Breadboard Case Design

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INTRODUCTION

The purpose of this report is to outline the design created for a case for the Light Fixture Prototype using Fusion 360. The case was designed for the system displayed in Figure 1 consisting of 3 LED lights and 2 push buttons, assuming the entire circuit was shifted 2 pins to the left. Overall, the designed case is 1.2mm thick throughout, with a 5.730cm x 8.410cm base and 2.42cm height. Tolerance values are all 1mm unless specified otherwise.

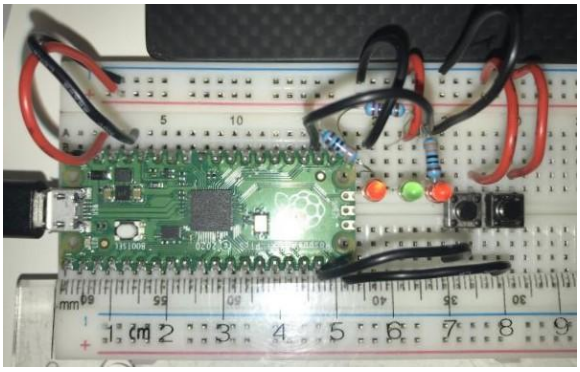
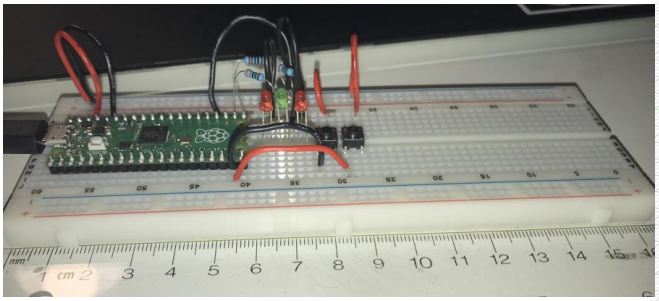


Figure 1. Light fixture circuit

CASE SIDES

As I was given a longer breadboard measuring around 16.5cm, my case design covers half of the board at 8.3cm to reduce printing time and save resources. As such, the front of the case is open for the rest of the breadboard to protrude outwards. Moreover, there are 3 rectangular protrusions on the left face of the breadboard, as displayed below in Figure 2. These were accounted for with 5.3x6.7mm gaps in the case design on the left face, illustrated in Figure 3.



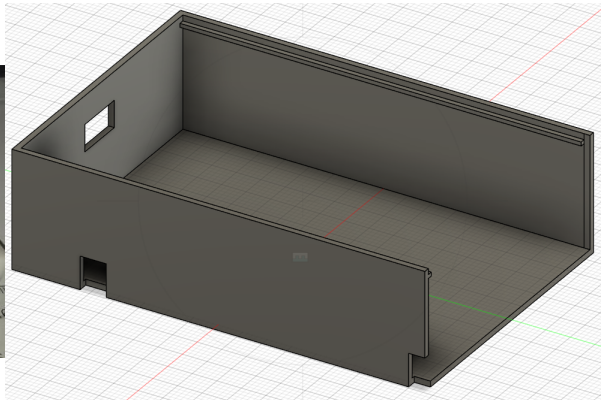
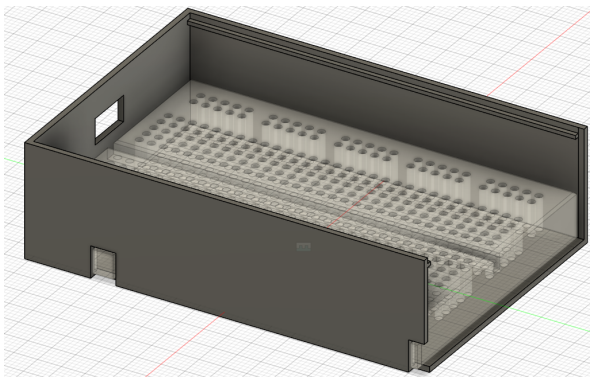


Figure 2. Breadboard, Figure 3. Case sides

The case was also designed for connectivity to a MicroUSB cable with the Raspberry Pi Pico. Thus, the back face of the case contains a hole for the cable to be plugged in, considering the height of the breadboard (see Figure 4). Lastly, 1.2mm from the top of the case, there are 2 protruding lid supports with grooves on the left and right faces of the case. These are 1mm each and exist for the lid to sit on and latch onto, such that no screws or gluing mechanism is necessary (Figure 5).



