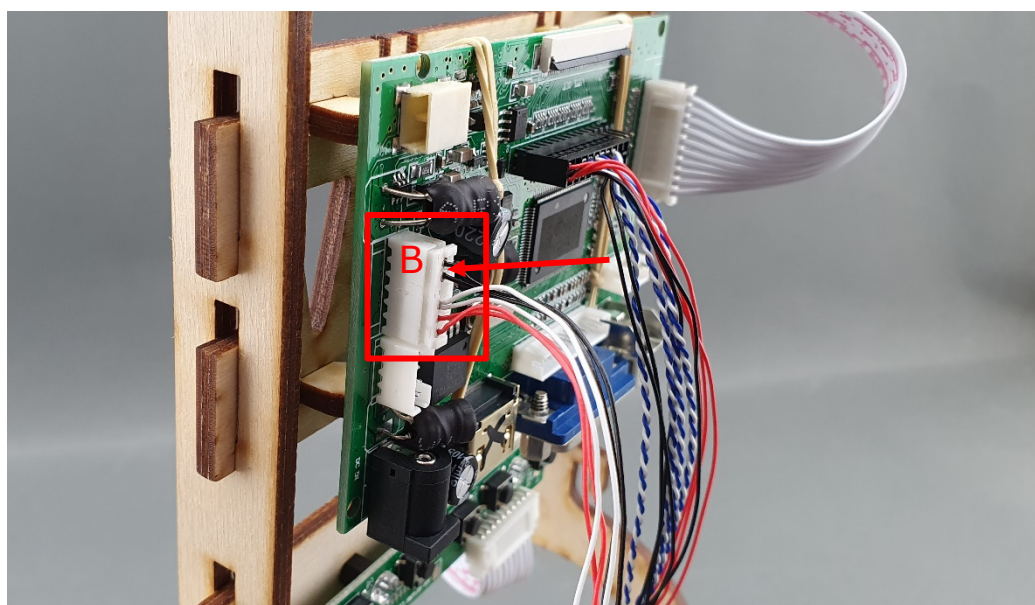
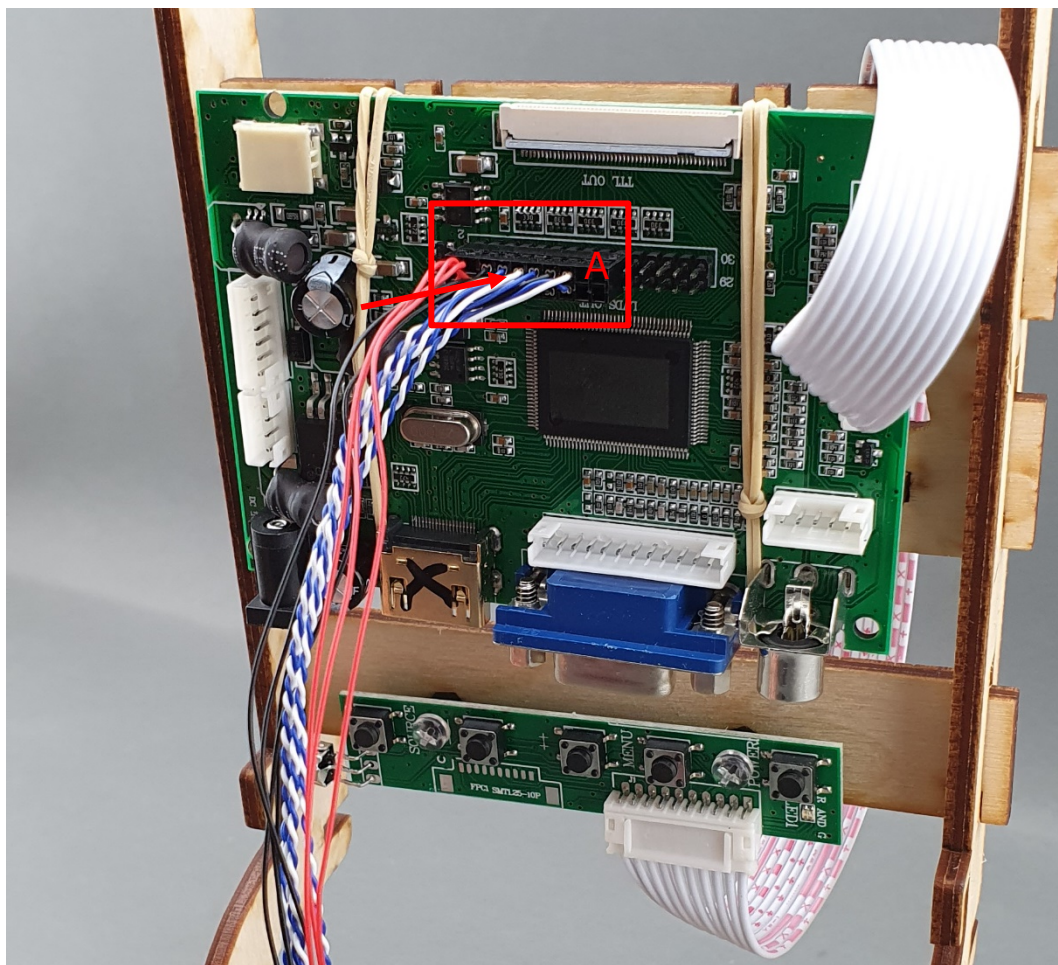
Step 4: Wiring of LCD Display Controller – Controller unit to I/O board:

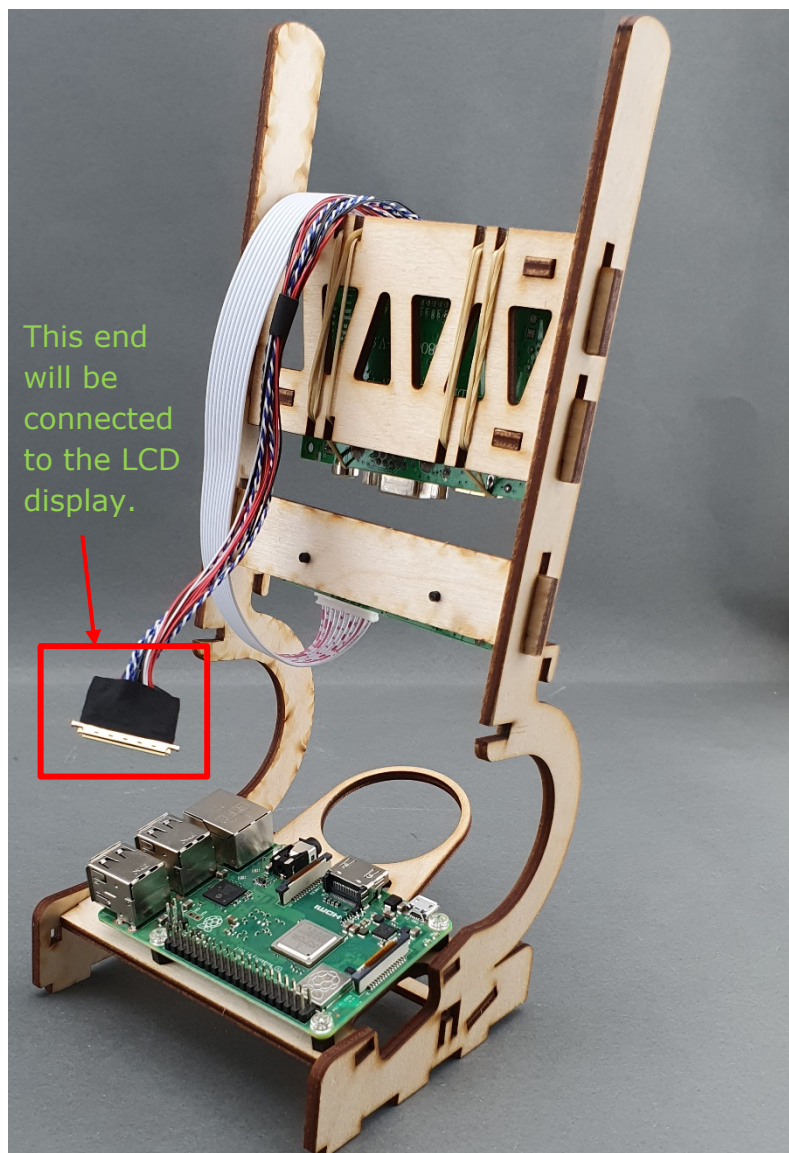




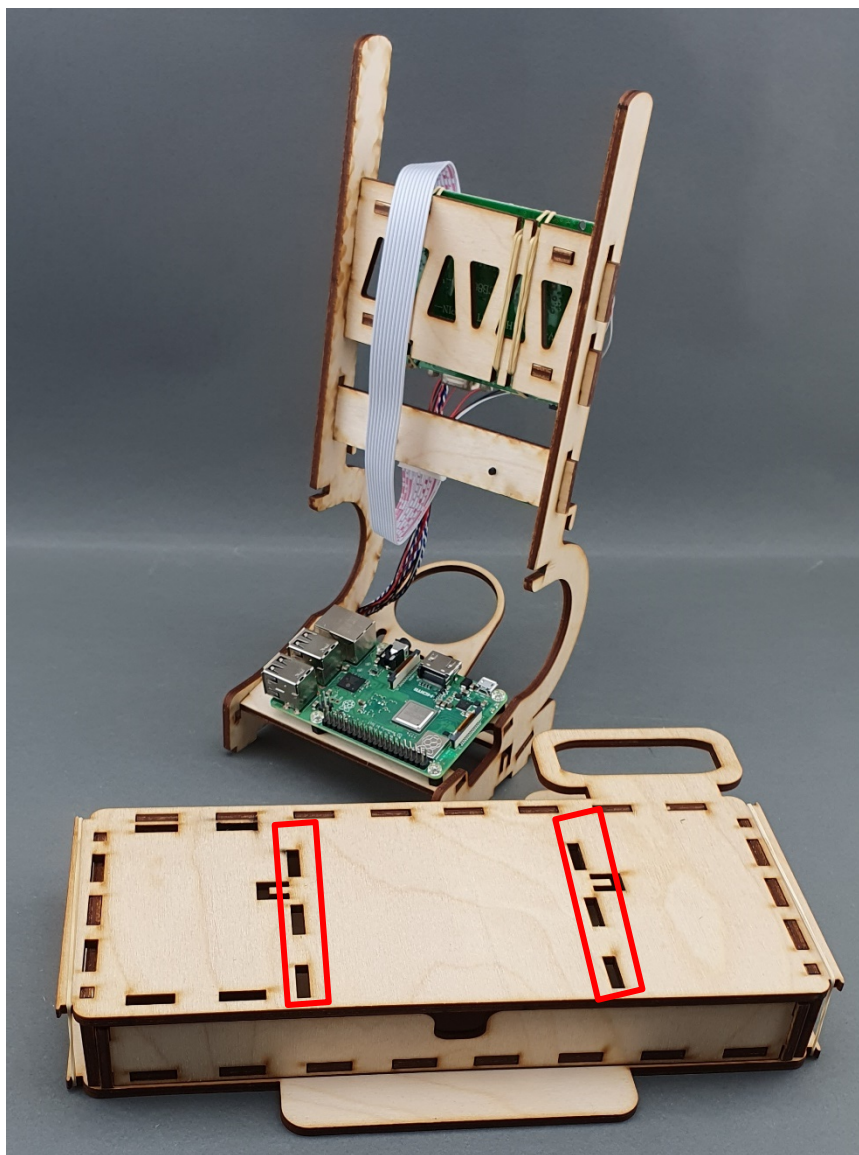
Step 5: Wiring of LCD Display Controller – I/O Board to LCD Display:

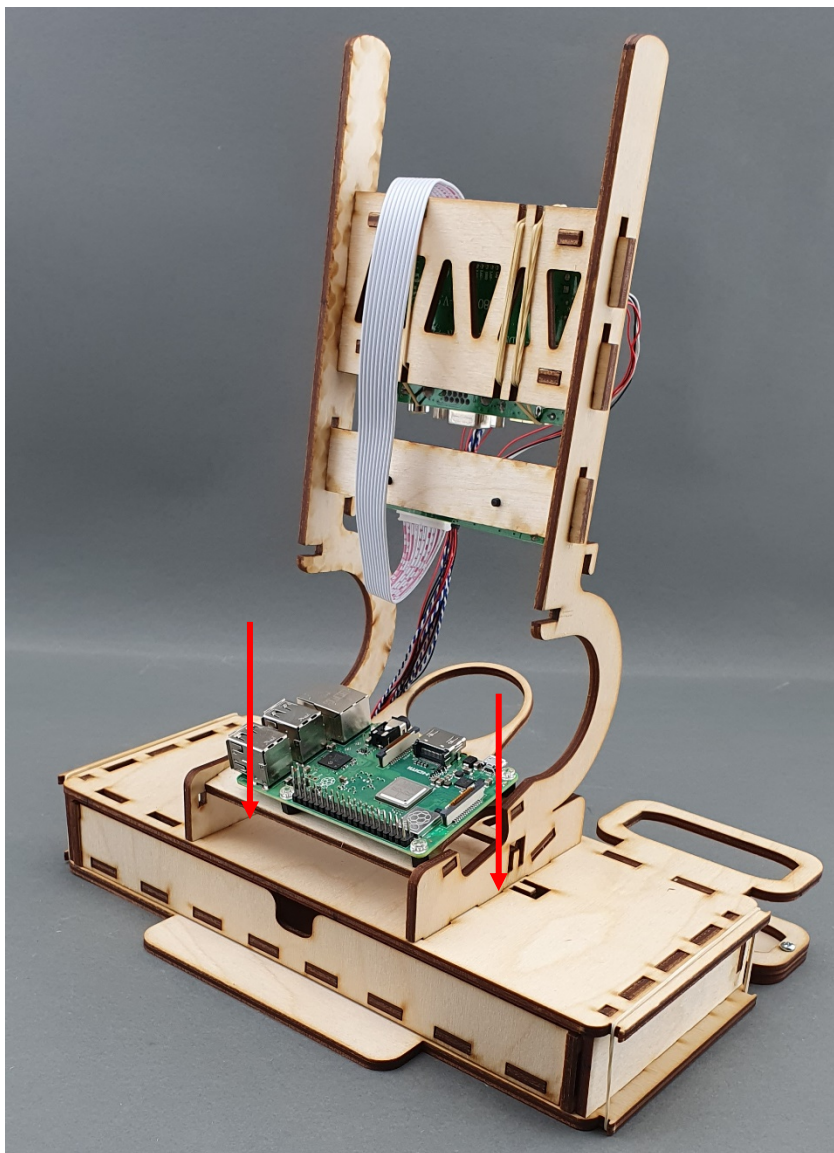






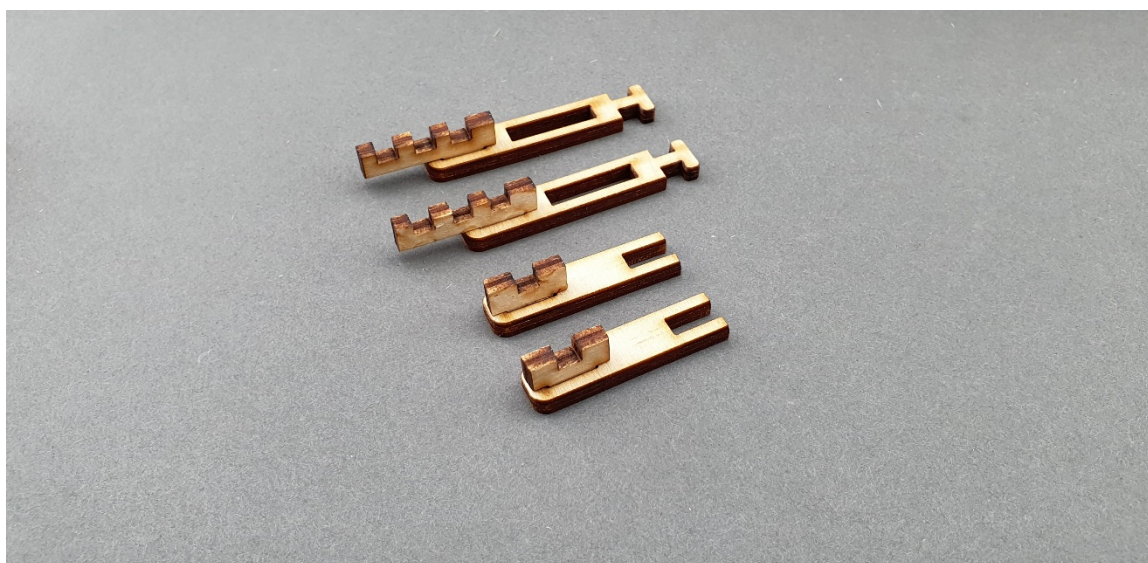
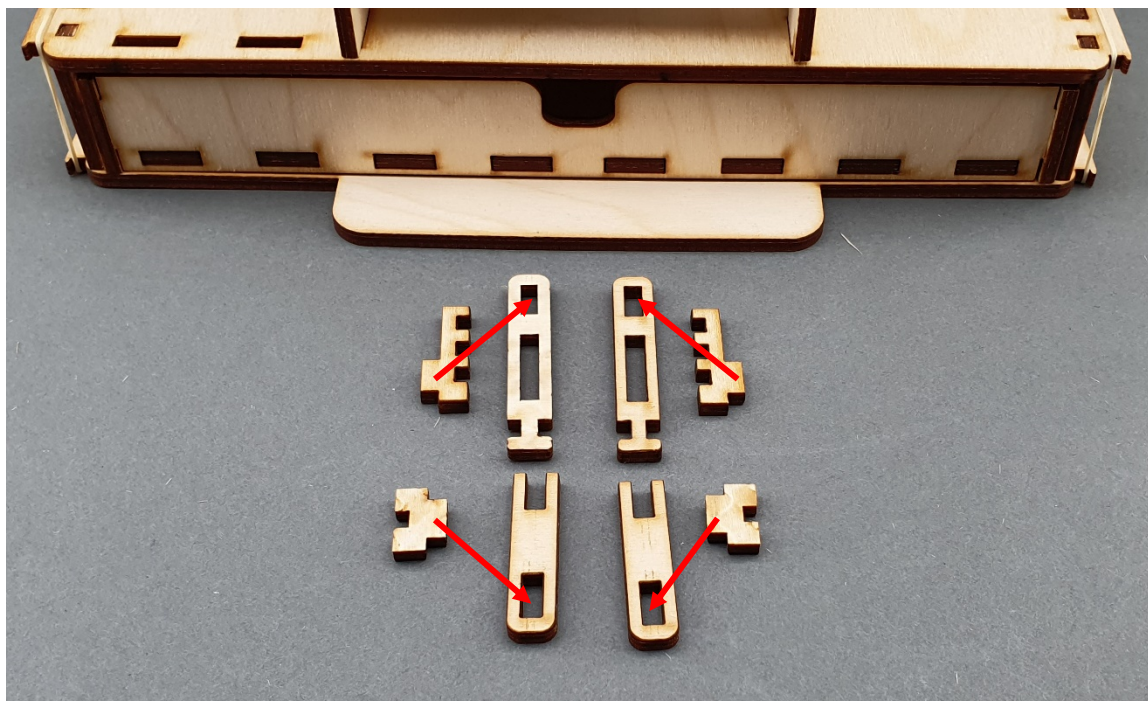
Step 6: Assembling upper body with base, as shown in the pictures below:



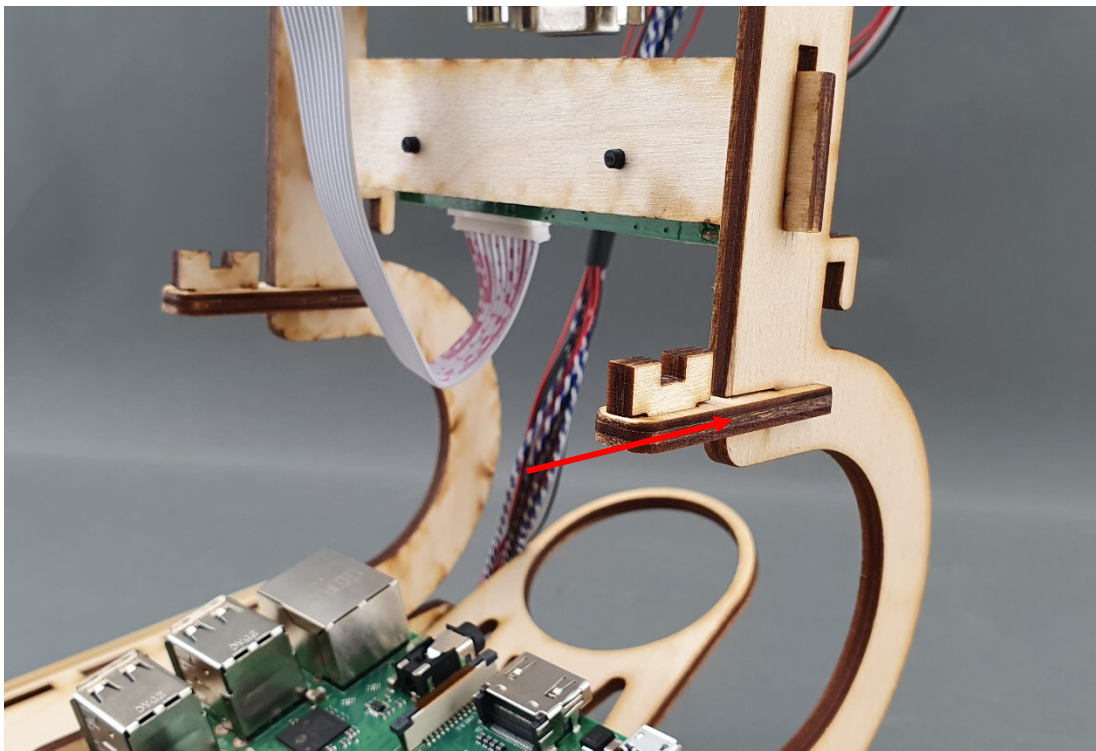
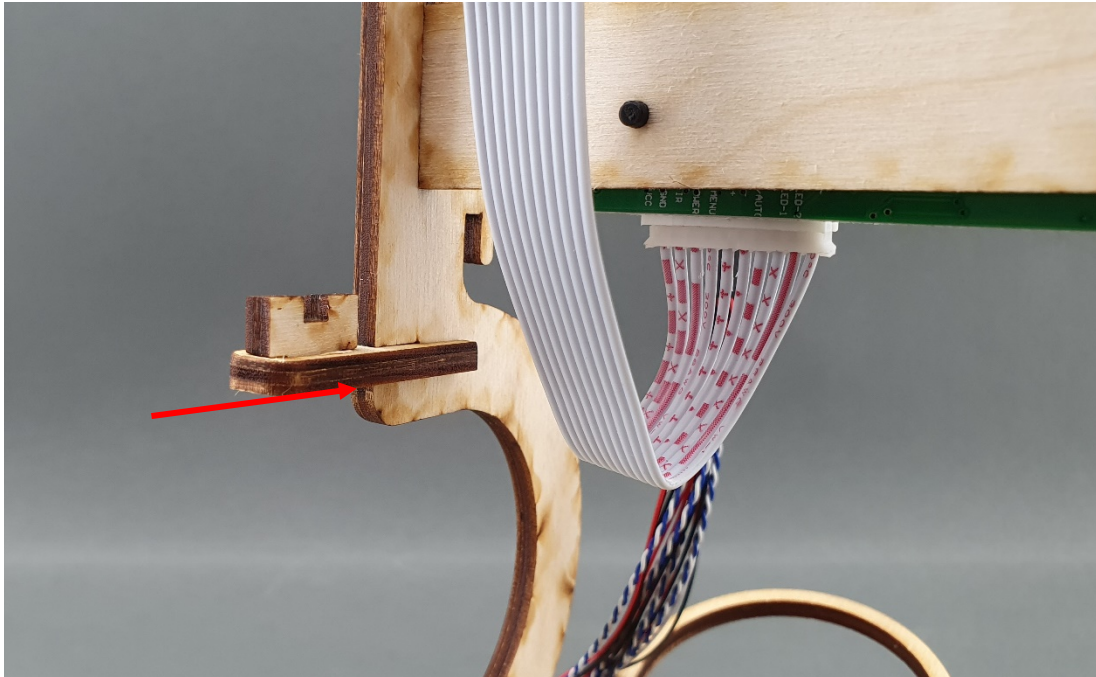


