Small Operating System With Preemptive Priority Based Schedular

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Introduction

A small operating system with a priority based preemptive scheduler based on time-triggered.

Detailed Requirements

Specifications

sos_init function, this function will initialize the SOS database.

Function Name	sos_init
Syntax	enu_system_status_t sos_init (void)
Sync/Async	Synchronous
Reentrancy	Non Reentrant
Parameters (in):	None
Parameters (out):	None
Parameters (in, out):	None
Return:	SOS_STATUS_SUCCESS: In case of Successful Operation. SOS_STATUS_INVALID_STATE: In case The SOS is already Initialized

sos_deinit function, this function will reset the SOS database to invalid values

Function Name	sos_deinit
Syntax	enu_system_status_t sos_deinit (void)
Sync/Async	Synchronous
Reentrancy	Non Reentrant
Parameters (in):	None
Parameters (out):	None

Parameters (in, out):	None
Return:	SOS_STATUS_SUCCESS: In case of Successful Operation. SOS_STATUS_INVALID_STATE: In case The SOS is already De-Initialized or was not initialized previously

sos_create_task API, this API will create a new task and add it to the SOS database

Function Name	sos_create_task
Syntax	enu_system_status_t sos_create_task(enu_task_priority_id_t enu_task_priority_id,str_tasks_config_t *str_tasks_config
Sync/Async	Synchronous
Reentrancy	Non Reentrant
Parameters (in):	enu_task_priority_id : Allocate task in order based on priority Id str_tasks_config : Holds all task info(periodicity,referance,args
Parameters (out):	None
Parameters (in, out):	None
Return:	SOS_STATUS_SUCCESS: In case of Successful Operation. SOS_NULL_ARGS: In case of Null poiters SOS_TASK_PERIODICITY_UNKNOWN : case undefined periodicity SOS_TASK_DUBLICATED_PIRIORITY : case of duplicated priority

sos_delete_task API, this API will delete an existing task from the SOS database

Function Name	sos_delete_task

Syntax	enu_system_status_t sos_delete_task(enu_task_priority_id_t enu_task_priority_id)
Sync/Async	Synchronous
Reentrancy	Non Reentrant
Parameters (in):	enu_task_priority_id : search for task in database
Parameters (out):	None
Parameters (in, out):	None
Return:	enu_task_priority_id : search for task in database SOS_STATUS_SUCCESS: In case of Successful Operation. SOS_TASK_PRIRORITY_ERROR: In case of wrong priority id SOS_TASK_NOT_FOUND : in case of not found task

sos_modify_task API, this API will modify existing task parameters in the SOS database

Function Name	sos_modify_task
Syntax	enu_system_status_t sos_modify_task(enu_task_priority_id_t enu_task_priority_id,str_tasks_config_t *str_tasks_config)
Sync/Async	Synchronous
Reentrancy	Non Reentrant
Parameters (in):	enu_task_priority_id : search for task in database str_tasks_config : Holds all task info(periodicity,reference,args)
Parameters (out):	None
Parameters (in, out):	None

Return:	SOS_STATUS_SUCCESS: In case of Successful Operation. SOS_NULL_ARGS: In case of Null pointers SOS_TASK_PERIODICITY_UNKNOWN : case undefined periodicity SOS_TASK_NOT_FOUND : in case of not found task

sos_run API, this API will run the small scheduler

Function Name	sos_run
Syntax	enu_system_status_t sos_run(void)
Sync/Async	Synchronous
Reentrancy	Non Reentrant
Parameters (in):	None
Parameters (out):	None
Parameters (in, out):	None
Return:	SOS_NO_TASKS_TO_RUN: In case of Empty Database.

sos_disable API, this API will stop the scheduler

Function Name	sos_disable
Syntax	enu_system_status_t sos_disable(void)
Sync/Async	Synchronous
Reentrancy	Non Reentrant
Parameters (in):	None
Parameters (out):	None
Parameters (in, out):	None

