

Intelligent Seasoner (調水神器)

Final Project Presentation

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January 14, 2022

A Device that Provides You with Desired Water.

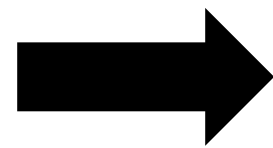
TDS

Total Dissolved Solids

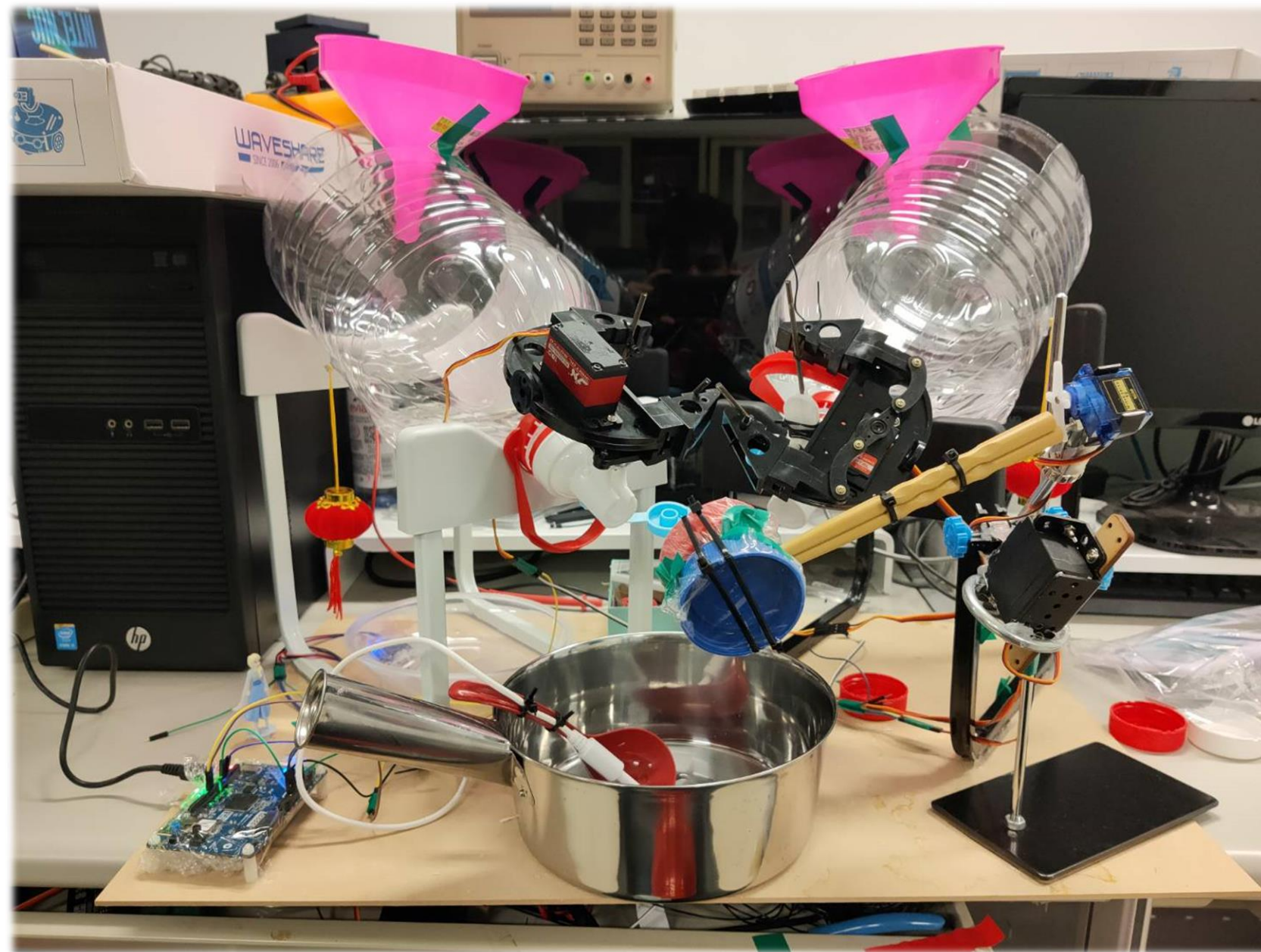
A measure of the dissolved content of all substances in the water

What is Intelligent Seasoner?

We want some drinks,
with specific concentration.



Intelligent Seasoner



error: $\pm 5 \text{ mg/L}$



Sweeter? Bitterer?



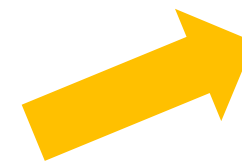
- Internet of Things: Bluetooth Control.
- Real-time precise and stable control.
- No calculations need for customers.
- Set up your favorite favor anytime.

Why Intelligent Seasoner?

Given a drink, it's hard to adjust the concentration manually.