4.6 LCD Placeholders Assembly and LCD Attachment

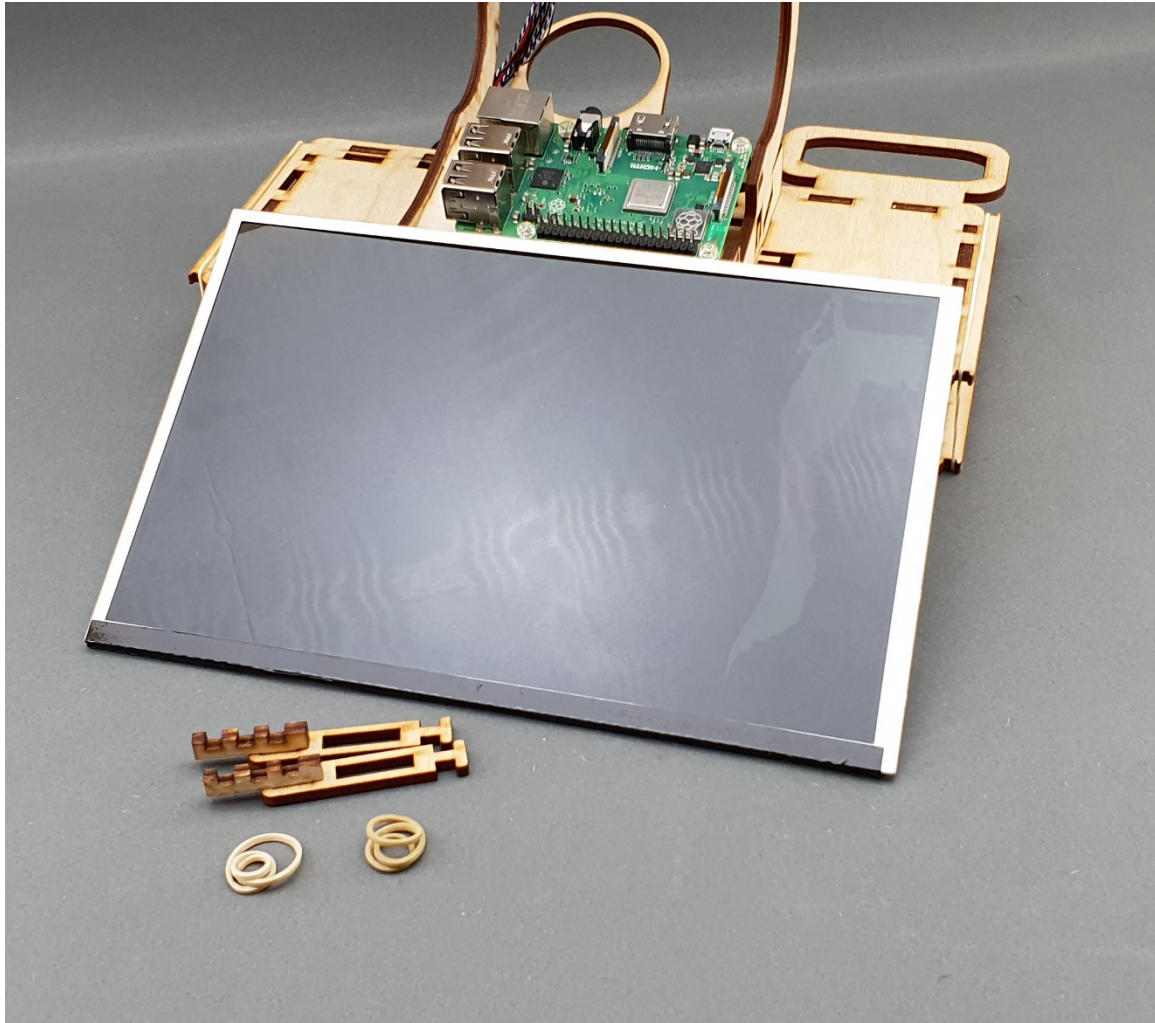
Step 1: Assembling the LCD display placeholders, as shown in the pictures below:

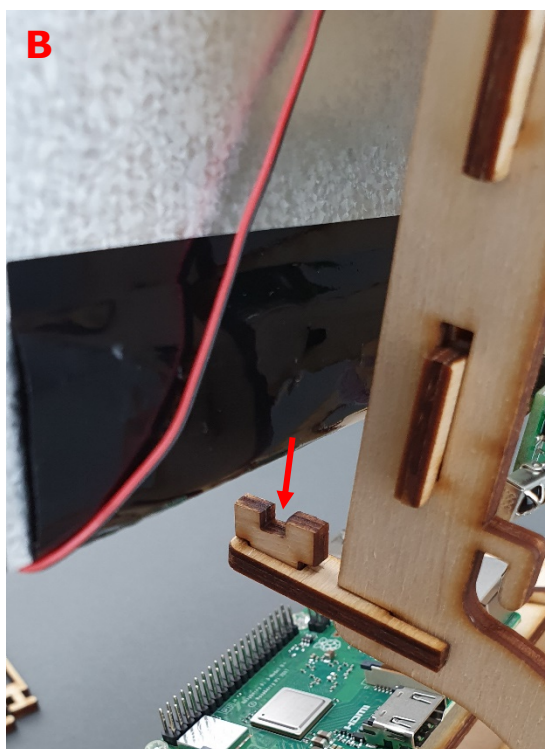
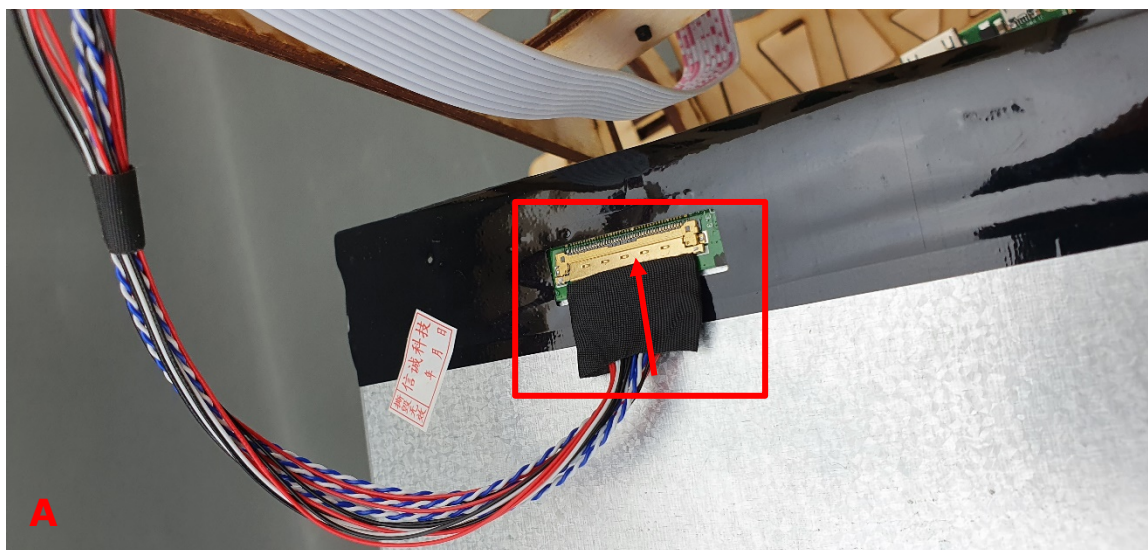


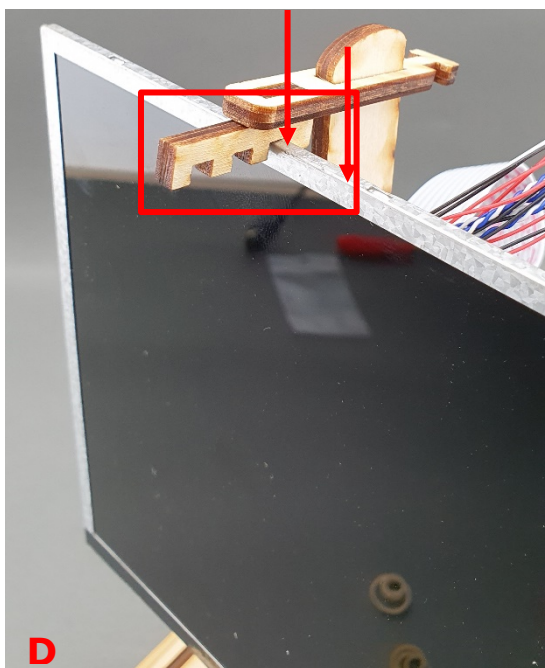
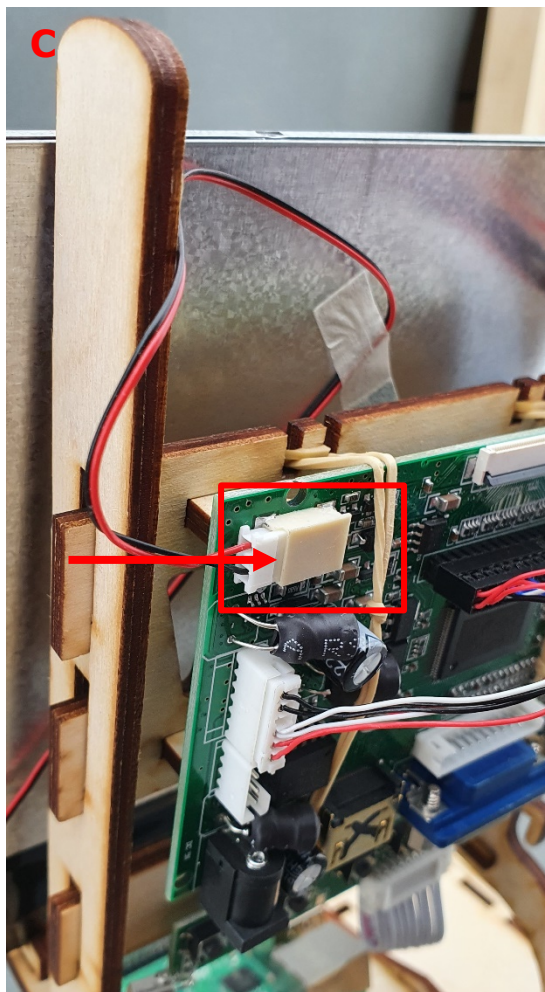
Step 2: Placing the LCD display placeholders to upper body, as shown in the pictures below:

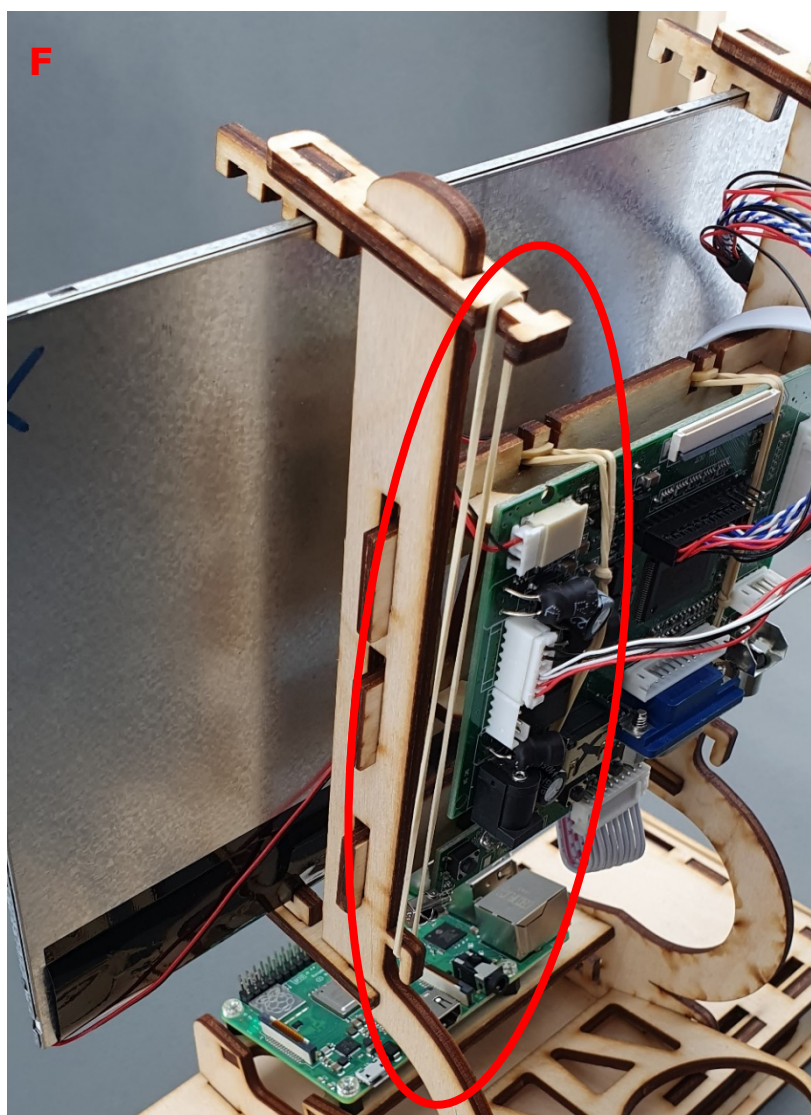
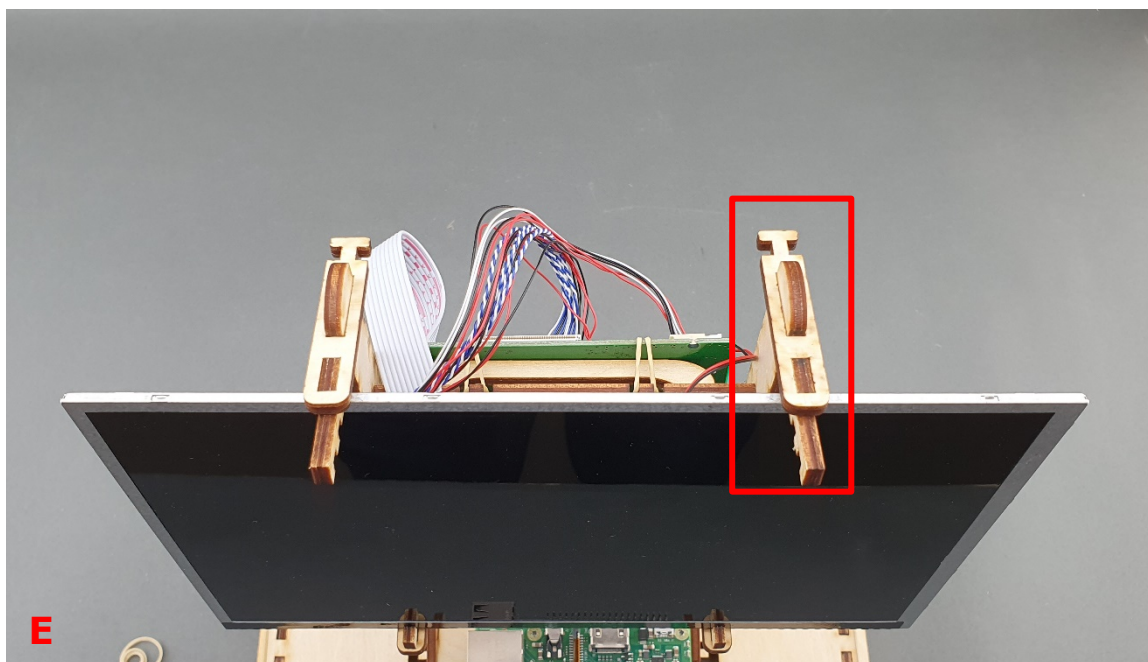


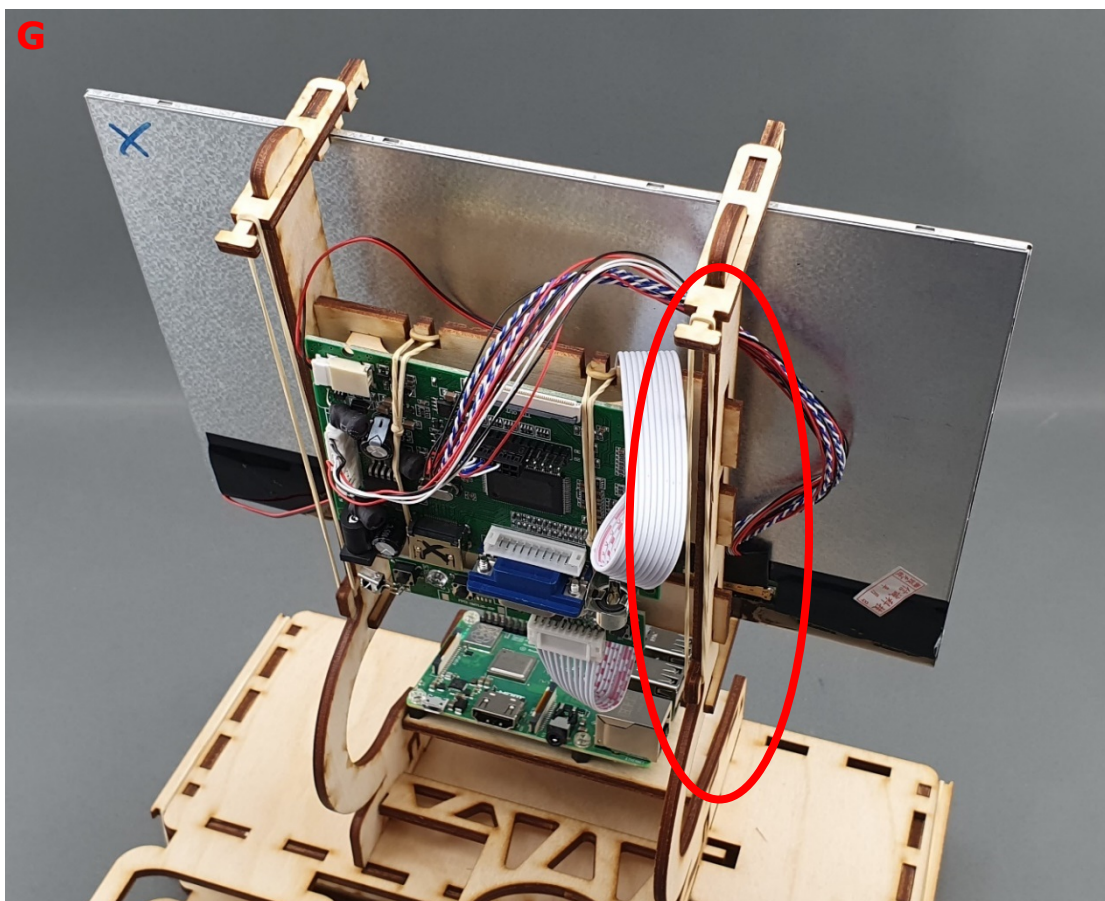
Step 3: Assembling the LCD display to the upper body, as shown in the pictures below:



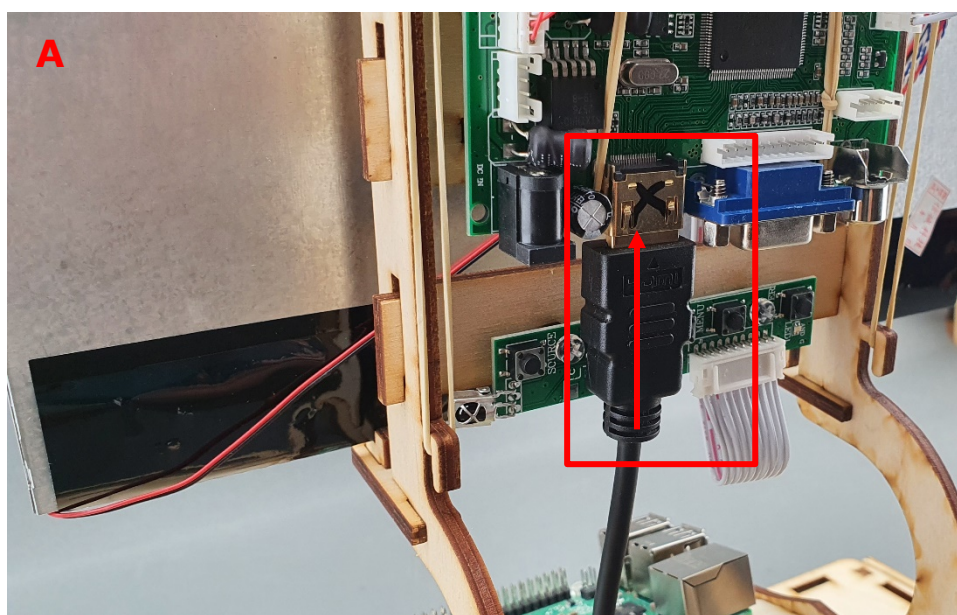
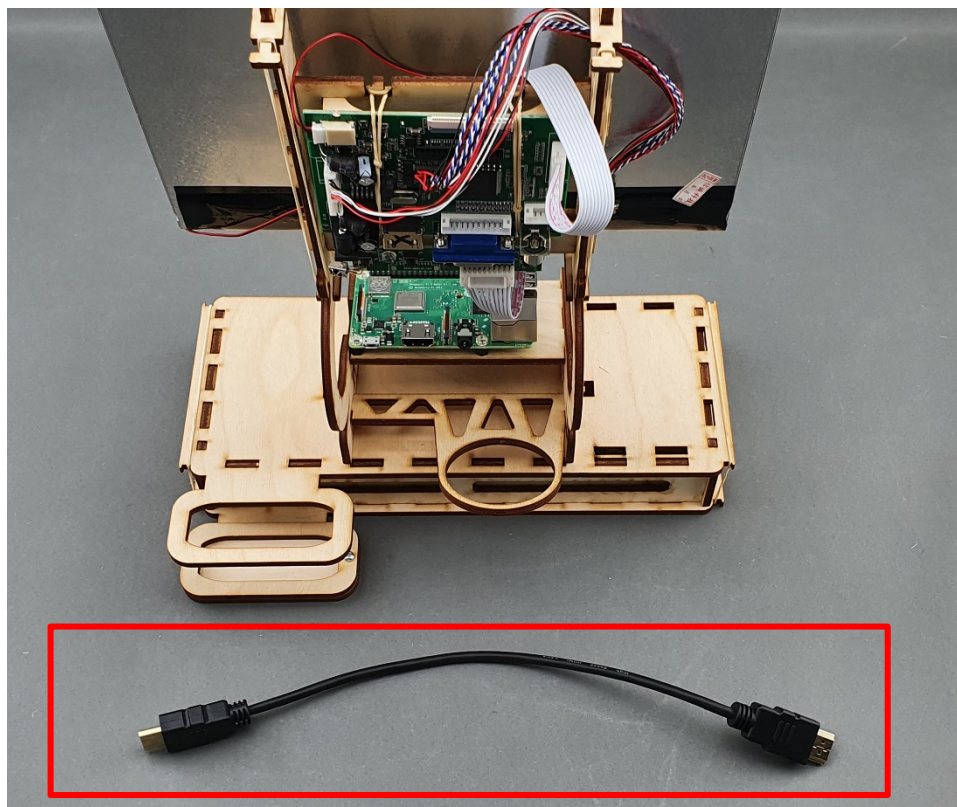


