Moving car design

DESIGN DOCUMENT

Team 8
SPRINTS

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Project Description:-

- **Car Components:**

1) Four motors (M1, M2, M3, M4)
2) One button to start (PB1)
3) One button for stop (PB2)
4) Four LEDs (LED1, LED2, LED3, LED4)

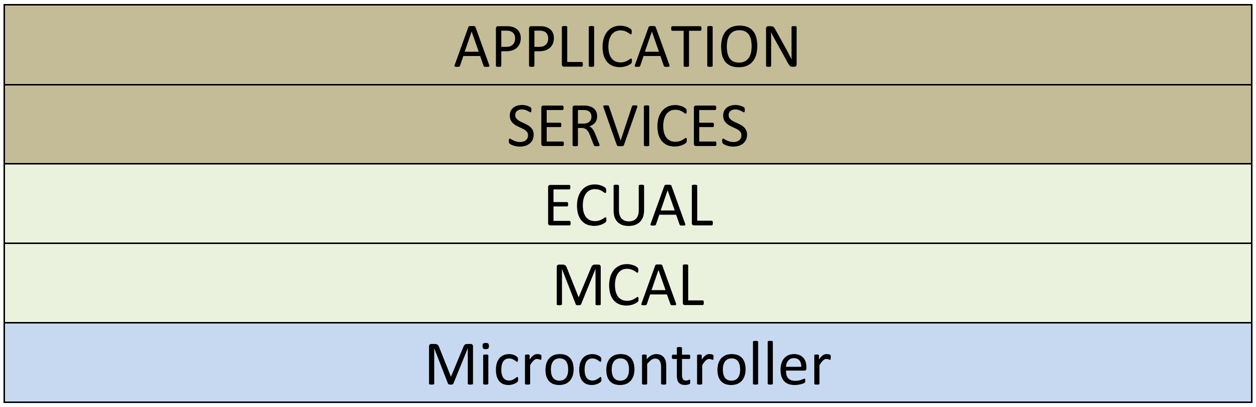
- **System Requirements:**

1) The car starts initially from 0 speed
2) When PB1 is pressed, the car will move forward after 1 second
3) The car will move forward to create the longest side of the rectangle for 3 seconds with 50% of its maximum speed
4) After finishing the first longest side the car will stop for 0.5 seconds, rotate 90 degrees to the right, and stop for 0.5 second
5) The car will move to create the short side of the rectangle at 30% of its speed for 2 seconds
6) After finishing the shortest side the car will stop for 0.5 seconds, rotate 90 degrees to the right, and stop for 0.5 second
7) Steps 3 to 6 will be repeated infinitely until you press the stop button (PB2)
8) PB2 acts as a sudden break, and it has the highest priority

