“Push to Talk” Prototype Rebuild and LoRaWAN Connection

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Contents

1. Introduction

This document will look at the changes that have taken place through the revisions process. From ethernet button version 1 through to LoRaWAN Button version 2.

This will include the original product specification and what has change through the revision process and a break down of the parts used and the changes and iterations that have been made. Using photographs to display the materials and parts that have been designed and then to be manufactured by DefProc and the parts and materials that are to be sourced from outside companies.

2. Product Specification

Button requirements:

- Closed case
- Easy to clean
- Basic materials for prototyping
- Button should be large for ease of use because some service users may have dexterity needs
- Button should **not** require a hard press
- Button should indicate when a call request is being made
- Button should indicate when it has been switched on
- Button lights (on light) should **not** remain on while it is plugged in to keep the power requirements low
- Button case should be hard wearing
- Non marking and **not** scratch surfaces
- Space for branding
- Space for sticker that has ID number and contact information

3. Ethernet Button Version 1

Figure 1 - External and internal views of the version 1 button.

3.1 PTT Shield

Figure 2 – Image of the PTT Shield

PTT Shield

- Bespoke button shield with single colour LEDs
- Provides physical location for the switch

3.2 Wiznet Ethernet Board W5100

- Provides access to internet router

Figure 3 - Wiznet ethernet board W5100

3.3 Uno Clone – Uno R3

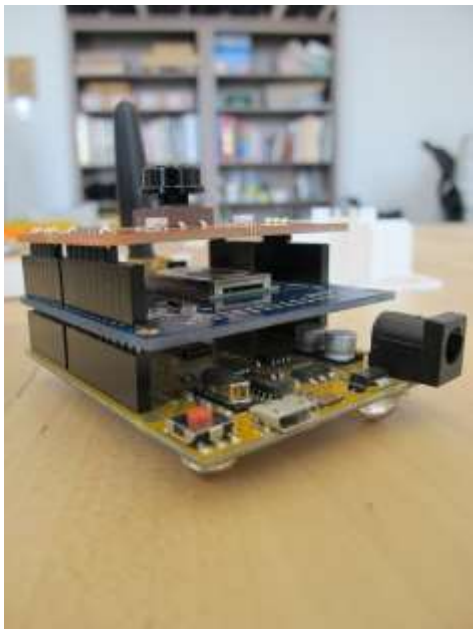
Figure 4 - Uno Clone - Uno R3

Microcontroller (8bit)

- Connects to the internet
- Sends the data to the server
- Holds the button ID
- Processes the button press request to receive calls
- Board also provides DC input Jack
- Reset button

4. Proof of concept for LoRaWAN

A basic proof of concept was produce to prove that is was possible for the button to connect to the local LoRaWAN gateway.



Still using PTT shield and Uno R3 the middle board is a bespoke DefProc LoRaWAN shield with RN2483 modem and antenna.

Figure 5 – Side view of PTT board

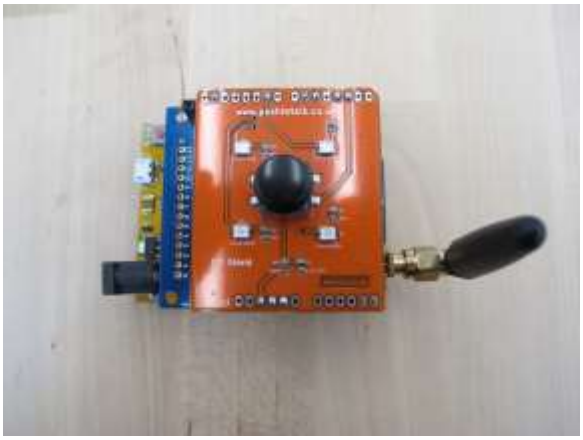


Figure 6 – View from above of PTT board

5. LoRaWAN Button Version 2

The PTT button is a Class A LoRaWAN device. This classification has a number features that are suitable for the type of low power that needs to be achieved.

Class A definition

- Radio is turned off other that to send a notification to the gateway that it is still turned on and waiting for input.
- The device will only turn when it is sending a message for example if the button is pressed when the user would like to receive a call or to send and “alive” message.
- When a message has been sent the device stays on for 2 seconds to wait for a return message.

PTT M0LoRaWAN board

This is a fully custom made board.

This replaces the 3 stacked boards and has all the features built into one

This board has replaced the need for the ethernet connection with a LoRaWAN Radio Module.

