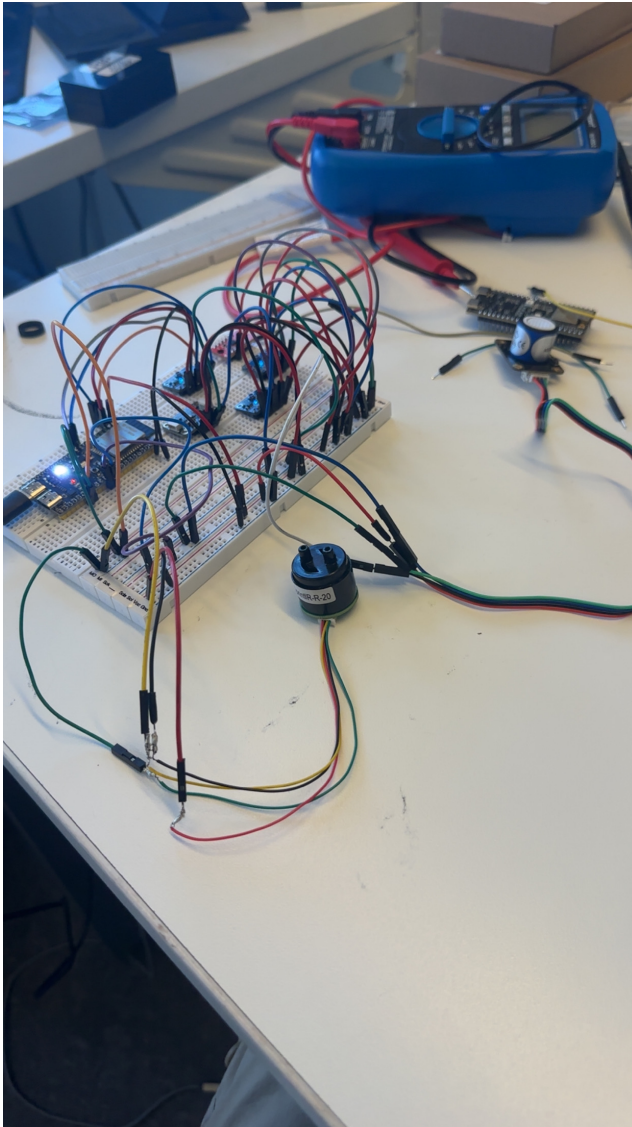
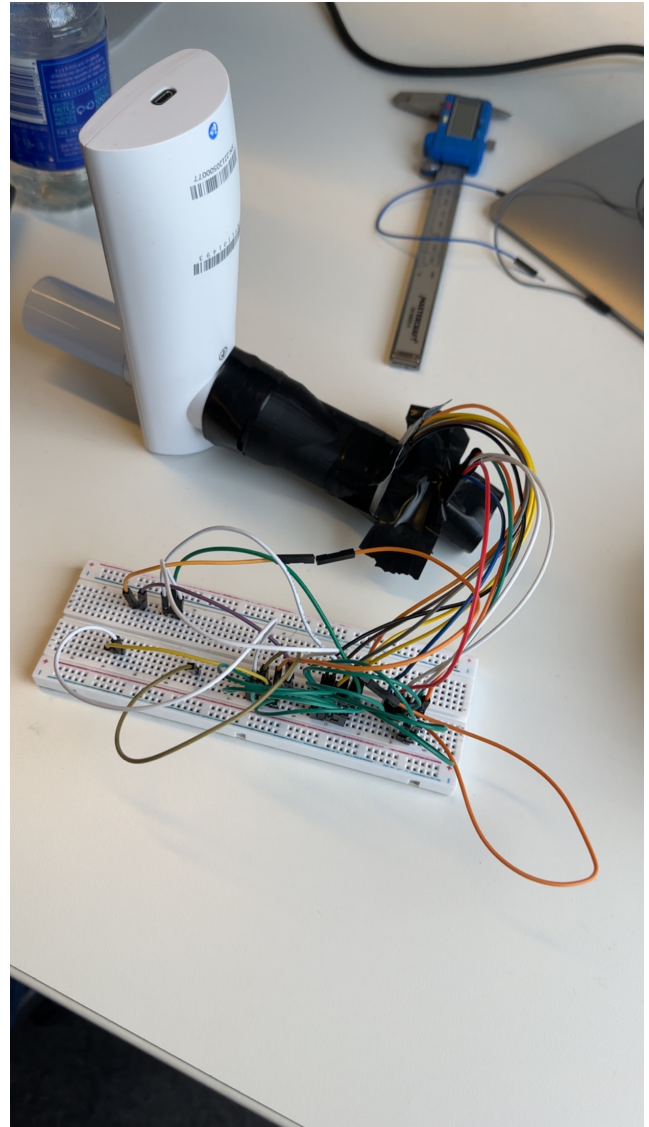