Layered architecture

The system may be divided to 4 layers:-

- Microcontroller
- MCAL
- ECUAl
- Application



APPLICATION

SERVICES

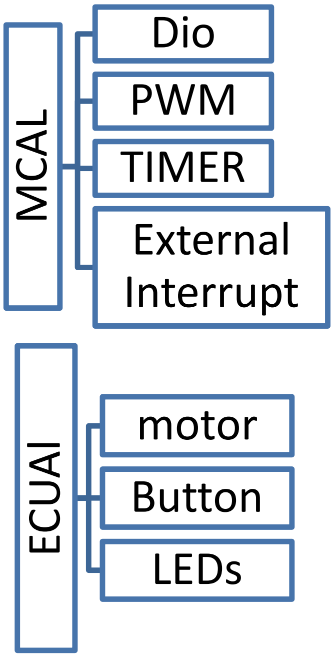
ECUAL

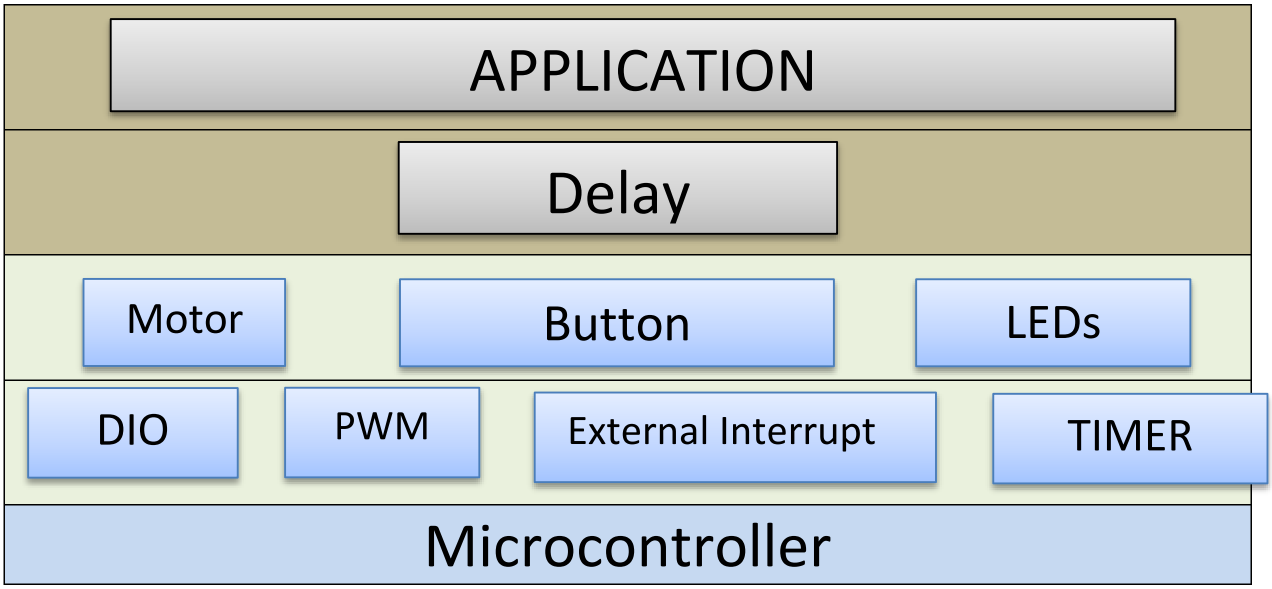
MCAL

Microcontroller

System modules

The system may be divided into drivers:-





Low Level Design:-

MCAL

DIO

APIs

```
void DIO_InitPin (PIn_name pin ,PIN_Status status );
void DIO_init (void);
void DIO_WRitePin (PIn_name pin ,Voltage_type s);
Voltage_type DIO_ReadPin(PIn_name pin);
void DIO_WritePort(PORT_Type Port,u8 data);
```

TIMER

APIs

```
void TIMER_init (uint8_t Mode,uint8_t intial_value);
void TIMER_start (uint8_t prescaler_value);
void TIMER_getStatus(uint8_t *value);
void TIMER_set(uint8_t intial_value);
void TIMER_Stop (void);
```

