

HAPPY PAWS

Automatic Pet Feeder

**ELE 417 – Embedded System
Design Project**

Presented by

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Presentation Outline



- 1. Project Motivation & Objectives**
- 2. System Architecture**
- 3. Software Implementation**
 - a. User Interface (LVGL)**
 - b. Backend Logic & Algorithms**
- 4. Mechanical Design & Manufacturing**
- 5. Integration & Testing**
- 6. Conclusion & Demo**



Project Motivation & Objectives

PROBLEM

- Busy Lifestyle
maintaining consistent feeding schedules
- Health Concerns
irregular feeding causes pet obesity or anxiety

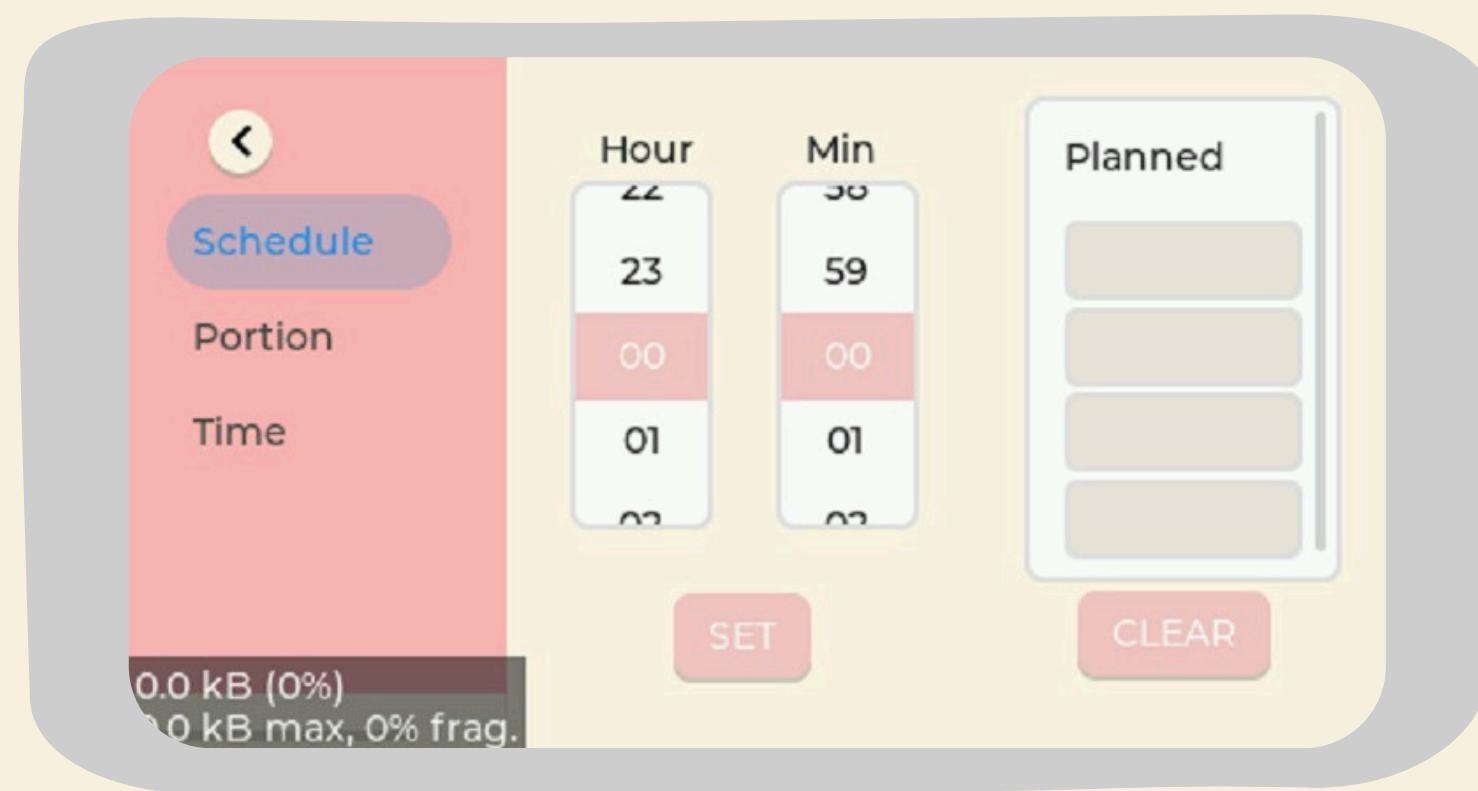
SOLUTION



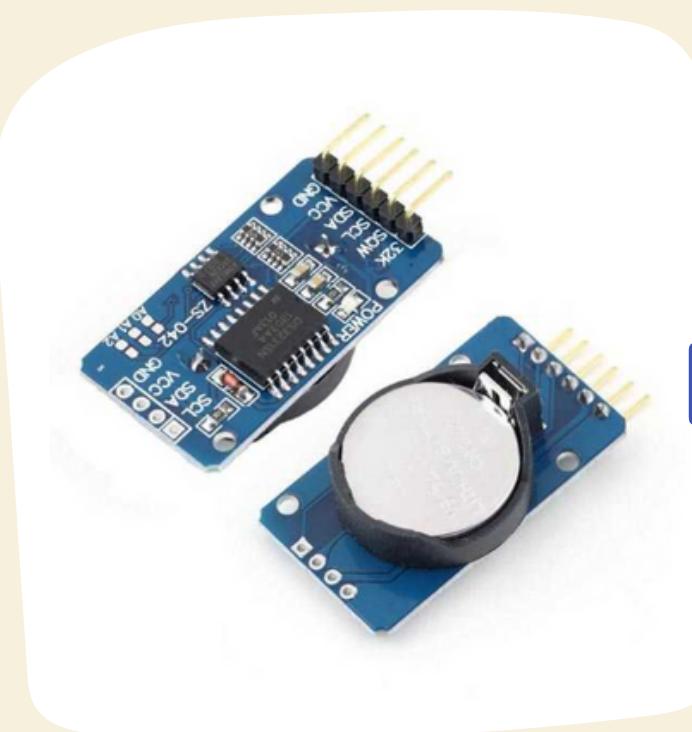
Interface Main Screen



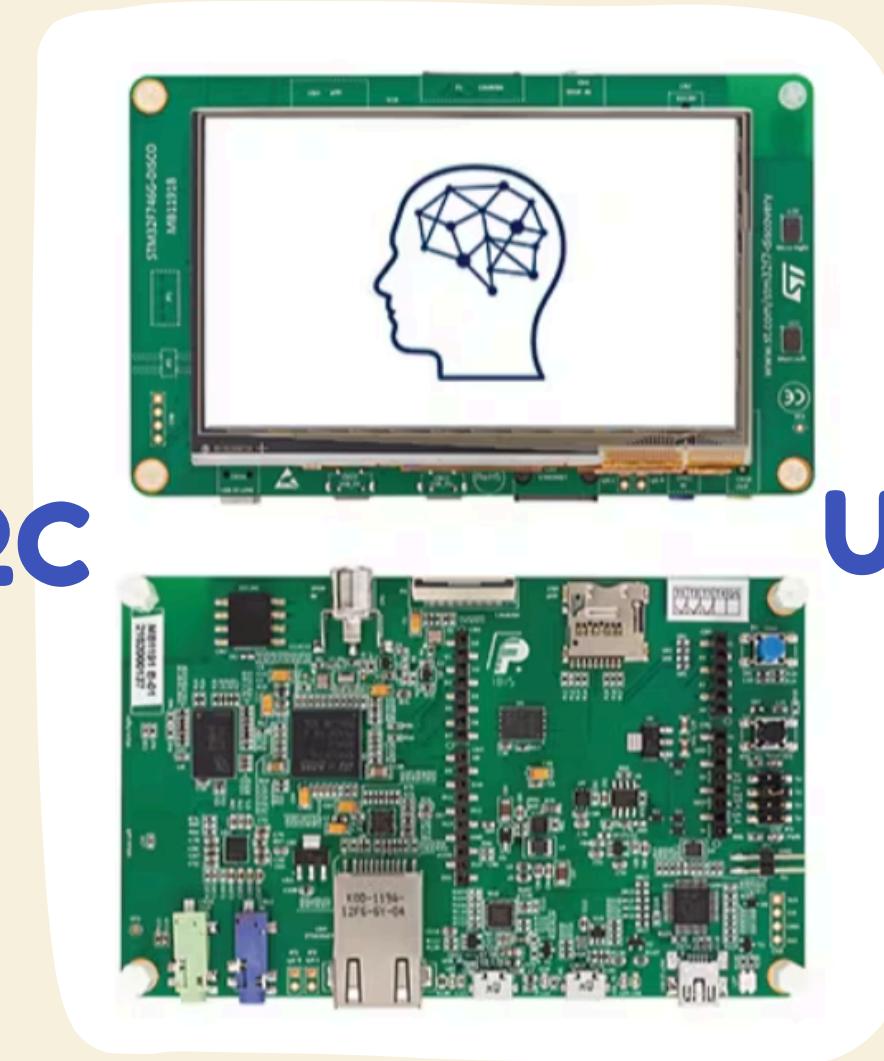
Settings Screen



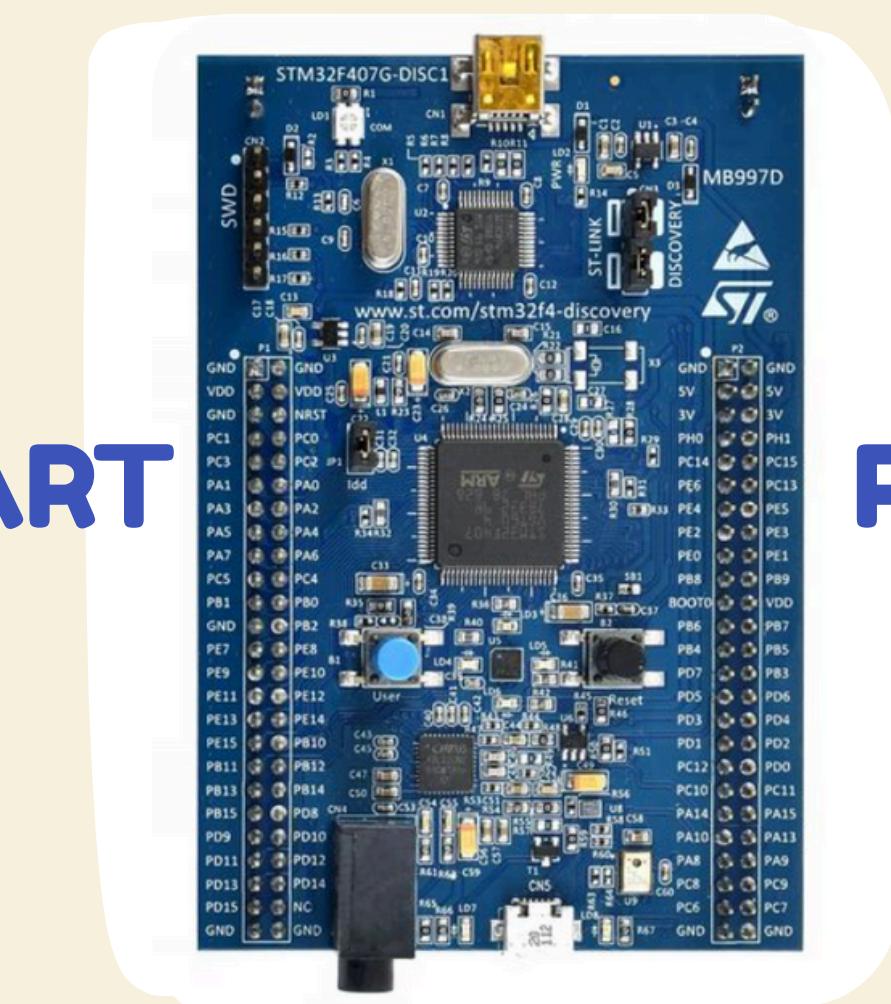
System Hardware Architecture



DS3231 RTC



STM32F746



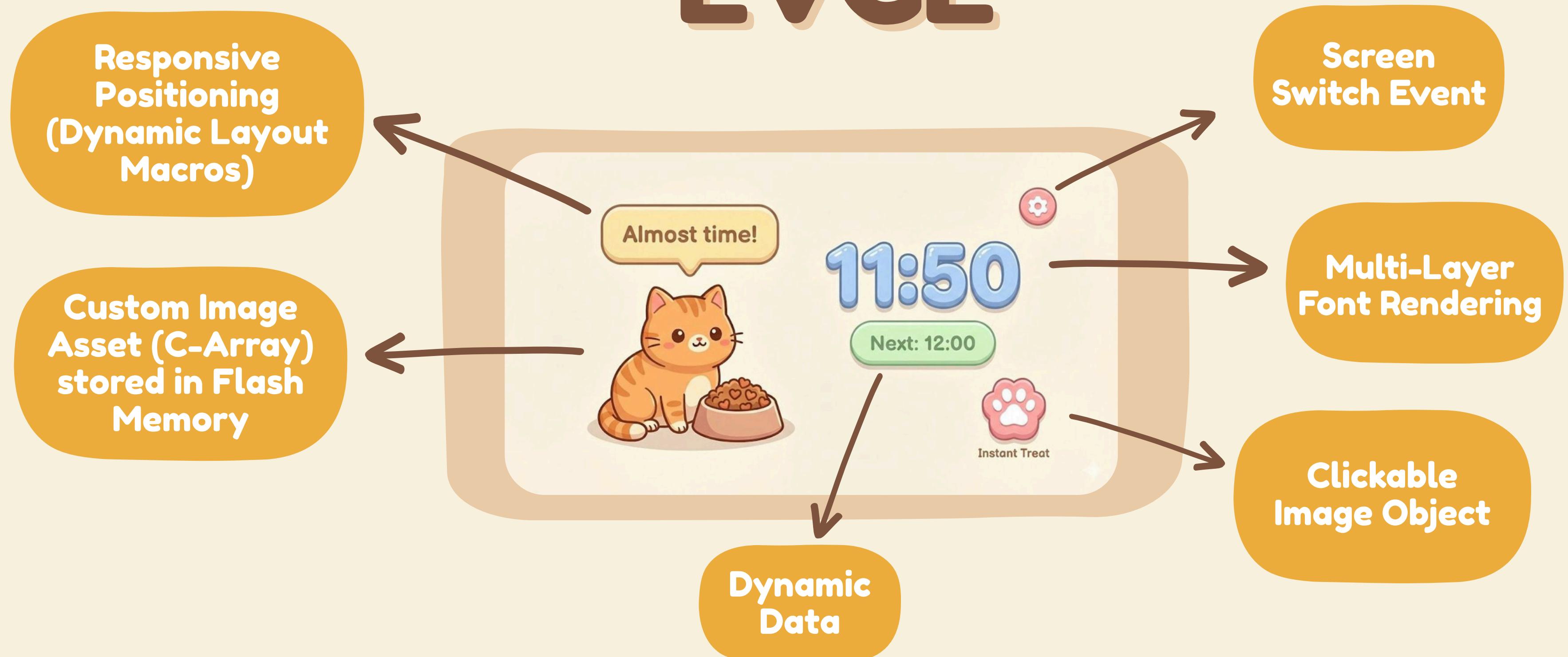
STM32F407



360° Continuous
Digital Servo
DM-S0306D

**Software
&
Logic**

Interface Implementation LVGL



LVGL Code Snippets

Custom Image Asset

```
LV_IMAGE_DECLARE(cat);
lv_obj_t* img_cat =