Too much sugar



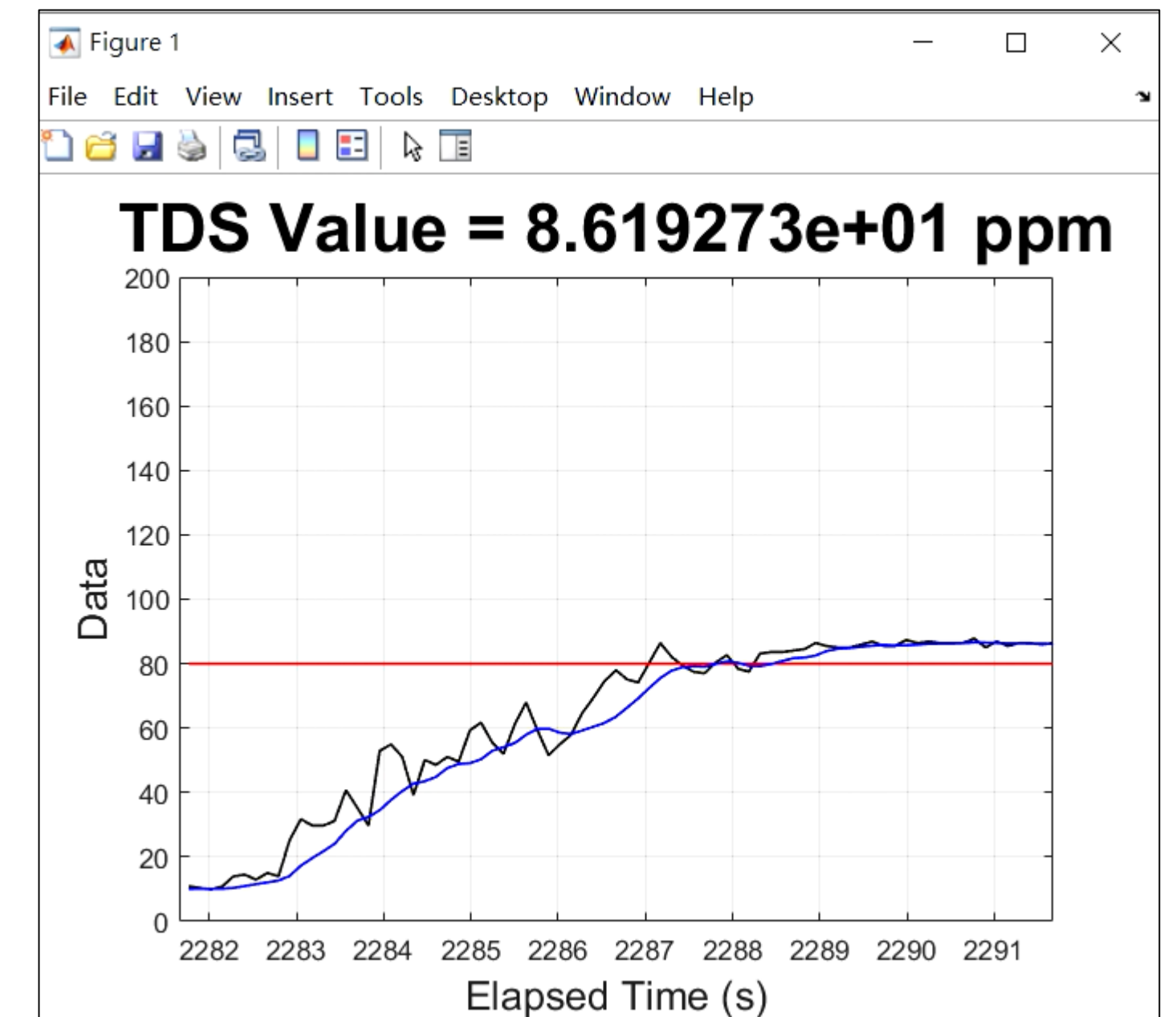
With
1. Sensor
2. Motor
3. Computer



Too much water



Automatic Control



Measurement Data of Water

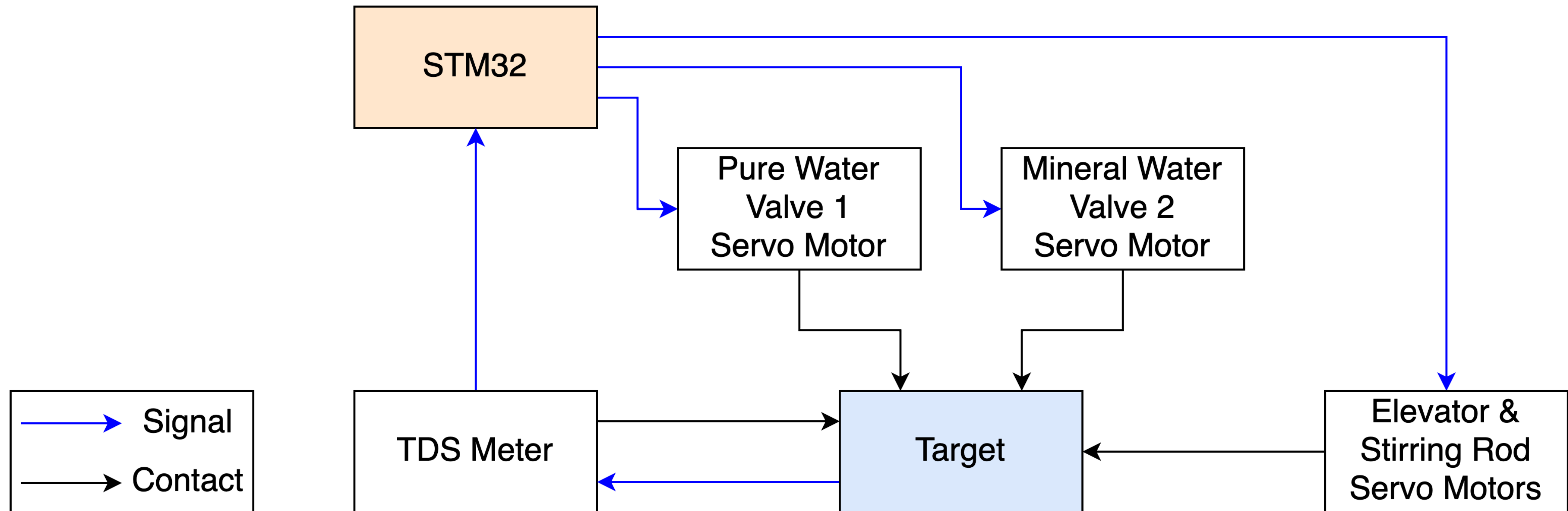
	Temperature(°C)	TDS Value
Pure Water	19.6	10 ppm
Mineral Water	19	180 ppm
Branded-Mineral Water (High-class, Expensive)	19.5	337 ppm

Demonstration

We'll be back after the demonstration.

Structure

Basic



3 different operation modes

Full Mode

Works without Computer

Works without Computer and Phone

Full Mode / Works without Computer

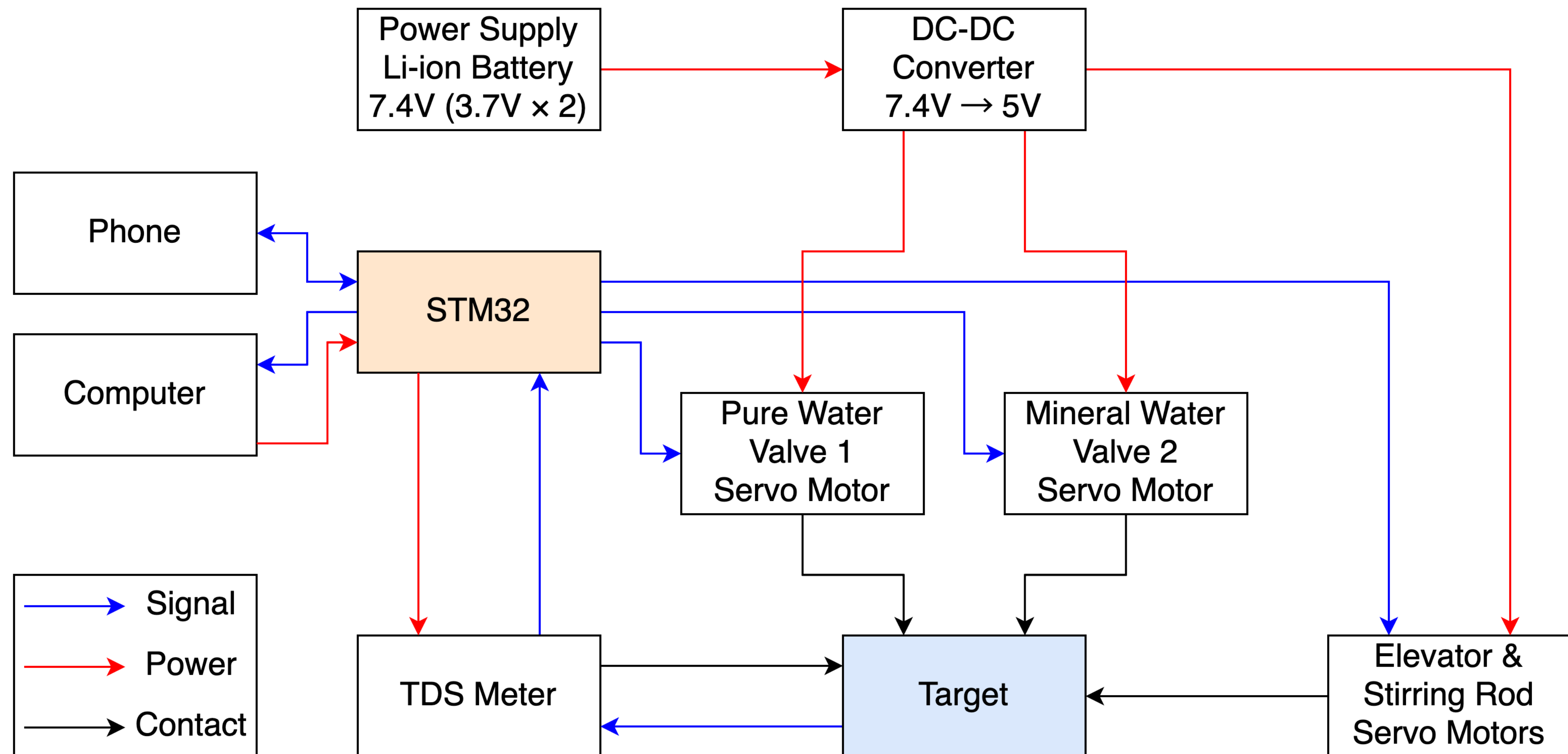
Features

Full Mode / Works without Computer

- Connect to Phone via Bluetooth
- Start/Stop by User Button on STM32 or Phone
- Tune Parameters by Phone
 - Customized Target TDS Value
 - Customized PID Control Parameters
- Display instant TDS Value and Graph on the screen (Full Mode Only)

