SMALL OPERATING SYSTEM

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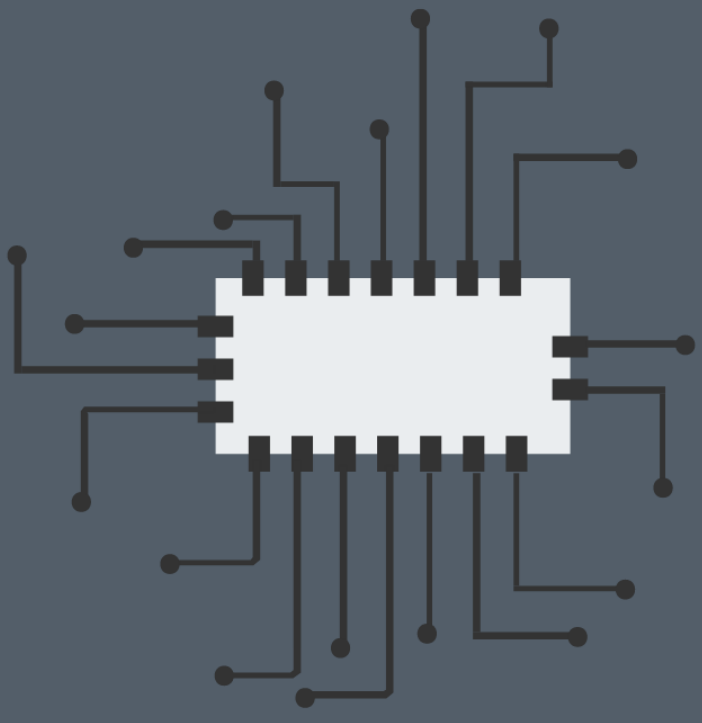
SUBMITED TO: SPRINTS



Contents

SMALL OPERATING SYSTEM

1. Project Introduction

This project aims to deliver an SOS -Small Operating System- which will manage the scheduling of some tasks. The project will resemble RTOS and for the delivery, it will be tested on some output/input modules which will toggle LEDs at different periodicities and check the buttons' states too.