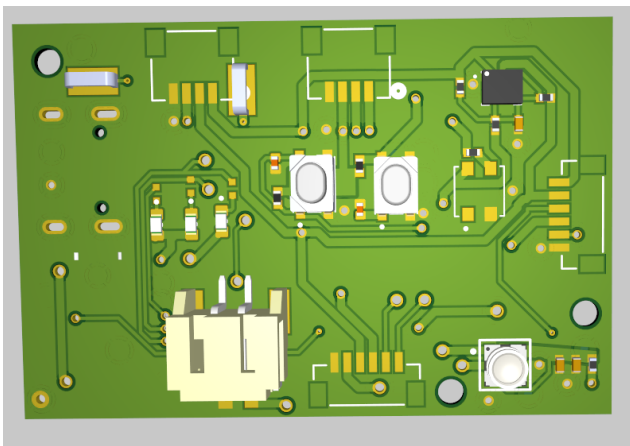
## ESP32 S3 Wearable Health and Respiratory Device



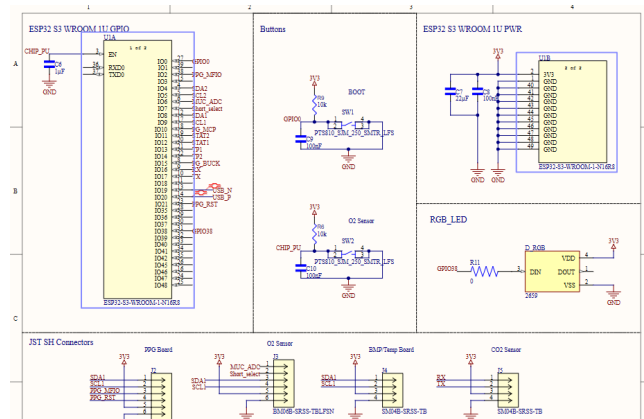
(a) Breadboard prototype



(b) Sensor and flow setup



(a) Custom Integrated ESP32-S3, Sensors, Power PCB



(b) ESP32-S3 Schematic



## Hardware and UI

ESP32 drives a 2.8 inch SPI TFT display and capacitive touch panel, with LVGL layouts for play, pause, skip, and volume.

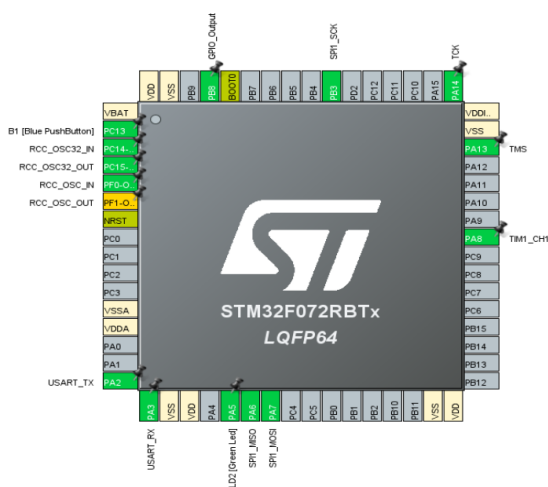
## Browser Extension

Chrome extension calls the YouTube metadata API to pull video title, playback state, and timestamp, then packages JSON and sends it with WebSockets.

