ELECTRICAL & COMPUTER ENGINEERING

Portland State UNIVERSITY

Practicum Product Description Specification

Tilt-Timer Cube

ECE 411 - *Industry Design Processes*

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Executive Summary with Concept of Operations

The Smart Timer Cube is a simple, hands-on way to keep track of time for studying, workouts, or lab work. Each side of the cube represents a different preset time—just flip it to start a countdown. A small OLED screen shows the timer, and a buzzer and LED light up when the time's up. The cube runs on a rechargeable LiPo battery and uses an Adafruit RP2040 microcontroller with an orientation sensor to recognize which face is active. Built from a 3D-printed shell, it's compact, sturdy, and easy to use anywhere. The goal is to make time management more intuitive and a little more fun for everyday use.

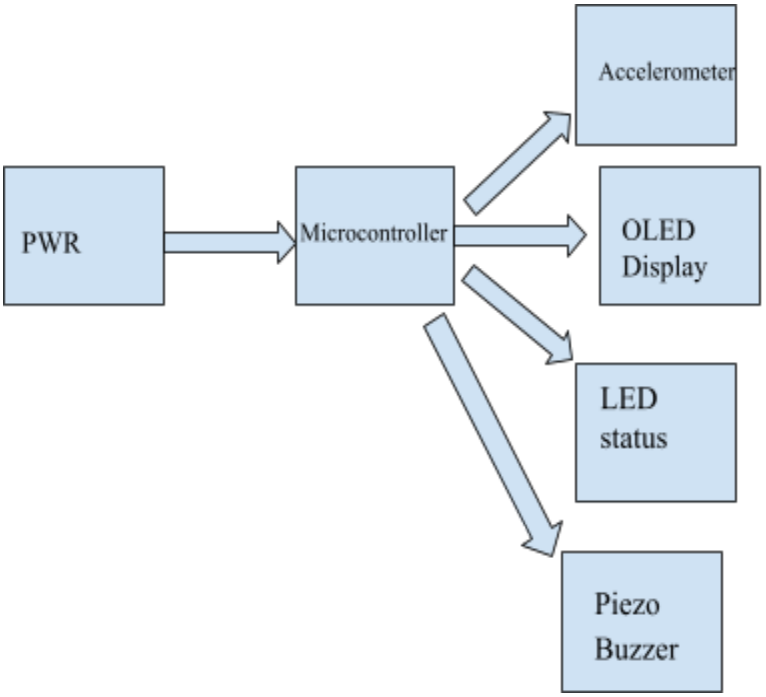
Marketing Analysis

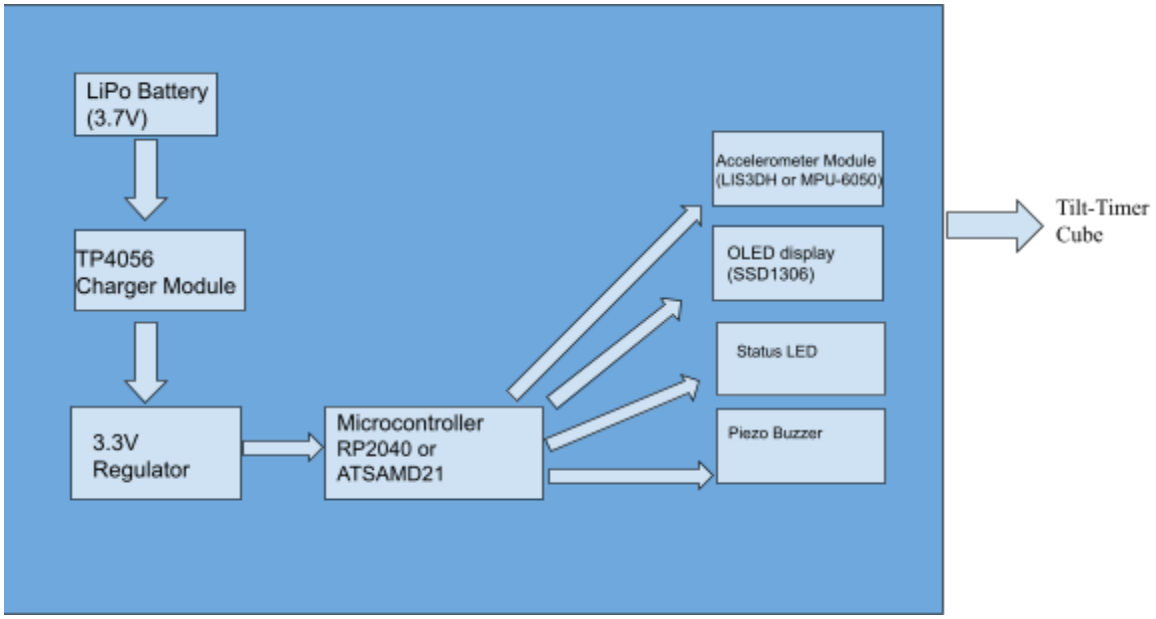
The Smart Timer Cube is designed for anyone who needs an easy way to manage time — students keeping track of study sessions, teachers timing classroom activities, or anyone who wants a quick, reliable timer on their desk. Other products like the TickTime Cube or TimeFlip offer similar ideas, but they're often limited or not customizable. What sets ours apart is that it's rechargeable, programmable, and open-source, meaning users can adjust it to fit their own needs. With a low build cost of about $25–$30, it could sell for around $45–$50, making it affordable while still offering more flexibility than what's currently on the market.

Requirements

- Must be portable
- Must have four different time settings
- Must last at least 1 hour
- Must be able to swap time settings while lying on each face
- Should be rechargeable
- Should be durable enough to fall from 4 feet
- Should beep when time is done
- The LED should blink with the Piezo
- May be in a colorful configuration
- May have a programmable face for user preference

System Architecture





Design Specification

- Processor/Board: Adafruit Feather RP2040 Adalogger RP2040 at 133 MHz, 8 MB QSPI.
- Actuators: SSD1306 128×64 OLED (I^2C 0x3C), piezo buzzer on D12 (PWM), status LED (D13) + onboard NeoPixel.

- Power: 3.7 V LiPo 150–300 mAh to on-board charger/regulator; USB-C for charge.
- I/O Bus: Shared I^2C via STEMMA QT for OLED + LIS3DH; SPI1 reserved for microSD (CS on D23).

- Mechanical: 120 mm 3D-printed cube, OLED on one face, internal standoffs, vent holes, labeled faces.
- Firmware: C, accelerometer low-pass + face map, OLED auto-rotate, buzzer/LED alarm.

- Arduino IDE
- Development Environment: VS Code + Arduino IDE