1.1. Project Components

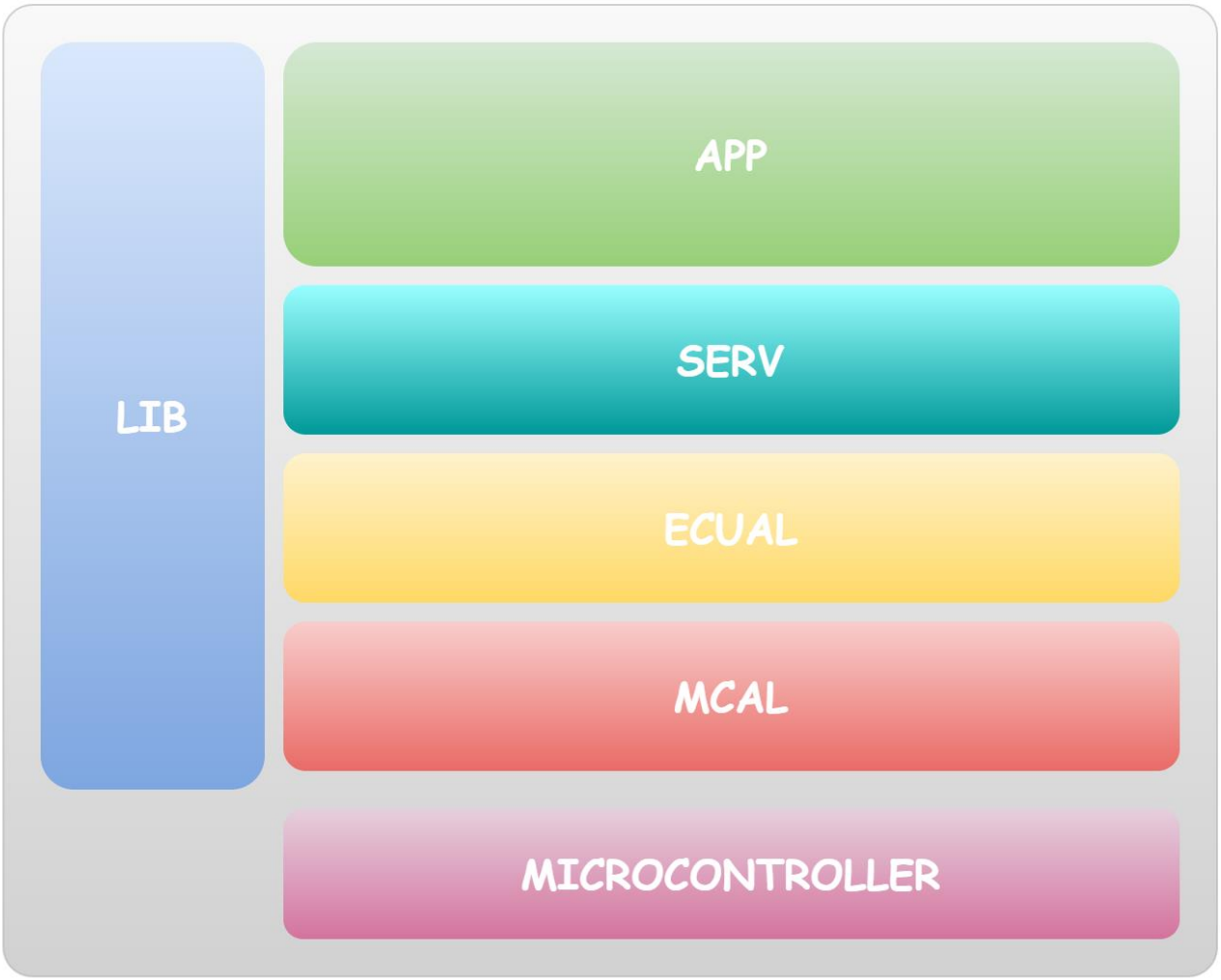
- ATmega32 microcontroller
- 2 LEDS
- 2 Buttons

So I will be using an ATmega32 microcontroller for generating timer interrupts which will be used as system tick, I will create two different tasks for the LEDs, 1 for the STOP button, and the START button will be checking on it in the super loop of the application.