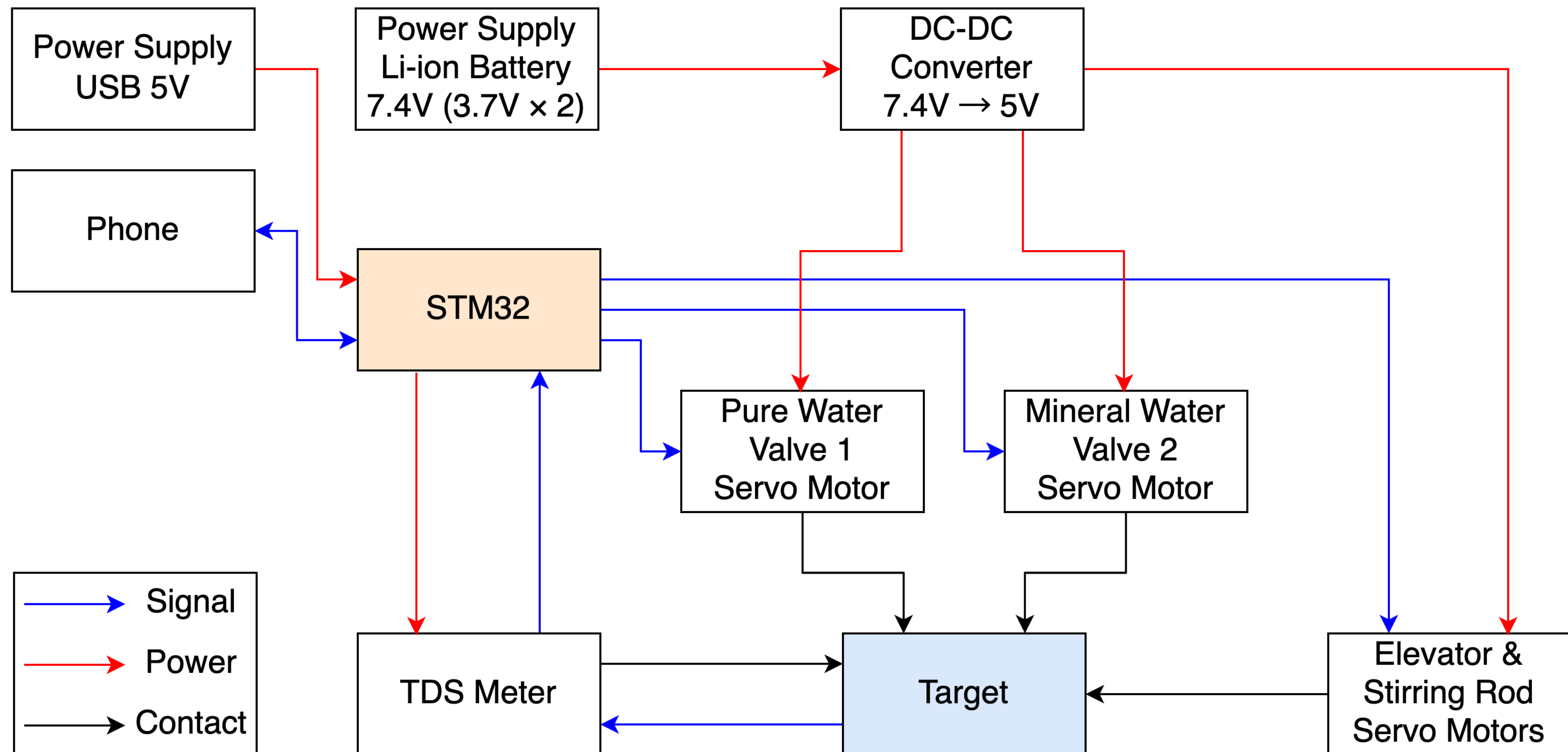
Structure

Full Mode



Structure

Works without Computer



Works without Computer and Phone

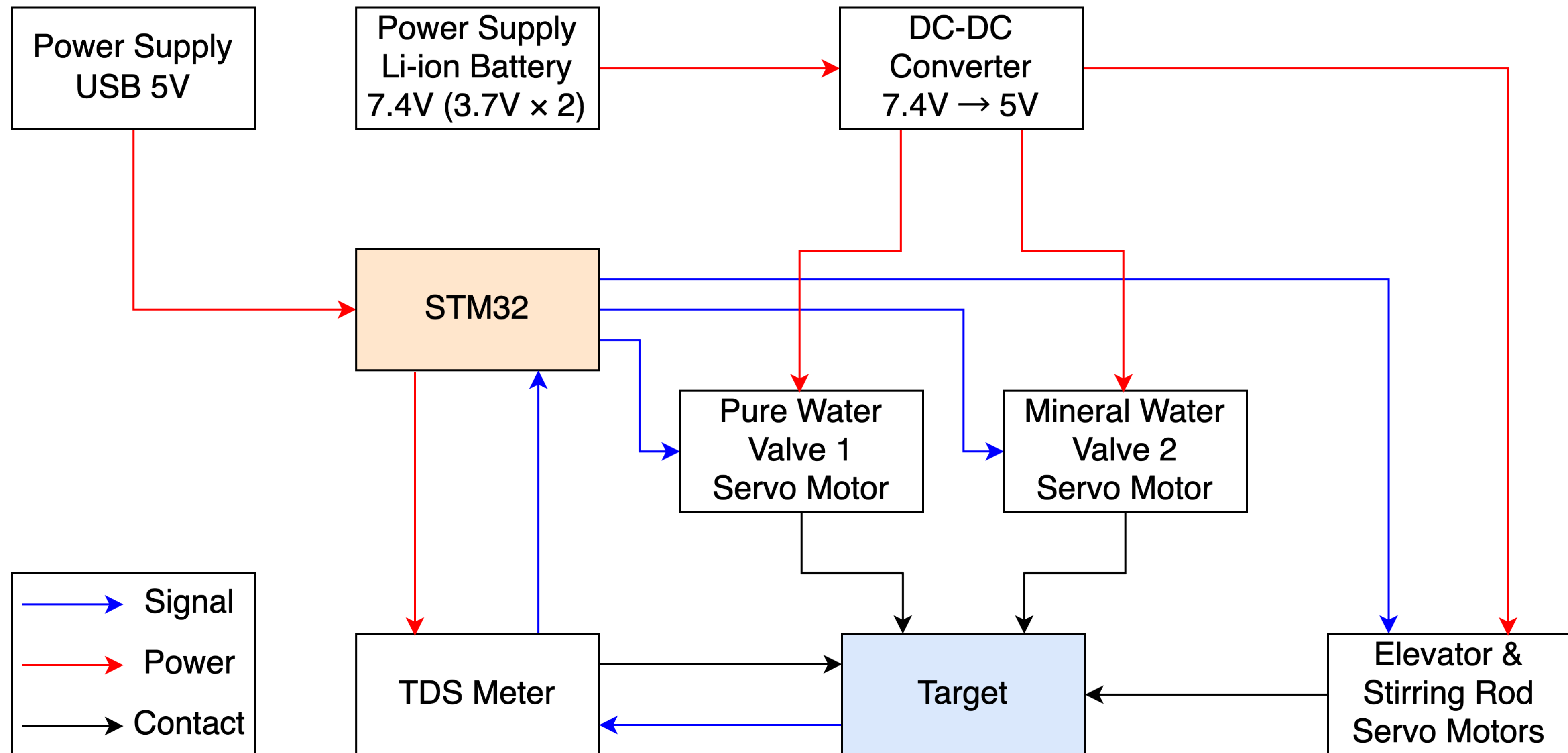
Features

Works without Computer and Phone

- Start/Stop by User Button on STM32
- Use onboard default parameters
- Parameters with fine-tuned values

