

Zebrafish Cognitive Learning Interface (ZebCLI)

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Background:



- Neurological disorder: disorder of the nervous system and it can result in a range of symptoms. Diseases such as brain tumors, parkinson's disease and stroke.[1]
- Cognitive Deficits [2]
- Degenerative nerve diseases
- Depression
- Autism
- ...

Background:



To study them, we
need...

Animal models:

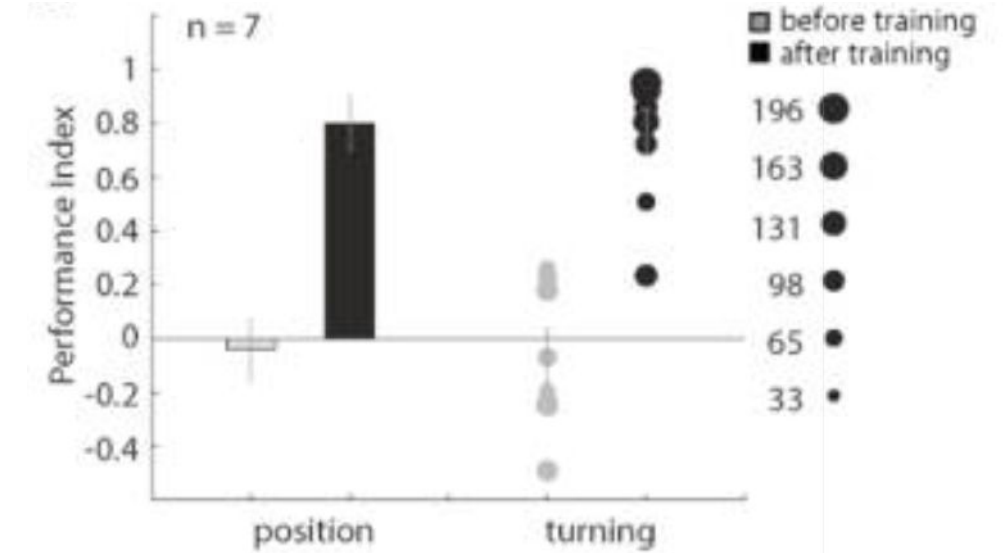
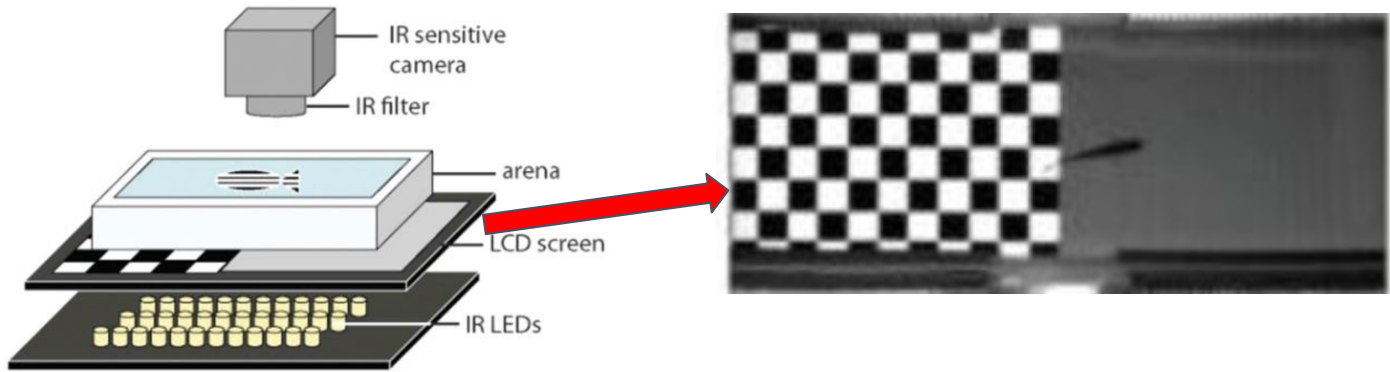
- Rodents: Rat and mice
- Rabbit
- Frog
- Primate
- Zebrafish
- ...

Why I chose Zebrafish?