PWM

APIs

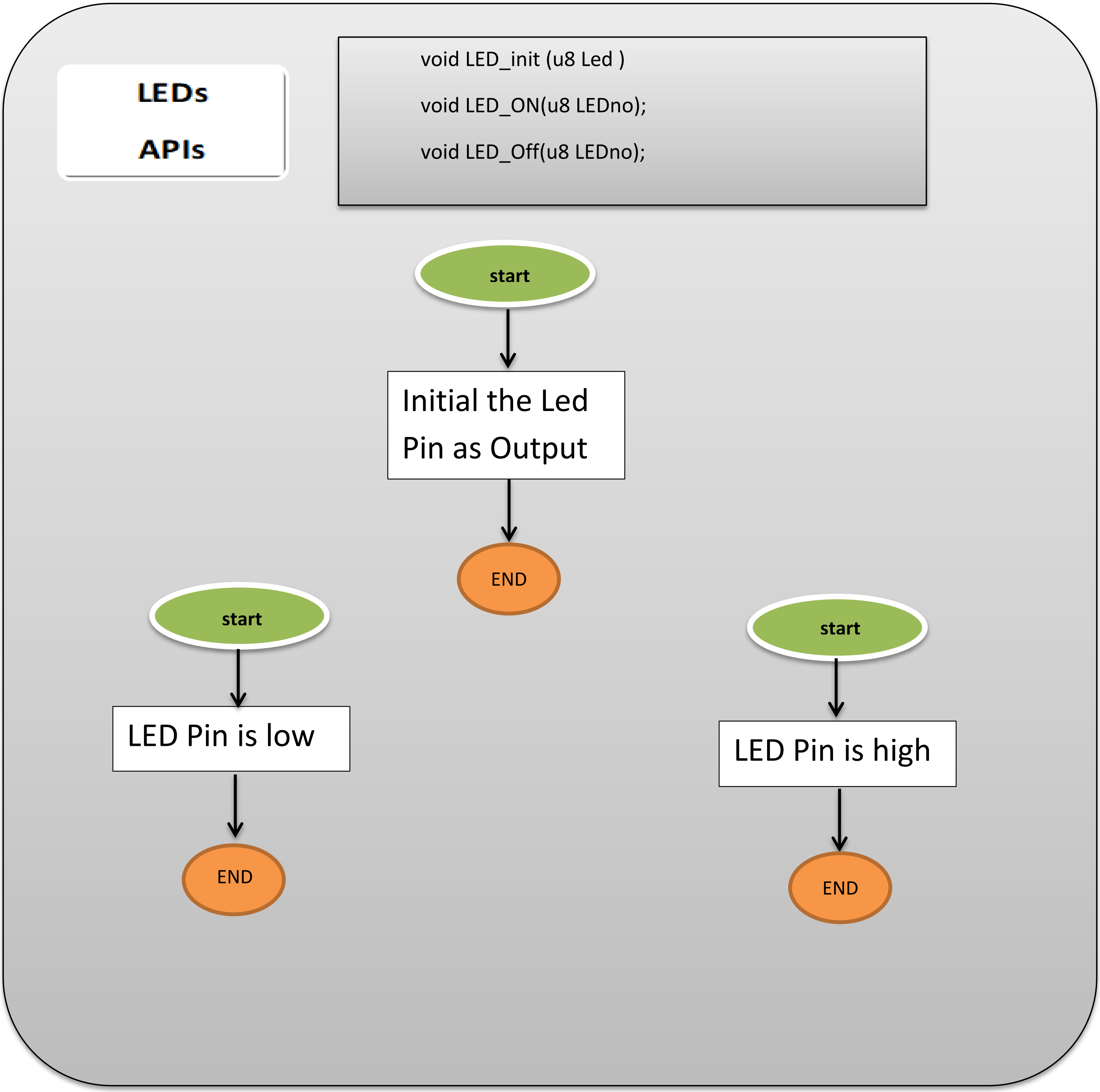
```
void PWM_init (void);
void PWM_start (uint8_t duty_percent);
void PWM_Stop (void);
```

External interrupt

APIs

```
void EXI_Enable (ExInterruptSource_type Interrupt);
void EXI_Disable (ExInterruptSource_type Interrupt);
void EXI_Trigger(ExInterruptSource_type Interrupt,TriggerEdge_type trigger);
void EXI_SetCallBack(ExInterruptSource_type Interrupt,void(*pf)(void));
```