lv_image_create(home_scr);
lv_image_set_src(img_cat, &cat);
```

Clickable Image Object

```
lv_obj_add_flag(img_paw,
LV_OBJ_FLAG_CLICKABLE);
lv_obj_add_event_cb(img_paw,
home_event_cb, LV_EVENT_CLICKED,
&home_paw_event);
```

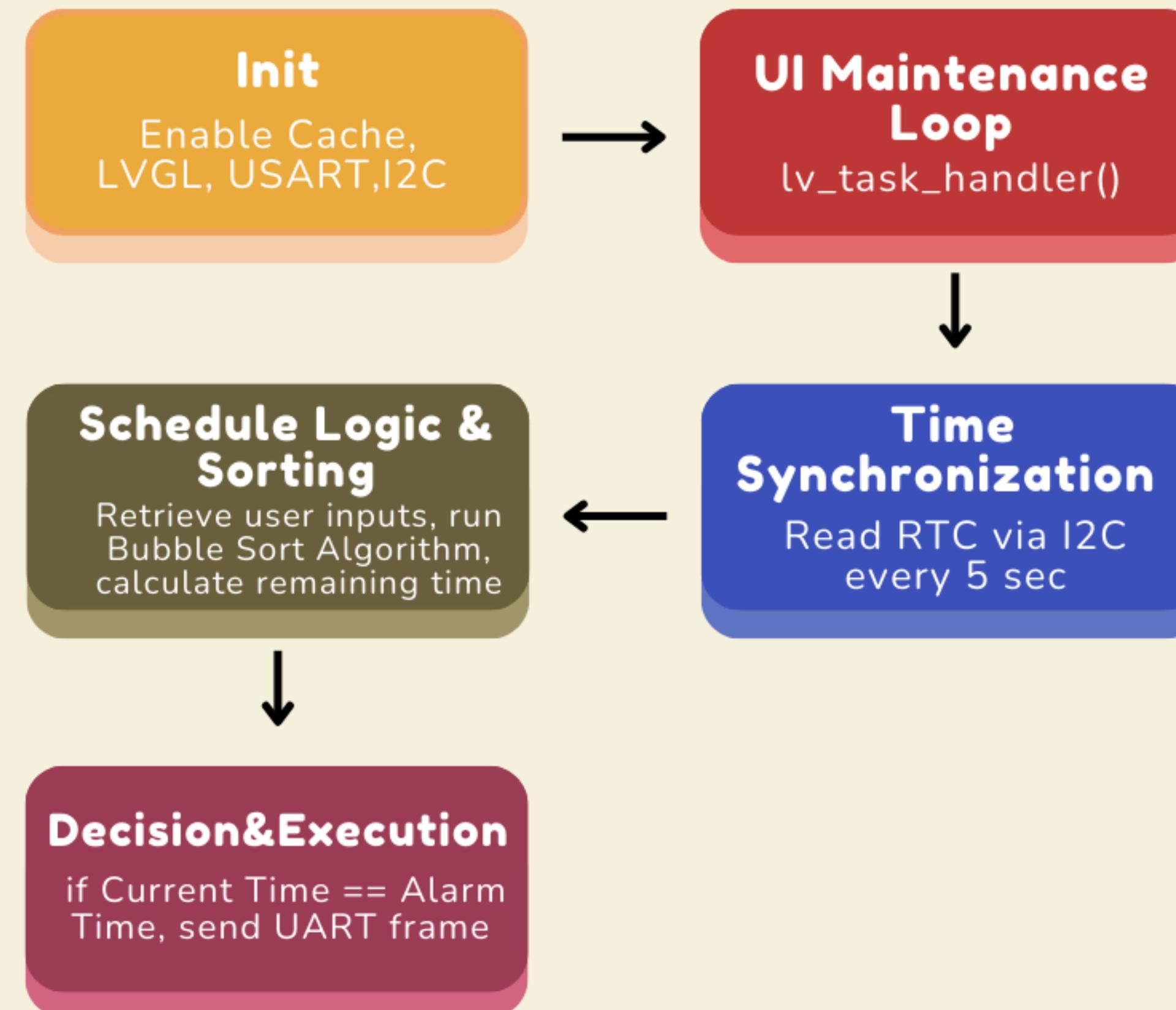
Event Handling

```
void home_event_cb(lv_event_t* e){
    uint8_t evt =
    lv_event_get_user_data(e);
    switch (evt){
        case PAW_CLICK:
            send_uart_feed();break;
        case SETTINGS_CLICK:
            lv_screen_load(settings_scr);
            break; }
```

