# Introduction

# Research

## Commercially Available Options

|  |  |
| --- | --- |
| Title |  |
| Link |  |
| Author |  |
| License |  |
| Cost |  |
| Notes |  |

## DIY Options

|  |  |
| --- | --- |
| Title |  |
| Link |  |
| Author |  |
| License |  |
| Cost |  |
| Test Build (Y/N) |  |
| Add to Library (Y/N) |  |
| Notes |  |

## Research Summary

<Summary of findings; potentially viable solutions; any gaps in existing options>

# Requirements

## Goals

|  |  |
| --- | --- |
| G01 |  |
| G02 |  |
| G03 |  |

## Functional Requirements

|  |  |
| --- | --- |
| F01 |  |
| F02 |  |
| F03 |  |

## Non-functional Requirement

|  |  |
| --- | --- |
| NF01 |  |
| NF02 |  |
| NF03 |  |

## Constraints

|  |  |
| --- | --- |
| C01 |  |
| C02 |  |
| C03 |  |

# Ideation

## Key Features

# Conceptual Design

# Prototyping

# Testing

# Detailed Design

# MVP Design

# Final Design

Programmer

<https://github.com/SpenceKonde/AVR-Guidance/blob/master/UPDI/jtag2updi.md>

Required Hardware

There has been some debate and questions have been raised over whether the recommendations below are the best. More study is required.

A USB serial adapter These can be had for as low as $1 on eBay and AliExpress based on the CH340G, slightly more for CP210x or "FT232". Ideally, you want to dedicate a serial adapter to this purpose for ease of use, rather than having to connect and disconnect things every time you want to switch between programming with it and using as a serial adapter

a fast signal Schottky diode such as one of the BAT series (BAT43, BAT54) or any of many others (recommended) or a resistor (see below to figure out value)).

1 resistor, a few hundred ohms - 220 to 1k, even 2k is fine (may not be needed).

A few jumper wires. Plan to replace these periodically if you use it a lot. Cheap dupont terminals don't last. Actual DuPont terminals (now made by Amphenol F. C. I) hold up much better, but they cost a fortune.

# Opportunities for Improvement / Future Work

## Controller

* Slide switch is tricky to solder, consider a through hole option
* Radio is a bit tricky to solder
* Could a 3D printed piece work for the LED spacer instead of the tubing? This would then be one less part to buy, and not have to worry about the precision of the cut on the tubing (slightly crooked causes the LED to be crooked)
* Add chamfers to screw holes to make screws easier to insert
* Consider adding a shadow line/inner ledge to help with alignment while screwing the case together
* 5.5 cm seemed to be a bit too wide for the foam, the PCB didn’t quite lay flat, maybe cut this down to 5.3 or 5 cm
* Covers on the buttons on the side could make them easier to press
* Foam pushes up on PCB, and there is nothing to keep the PCB down on the left side, so the knob buttons are getting jammed by being pressed down by the enclosure
* Consider adding bumps to the knobs to make them easier to turn
* Screws
  + 25 mm M2 Screws are hard to source in small quantities. These could be replaced with shorter sheet metal type screws to fasten the enclosure
  + Screws can be easy to strip

## Sensors

* Same as above, slide switch and radio are tricky to solder
* Consider adding hard stops to the sensor enclosure bottom to prevent the PCB from getting pushed down too far and damaging the slide switch
  + I accidentally pushed mine too far down and the slide switch bent upwards
* Consider adding a switch cover to the slide switch on the sensor to make it easier to turn on and off
* Easier way to program boards that does not require custom programmer
* If using custom programmer, more solid connection

## Lithium Batteries

* Need to be extremely cautious with the polarity of connectors from different suppliers!
* These can pose a safety risk and the user should be warned accordingly.