ECUAL



LEDs

APIs

```
void LED_init (u8 Led )
void LED_ON(u8 LEDno);
void LED_Off(u8 LEDno);
```

start

Initial the Led Pin as Output

END

start

LED Pin is low

END

start

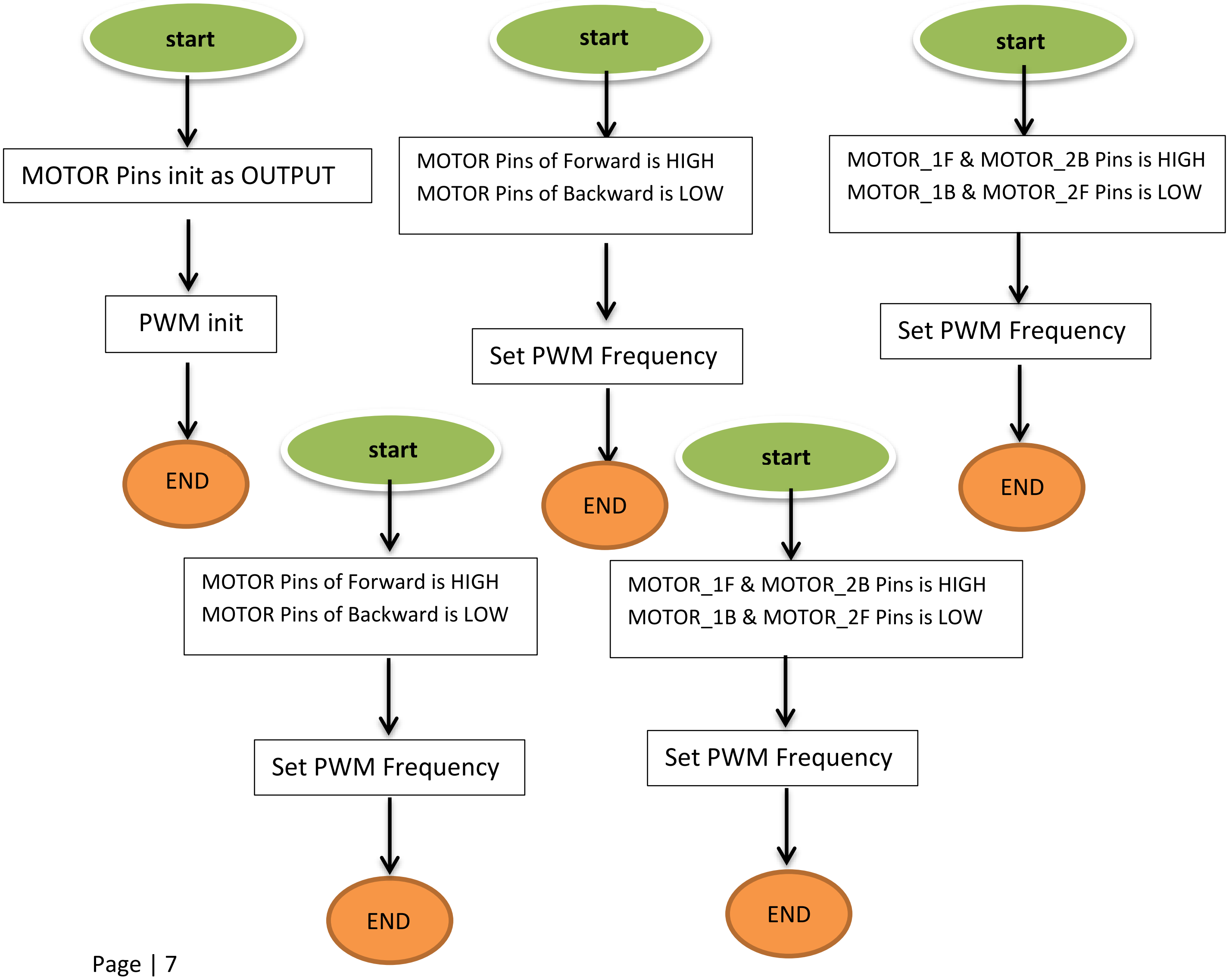
LED Pin is high

END

MOTOR

APIs

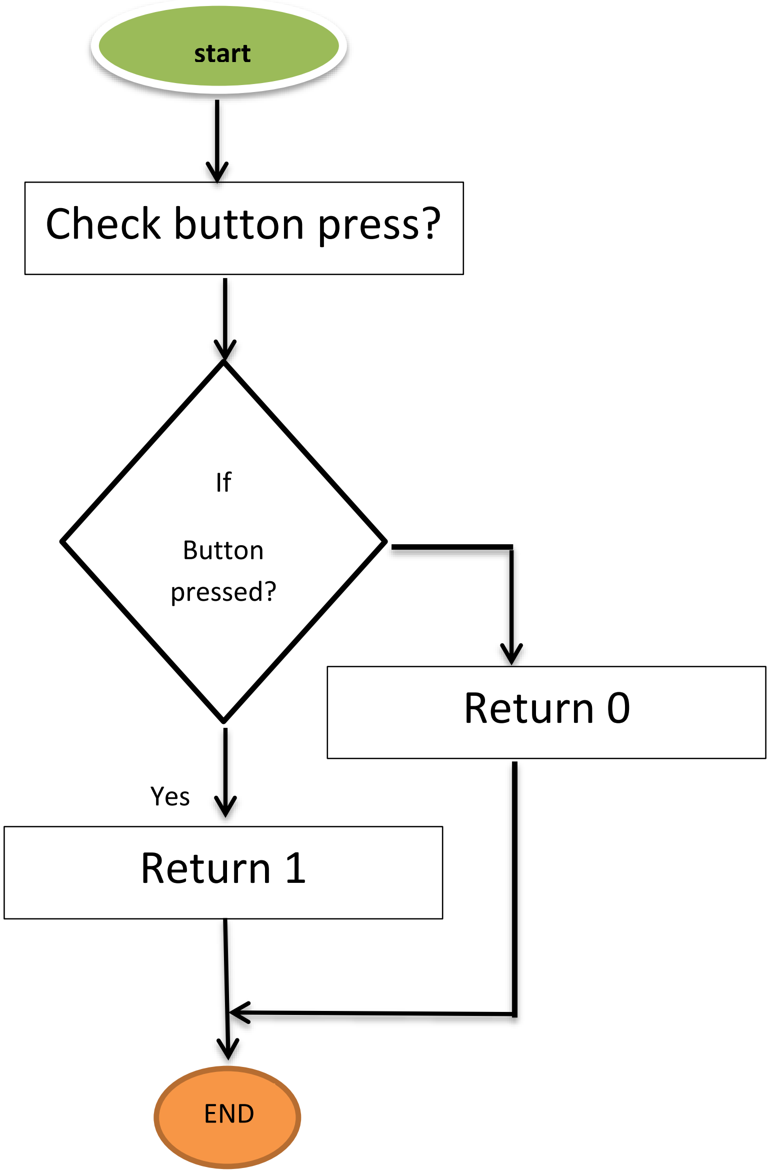
```
void motors_init ( PIn_name pin_motor1_F , PIn_name pin_motor1_B ,PIn_name pin_motor2_F, PIn_name
pin_motor2_B);
void motors_forward ( PIn_name pin_motor1_F , PIn_name pin_motor1_B ,PIn_name pin_motor2_F,
PIn_name pin_motor2_B , uint8_t speed);
void motors_Backward( PIn_name pin_motor1_F , PIn_name pin_motor1_B ,PIn_name pin_motor2_F,
PIn_name pin_motor2_B, uint8_t speed);
void motors_right( PIn_name pin_motor1_F , PIn_name pin_motor1_B ,PIn_name pin_motor2_F, PIn_name
pin_motor2_B ,uint8_t speed);
void motors_left( PIn_name pin_motor1_F , PIn_name pin_motor1_B ,PIn_name pin_motor2_F, PIn_name
pin_motor2_B , uint8_t speed);
void motors_stop( PIn_name pin_motor1_F , PIn_name pin_motor1_B ,PIn_name pin_motor2_F, PIn_name
pin_motor2_B);
```