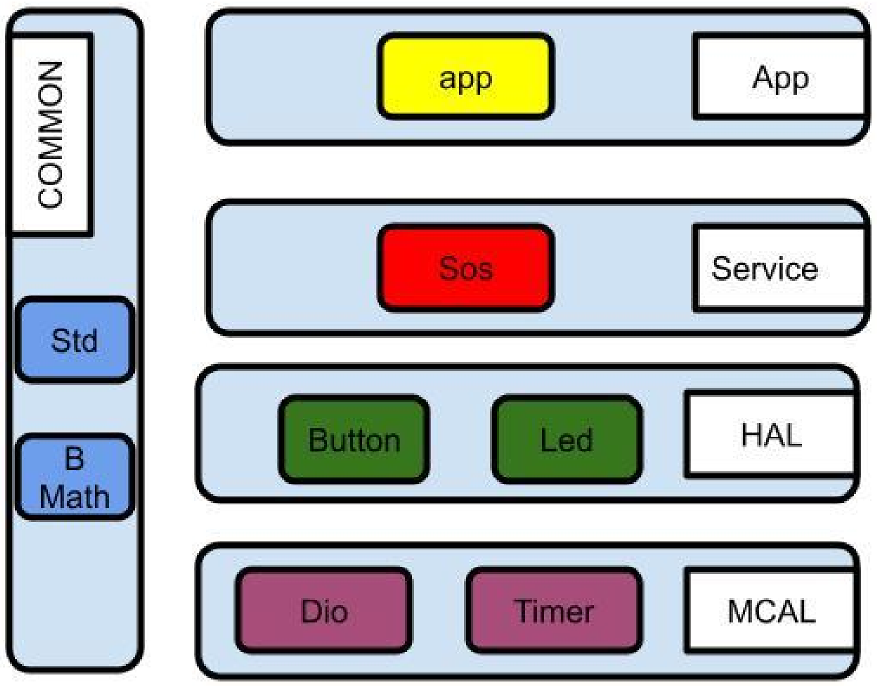
Return:	SOS_STATUS_SUCCESS: In case of Successful Operation.

Main Application Flow

- Implement an application that calls the SOS module and use 4 tasks
  - Task 1: Toggle LED_0 (Every 3 Milli-Seconds)
  - Task 2: Toggle LED_1 (Every 5 Milli-Seconds)
- Make sure that these tasks occur periodically and forever
- When pressing P_BUTTON0, the SOS will stop (stop task)
- When Pressing P_BUTTON1, the SOS will run (start task)

High Level Design

Layered Architecture



Modules Descriptions

- Dio

Stands for Digital Input/Output. It is an interface component that allows the system to send digital signals to devices. Also read signals from others

- Timer

A timer is a specialized type of clock used for measuring specific time intervals

- Led

This Module Controls Leds state in the program

- Button

The push button module allows detection in states of high or low from the onboard momentary push button

- Sos

Small operating system that manages all Application processes.

- App

Contain Main application Logic

Drivers' documentation

- Dio

Description : This function initialize PIN and set it's direction

ARGS : take PIN Number and PORT Number and Direction (INPUT,OUTPUT)

return : return DIO_OK if the PIN initializes correctly, DIO_NOT_OK otherwise

EN_DIO_ERROR DIO_init(EN_DIO_PINS pinNumber,EN_DIO_PORTS portNumber,EN_DIO_DIRECTION direction);

Description : This function write on PIN and set it's level

ARGS : take PIN Number and PORT Number and level (LOW,HIGH)

return : return DIO_OK if the PIN level sets correctly, DIO_NOT_OK otherwise

EN_DIO_ERROR DIO_write(EN_DIO_PINS pinNumber,EN_DIO_PORTS portNumber,EN_DIO_LEVEL level);