Structure

Works without Computer and Phone

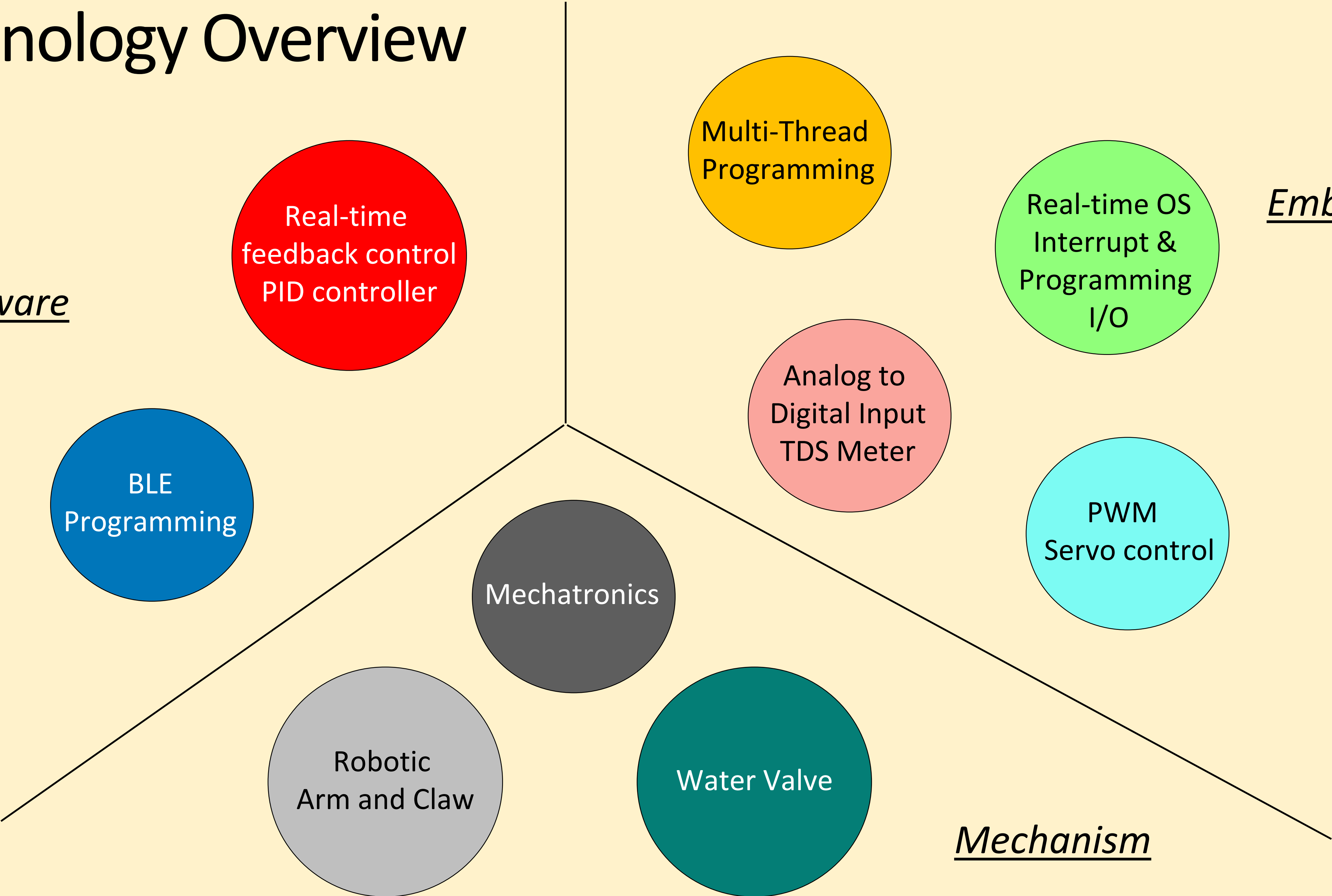


Technology Overview

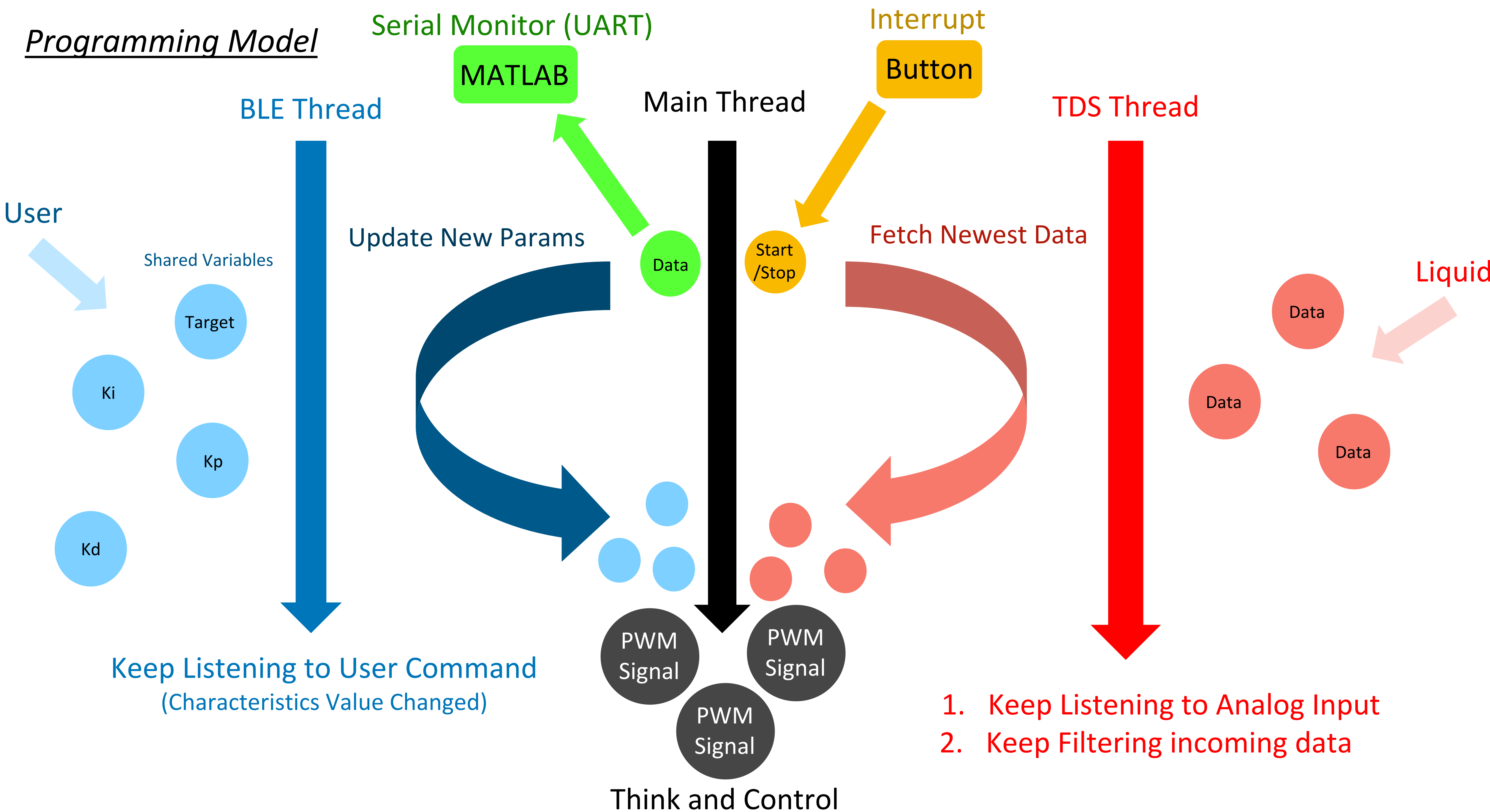
Software

Embedded