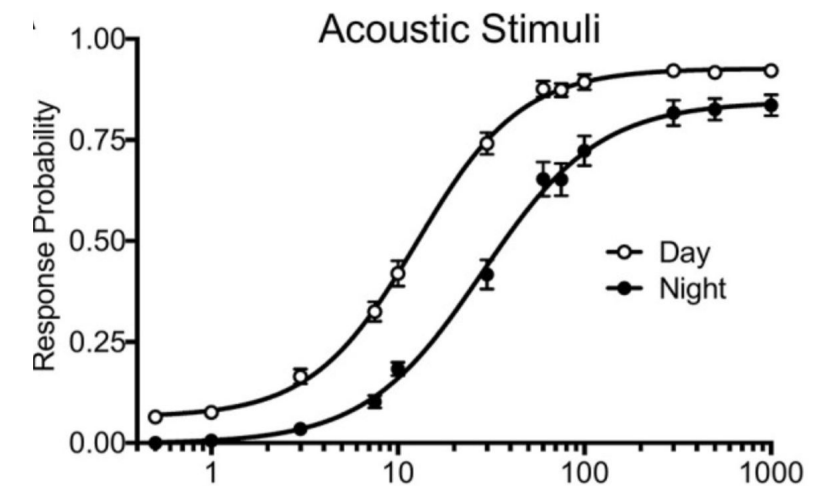
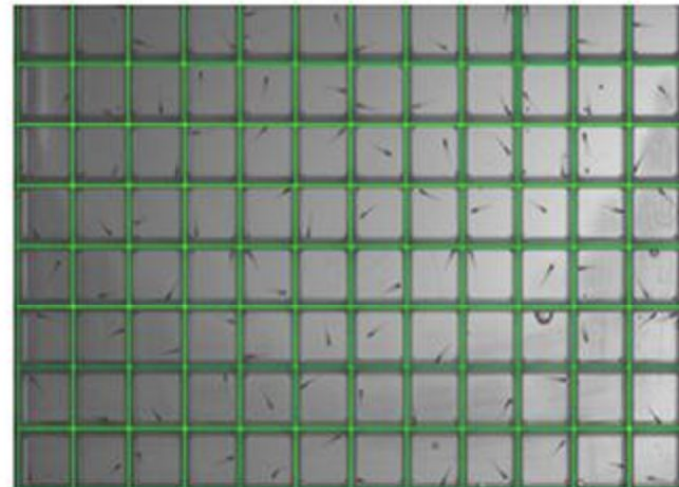
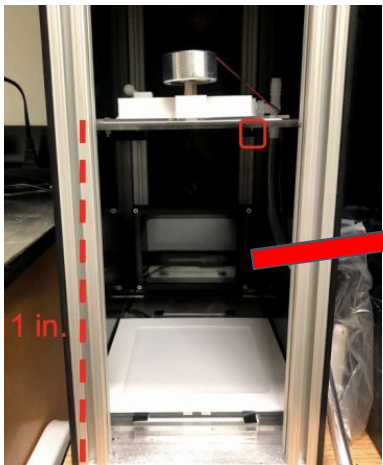
- Zebrafish share 70% of human genes, and many of the genes and pathways required for these features are highly conserved between the two species
- Zebrafish and humans share similar physiological, emotional, and social behavioral patterns.
- Low costs (relatively)
- Rapid generation time
- Easy genetic engineering

Previous research:

Previous research 1 [3]:



Previous research 2 [4]:



If we already have these existing systems, why are you going to build another new one?



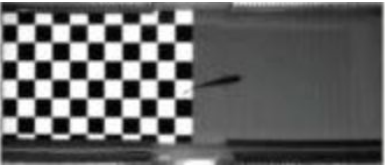




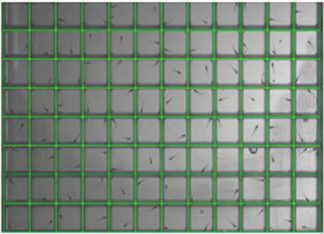








Because it's a requirement, I have to do some projects in order to graduate....