Description : This function toggles PIN level

ARGS : take PIN Number and PORT Number

return : return DIO_OK if the PIN toggles correctly, DIO_NOT_OK otherwise

EN_DIO_ERROR DIO_toggle(EN_DIO_PINS pinNumber,EN_DIO_PORTS portNumber);

Description : This function reads PIN level and store it in the variable

ARGS : take PIN Number and PORT Number and pointer to the variable

return : return DIO_OK if the PIN value stored correctly , DIO_NOT_OK otherwise

EN_DIO_ERROR DIO_read(EN_DIO_PINS pinNumber,EN_DIO_PORTS portNumber, u8_t * value);

- Timer

Description : This function initialize Timer 1 with CTC mode and enable interrupts
ARGS : void

return : void

void TIMER_ONE_init(void);

Description : This function starts Timer 1 with configured prescaller

ARGS : void return : void

void TIMER_ONE_start(void);

Description : This function stops Timer 1

ARGS : void

return : void

void TIMER_ONE_stop(void);

Description : This function calculate number of ticks to achieve desired time and assign the value in compare register

ARGS : time in milliseconds

return : void

void TIMER_ONE_setDelay(u16_t delay_ms);

Description : This function set call Back when ISR fired the call back function executes

ARGS : pointer to call back function

return : void

void TIMER_ONE_setCallBack(void(*ptr_func)(void));

- Led

Description : This function inits led as output

ARGS : pointer to struct (pin/port)

return : return LED_OK if the Led initialized correctly , LED_NOT_OKAY otherwise
enu_led_error_t LED_init(str_led_config_t *str_ptr_led_config);

Description : This function sent High to pin

ARGS : pointer to struct (pin/port) return : return LED_OK if the Led turns high correctly , LED_NOT_OKAY otherwise

enu_led_error_t LED_on(str_led_config_t *str_ptr_led_config);

Description : This function sent Low to pin

ARGS : pointer to struct (pin/port)

return : return LED_OK if the Led turns Low correctly , LED_NOT_OKAY otherwise
enu_led_error_t LED_off(str_led_config_t *str_ptr_led_config);

Description : This function toggle pin state

ARGS : pointer to struct (pin/port)

return : return LED_OK if the Led toggled correctly , LED_NOT_OKAY otherwise
enu_led_error_t LED_toggle(str_led_config_t *str_ptr_led_config);

- Button

Description : This function initialize PIN and set it's direction as Input

ARGS : take PIN Number and PORT Number

return : return BTN_OK if the PIN initializes correctly, BTN_NOT_OK otherwise
EN_BTN_Error_t Button_init(EN_DIO_PINS pinNumber,EN_DIO_PORTS portNumber);

Description : This function Read PIN value and store it in variable

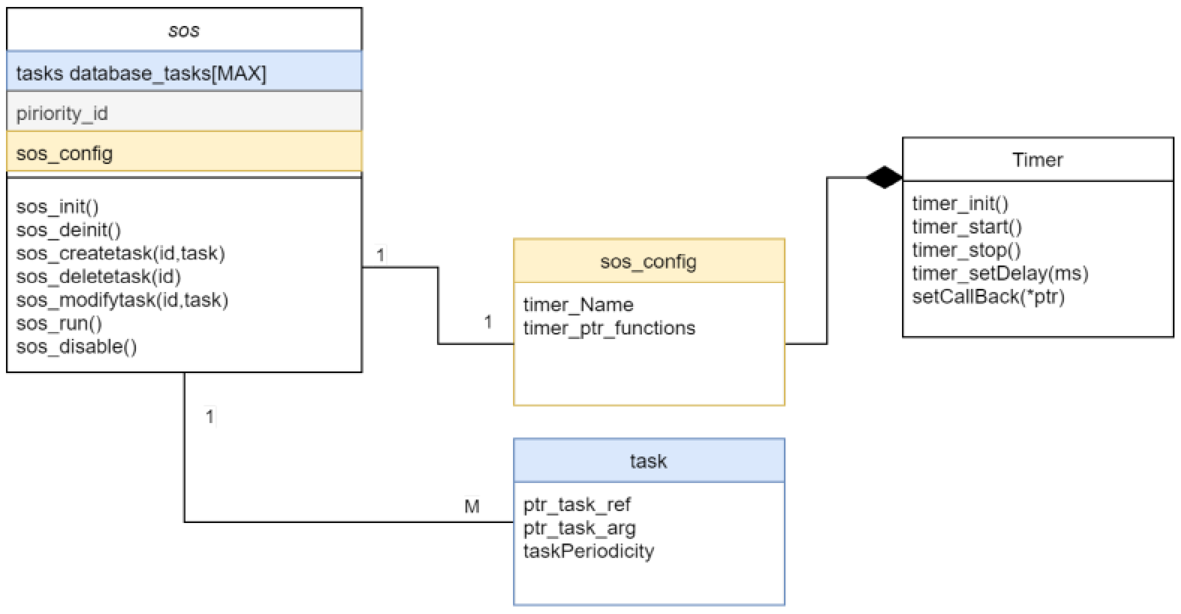
ARGS : take PIN Number and PORT Number and the address of the variable