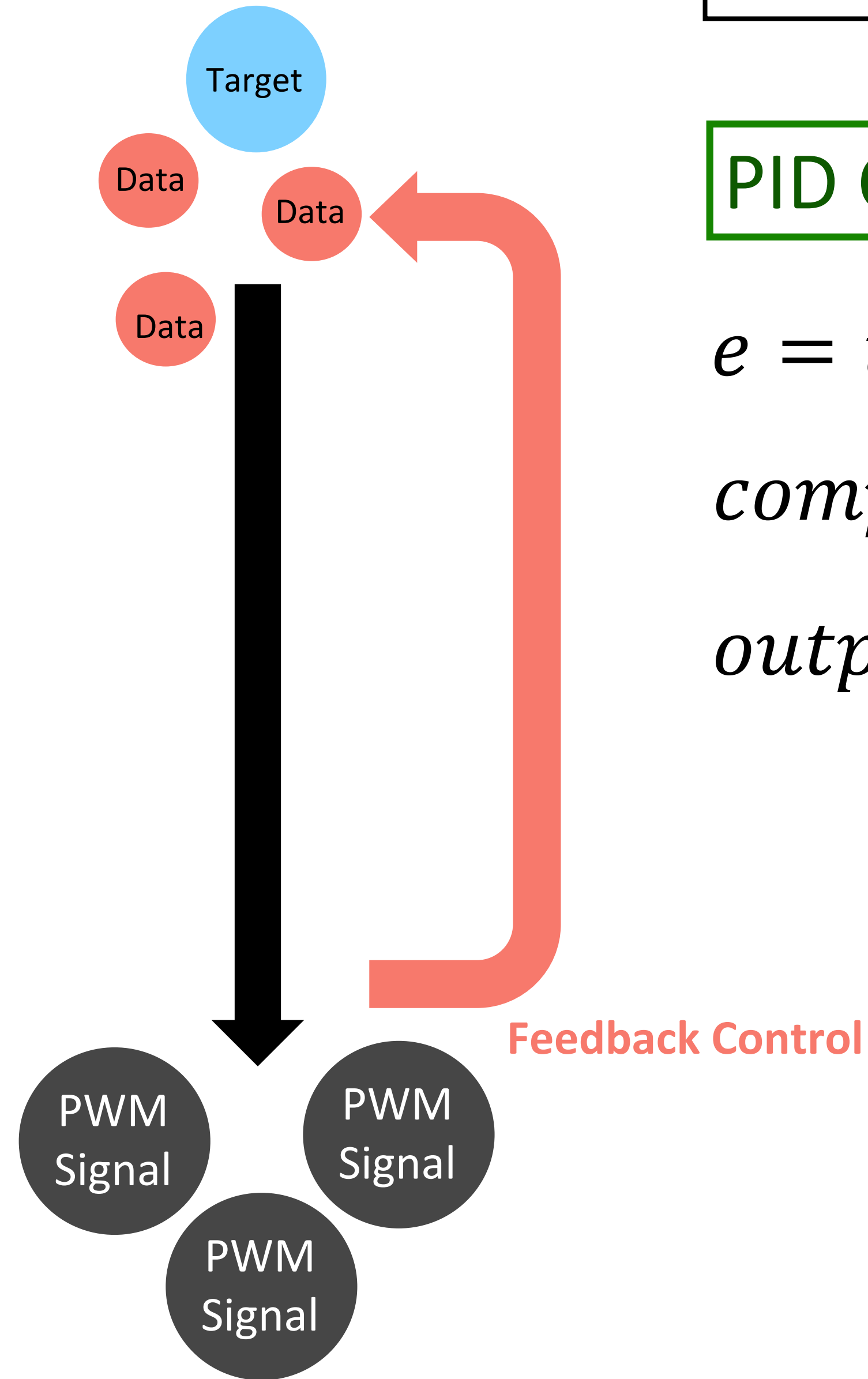
Mechanism



Programming Model



Control Strategy

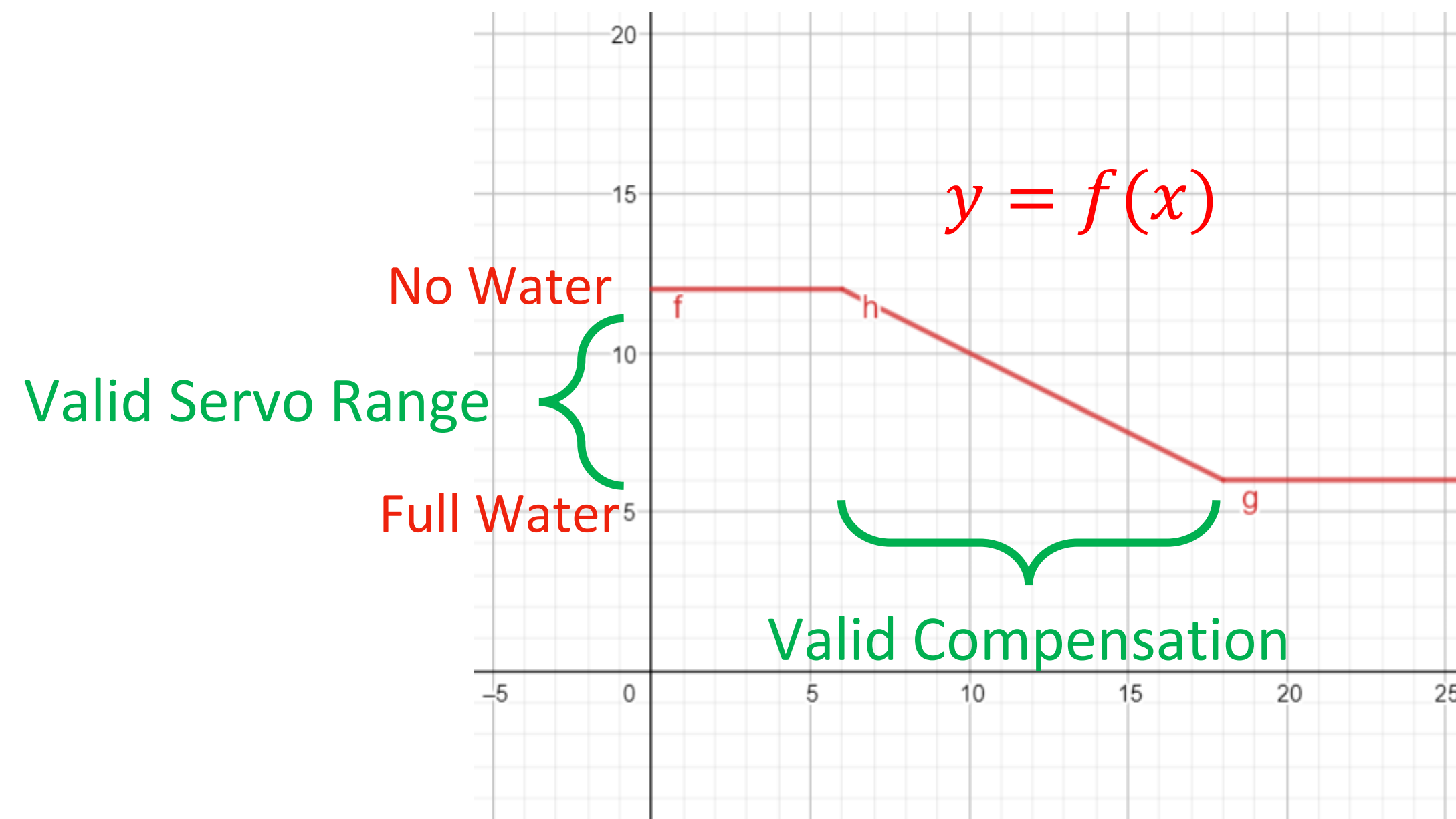


Think and Control

How to map TDS Measurement to Output Servo PWM?