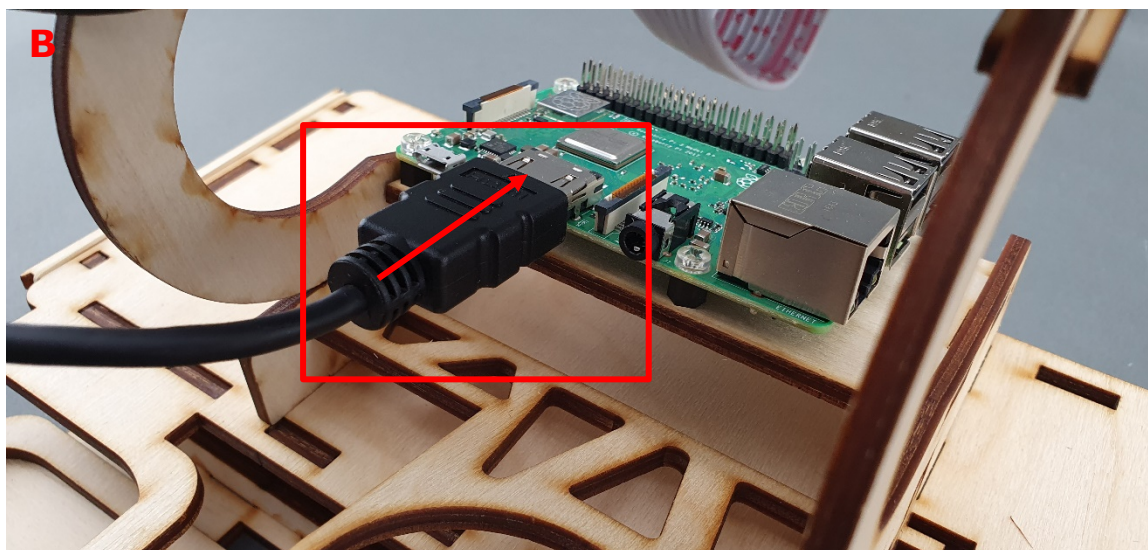




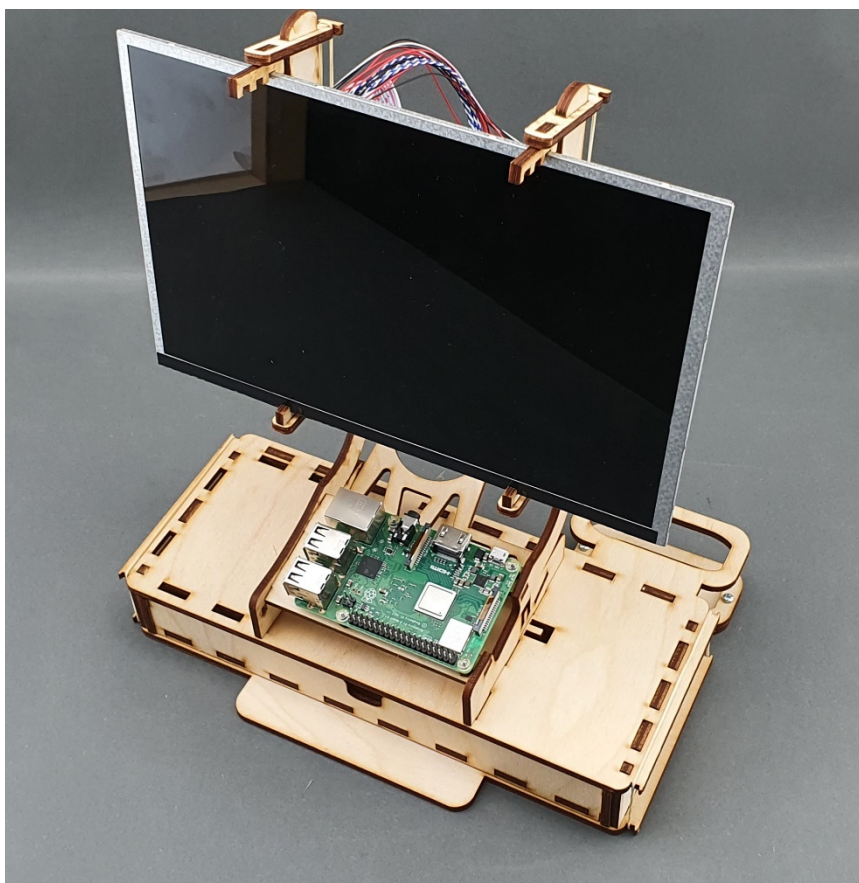


Step 4: Connecting the HDMI cable, as shown in the pictures below:



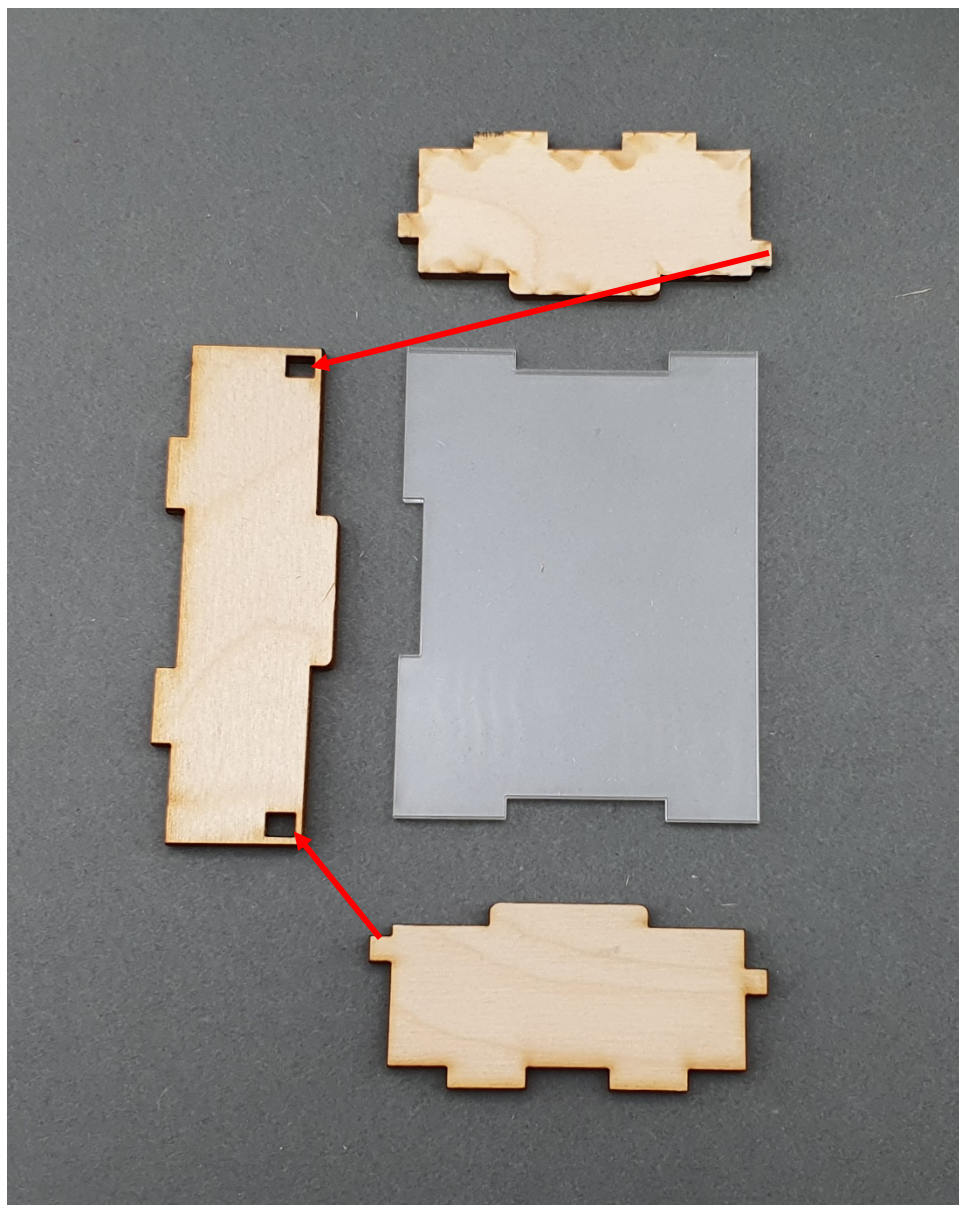


Step 5: The assembly process of the upper body is completed:

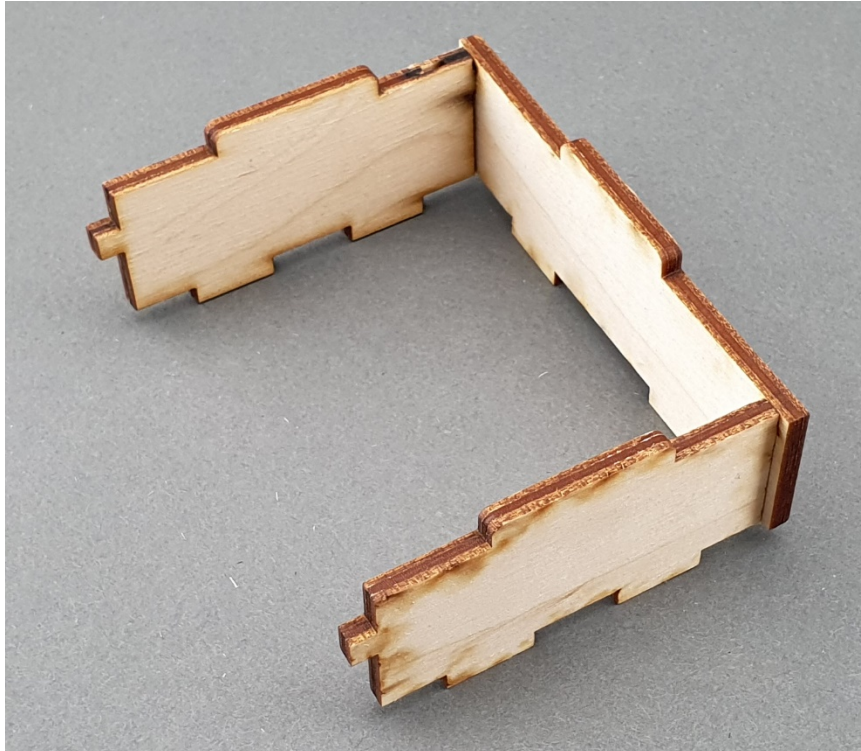


4.7 Cupboard Assembly

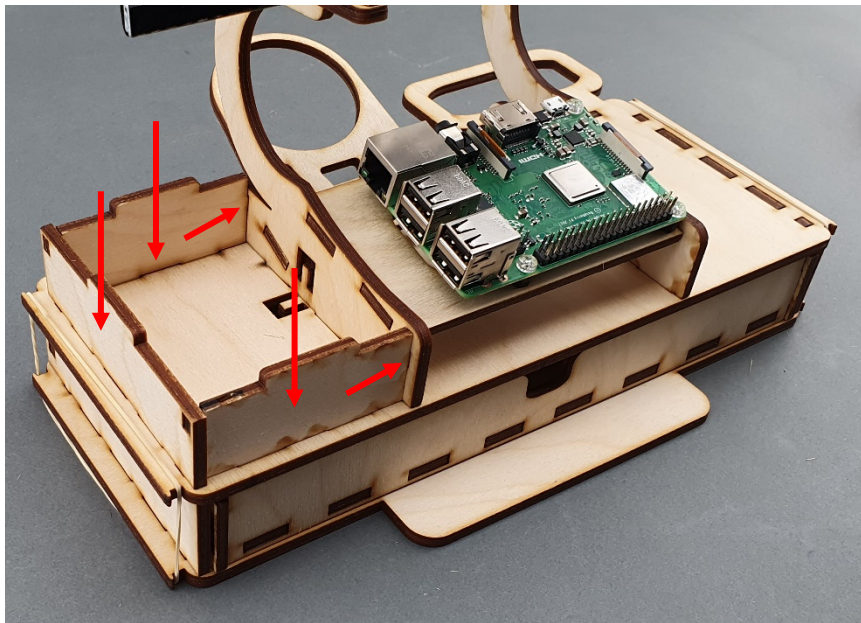
Step 1: What you will need:



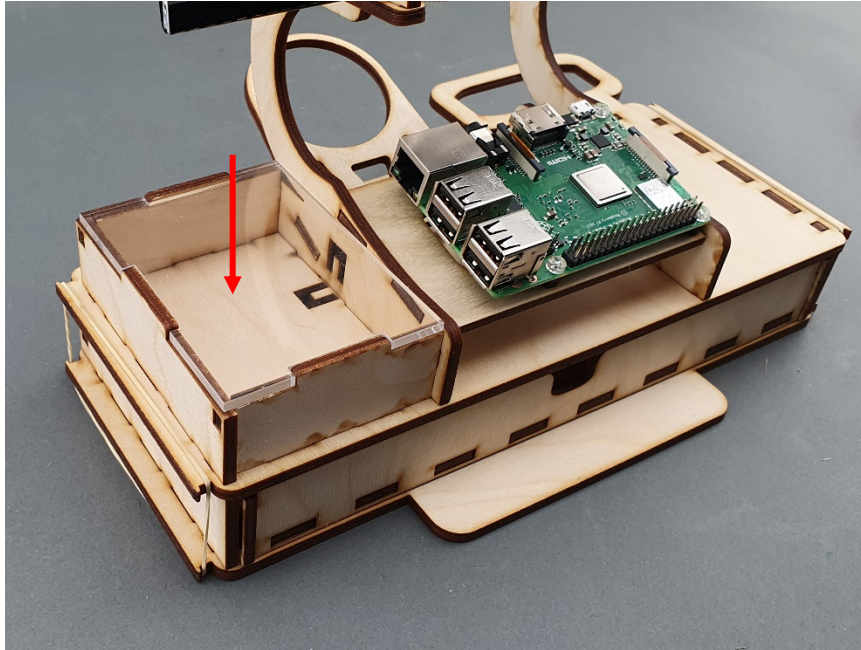
Step 2: Assembling the cupboard body:



Step 3: Placing the cupboard body to the STEM4CLIM8 Console base:



Step 4: Placing the cupboard body to the STEM4CLIM8 Console base:

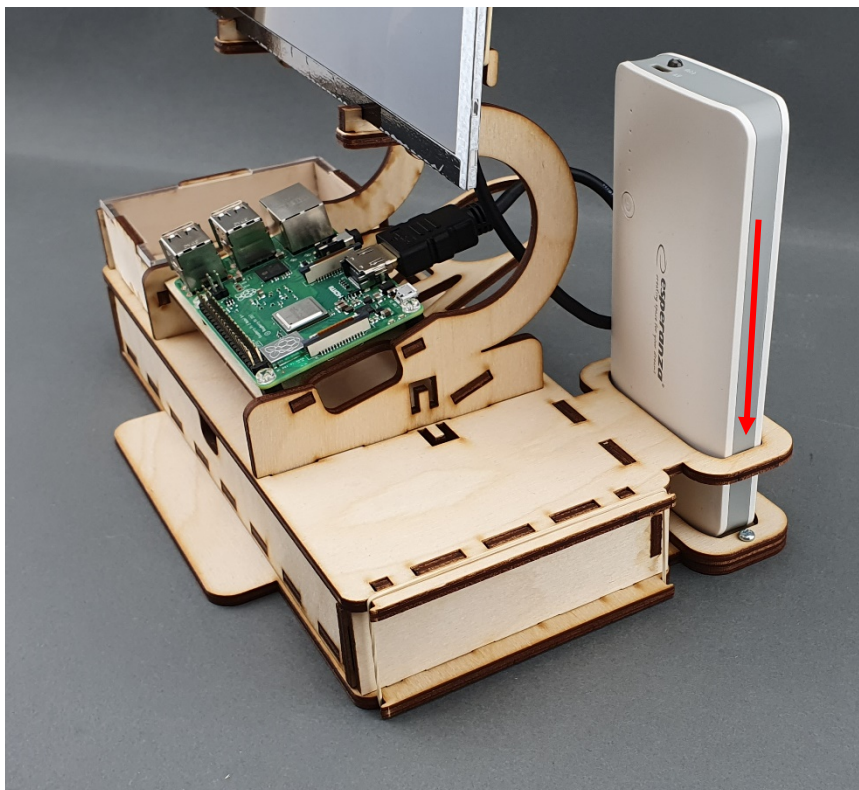


4.8 Powerbank and Speaker

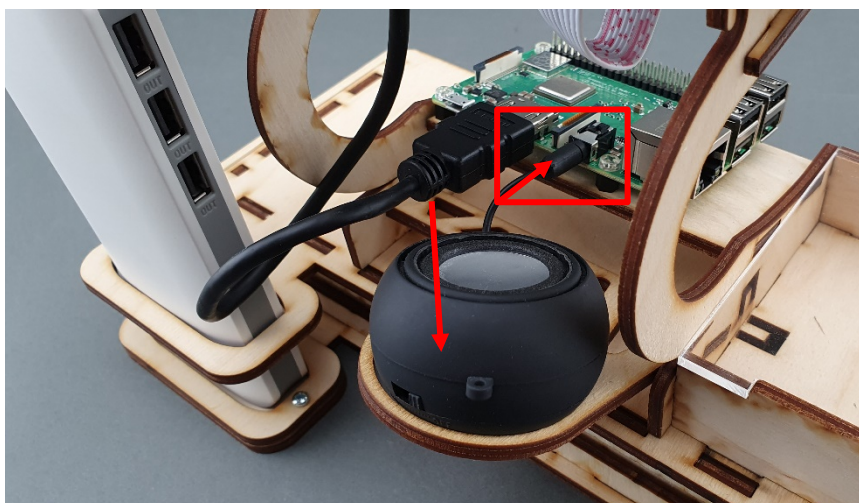
Step 1: What you will need:



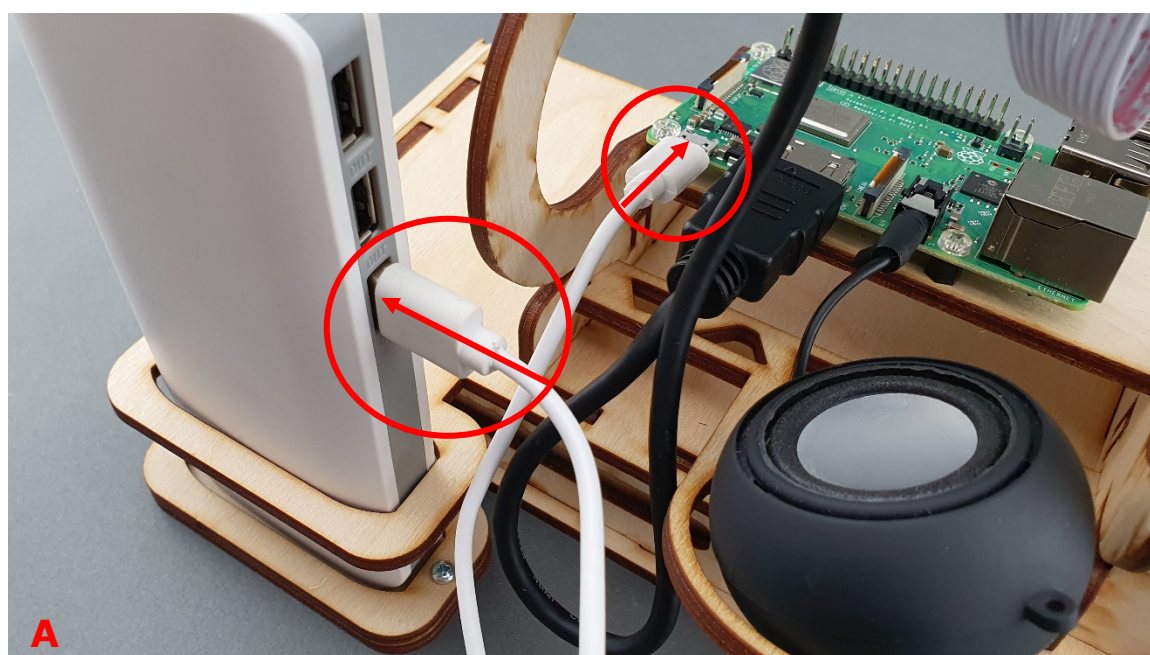
Step 2: Placing the power bank to the power bank holder, as shown in the picture below:



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



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



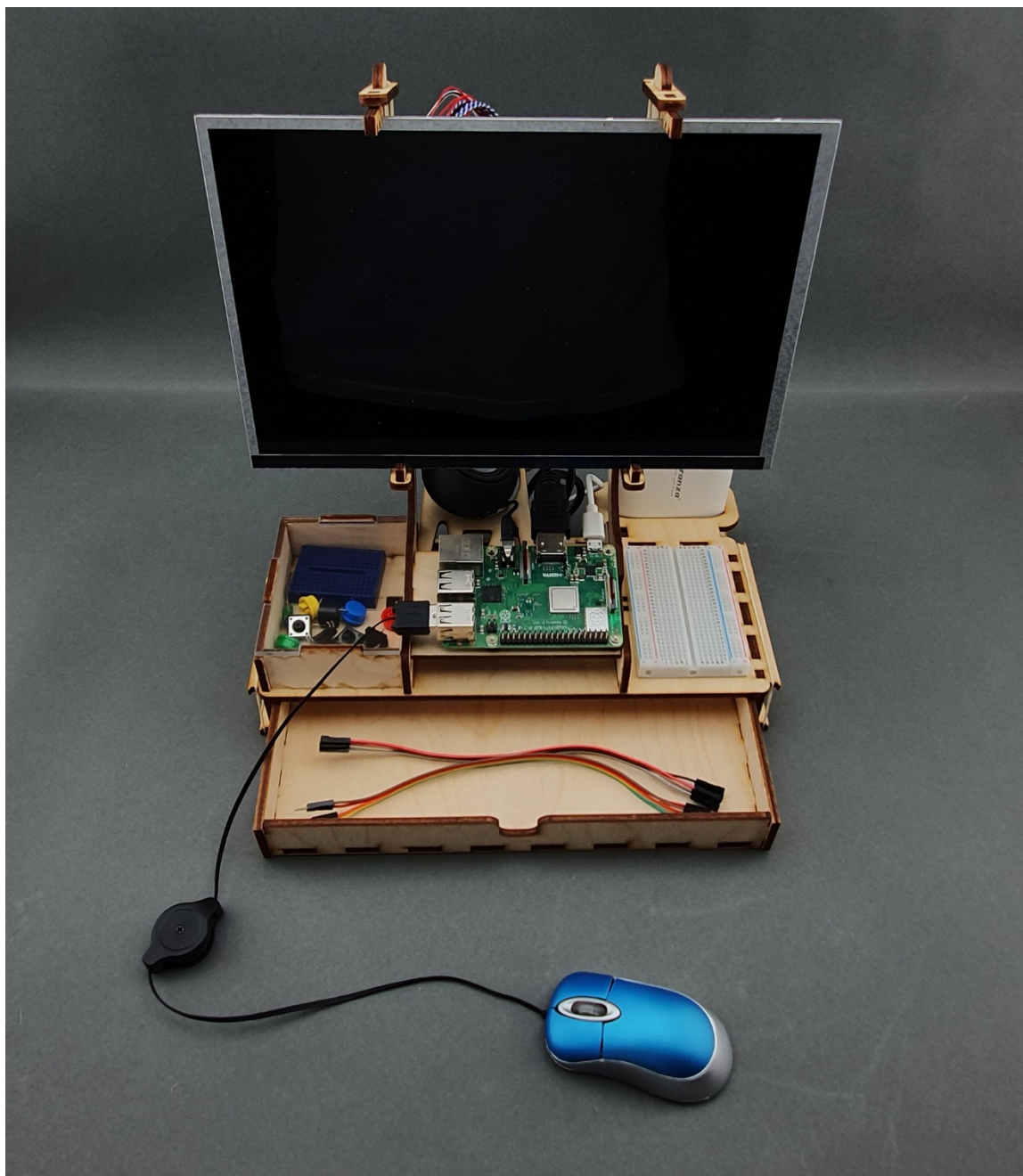


4.9 Electronics and Mouse

Step 1: What is included in the STEM4CLIM8 package:



Step 2: Placing the electronic components and mouse:



5. Software

The STEM4CLIM8 Console 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.

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, **Pi Improved X-Window Environment, Lightweight** 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.



5.1 Raspberry Pi OS (Raspbian Buster)

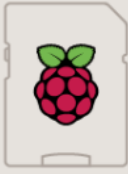
All we need is to download the desired software version from [raspberrypi.org](https://www.raspberrypi.org) <https://www.raspberrypi.org/downloads/raspberry-pi-os/> (Raspberry Pi OS with desktop and recommended software is the full version)

Raspberry Pi OS (previously called Raspbian)

Raspberry Pi OS (previously called Raspbian) is the Foundation's official supported operating system. You can install it with [NOOBS](#) or download the image below and follow our [installation guide](#).

Raspberry Pi OS comes pre-installed with plenty of software for education, programming and general use. It has Python, Scratch, Sonic Pi, Java and more.

The Raspberry Pi OS with Desktop image contained in the ZIP archive is over 4GB in size, which means that these archives use features which are not supported by older unzip tools on some platforms. If you find that the download appears to be corrupt or the file is not unzipping correctly, please try using [7Zip](#) (Windows) or [The Unarchiver](#) (Macintosh). Both are free of charge and have been tested to unzip the image correctly.