- HopeRF RFM95W

Added a Helical coil anntena for 868 MHz

Changed the 4 singal colour LEDs to programmable RGB LEDs (WS2812b)

Changed Microcontroller Uno R3 for SAMD21 (a 32 bit, Arm Cortex M0+ processor) to increase program space for LoRaWAN

Figure 7 – PTT M0LoRaWAN board

Micro USB port has been added for ease of programing and feedback for prototyping.

A Tag Connect footprint for the JTAG programmer connection using SWDIO protocol.

The button is a 12mm square button with a 5mm depth. The button cap is 12mm flat top square in white

DC input jack to allow for a voltage range from 5V to 12V and offers reverse voltage protection.

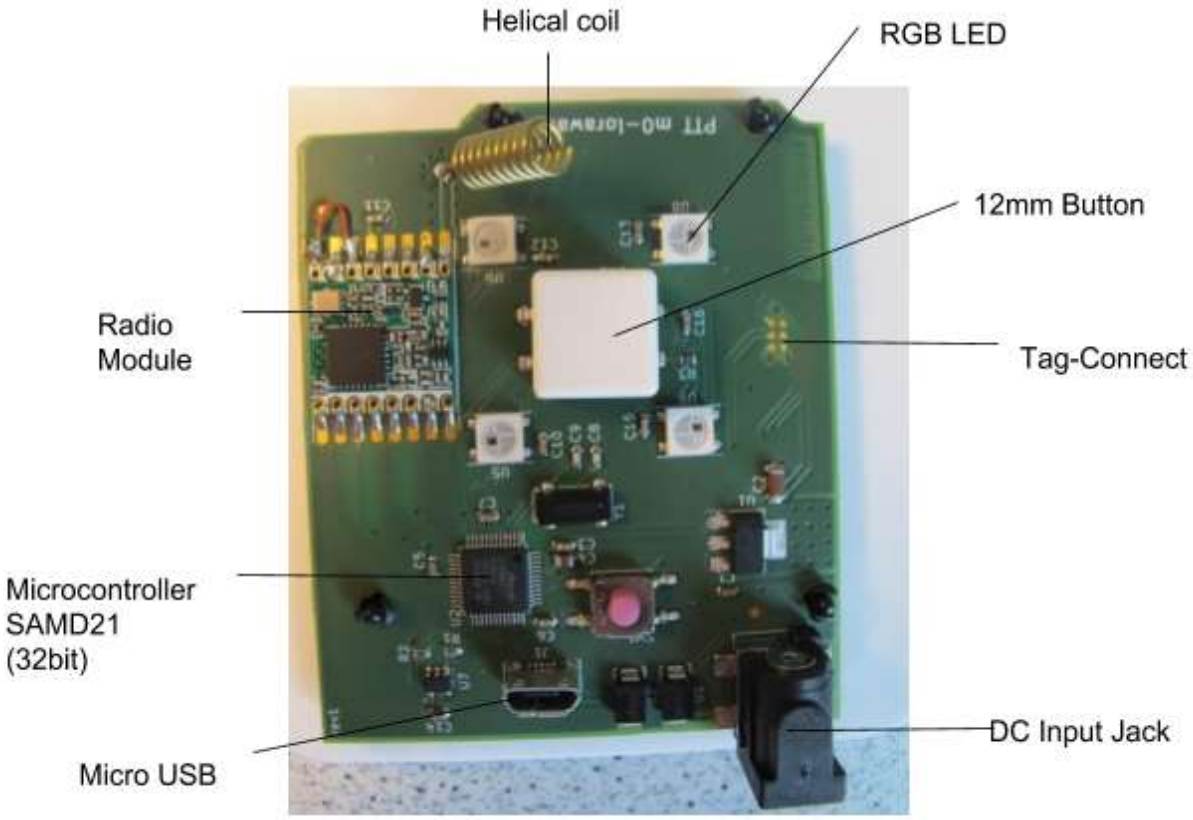


Figure 8 – Labelled PTT M0LoRaWAN board

5.1 LED indicators

Orange - showing that the device is starting up

Blue - after the button has been pressed the blue light indicates the message has been sent

Green - the green light will pulse to indicate that a call is about to happen, this will last for 30 seconds and ends when the call starts

Figure 9 – PTT button in case with orange indicator

Figure 10 – PTT button in case with blue indicator

Figure 11 – PTT button in case with green indicator

5.2 PTT Button Case

The case is made so that is easy to clean, is inexpensive to produce as a prototype and easy to assemble as part of the in house manufacturing process.

The case has been revised, however, the original ethernet port cut out can been seen in the image. The second iteration has yet to be manufactured, and the cutout is being used for programming access.