return : return BTN_OK if the PIN read correctly, BTN_NOT_OK otherwise
EN_BTN_Error_t Button_read(EN_DIO_PINS pinNumber,EN_DIO_PORTS portNumber,u8_t *value);

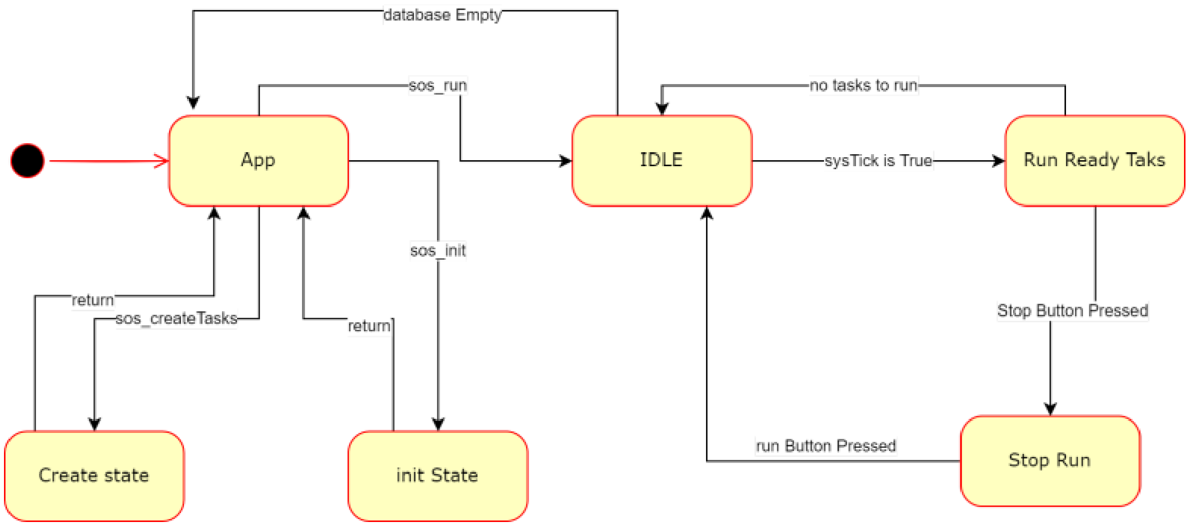
- Sos Go to page 2,3,4,5,6

UML