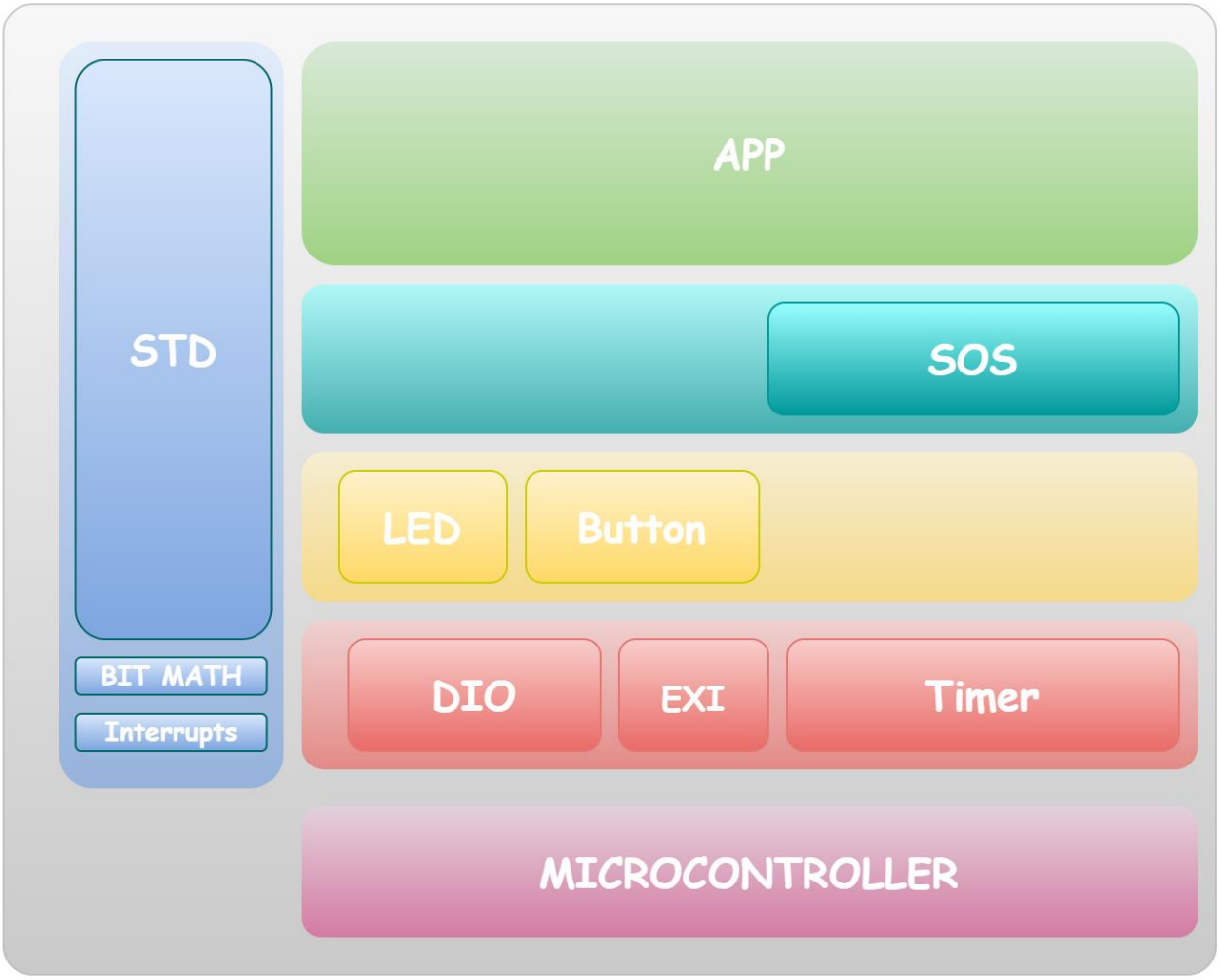
2. High-Level Design

2.1. System Architecture

2.1.1. Layered Architecture



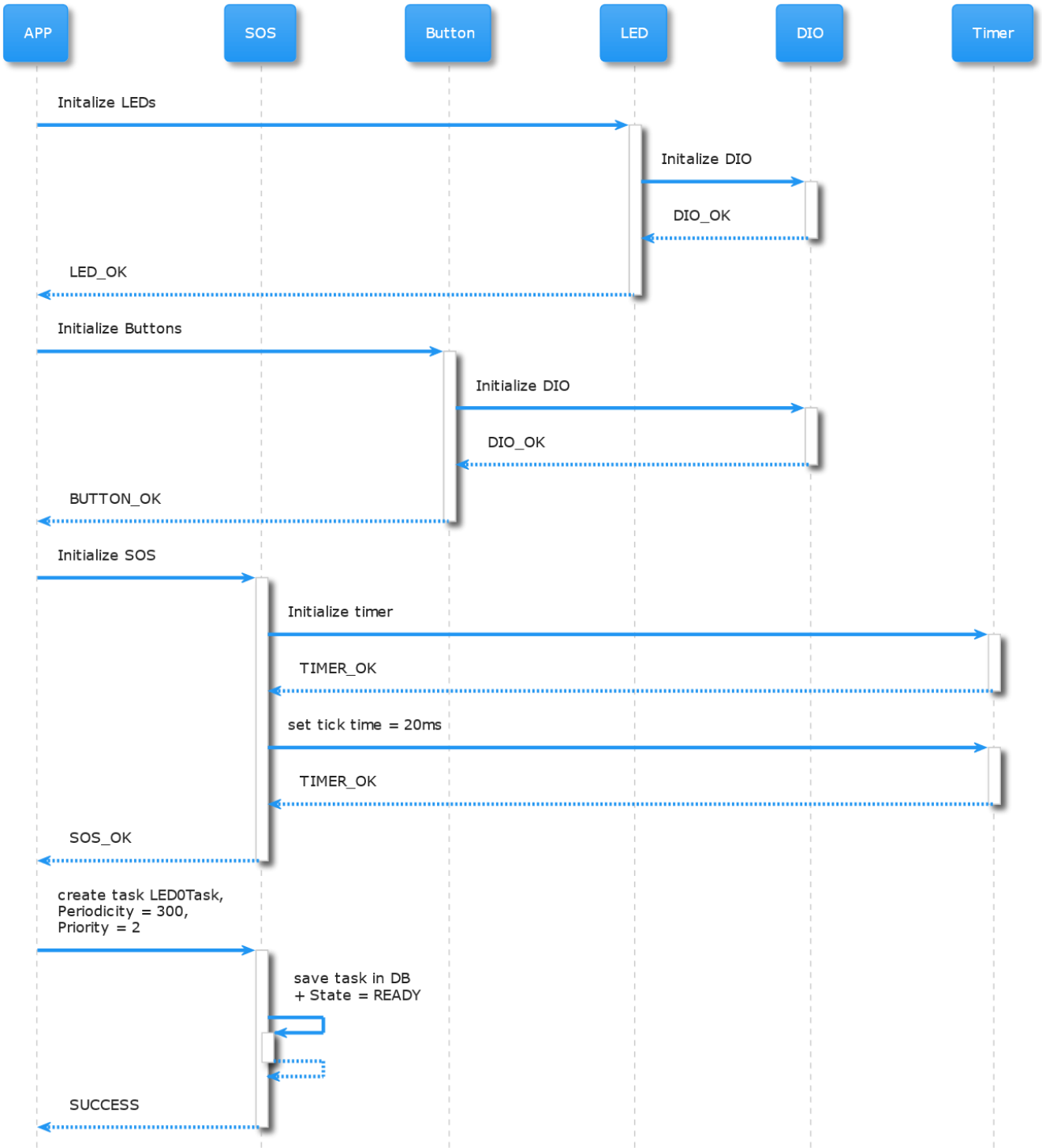
2.1.2. Design


APP
STD
SOS
LED
Button
DIO
EXI
Timer
BIT MATH
Interrupts
MICROCONTROLLER