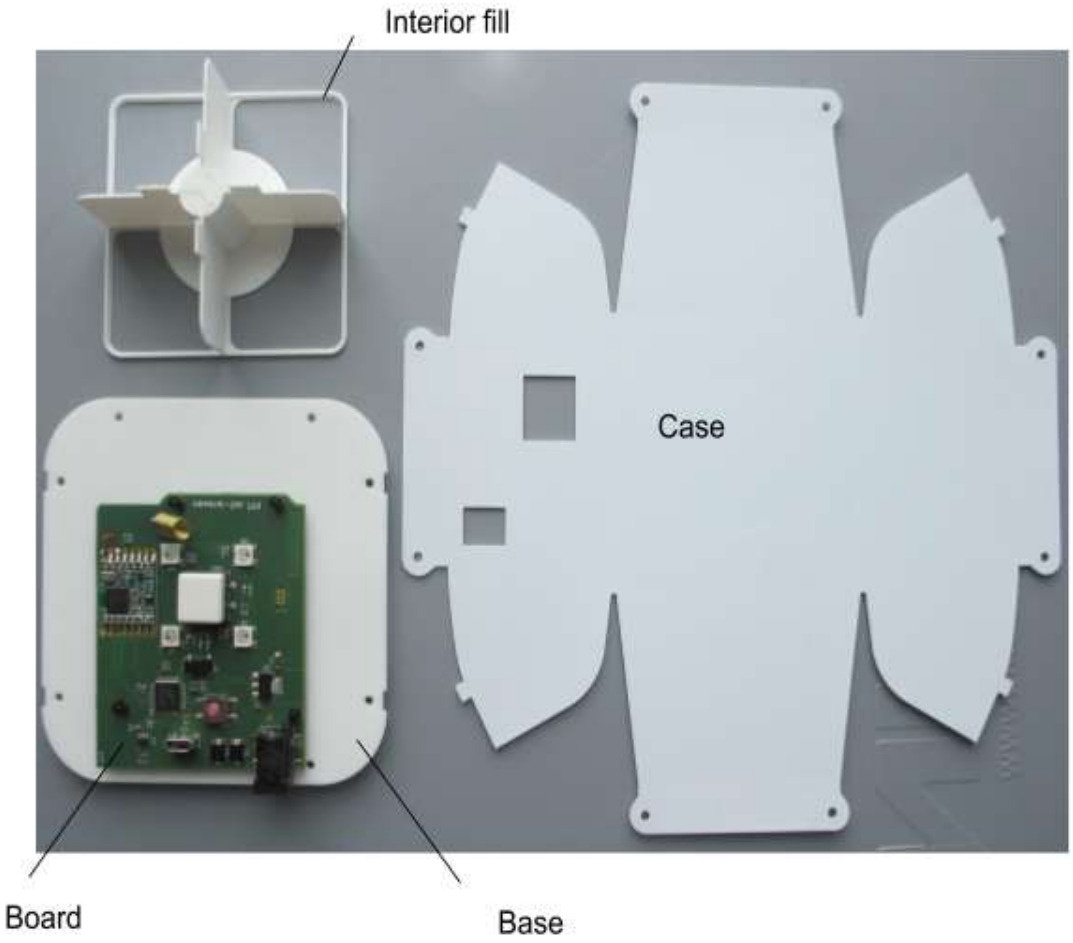


Figure 12 – PTT button case parts

Cover (case) - Polypropylene 0.8mm white, manufactured using laser cutting
Base - 3mm white cast acrylic (PMMA) manufactured using laser cutting
Internal Fill - PLA, white manufactured using 3D printing

5.3 Internal Fill

The internal fill has been designed to fill the now empty space that has been left by reducing the size of the boards. By taking away the ethernet connection and placing everything that is required on one board.

The internal fill creates the connection to the button so the original shape can be maintained. The current size and shape of the button was created with the ergonomics of it users interactions in mind.

3D printing also allows for the manufacturing to be done in-house and produce multiple items at a time, with some automation.

The internal fill went through three revisions until it was correct.