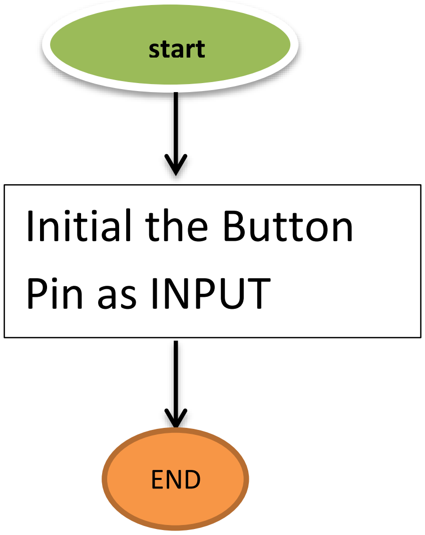

start
MOTOR Pins init as OUTPUT
PWM init
END
start
MOTOR Pins of Forward is HIGH
MOTOR Pins of Backward is LOW
Set PWM Frequency
END
start
MOTOR_1F & MOTOR_2B Pins is HIGH
MOTOR_1B & MOTOR_2F Pins is LOW
Set PWM Frequency
END
start
MOTOR Pins of Forward is HIGH
MOTOR Pins of Backward is LOW
Set PWM Frequency
END
start
MOTOR_1F & MOTOR_2B Pins is HIGH
MOTOR_1B & MOTOR_2F Pins is LOW
Set PWM Frequency
END

Button APIs

```
Button_Status Button_Check (PIn_name pin);

void button_init(PIn_name pin);
```