Driver Integration

```
static uint16_t buf1[HOR_RES * 68];
static uint16_t buf2[HOR_RES * 68];
disp=lv_display_create(HOR_RES,
VER_RES); lv_display_set_buffers(disp,
buf1, buf2, ...);
lv_display_set_flush_cb(disp,
tft_flush_cb);
```

Main Loop Architecture



UART Communication Protocol



#

1

3:Instant
Feed
4:Set
Portion

A: 10g
B: 20g
C: 30g
D: 40g
E : 50g

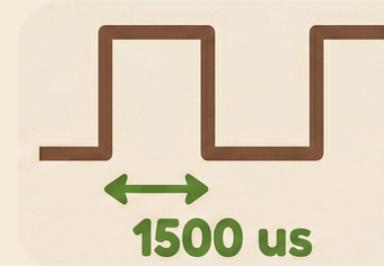
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Actuation Logic

Continuous Rotation Servo

PWM Signal - TIMxCCR

- 1500 us: STOP (Neutral point)
- 1100 us: FAST RIGHT (Feeding direction)
- 1900 us: FAST LEFT (Un-jamming direction)



Smart Dispensing & Anti-Jamming

`dispense()`

**breaks the total feeding
time into smaller chunks**

`jerk()`

**dislodges any jammed
food automatically**

Left → Right → Stop

Receiver Logic & State Machine

UART State Machine

switch-case structure:
uart_process()

1. Idle (Wait #)
2. Check Addr
3. Check Cmd
4. Get Data
5. Check End (!)

Execution Logic

process_command()

1. Check Addr
2. switch(cmd)
3. InstantFeed → dispense()
4. SetPortion →
update_dispense_time() and
dispense()

Mechanical Design and Fabrication



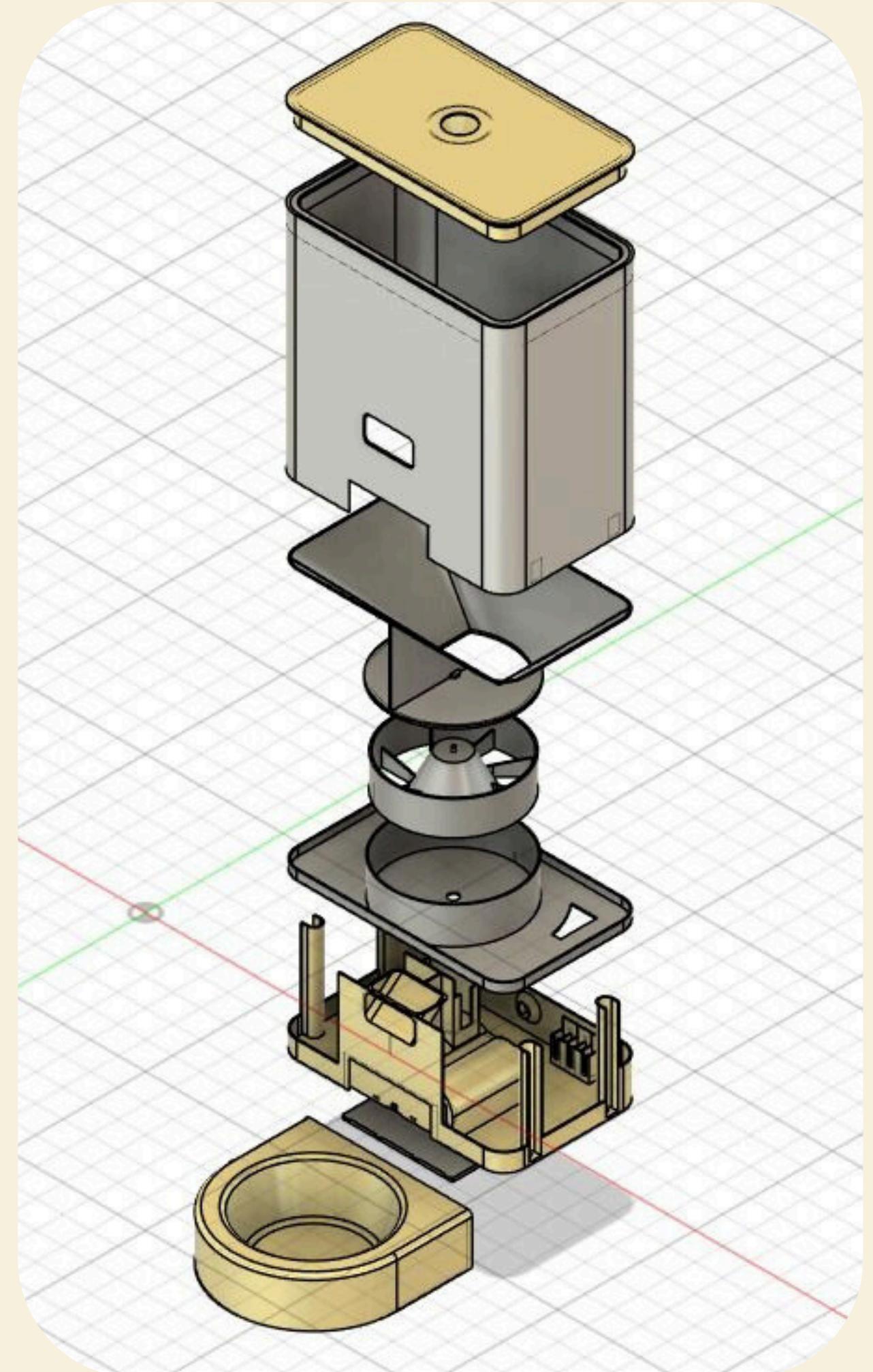
Modeled in Autodesk
Fusion (CAD)

