Introduction

This is **RGB Rush**! An interactive color-mixing game designed in embedded C. Experience the fun of FreeRTOS, ADC, timers, & multiplexing!

Touch the pressure sensors to start mixing colors! Do it for **5 rounds in a row** to win!

Results & Discussions

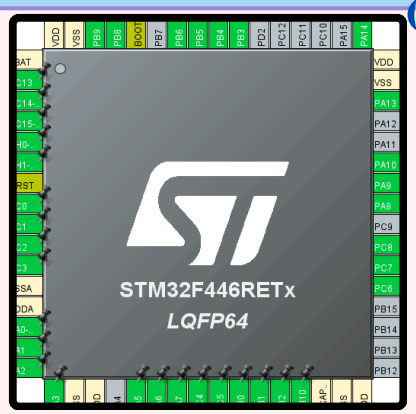
We found that users can win in **<20 seconds**, showcasing strong skills in:

- **Hand-eye coordination**
- **Color theory**
- **Pattern recognition**
- **Problem-solving**

Conclusions

This project successfully realized a fully functional embedded game system, validating **FreeRTOS**.

High **performance**, **stability**, & **satisfactory UI/UX** demonstrates a scalable & robust architecture for complex real-time control applications.



Materials & Methods - 1

- **STM Nucleo F446RE** x1
- **DF9-16** Pressure Sensors x2
- **5161AS** 7-Segment Displays x3
- Ardunio **RGB LEDs** x4
- Wires & Resistors **(220Ω/10kΩ)**
- SYS:
  - **Serial Wire**
  - Timebase Source: **TIM6**
  - Clock Speed: **84 MHz**
- Analog
  - **IN0** *(ADC1)*
  - **IN1** *(ADC2)*
- Timer **(TIM10)**
  - Prescaler: **83**
  - Counter Period: **1999**
- **TIM1/10, USART, ADC Interrupts**
- **Inputs:**
  - PA0: (DF9-16 ADC1)
  - PA1: (DF9-16 ADC2)
- **Output LEDs:**
  - PC0, PC1, PC2 (Color1)
  - PB0, PB1, PB2 (Color2)
  - PB6, PA6, PA7 (Mix)
  - PC5, PC6, PC8 (Target)
- **7-Segment Display:**
  - **PA10** (A), **PB3** (B), **PB5** (C), **PB4** (D), **PB10** (E), **PB8** (F), **PB9** (G)
  - Multiplexing Selects
    - **PC7** (Score)
    - **PC9** (Tens Place)
    - **PC3** (Ones Place)
- **Debugging:**
  - USART **(PuTTY)**

FreeRTOS Tasks:

- Input Task **(xInputQueue)**
  - Reads sensors & bundles data to be sent to LogicTask
- Logic Task **(xScoreMutex)**
  - Game logic, decreasing round counter & color decision
- Display Task **(xWinSemaphore)**
  - Logic for display of score, timer, & win animation

GitHub Repository

github.com/dannyjtaylor/RGB-Rush

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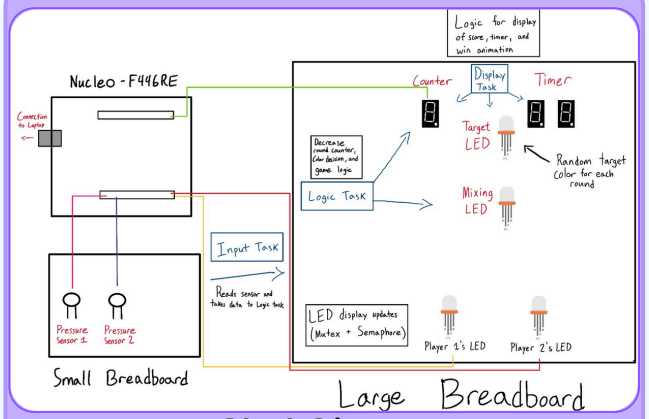
Materials & Methods - 2



Block Diagram

Acknowledgement

We wish to thank **Dr. Hoan Ngo** for his support in this project. His insights for FreeRTOS, task scheduling, & hardware wiring were critical in the making of this game.

Special thanks to **Valentina** & **Gianna** for being our first test subjects! ***—The RGB Rush Team***

References

- *Working with Seven Segment Displays*
  - ***Phillip Kane***, *Jameco Electronics*
- *7-Segment Display Using Multiplexer*
  - ***UL Dara***, *YouTube*
- *Intro to RTOS Part 5 - Queue*
- *Intro to RTOS Part 6 - Mutex*
- *Intro to RTOS Part 7 - Semaphore*
  - ***Digi-Key Electronics***

RGB RUSH

Embedded Operating Systems
CDA3631
Dr. Hoan Ngo