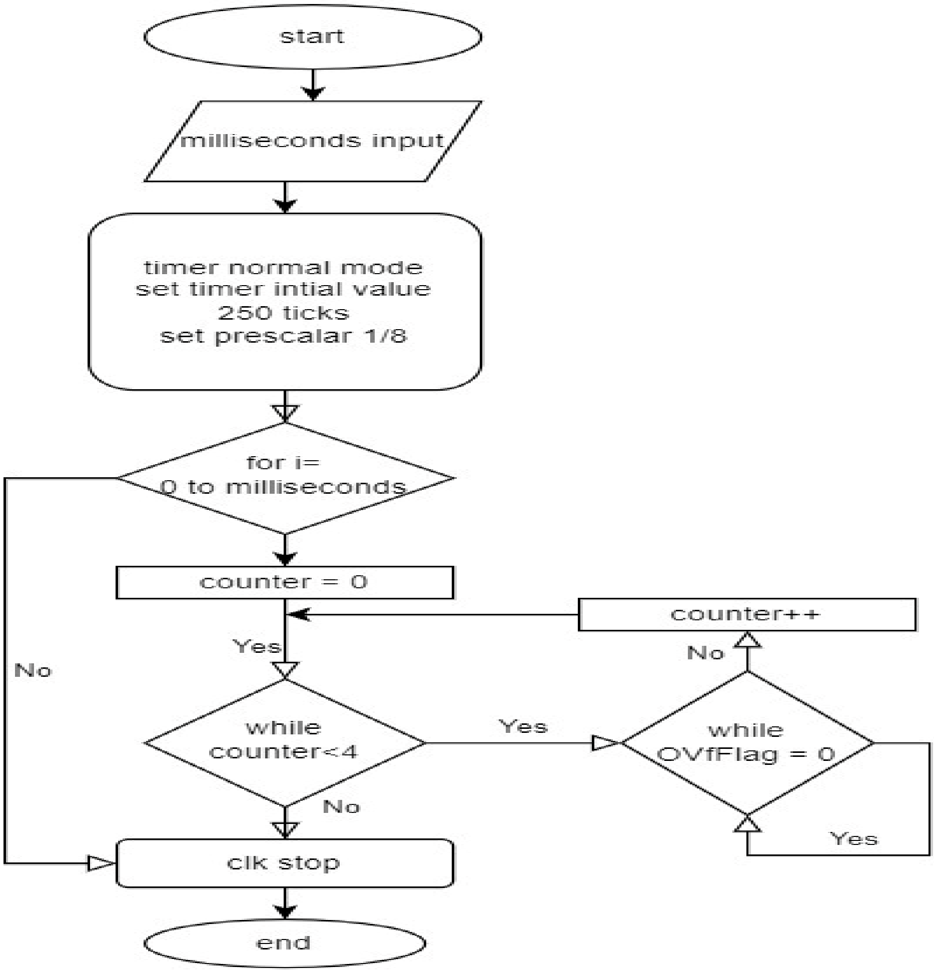
Services

Delay

APIS

void Delay(uint32_t seconds);

Delay(uint8_t milliseconds)



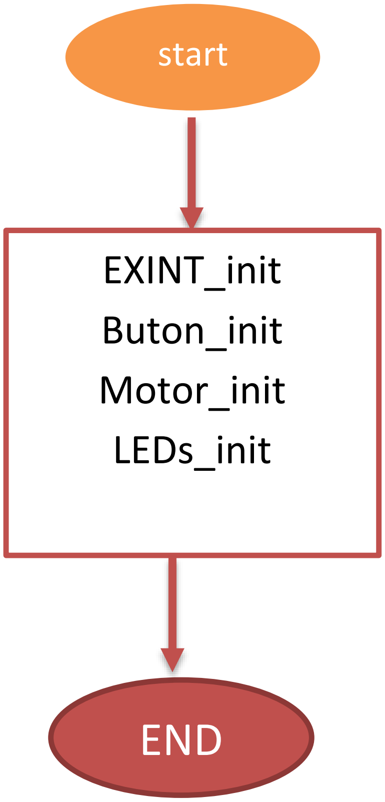
Application

Application

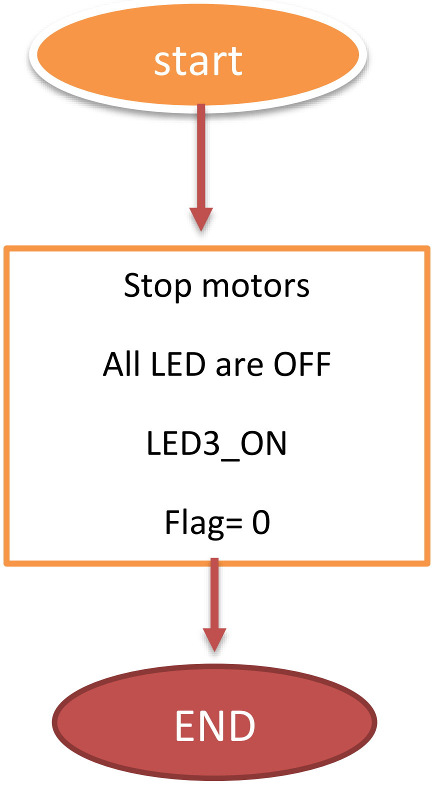
APIs

```
void APP_Init(void);
void APP_Start(void);
void APP_Stop(void);
```