More importantly:

- No plagiarism
- Even though I want to do 'copy and paste', their papers are not even open-sources projects
- Current existing systems previous studies used are expensive

Product comparison:

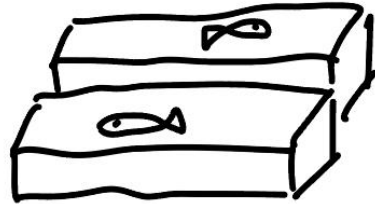
	Cost	Efficiency	Conditional learning	Programmable (user-friendly)
#1 	 (Unknown)			
#2 	 (\$4,665.41)			
My expected design				

Need Statement:

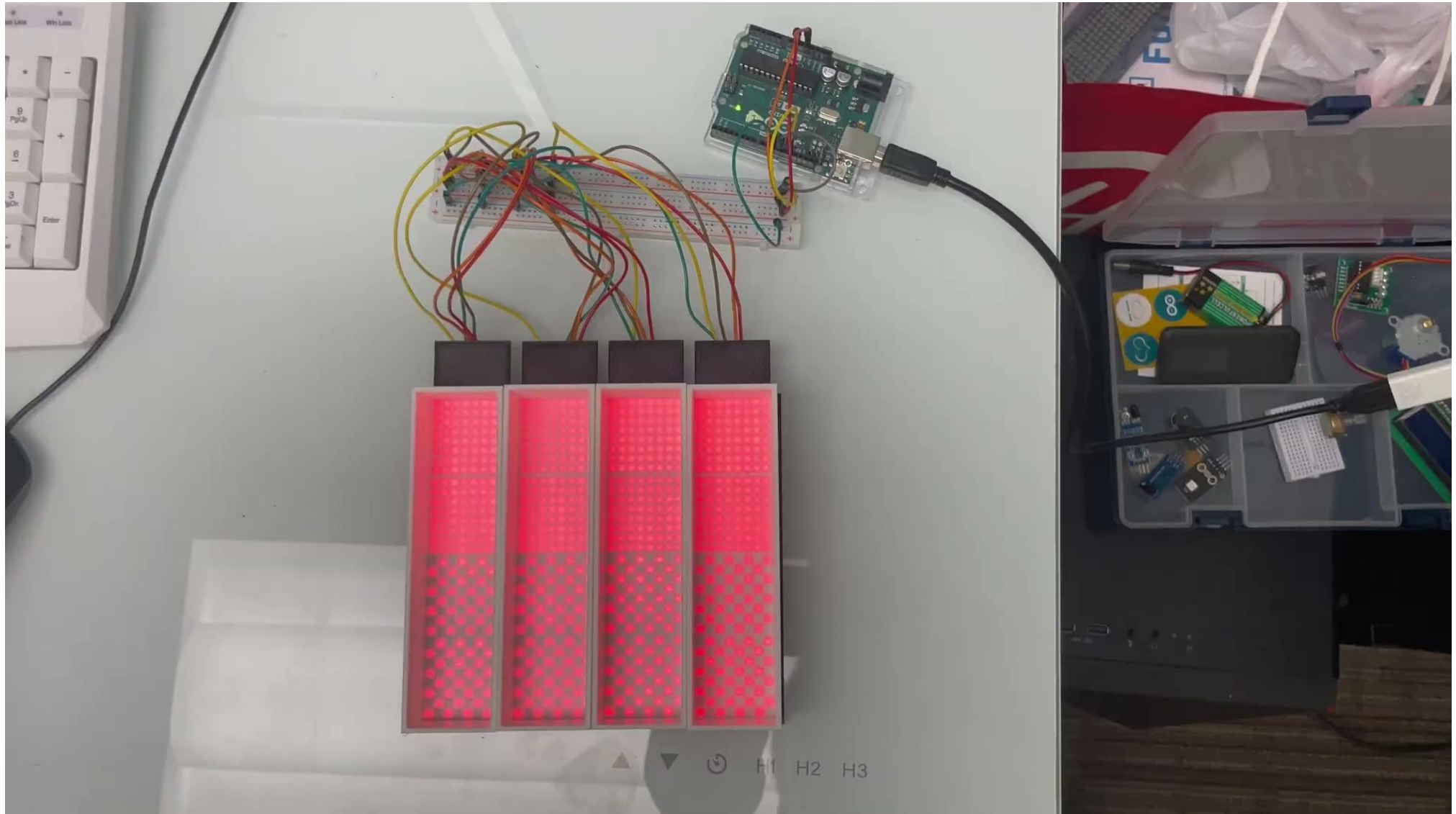
My goal is to build a system to monitor and quantify the conditional learning behavior of zebrafish at early life stages efficiently and at a low cost.