PID Controller

$$e = target - measurement$$
$$compensation = \underbrace{kp \cdot e}_{\text{Proportional}} + \underbrace{ki \cdot \int e dt}_{\text{Integral}} + \underbrace{kd \cdot \frac{de}{dt}}_{\text{Derivative}}$$
$$output PWM = f(compensation)$$

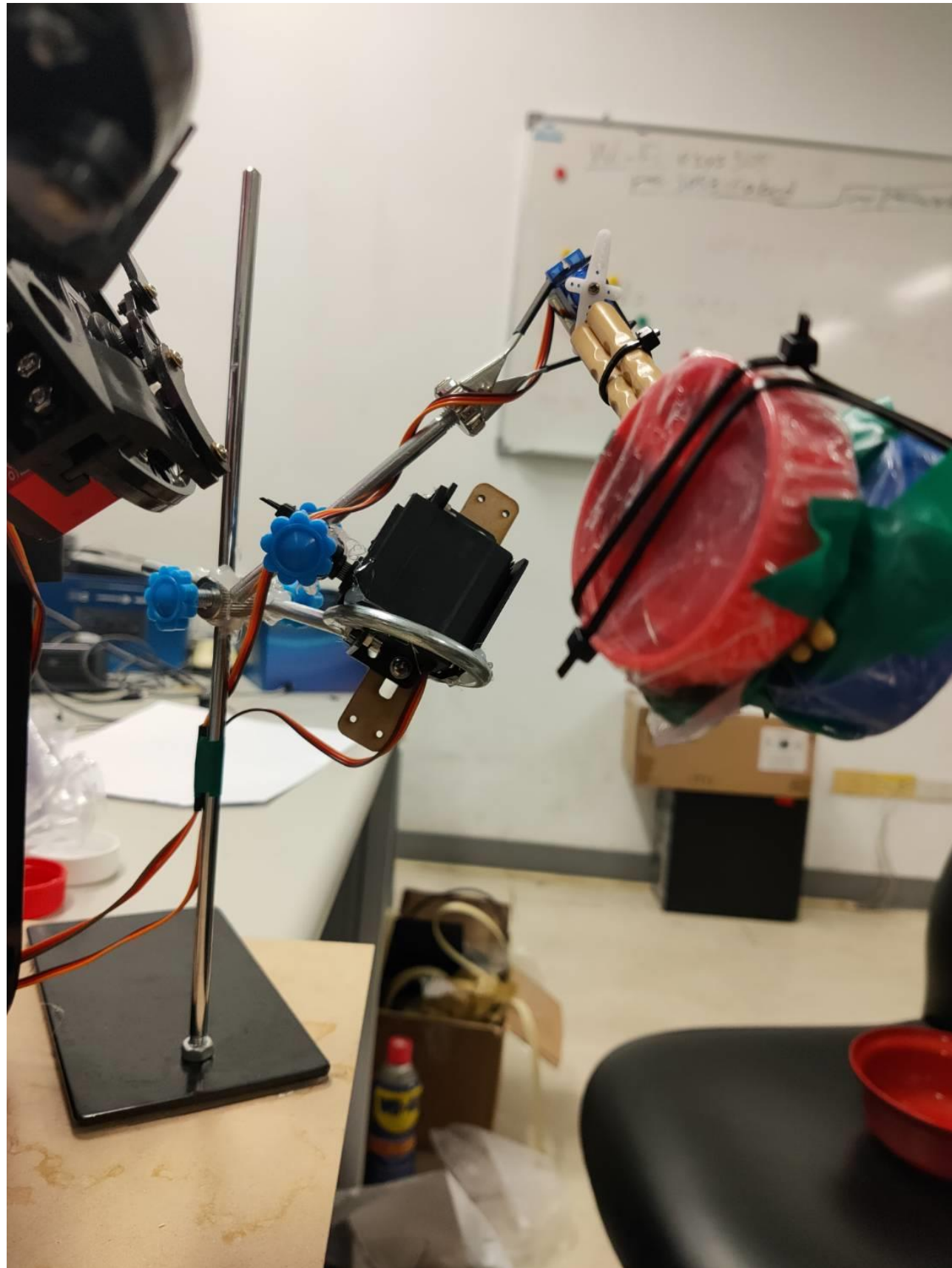


Mechanisms

How to design mechanisms to meet our needs?