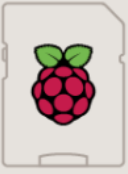


Raspberry Pi OS (32-bit) with desktop and recommended software
Image with desktop and recommended software based on Debian Buster

| | |
|-----------------|------------|
| Version: | May 2020 |
| Release date: | 2020-05-27 |
| Kernel version: | 4.19 |
| Size: | 2523 MB |

[Release notes](#)

Download Torrent
Download ZIP



Raspberry Pi OS (32-bit) with desktop
Image with desktop based on Debian Buster

| | |
|-----------------|------------|
| Version: | May 2020 |
| Release date: | 2020-05-27 |
| Kernel version: | 4.19 |
| Size: | 1128 MB |

[Release notes](#)

Download Torrent
Download ZIP

SHA-256: b9a5c5321b3145e605b3bcd297ca9ffc350ecb1844880afd8fb75a7589b7bd04

Figure 16 Downloading Raspberry OS

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

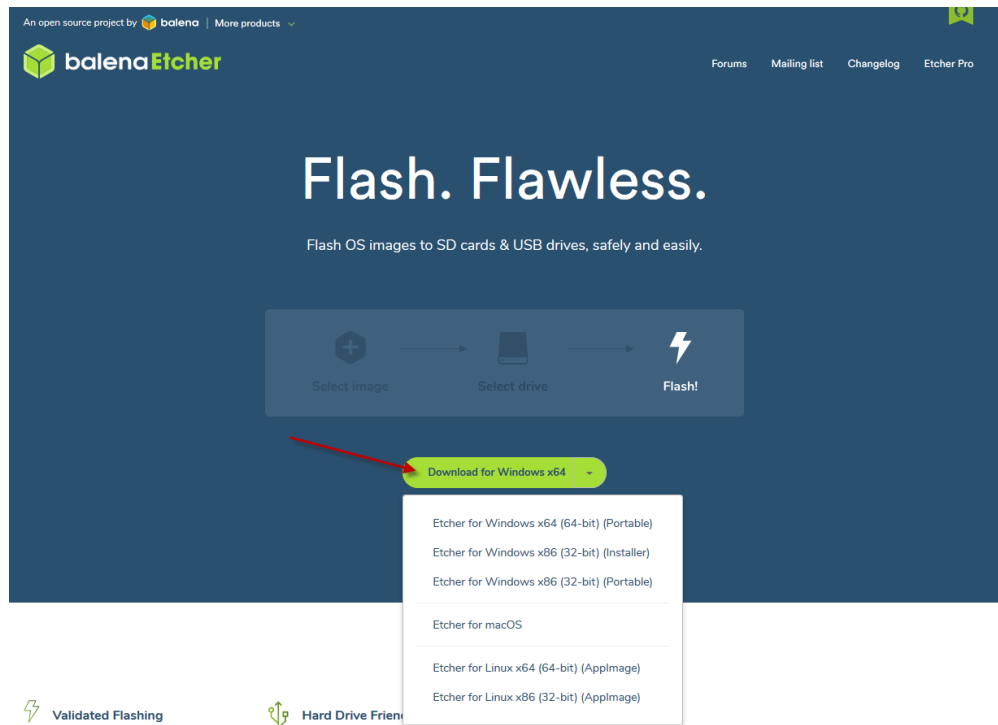


Figure 17 Downloading Etcher

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.

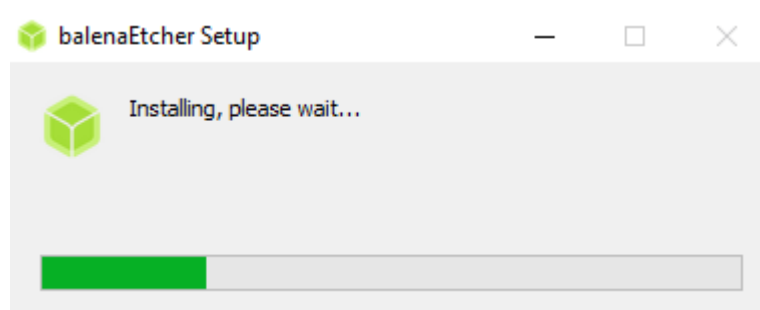


Figure 18 Etcher installation window

When it is completed, run Etcher.

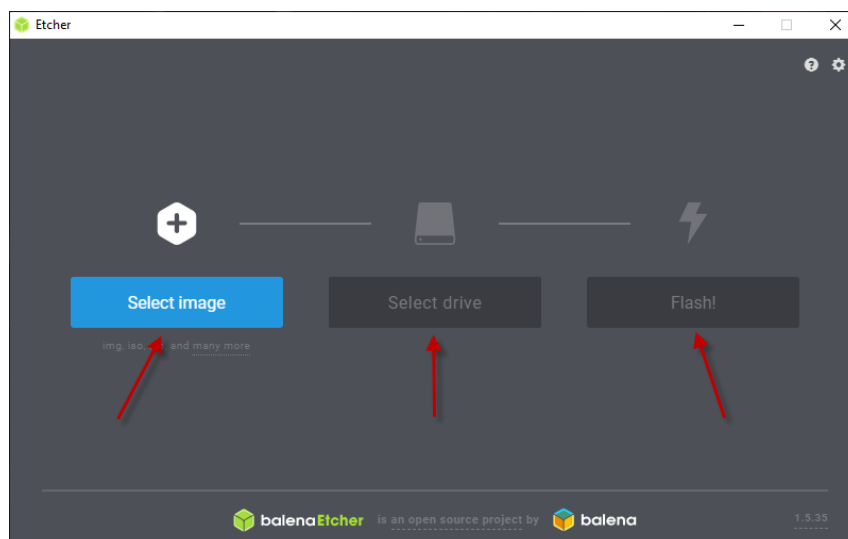


Figure 19 Etcher application window

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.

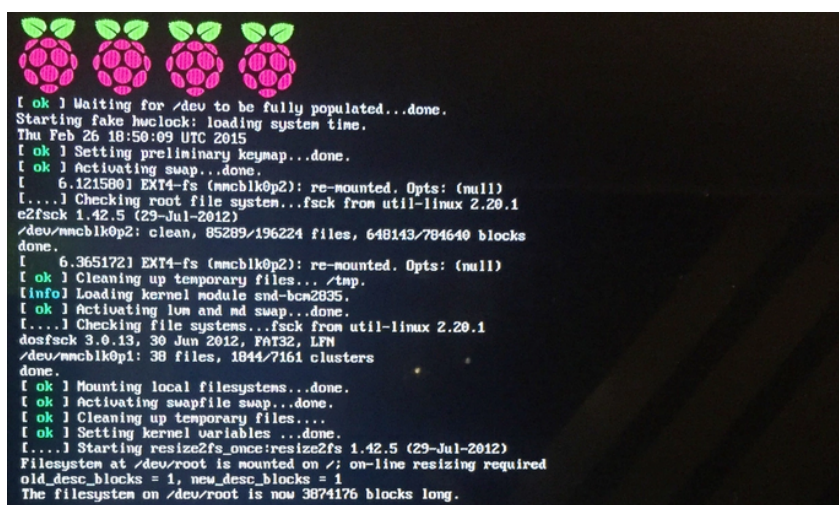


Figure 20 Raspberry Pi booting screen

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

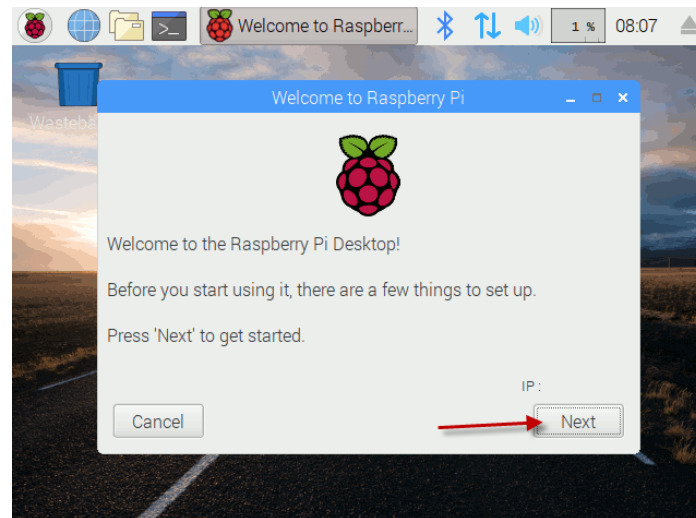


Figure 21 Raspberry installation procedure

Choose Country, Language and Time zone.

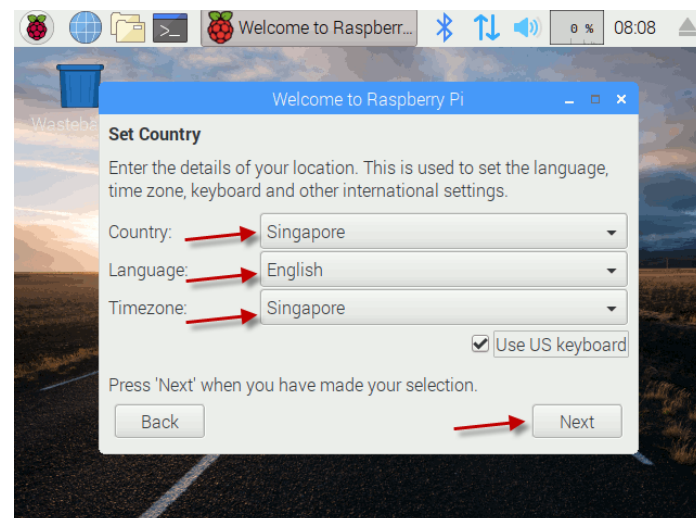


Figure 22 Setting-Up Raspberry Pi

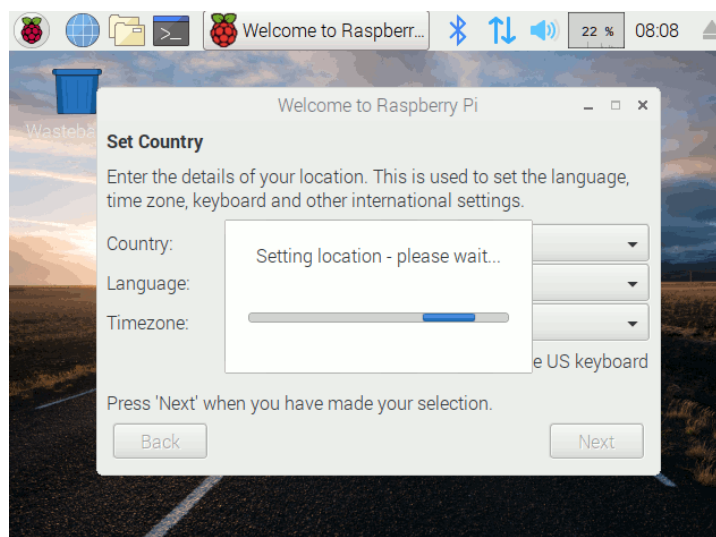


Figure 23 Setting Location.

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.