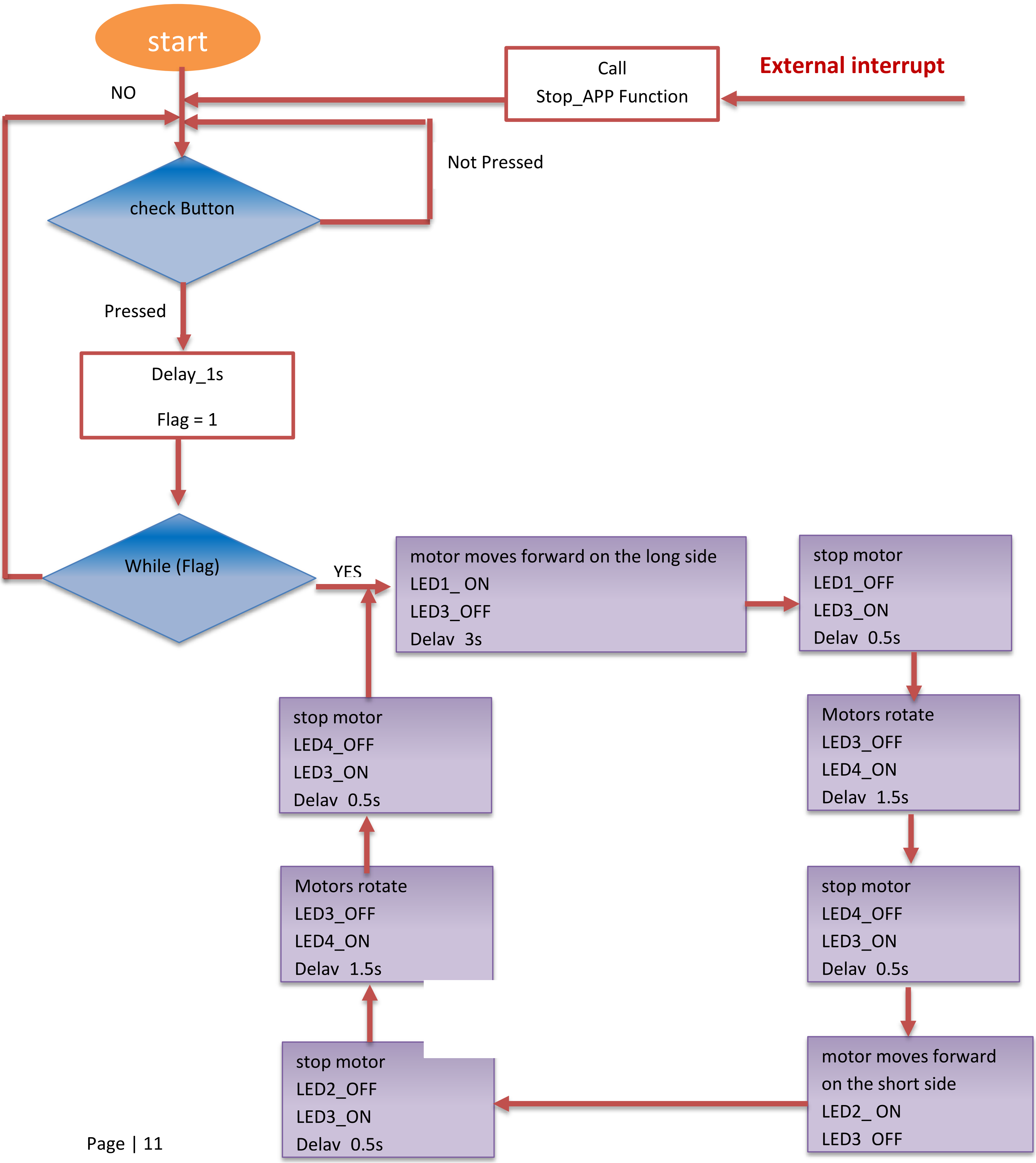
APP_Init



APP_Stop



APP_Start


start
NO
Call
Stop_APP Function
External interrupt
check Button
Not Pressed
Pressed
Delay_1s
Flag = 1
While (Flag)
YES
motor moves forward on the long side
LED1_ ON
LED3_OFF
Delav 3s
stop motor
LED1_OFF
LED3_ON
Delav 0.5s
Motors rotate
LED3_OFF
LED4_ON
Delav 1.5s
stop motor
LED4_OFF
LED3_ON
Delav 0.5s
motor moves forward
on the short side
LED2_ ON
LED3 OFF
stop motor
LED2_OFF
LED3_ON
Delav 0.5s
Motors rotate
LED3_OFF
LED4_ON
Delav 1.5s
stop motor
LED4_OFF
LED3_ON
Delav 0.5s