Modular Architecture

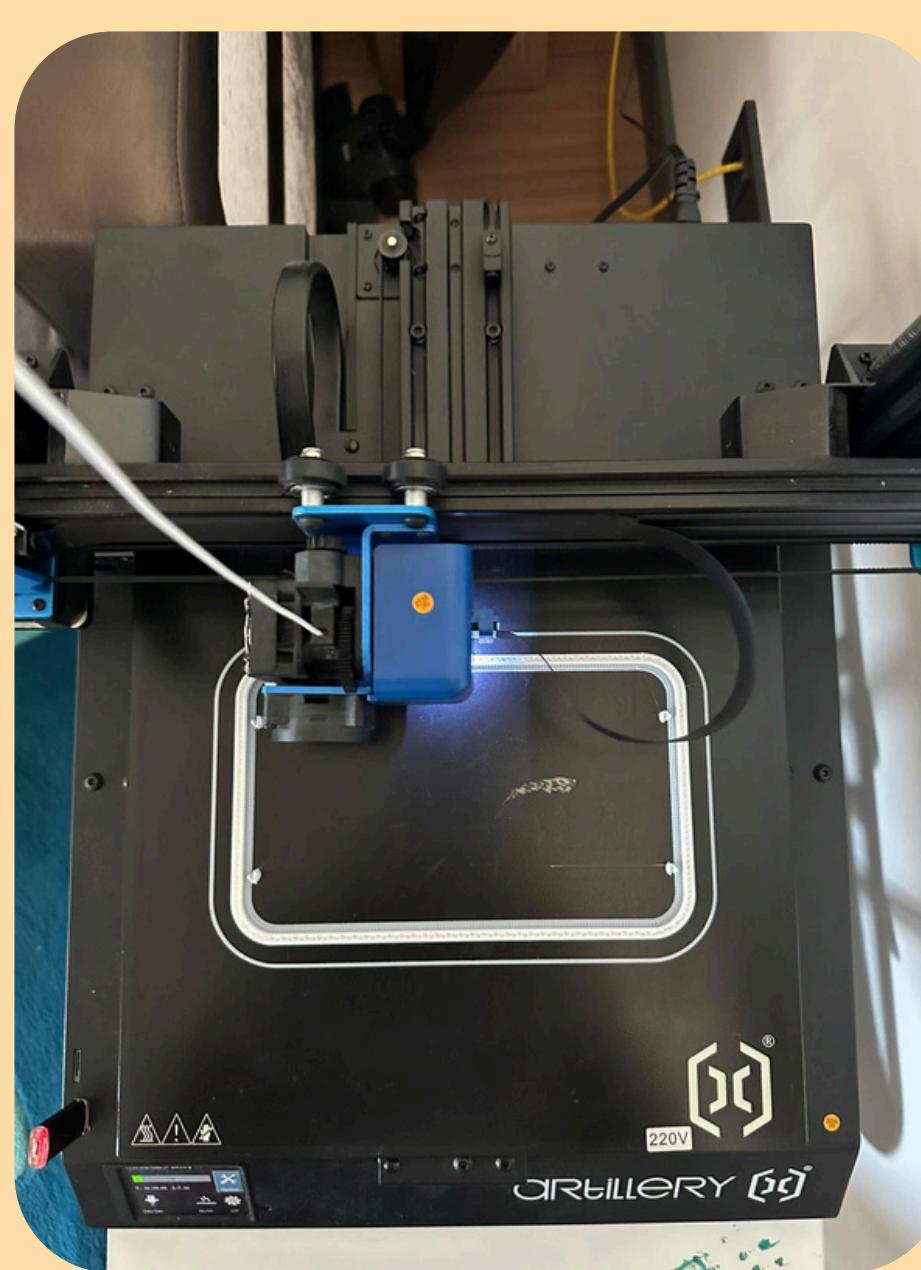
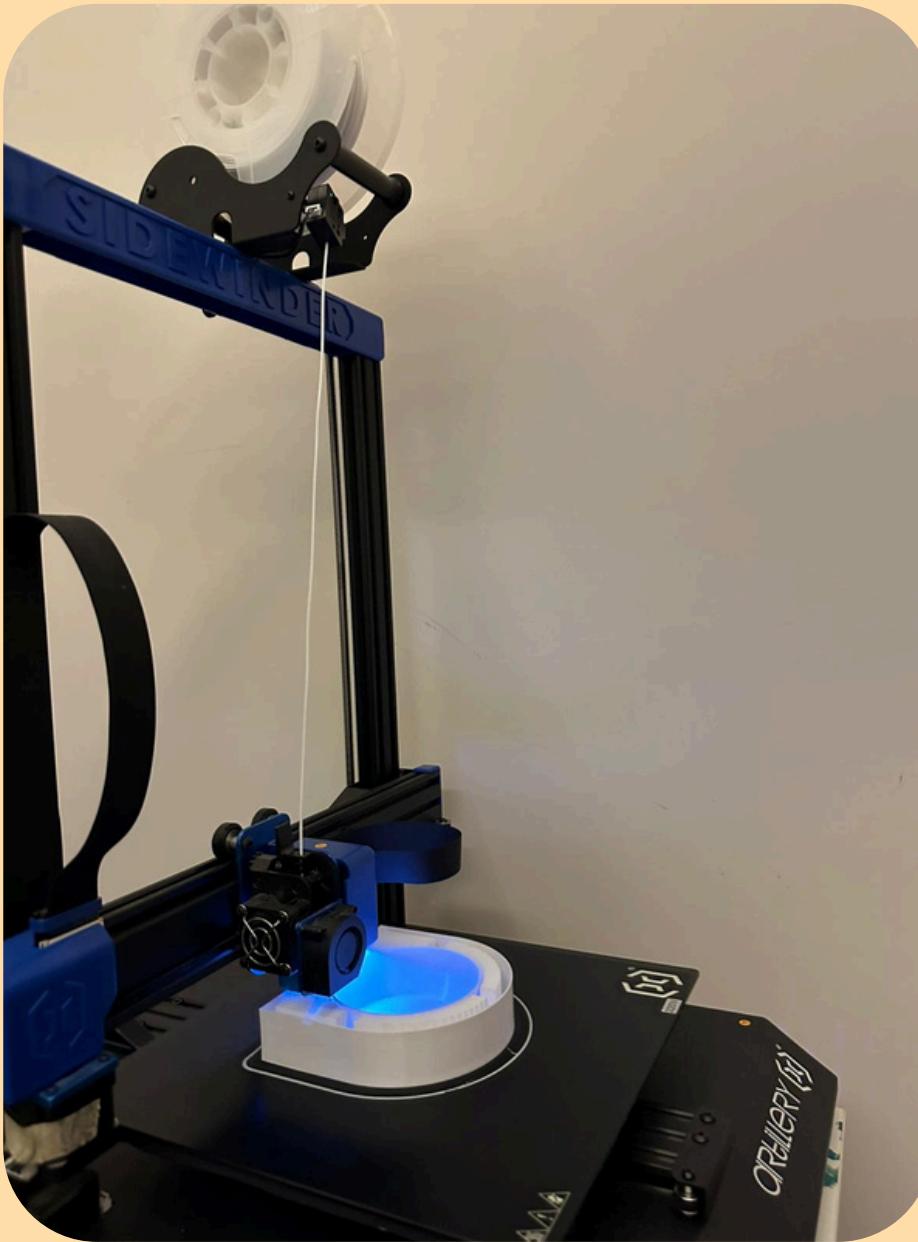
- easy assembly, cleaning, and maintenance.