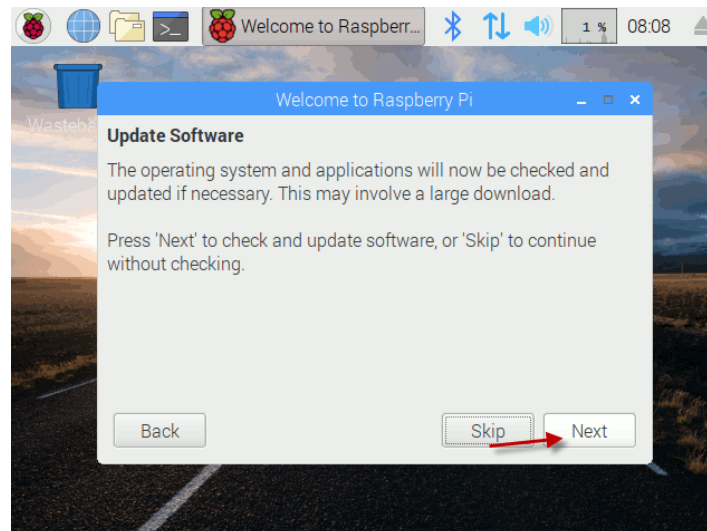


Figure 25 Software Update Process

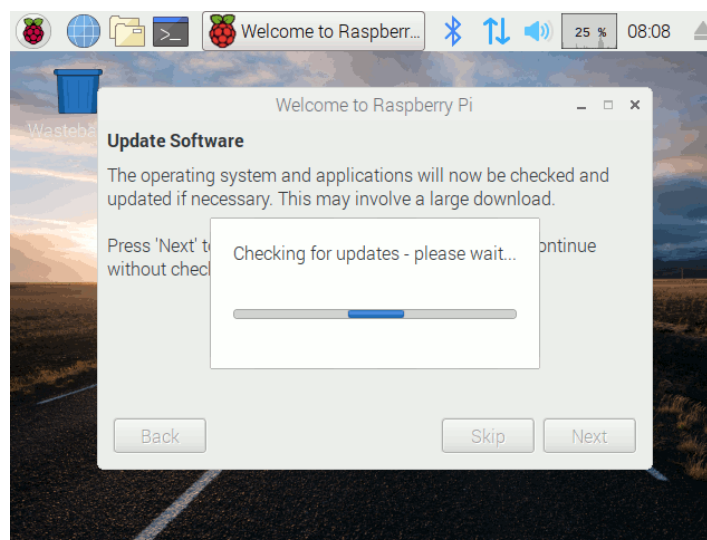


Figure 26 Checking for Updates

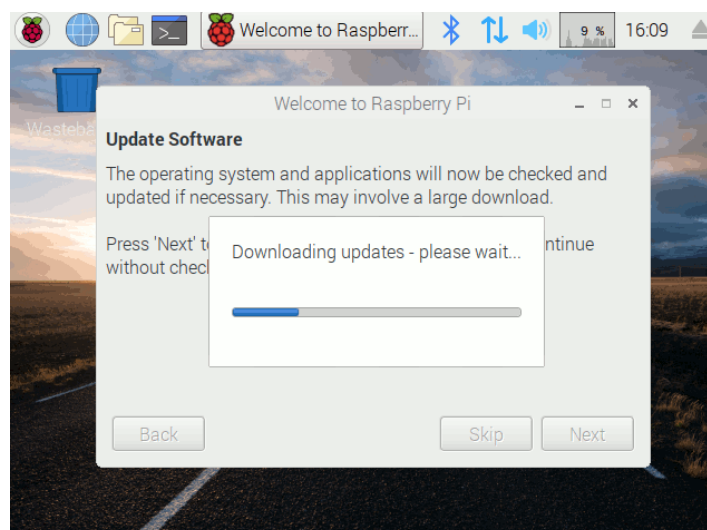


Figure 27 Downloading Updates

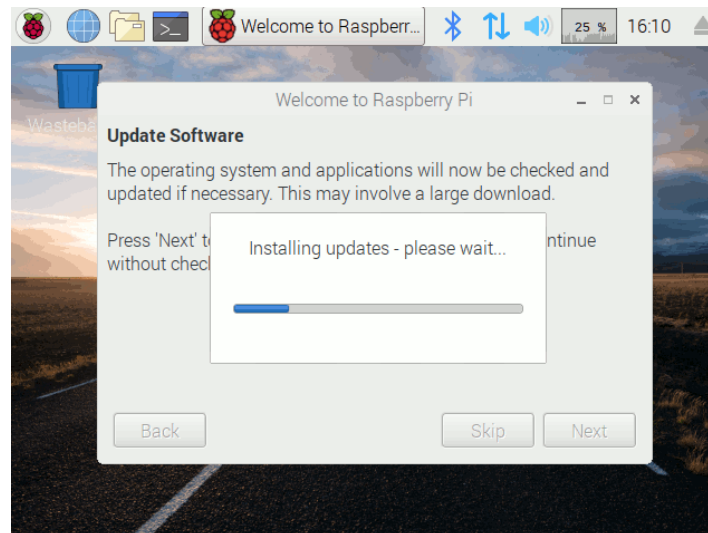


Figure 28 Installing Updates

When updates are completed, click ok.

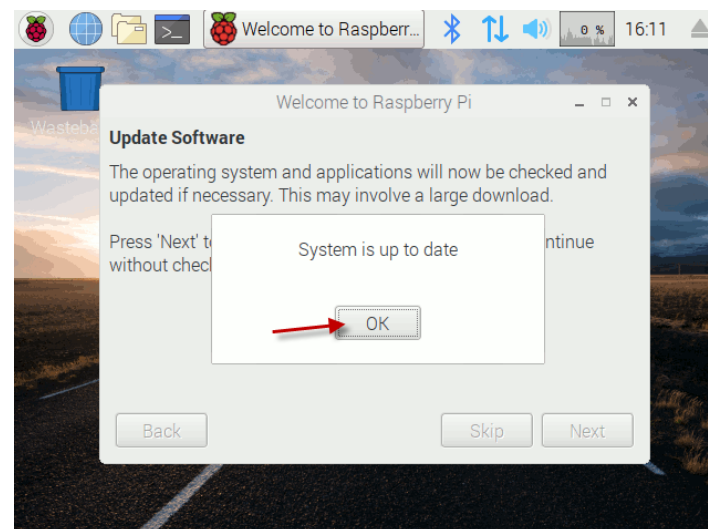


Figure 29 Finishing with Updates

Reboot for updates to take effect.

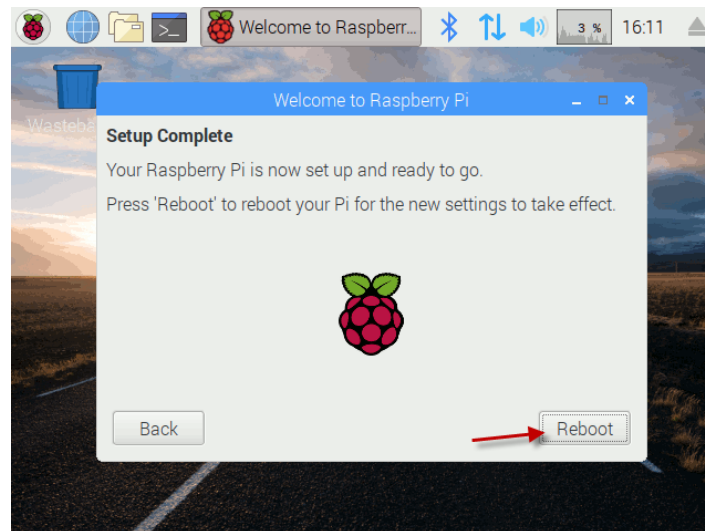


Figure 30 Reboot Screen

and everything is ready for use.

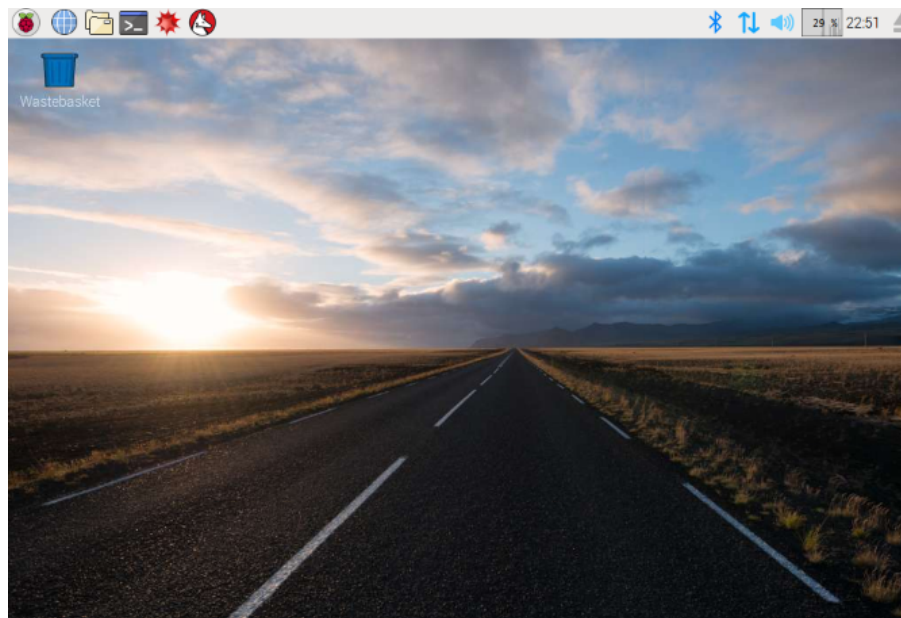


Figure 31 Raspberry Pi OS User Desktop

5.2 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.

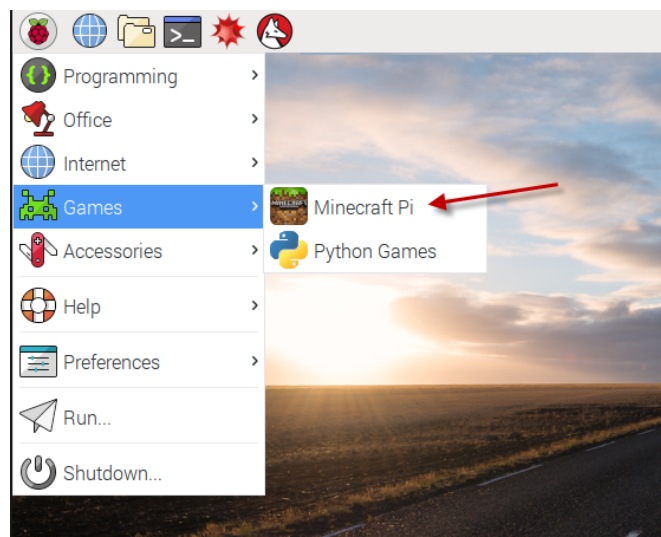


Figure 32 Locating Minecraft Pi

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 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.

5.3 Thonny Python

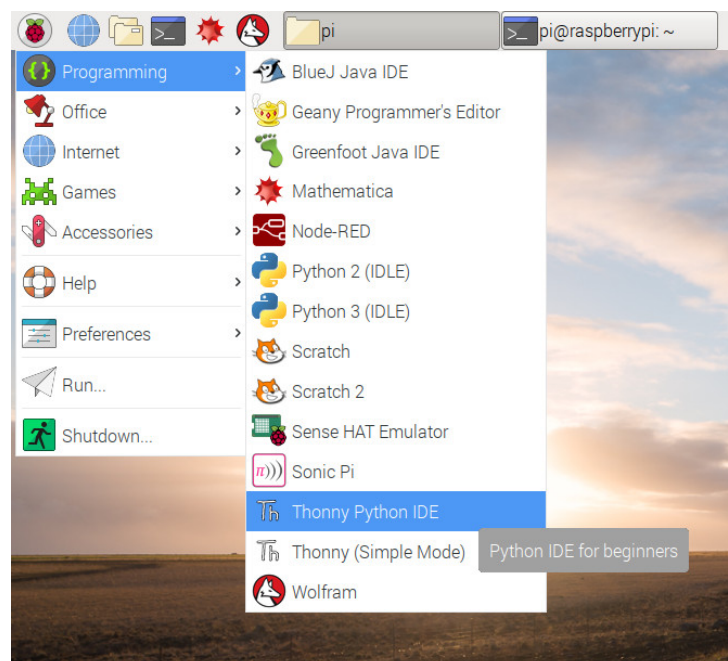


Figure 33 locating Thonny Python.

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 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 34 Fibonacci Series in Python

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

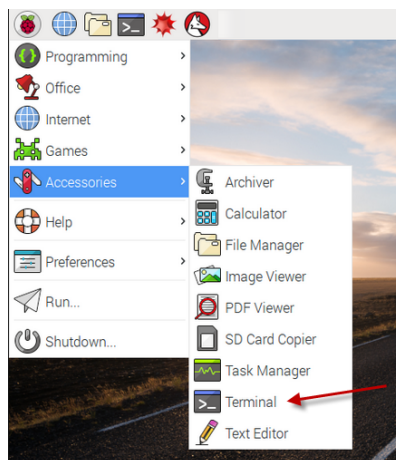


Figure 35 Locating the Terminal Window

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

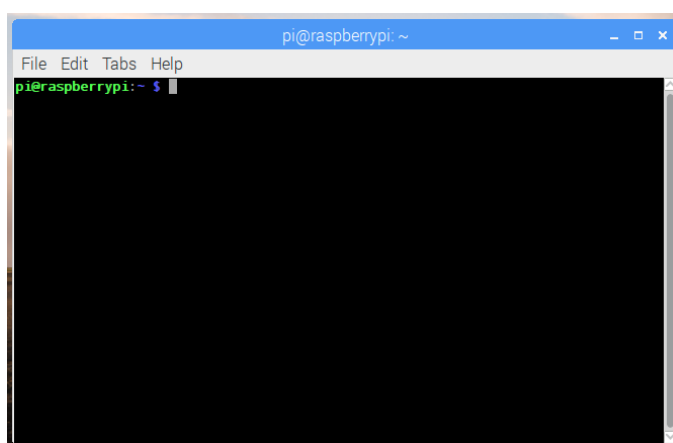


Figure 36 Terminal Window in Raspberry OS

6. Annex

| Bill of Material for the ST3M4CLIM8 Console | | |
|---|--------------------------------|----------|
| No. | Item | Quantity |
| 1 | Plywood pieces | 30 |
| 2 | Plexiglass cap | 1 |
| 3 | Screws (metal) | 2 |
| 4 | Screws (plastic) | 6 |
| 5 | Screw locks (plastic) | 6 |
| 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 | Jumper cables (Male-to-Female) | 5 |
| 23 | Jumper cables (Male-to-Male) | 5 |
| 24 | Buttons | 4 |
| 25 | Button caps | 4 |
| 26 | Buzzer | 1 |
| 27 | LEDs | 4 |
| 28 | Resistors 220 Ohm | 5 |
| 29 | Resistors 1k Ohm | 5 |