Sweat, Tears, and \$

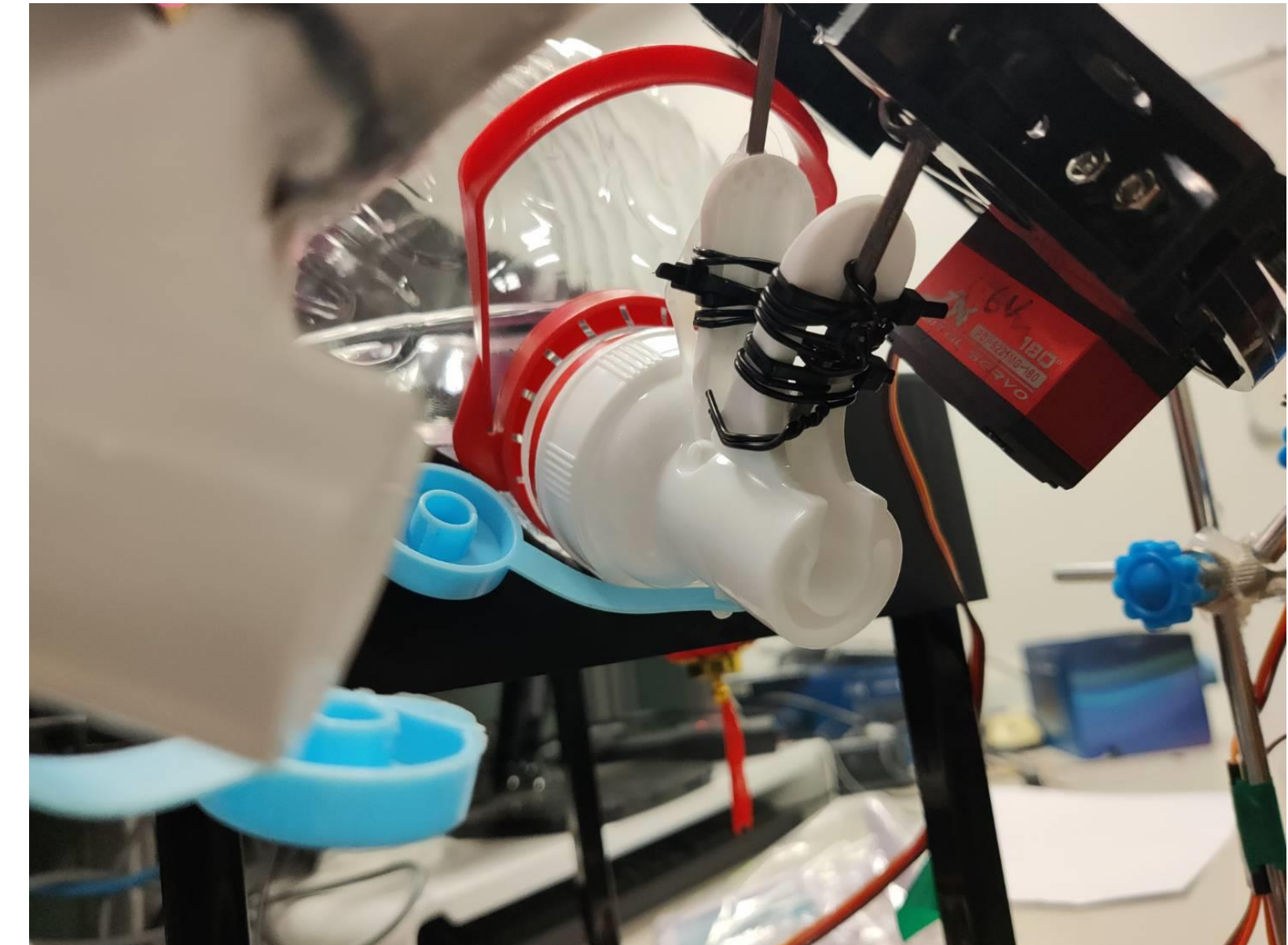
Stirring Mechanism – 2 axis robotic arm



Robotic Claw



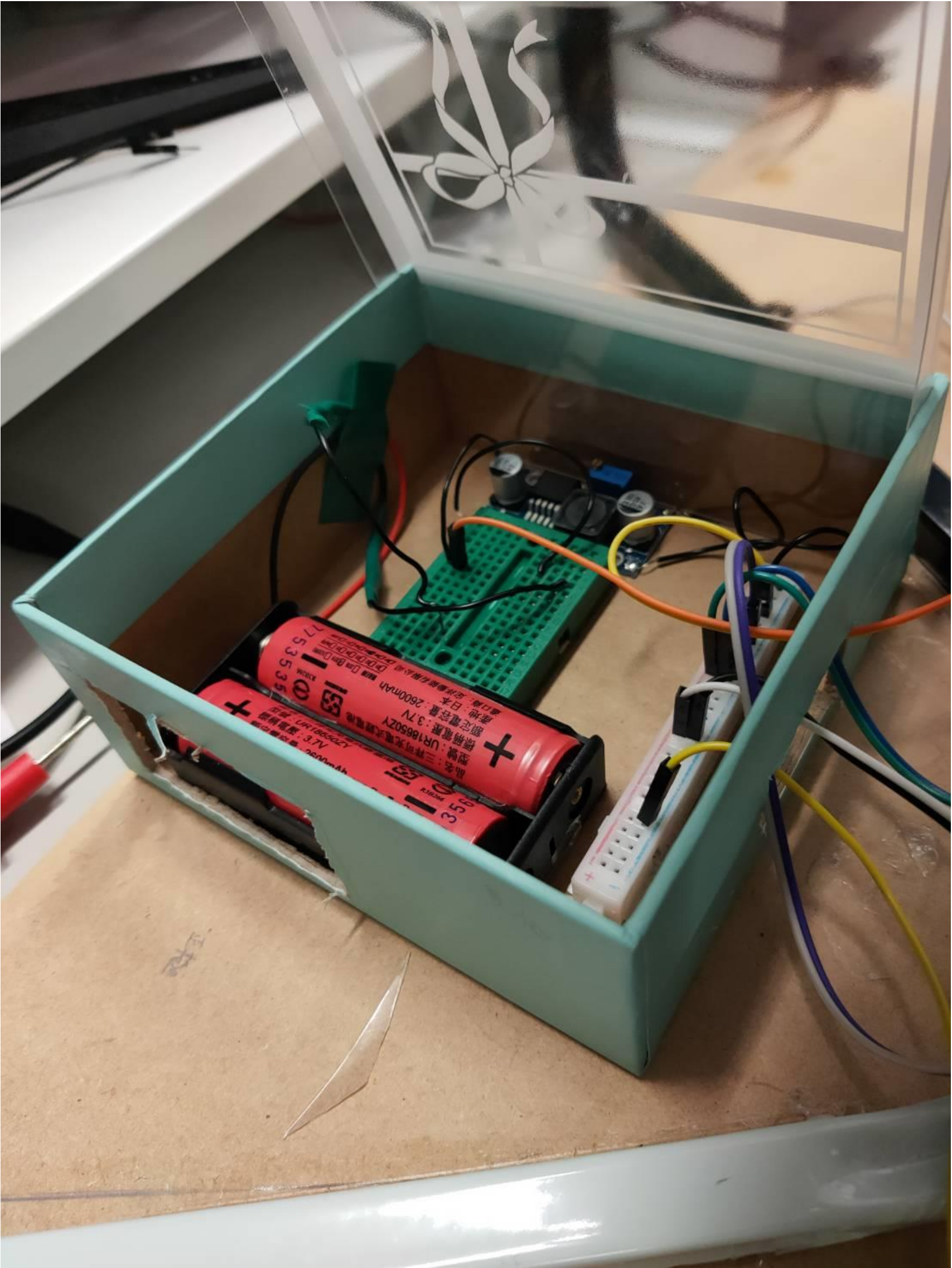
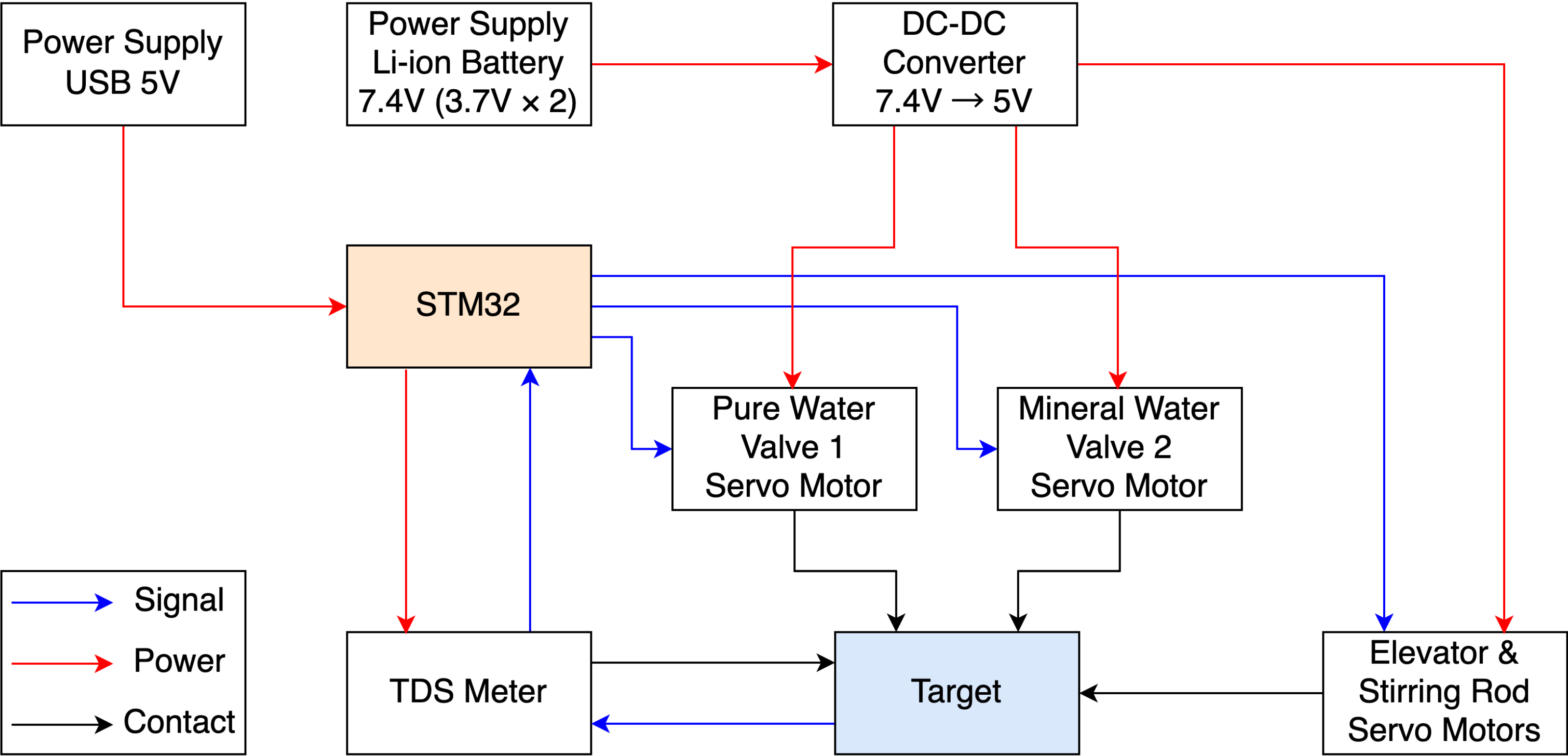
Customized water valve



推薦好用工具: 束帶, 電工膠帶, 密集板, 鐵棍, 水瓶架, 攪拌支架, 測量容器, 線組小的杜邦線, 教室裡的焊槍, 熱熔膠槍, 保鮮膜, 自製防水禮物盒, 漏斗, 水桶, 拖把, 以及明達的電梯 (幫忙扛水)

Mechatronics

All I want is a stable cable.