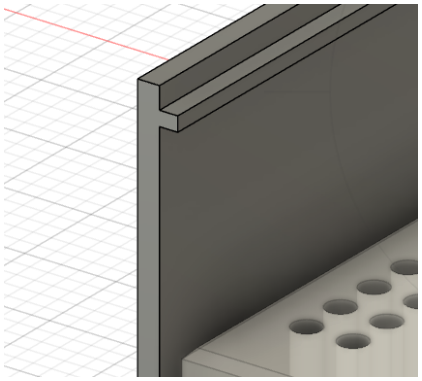


Figure 4. Case with breadboard, Figure 5. Case front face: zoomed in to one of the lid supports

CASE LID

The 5.49cm x 8.29cm lid of the case was designed to sit and latch onto the 2 supports and is 1.2mm thick, matching the rest of the case. This was designed for accessibility and simplicity, where there is no need for screws or adhesives. As such, the lid is easy to remove for efficient access to the circuit when changes are required. The system as a whole is also optimized for sustainability as it can be taken apart easily and components can be reused. Subsequently, if the light fixture design is subject to change, only the lid of the case would need to be updated.

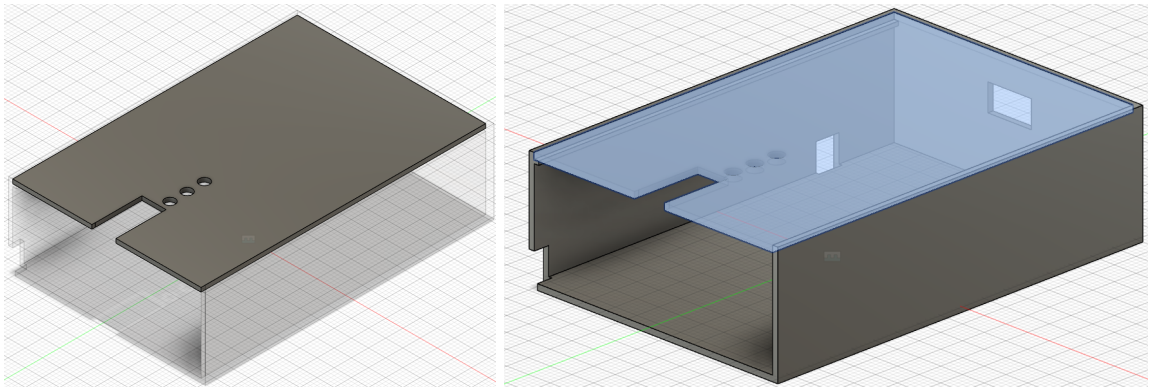


Figure 6. Lid design

As following the breadboard layout seen in Figure 1, there are three 3mm holes in the lid for visualization of the LEDs. The diameter of LEDs was found to be 3mm with a height of 1.5cm above the breadboard when plugged in, which was taken into consideration when choosing the case height. The case height was also designed for stability, as the lid was created slightly shorter than LEDs which have a height of 1.4cm above the breadboard. This allows the lid to secure the LEDs in place. The design also assumes that the LEDs are spaced out 2mm from each other, as measured using a ruler.

Similarly, the case also has a 1.48 x 0.7 cm open area for accessing the pushbuttons without moving the case. The design for the pushbuttons placed them near the front face for accessibility purposes. Had the pushbuttons been located further back, users would need to stick their fingers inside of the case due to the shorter height of the buttons (5mm above the breadboard) compared to the case. This would have made accessibility more difficult as the buttons would be cumbersome to reach. Thus, placing the buttons where the case opens for the rest of the breadboard was deemed optimal for usability and accessibility. Furthermore, if the circuit design were to be updated with additional pushbuttons, the new buttons could be placed beside the current button layout. Thus, this case design eliminates the need for a new case and was designed for adaptation.

PRINTING

Overall, the printing time was estimated to be 1h 42min with PrusaSlicer with a 0.20mm nozzle and default settings (see Figure 7). The printing design decision of selecting 3 perimeters without extra reinforcement or density was made to optimize efficiency, allowing colleagues to use the printing resources.

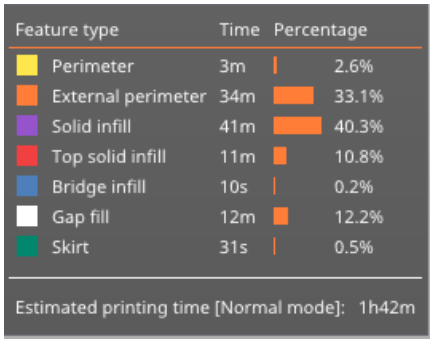


Figure 7. Estimated printing time