A diagram consisting of six red arrows. One arrow points diagonally upwards and to the right from the word 'quantify'. Five arrows point diagonally downwards and to the left from various points along the bottom half of the sentence: 'behavior', 'at', 'stages', 'efficiently', and 'cost'.

What my design looks like ?

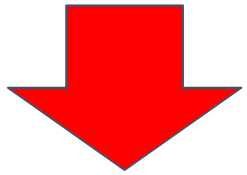


Demo (what I have built so far...):



Three challenging parts I will encounter:

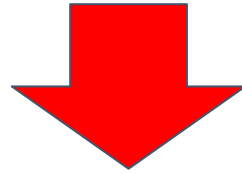
Visual stimuli



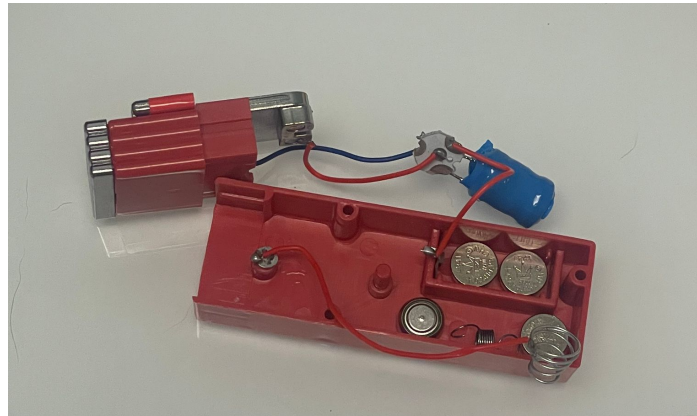
LEDs Screen



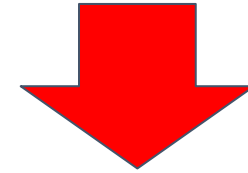
Generating electroshocks:



The most challenging part
Haven't figured out yet
But here is a potential toy...



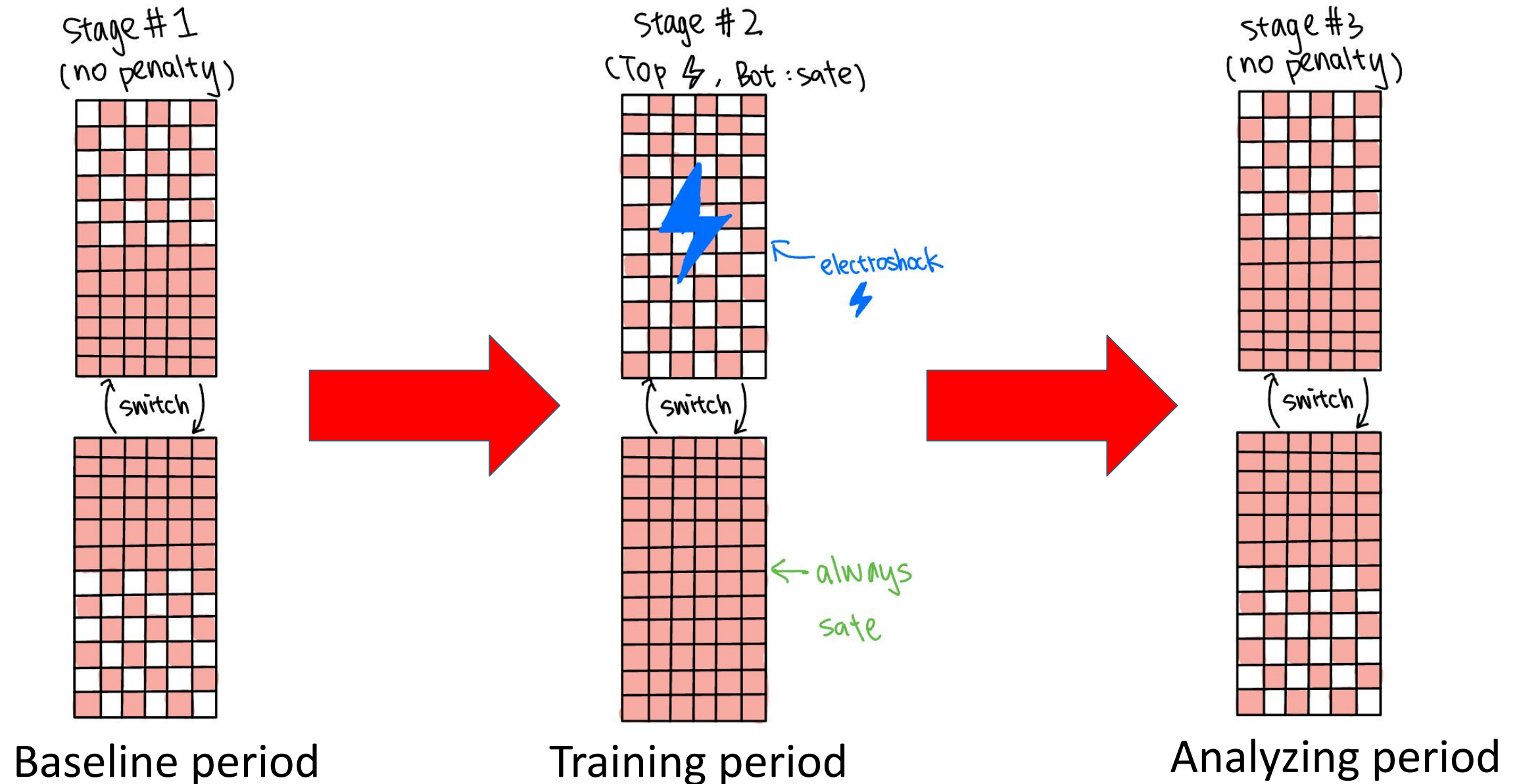
Video tracking:



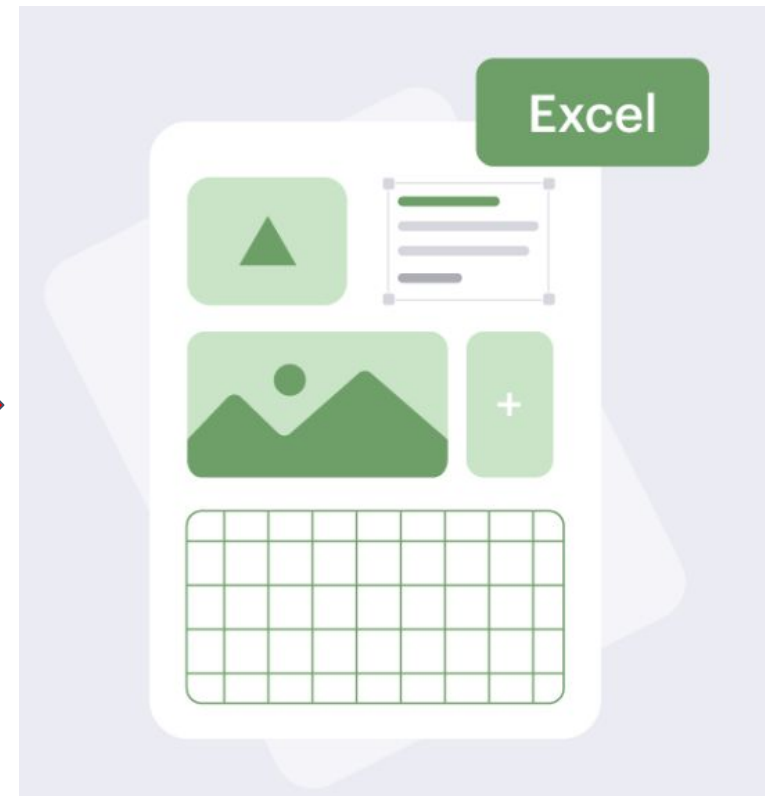
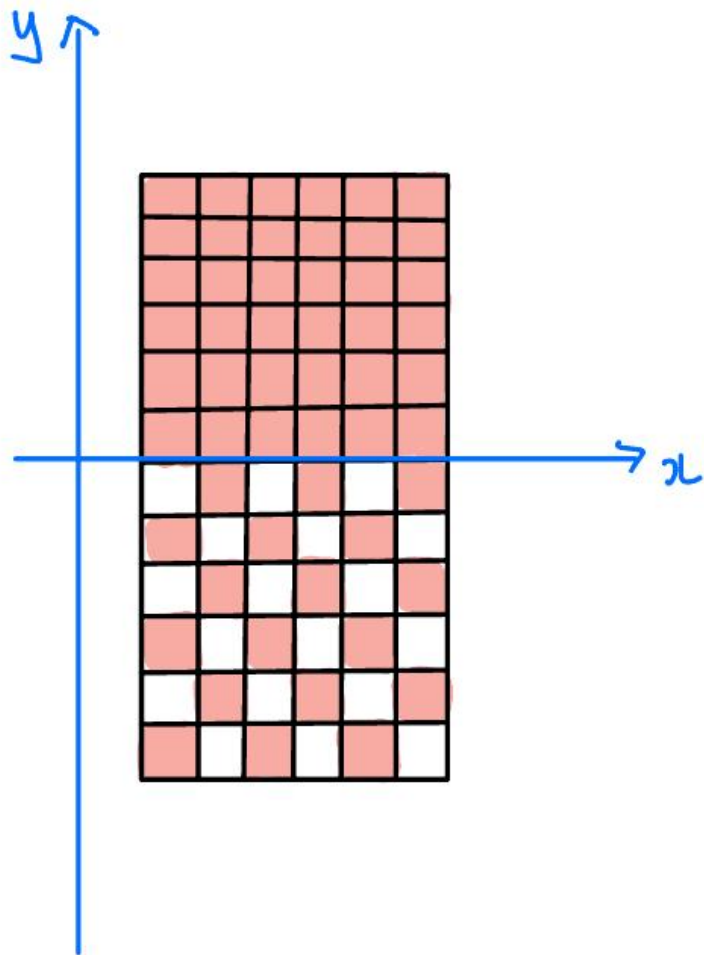
Infrared Camera