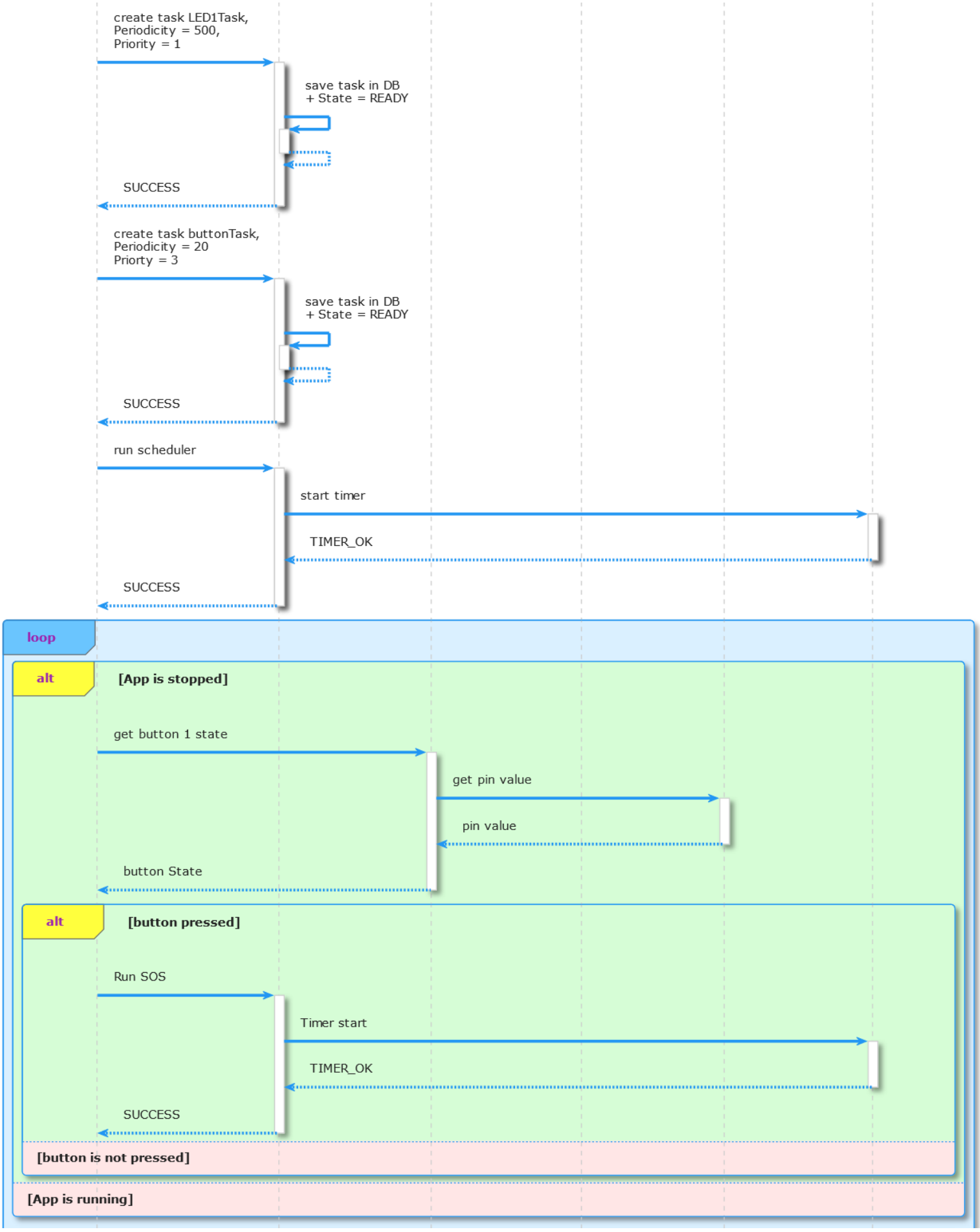
2.2. Sequence Diagram

You can find an SVG copy in that LINK

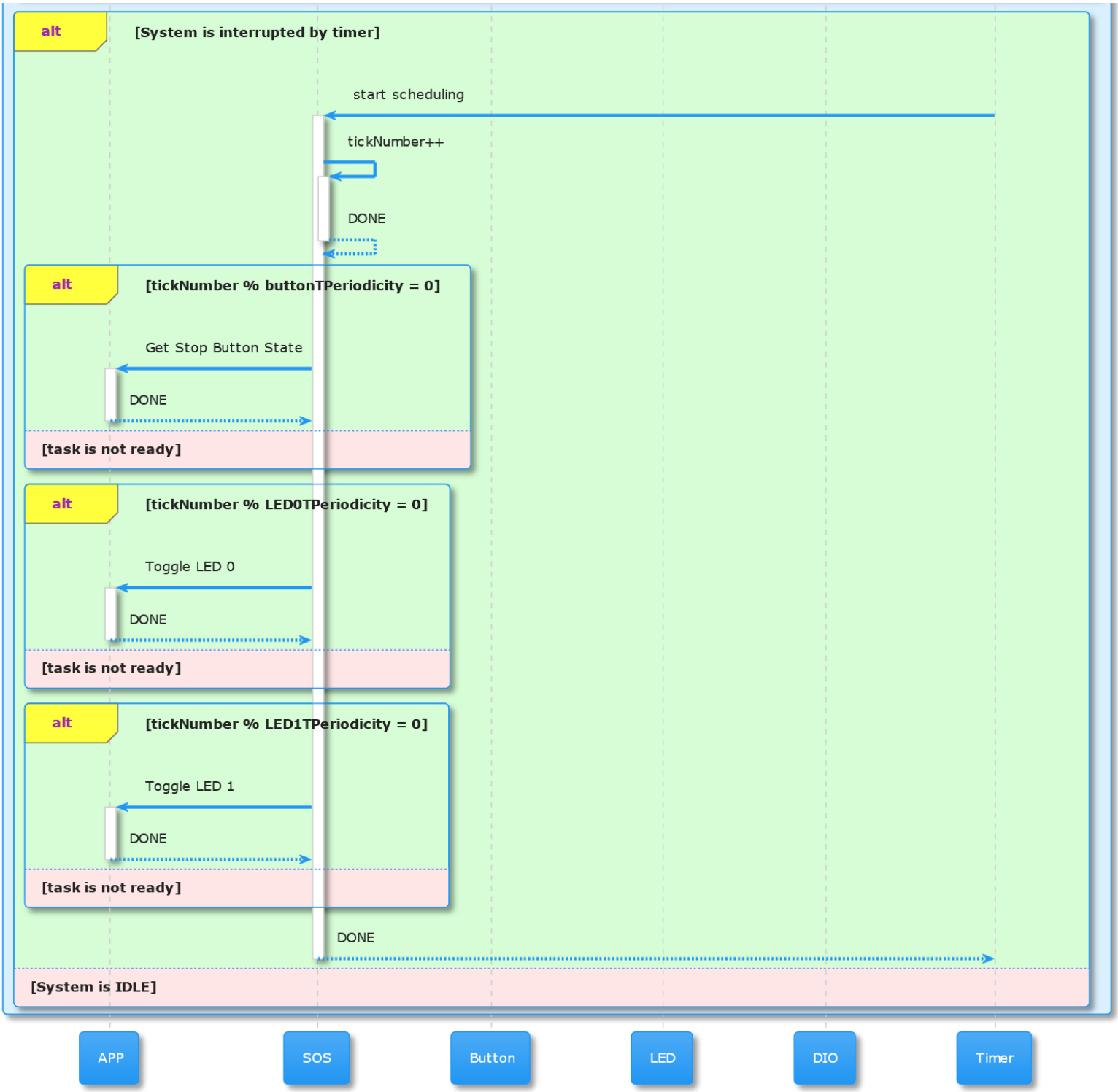
Part 1



Part 2

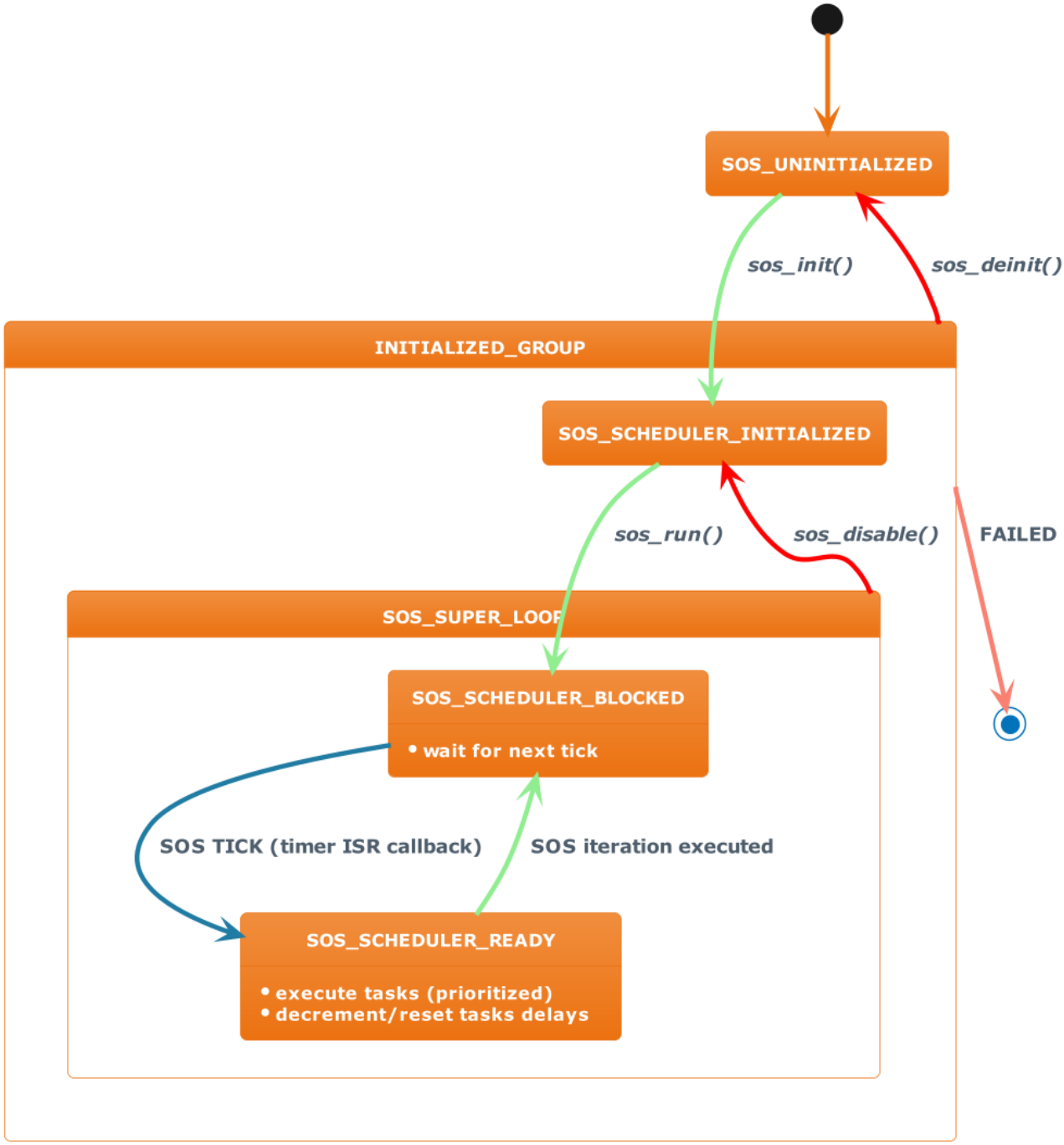

create task LED1Task,
Periodicity = 500,
Priority = 1
save task in DB
+ State = READY
SUCCESS
create task buttonTask,
Periodicity = 20
Priorty = 3
save task in DB
+ State = READY
SUCCESS
run scheduler
start timer
TIMER_OK
SUCCESS
loop
alt
[App is stopped]
get button 1 state
get pin value
pin value
button State
alt
[button pressed]
Run SOS
Timer start
TIMER_OK
SUCCESS
[button is not pressed]
[App is running]

Part 3


alt
[System is interrupted by timer]
start scheduling
tickNumber++
DONE
alt
[tickNumber % buttonTPeriodicity = 0]
Get Stop Button State
DONE
[task is not ready]
alt
[tickNumber % LED0TPeriodicity = 0]
Toggle LED 0
DONE
[task is not ready]
alt
[tickNumber % LED1TPeriodicity = 0]
Toggle LED 1
DONE
[task is not ready]
DONE
[System is IDLE]
APP
SOS
Button
LED
DIO
Timer