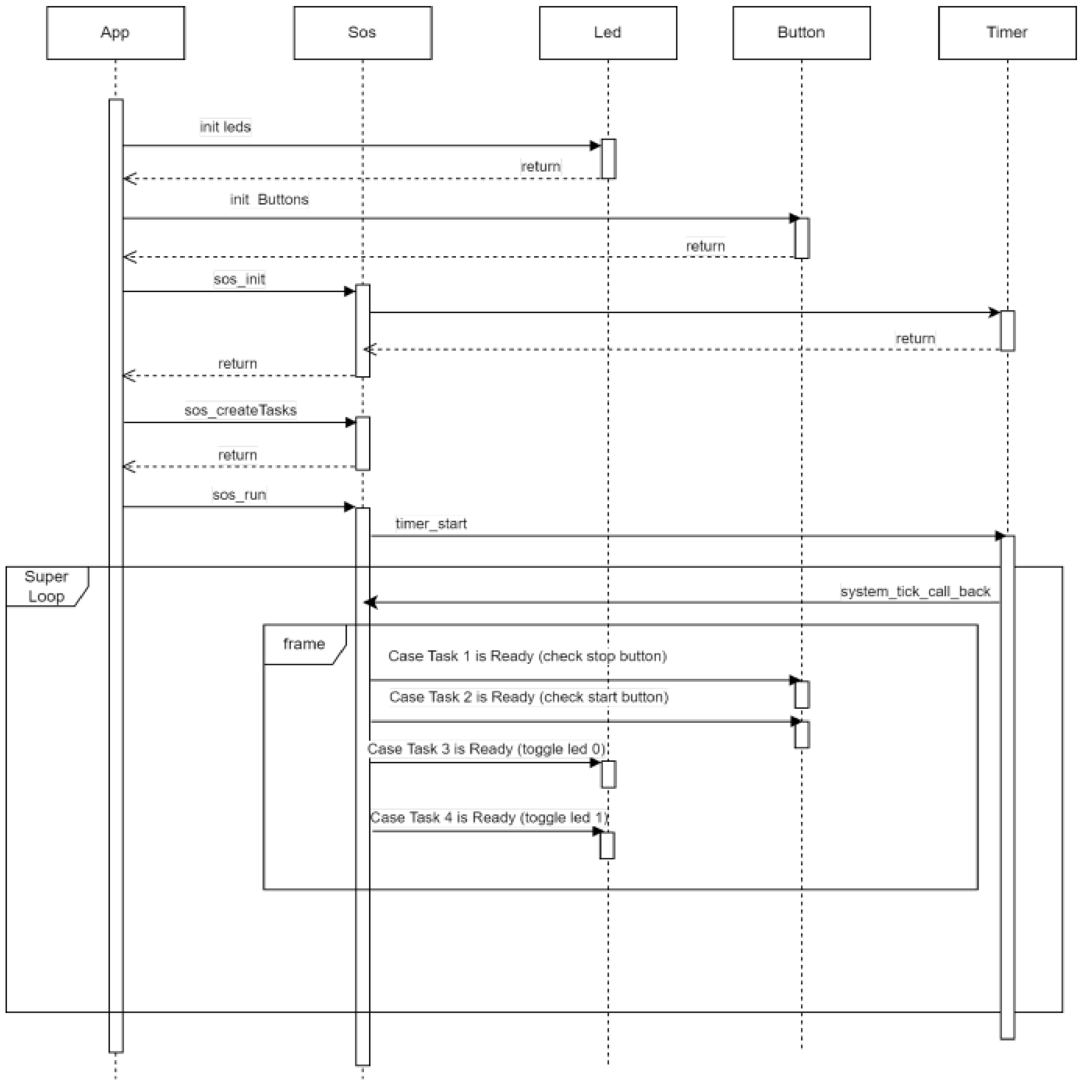
Sos Class Diagram



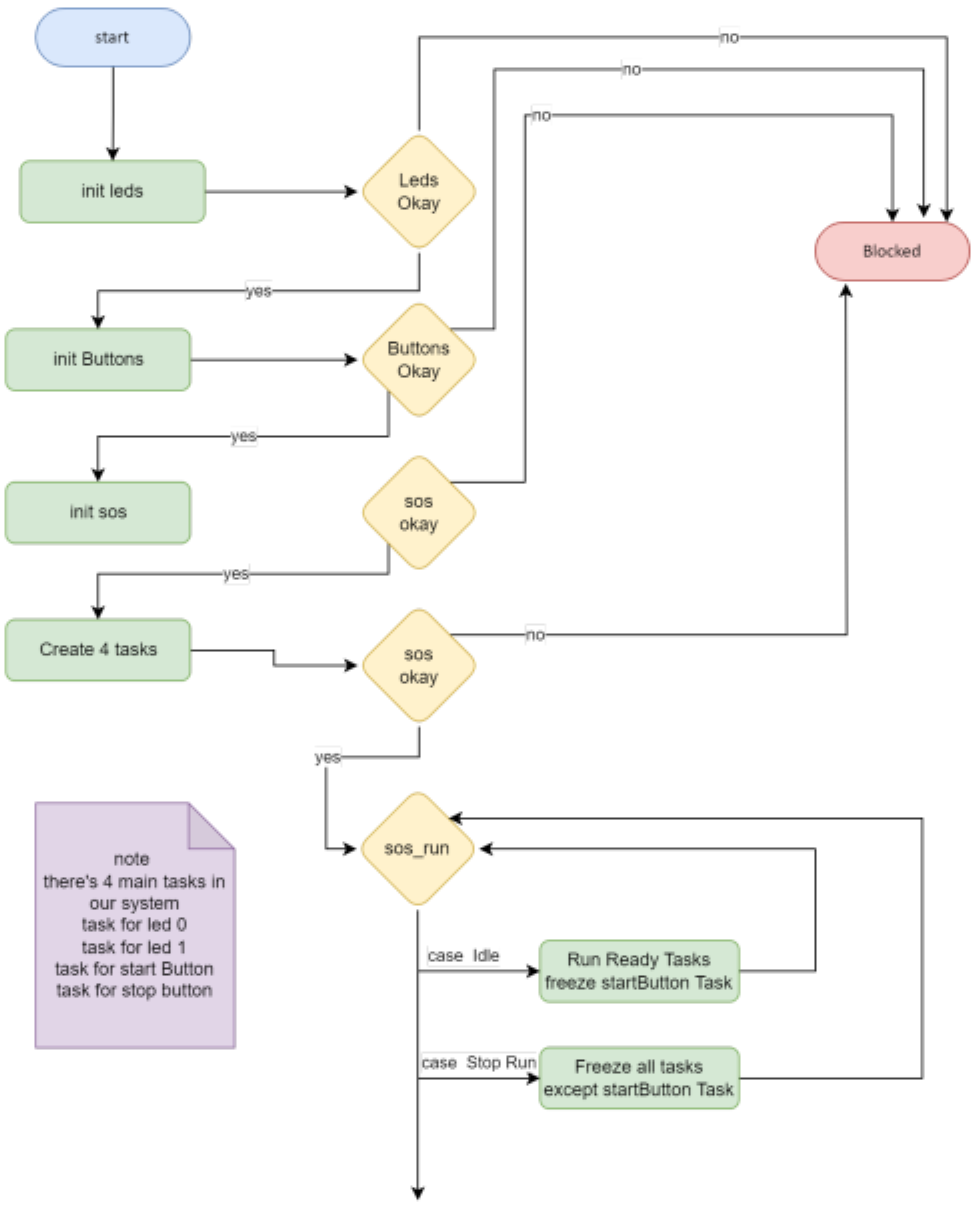
Sos State Machine



Sequence diagram


App
Sos
Led
Button
Timer
init leds
return
init Buttons
return
sos_init
return
return
sos_createTasks
return
sos_run
timer_start
Super Loop
system_tick_call_back
frame
Case Task 1 is Ready (check stop button)
Case Task 2 is Ready (check start button)
Case Task 3 is Ready (toggle led 0)
Case Task 4 is Ready (toggle led 1)

App Flow chart



Thanks