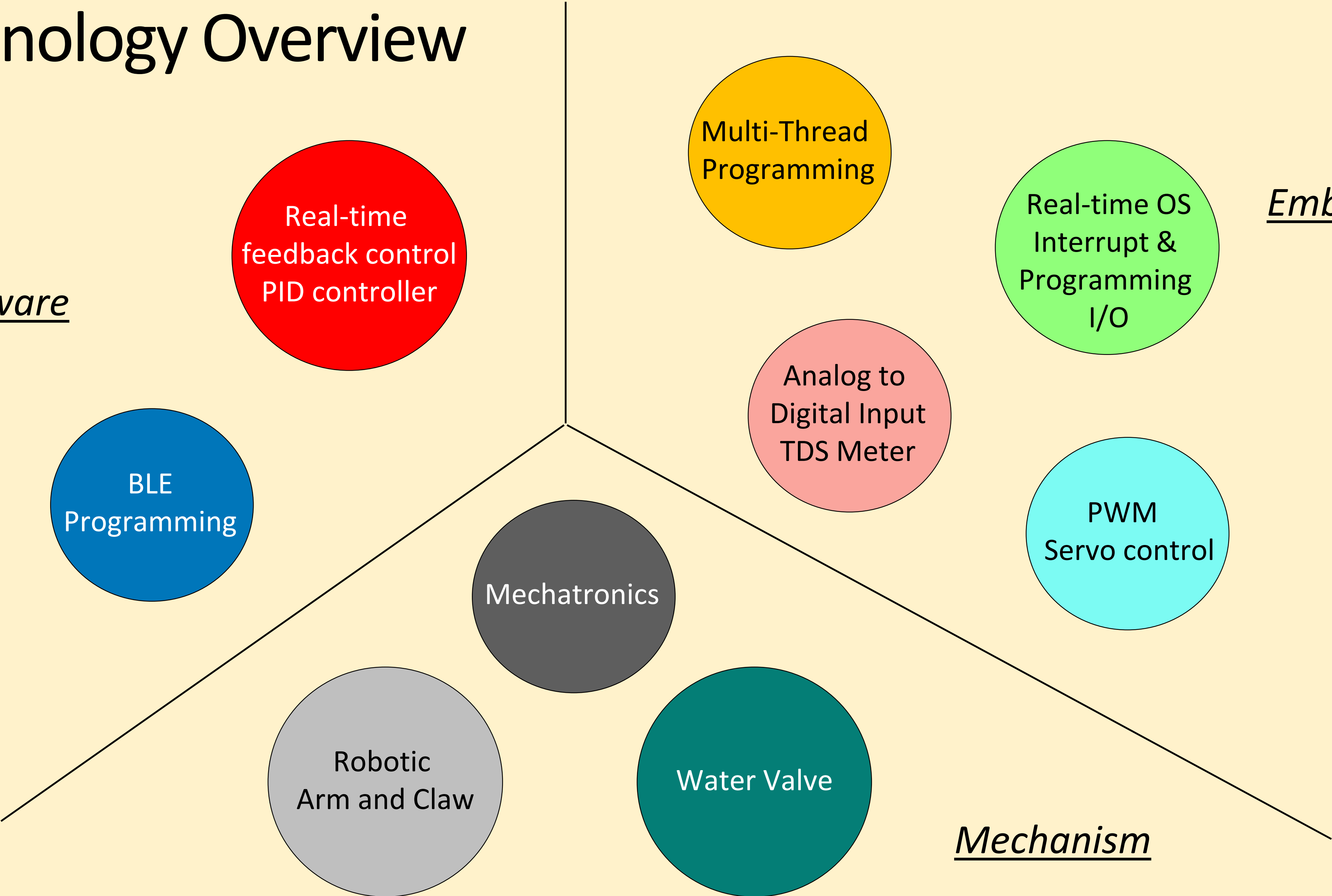


Technology Overview

Software

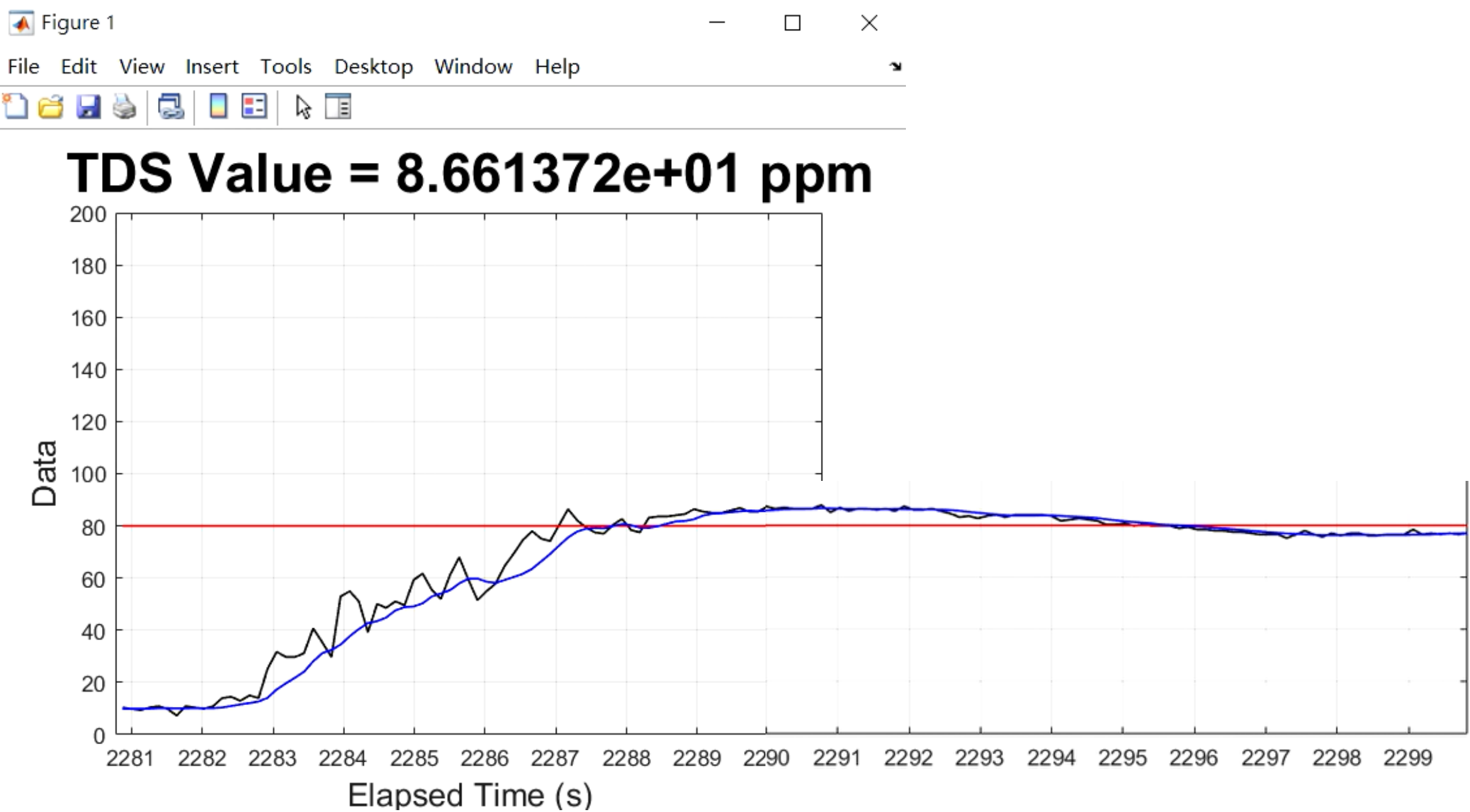
Embedded

Mechanism



1. Starting from 3 ppm to target = 80 ppm => Result: 77 ppm, error: <4%

Experiment Results



2. User changed target to 120 ppm => real-time control, result: 118 ppm, error: <2%