The Mechanism

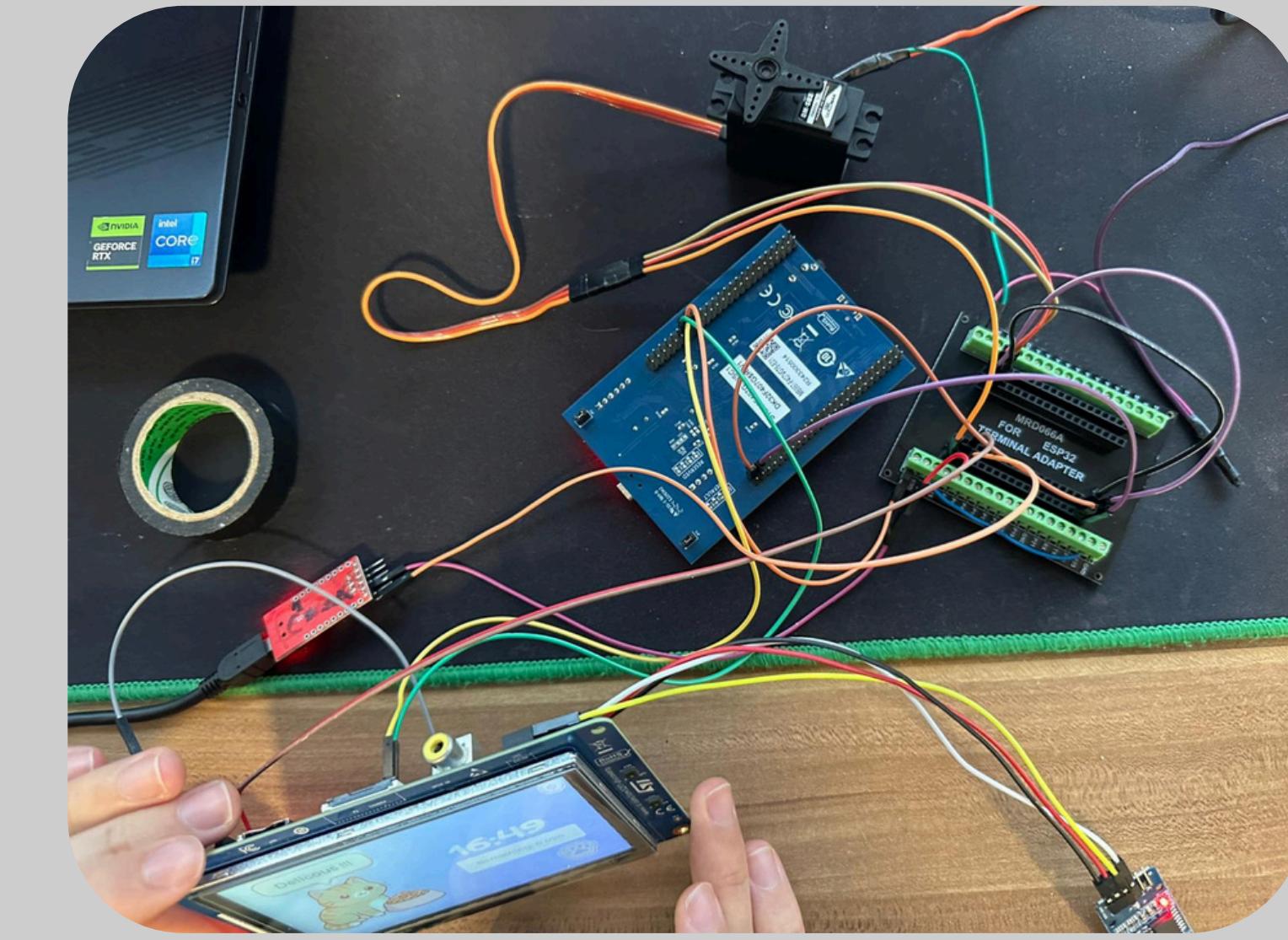
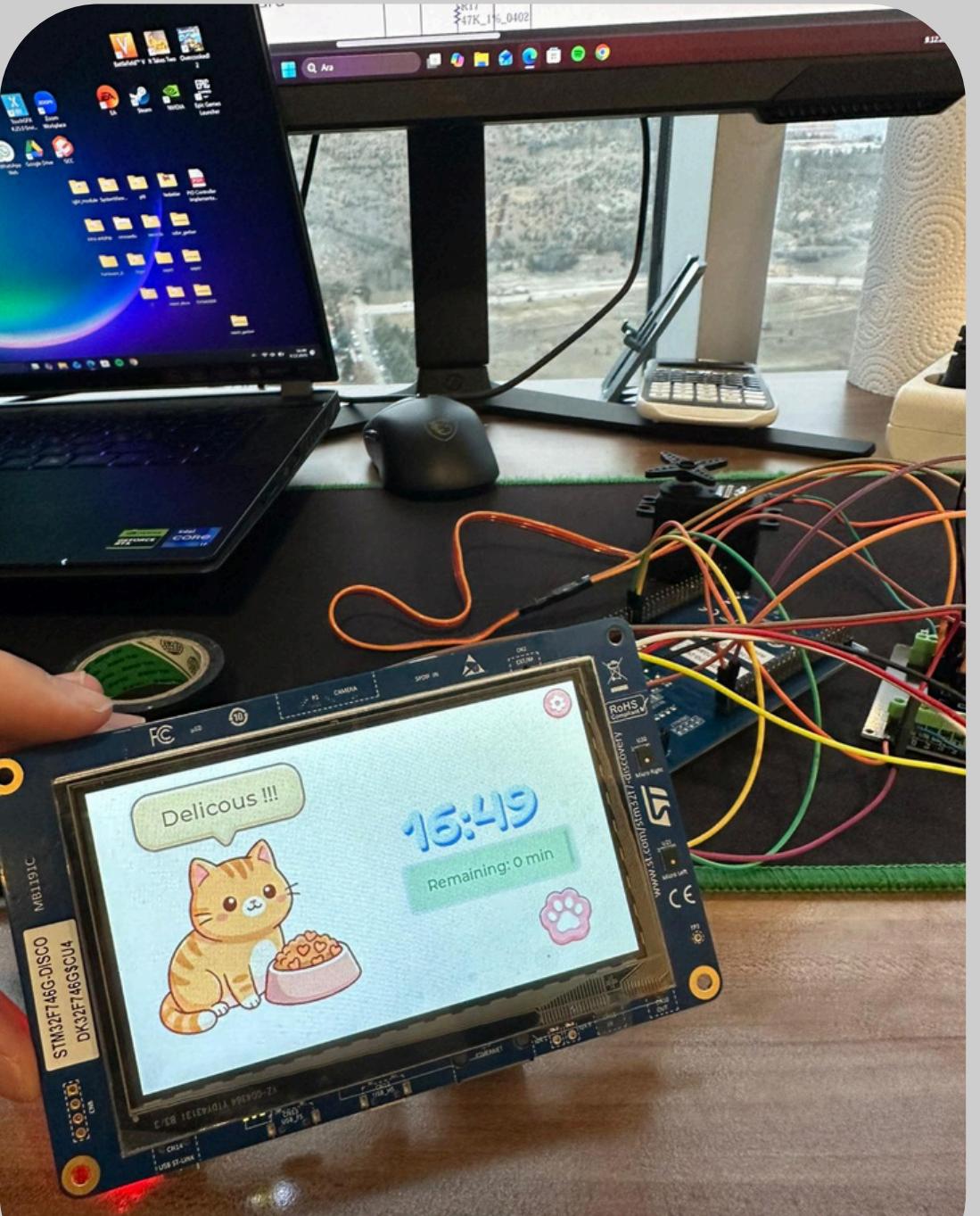
- Screw coupled to the 360° Servo
- Ensures consistent portion volume per rotation.