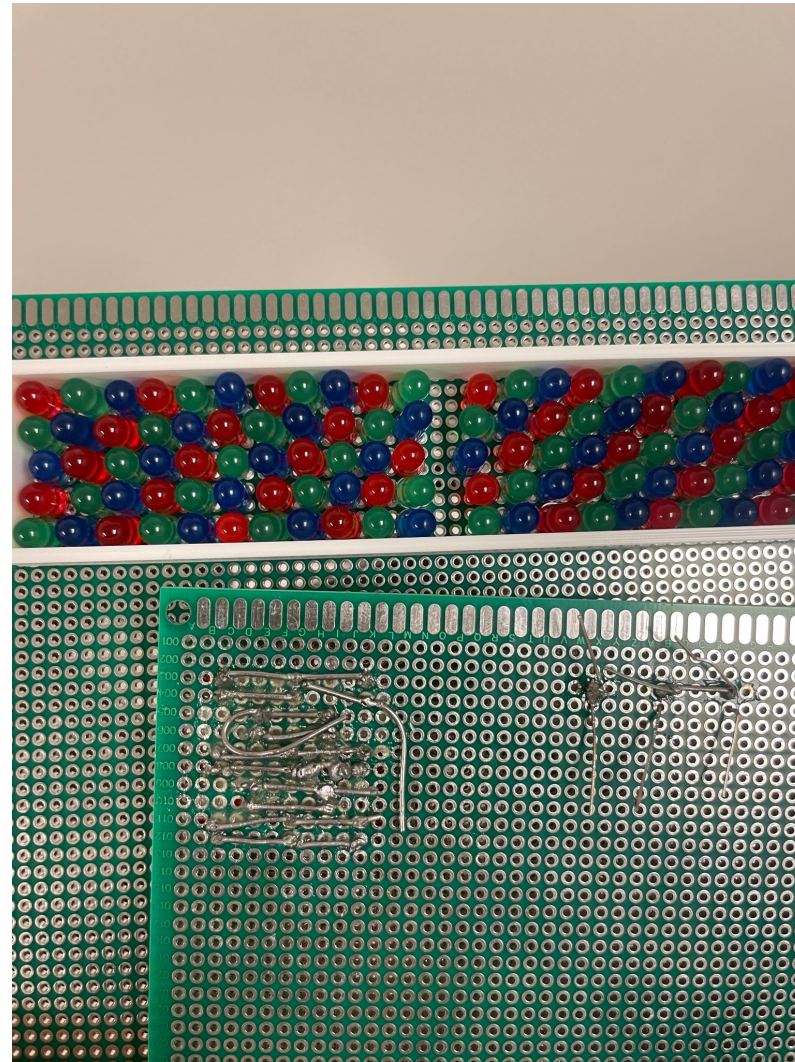
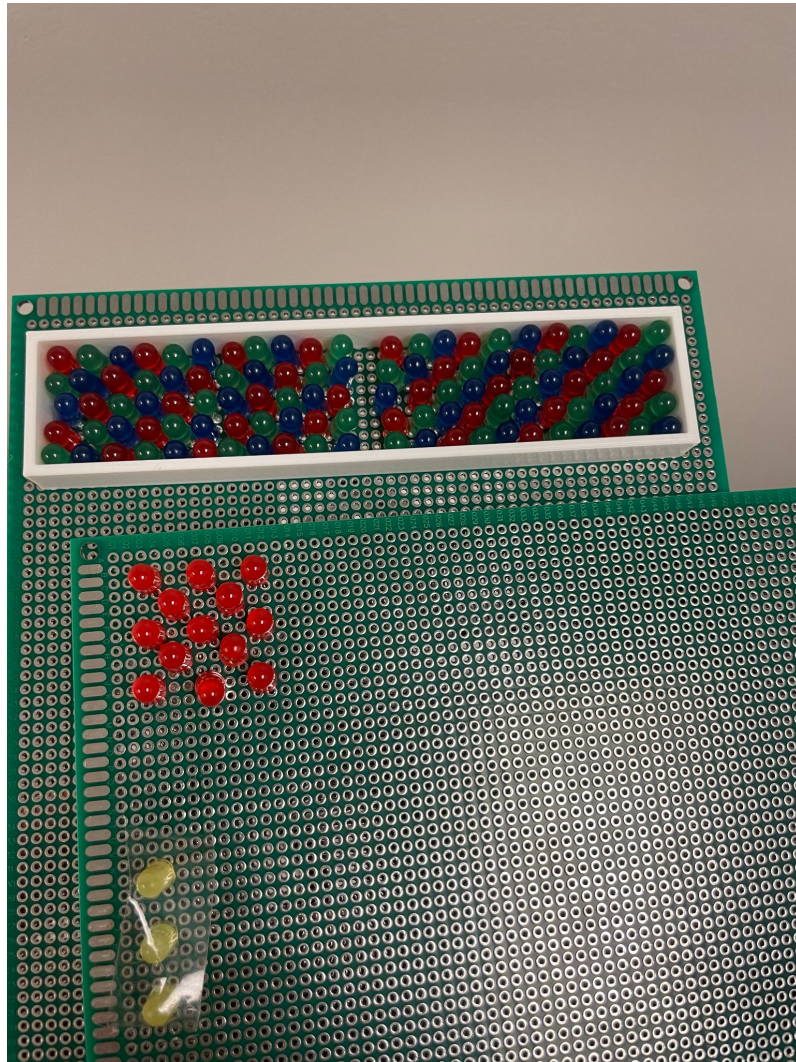
Training Protocol:



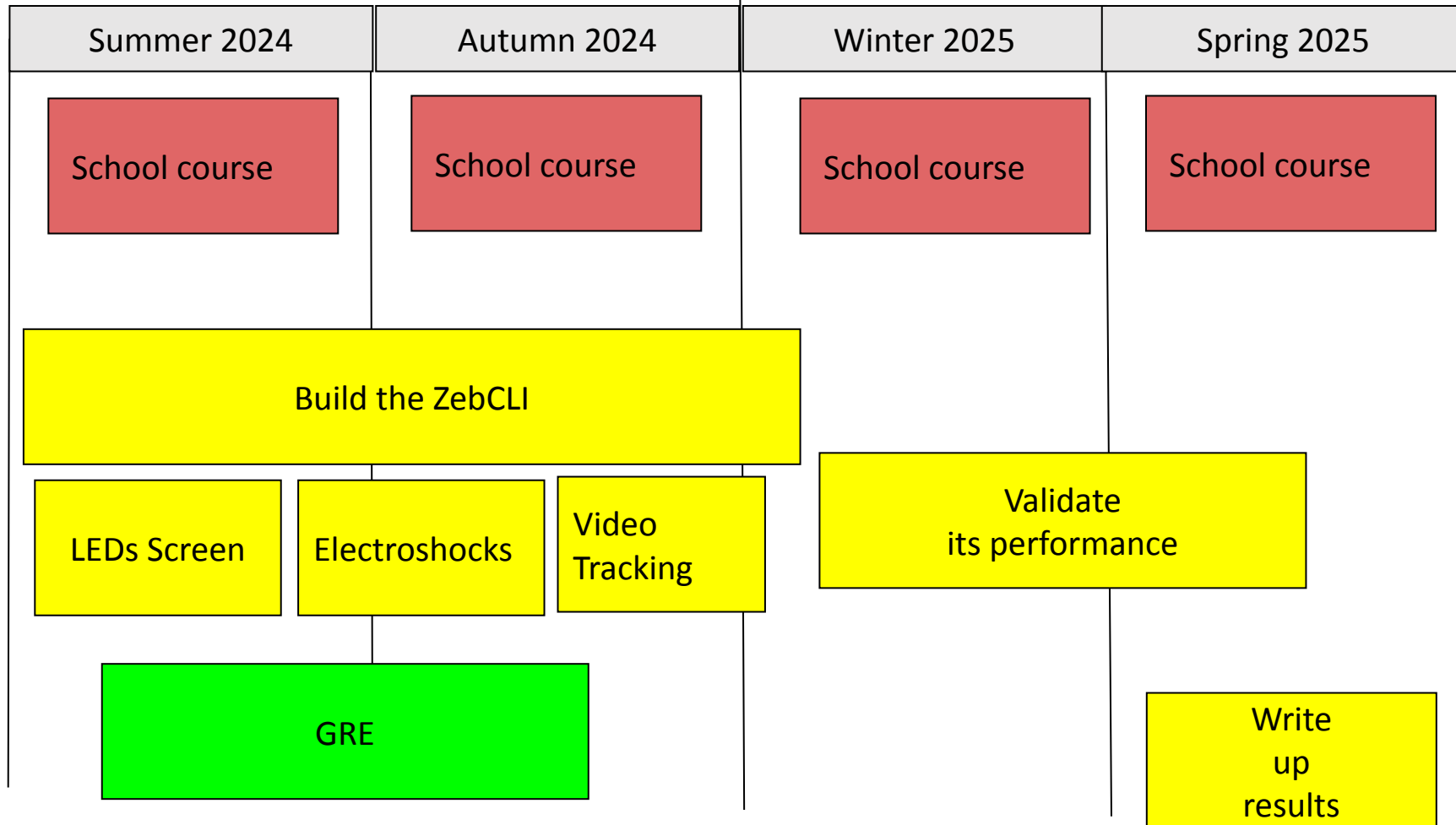
Data analysis:



Failure I had before:



Future plan:



Reference:

- [1] Gilmour, Gabriela S et al. "Management of functional neurological disorder." *Journal of neurology* vol. 267,7 (2020): 2164-2172. doi:10.1007/s00415-020-09772-w
- [2] Sheffield, Julia M et al. "Cognitive Deficits in Psychotic Disorders: A Lifespan Perspective." *Neuropsychology review* vol. 28,4 (2018): 509-533. doi:10.1007/s11065-018-9388-2
- [3] Valente, André et al. "Ontogeny of classical and operant learning behaviors in zebrafish." *Learning & memory* (Cold Spring Harbor, N.Y.) vol. 19,4 170-7. 20 Mar. 2012, doi:10.1101/lm.025668.112
- [4] Joo, William et al. "A Customizable Low-Cost System for Massively Parallel Zebrafish Behavioral Phenotyping." *Frontiers in behavioral neuroscience* vol. 14 606900. 18 Jan. 2021, doi:10.3389/fnbeh.2020.606900