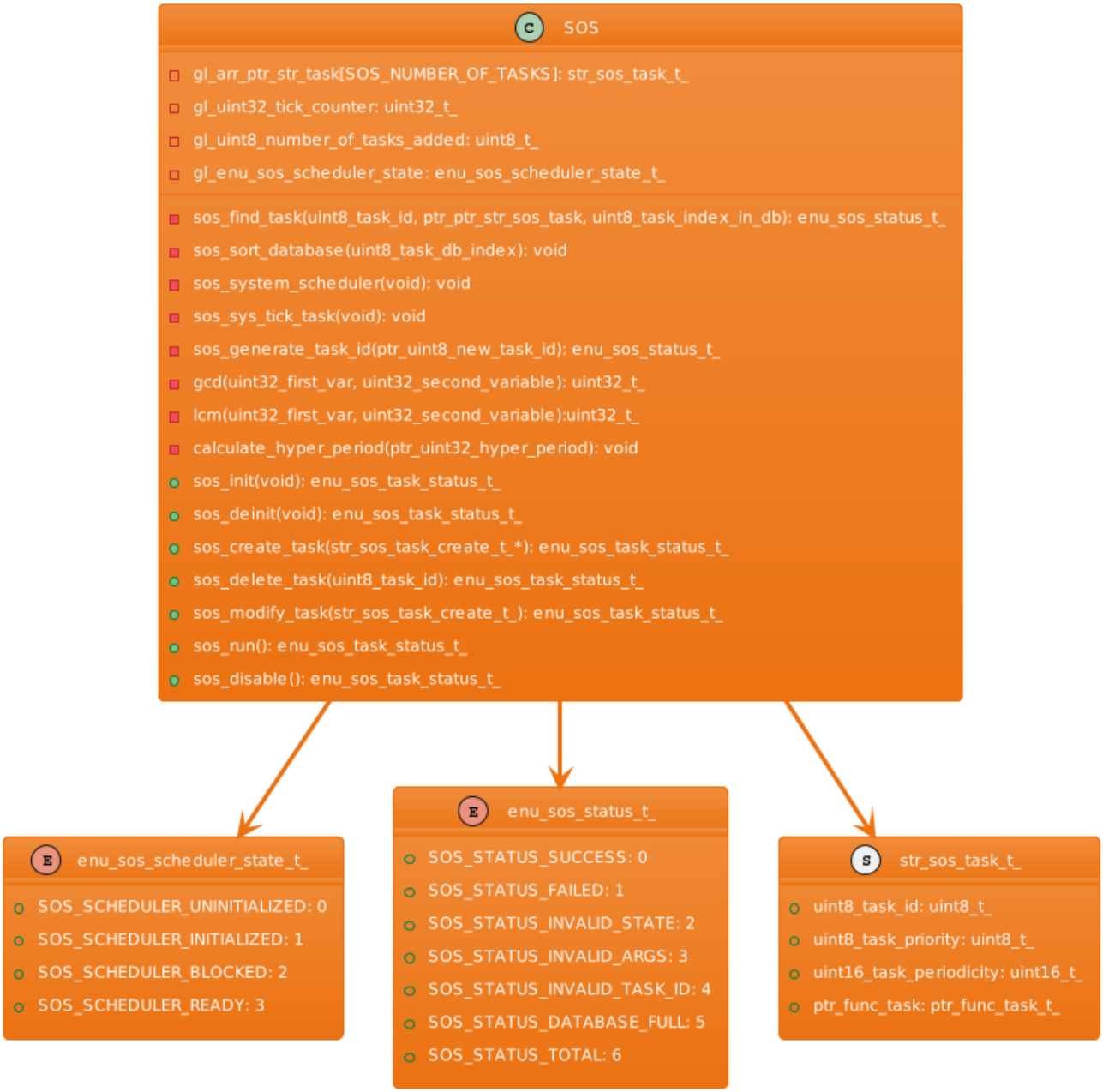
2.3. State Machine Diagram

You can find an SVG copy in that LINK



2.4. Class Diagram

You can find an SVG copy in that LINK.



2.5. Peripheral/Module Description

2.5.1. DIO (Digital Input/Output)

The DIO driver is responsible for reading input signals from the system's sensors (such as buttons) and driving output signals to the system's actuators (such as LEDs). It provides a set of APIs to configure the direction and mode of each pin (input/output, pull-up/down resistor), read the state of an input pin, and set the state of an output pin.

2.5.2. EXI (External Interrupt)

The EXI (External Interrupt) module is responsible for detecting external events that require immediate attention from the microcontroller, such as a button press. It provides a set of APIs to enable/disable external interrupts for specific pins, set the interrupt trigger edge (rising/falling/both), and define an interrupt service routine (ISR) that will be executed when the interrupt is triggered.

2.5.3. Timer

The Timer driver is responsible for initializing the timer peripheral, it can be configured to choose which timer will be working in which mode and other important configurations for the timer, but mainly I developed the timer to be working in normal mode only and the same time it can generate any kind of output using normal mode.

2.5.4. LED

The LED driver is used to initialize LEDs used as output and control them as it can turn them on or off or toggle them.

2.5.5. Button

The button driver is responsible for initializing the buttons used as inputs and controlling them as it gets the button state.

2.5.6. SOS

The SOS driver is used for initializing Timer used for the operating system, for initializing tick time too, for creating the database for tasks, and finally for scheduling the tasks.