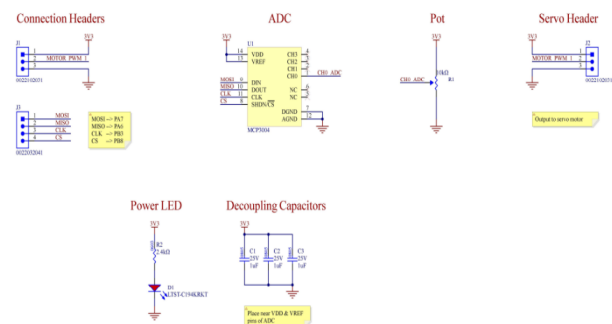
## Communication

- **Incoming:** Flask WebSocket server relays JSON from the browser to the device.
- **Outgoing:** Device sends button press commands back to the server over UART to trigger play, pause, or skip.

## Motor Tester

[GitHub](#)


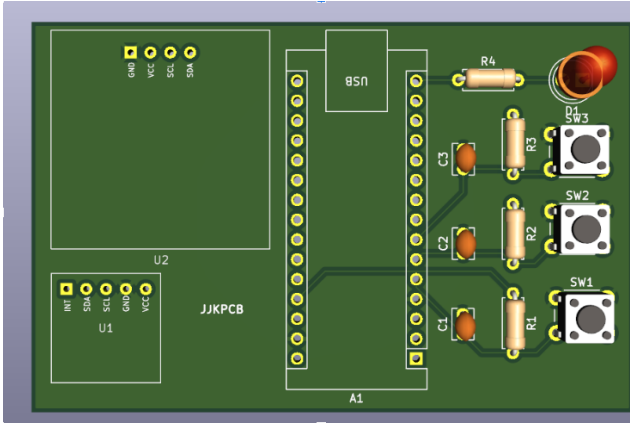
(a) STM32 pin mapping



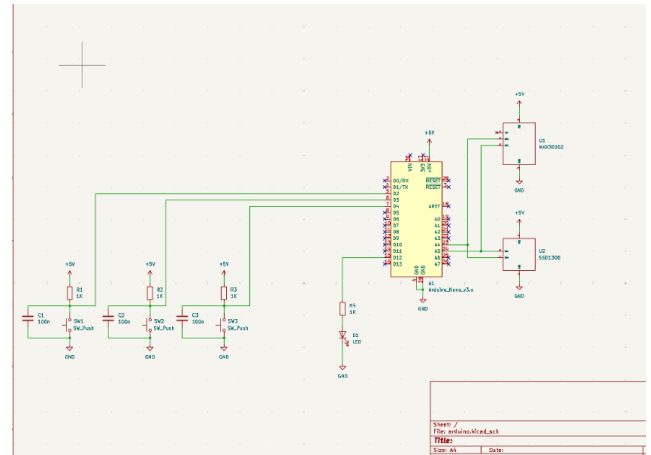
(b) ADC and servo schematic

- Automated servo and continuous rotation motor tests by reading potentiometer positions through an SPI connected ADC and generating PWM control signals.
- Wrote SPI drivers to sample external ADC voltages and tuned timer based PWM to convert readings into speed and direction.

## Heartbeat Monitor PCB Design



(a) PCB render



(b) Circuit schematic

- Designed a custom PCB in KiCad with the MAX30102 for heartbeat and oxygen saturation.
- Integrated I<sup>2</sup>C with an Arduino for live BPM and SpO<sub>2</sub> on an OLED display.
- Optimized placement and decoupling to improve signal quality and reduce noise.
- Implemented USB C power input with ESD protection and verified manufacturability with production Gerbers.