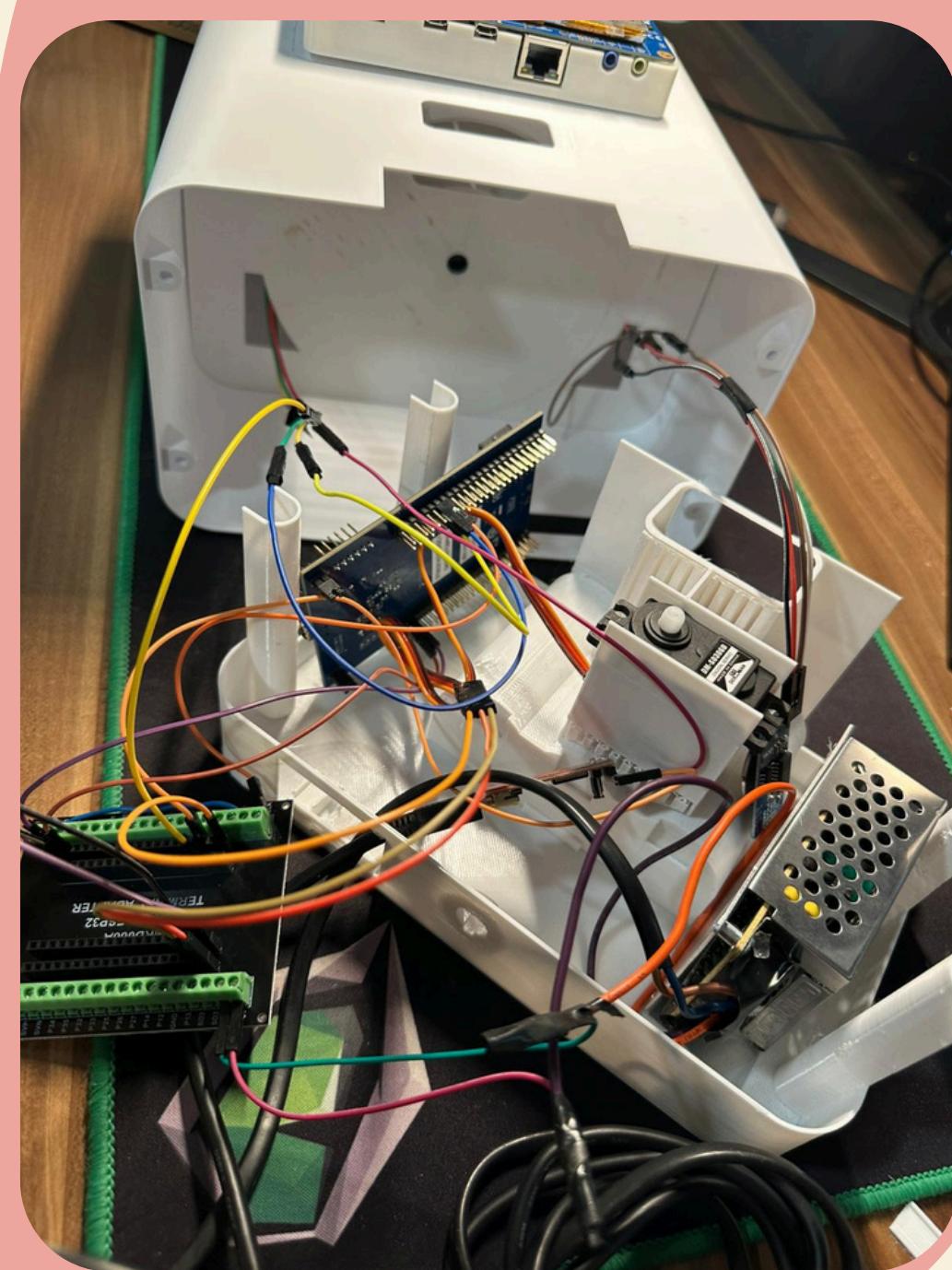
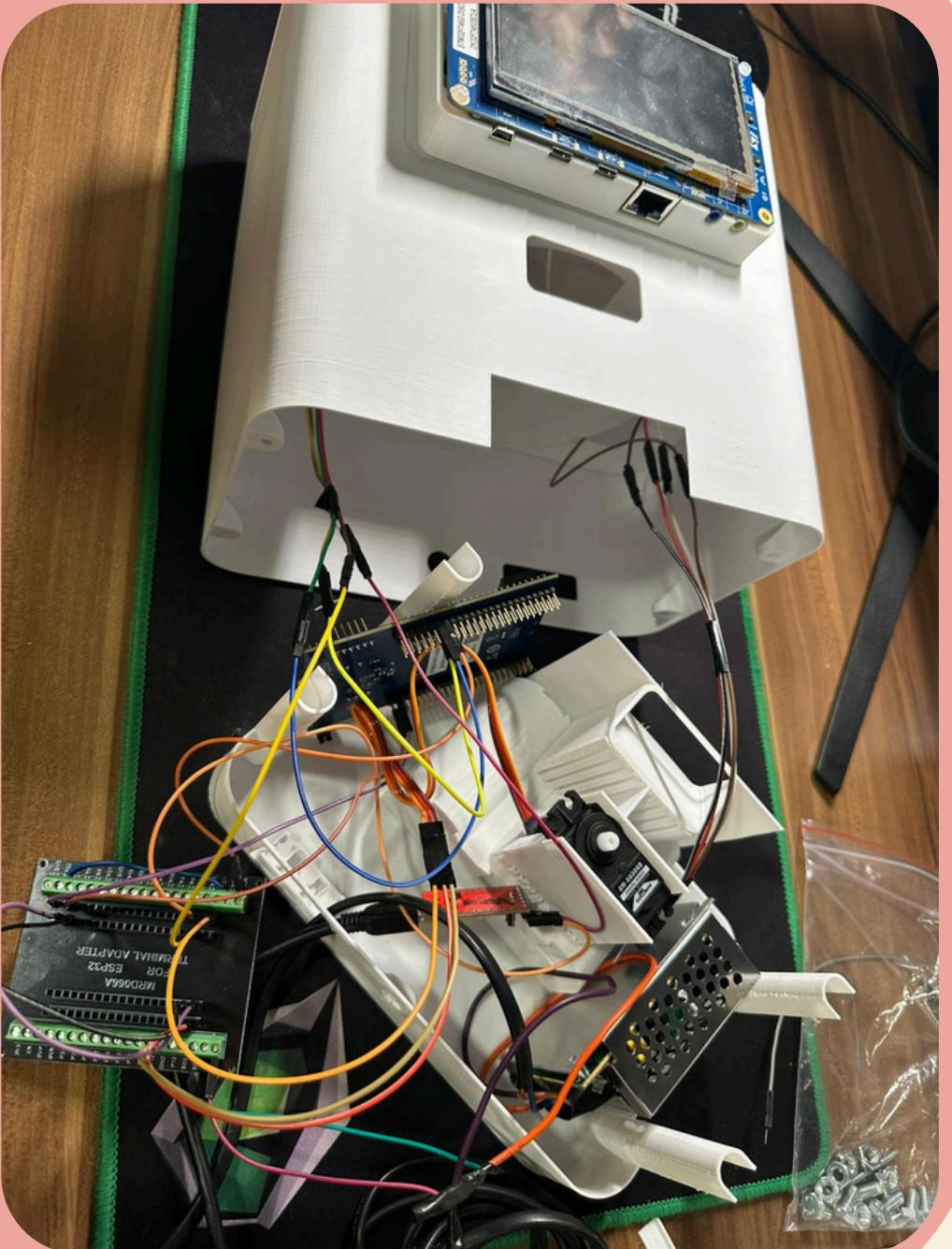
Fabrication Process



Integration & Bench Testing



System Integration



HAPPY PAWS !





YouTube

Happy Paws - Hacettepe University ELE417

Embedded System Design

https://youtu.be/s-Ppv_qkkEE?si=Rj4htiv9ozRpaj5X