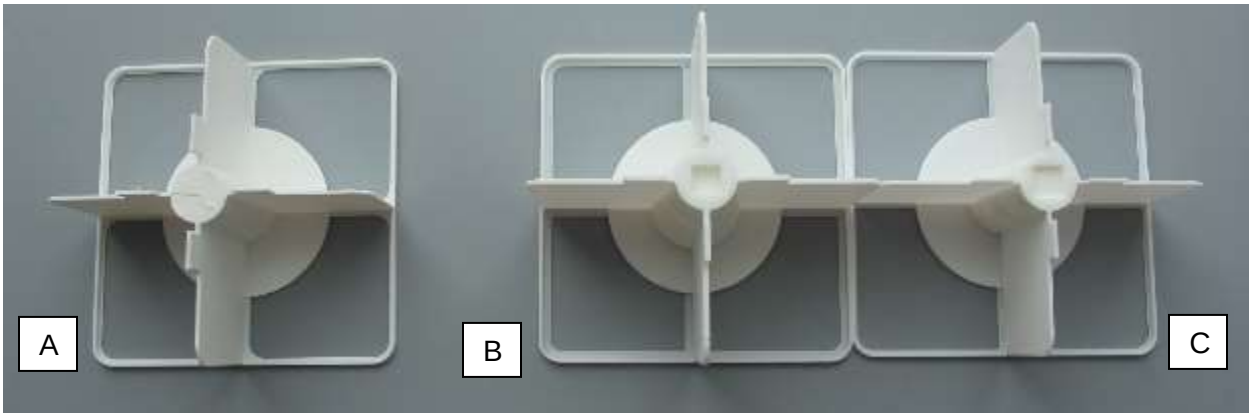


Figure 12 - Internal fill revisions

A - The final version and uses the button cap to ensure that it connects consistently

B - Was intending to have the button sit inside so it can had a guarantee on the location on the button, however this approach failed because the button without a cap is very small. During testing the button and the internal fill would not reliably connect.

C - The first iteration and was the proof of concept, however, it was to short and narrow and unreliable.

Figure 14 – Side view of iteration A

Figure 15 - Side view of iteration B

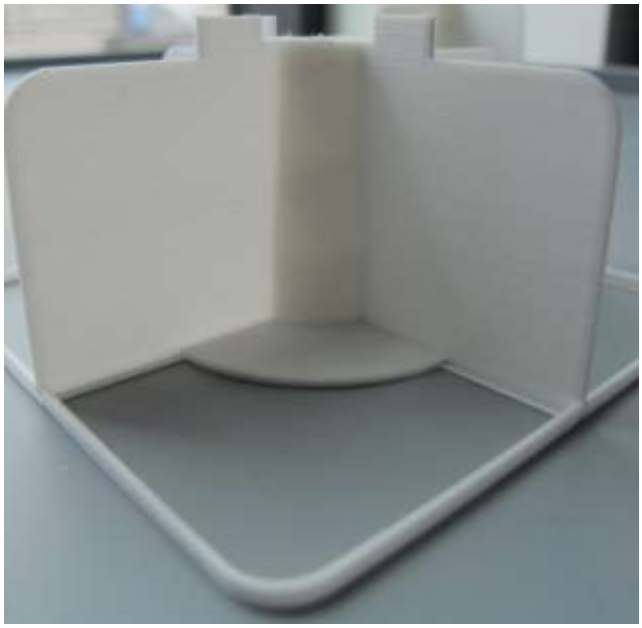


Figure 15 - Side view of iteration C

The internal fill connects to the top of the case with a specialist adhesive tape so that it remains in place.

The button on the board and the internal fill have been design to ensure that the are placed in the center of the device and line up accuracy for every button press.

The frame of the internal fill also provides structural support for the polypropylene so no distortion of the case can take place while the button is being pressed.

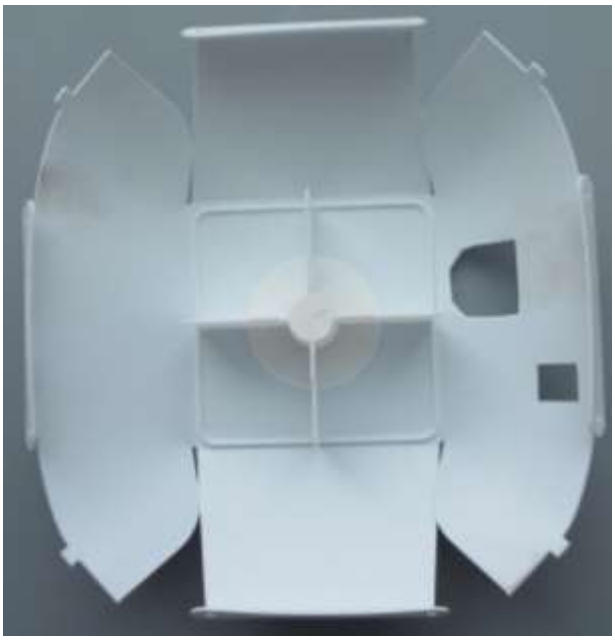


Figure 16 – Inside view of the top of the PTT button case

5.4 Product ID

The base has 4 soft feet so that it will rest on any surface without scratching, marking, or sliding around.

The sticker on the bottom has all the contact information for PTT and the button ID and activate phone number that the installer will use to onboard the user.

Figure 17 – View from underneath the PTT button