1. It will have an internal power supply as it will need to produce 30A for the LED panels at 5v.
   1. It will use a standard IEC power connector with a hard power switch.

It used the 30A at 5v as per planned with and IEC connecter and a 5A mains switch isolating power from the power supply, for a future version, the LEDs could dynamically change their brightness to maintain a lower current to save power.

1. It will have a black painted wood case to make the display stand out
   1. The wood will be painted black once the unit is assembled to hide the joints in the wood

I used a black painted case made from wood as per planned, although, a laser cutter was used to create the parts, if I made a future version I would use as CNC Milling machine to mill the parts from MDF, this would have created a stronger case as the side panels were made from layers of plywood, which are not as strong as MDF.

1. There will be a clear acrylic sheet in the front of the case to protect the led boards and to stop people touching the led boards

I used a piece of 5mm frosted black tinted acrylic because the LEDs were brighter than planned and they needed to be diffused because it filled in the dark spots between LEDs, for a future version the LEDs could dynamically change their brightness to prevent it needing a piece of tinted acrylic and just a piece of frosted acrylic to allow the LEDs to be slightly diffused.

1. Picture hook for the option to wall mount the unit

I did not add a picture hook for the product as the case would need to be redesigned for it to work as the piece I had planned to mount it onto was not strong enough to hold it, for a future version, the case could be redesigned to incorporate the picture hook.

1. It will have mounting slots on the back for laser cut acrylic legs to make the unit more stable so it doesn’t fall over. The acrylic legs will have holes in them for a screw in the side of the case to slot into them so they are secure and they don’t fall out

I added them from a piece of black acrylic and they worked as planned as the unit was quite top heavy owing to the power supply being mounted near the top of the case, they successfully prevent it from also being knocked over, for a later version a better way to secure them would help as inserting the screws can be tedious.

1. It will have the power socket, audio ports and SD card slot recessed on back of unit in a recess that so when it is on a wall it lies flat. The recess will have the inputs at a 90° angle so the ports are facing sideways. The recess will be fairly large to allow for different connector sizes and cables

I added the power socket in the form of an IEC socket, the audio ports in the form of RCA sockets, and a full size SD socket was installed to allow Image Data to be loaded, for a later version 3.5mm audio sockets could be added to allow different connector types.

1. It will have a groove cut out of bottom lip on unit so cables can run down the wall it is mounted on

I added the groove in the bottom to allow cables to run down a wall but due to not being able to add a picture hook, it is not currently being used, for a future version it could have a loop for using a cable tie to keep the cables tidy, it could also be made bigger to allow larger cables to fit through it. Visually it could be centred as currently it is not centred and this does not look right.

1. It will have a hard power switch on side of unit so power can be completely isolated from the unit to minimise fire risk

I added a hard power switch which successfully isolates the mains power to the power supply but it is mounted on the back of the unit which allows the unit to be placed up flat against walls and it looks neat as otherwise it would have interfered with the rear stands, for a future version, it could have an led in it to allow the user to see if it is switched on so they can easily know if it is turned off, which reduces fire risk.

1. The audio inputs it will have:
   1. Microphone for use with audio sources which can be heard by the unit and do not want to use an Aux cable
      1. Microphone should be mounted to the front of the unit for the best signal from the sound in the surrounding area
      2. Microphone needs a preamp to bring it up to line level
   2. 3.5mm audio socket with another 3.5mm audio socket for pass-through and isolation so it doesn’t distort the audio going in if they are using a passive splitter
      1. Audio must be actively converted to mono to prevent distortion on the audio input as it could be passively split somewhere or be using the pass-through socket

I used an Electret microphone with an amplifier to bring it up to a signal that the microcontroller can read, for a future version, I could mount the microphone near the front, next to the IR receiver to allow it to better pick up sound. I used RCA sockets without a pass-through to prevent distortion when it is being passed through and the connecters are stronger than 3.5mm and are harder to accidentally pull out, for a future version both could be used to allow the user to choose which connecter they want and audio isolator could be used to allow the signal to be passed through it.

1. All audio inputs must be isolated from each other and when an input is selected it must pass through an auto volume control circuit before entering the microcontroller. So the audio can be scaled to get the most amount of detail out of it

The audio inputs are not isolated but do not affect each other, the signal does not pass through an auto volume control circuit but passes through an amplifier to allow the best use of the signal, for a future version, an auto volume circuit could be implemented to allow quieter audio signals to be used and the audio signals could be isolated to prevent distortion.

1. It will have an IR remote control for control without touching the unit
   1. A button on the remote should be used to change between the audio inputs and turn of the unit in turn in the pattern: Aux socket, Microphone, Off
   2. A button on the remote should be used to change the display style for the spectrum analyser, modes could include variants of live mode showing the current audio frequencies, peak hold mode where dots show when the audio peak in the last few seconds and how high the peak was, and a mode when the whole screen is on and gets dimmer and gets brighter when a beat happens in the audio. The modes could include horizontal or vertical variants of these modes.
   3. A button on the remote should be used to change the colour pattern of the screen. Patterns would be stored on a SD card with a picture for each pattern so the user could create their own patterns

I added an IR remote but required a secondary microcontroller to be added due to the main microcontroller not being able to read the IR receiver when it is sending data to the display, some of the display styles were not implemented but could be implemented in a later version of the firmware, for future versions the secondary microcontroller could be added to the main control board instead of an external interface board and it could also use the number buttons on the remote the quickly change the pattern to a specific ID.

1. The unit must have an SD card slot for image files stored on an SD card. The file format used will be a custom file type for storing images for the led matrix

Images will be stored in a folder called .imx

I created a program on windows using python to convert images into a simple image format that can easily be used by the microcontroller, the program stores the data on a database on the SD Card and it stores the files in a folder called “.imxs” with the image files being called “.imx” and the file containing the number of patterns called “imdbsize.dbl”, for a future version, native support for image types such as “.jpg” and “.png” could be used instead of the custom program on windows.