

EMBEDDED INNOVATORS HACKATHONS 2025

MIT Academy of Engineering
Group No. : 2

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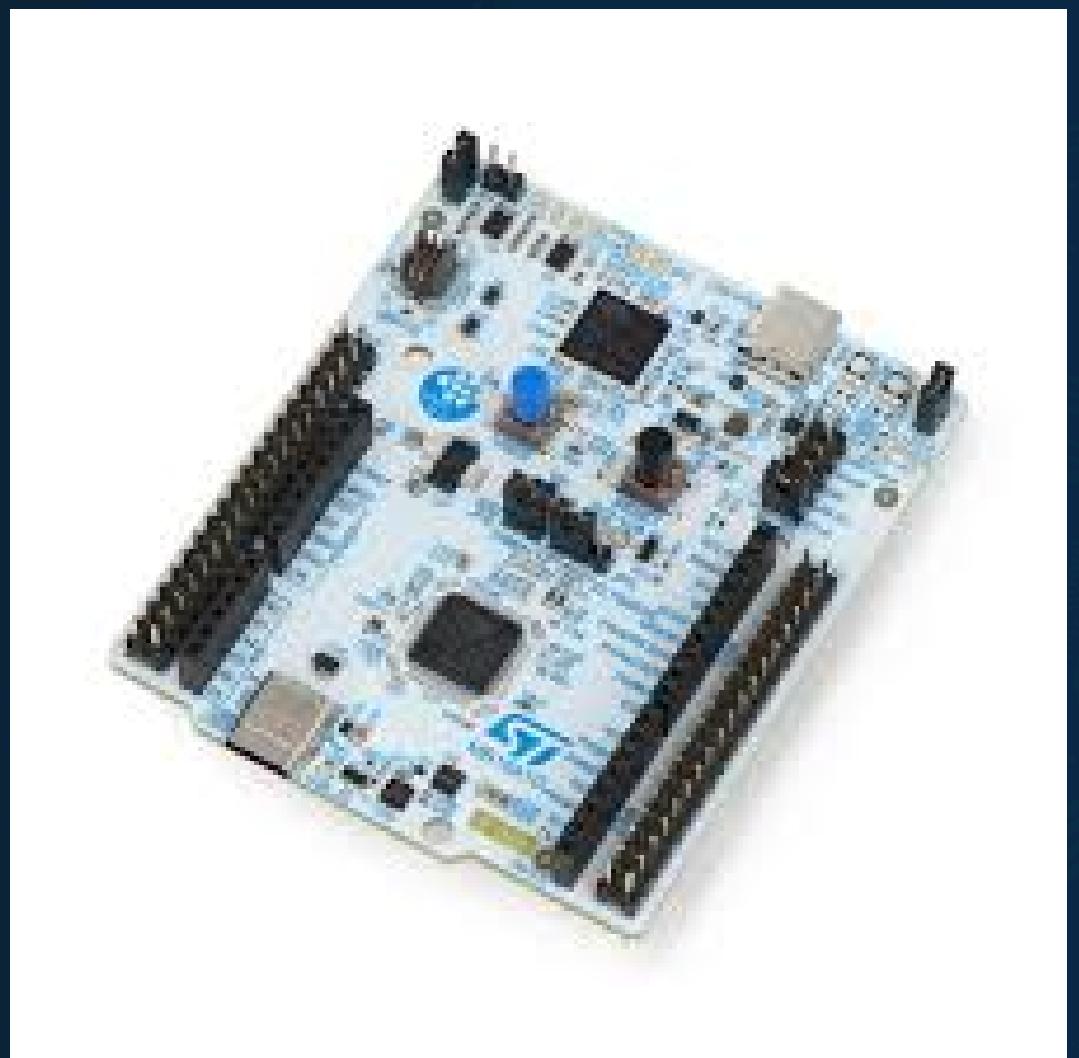
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Problem Statement

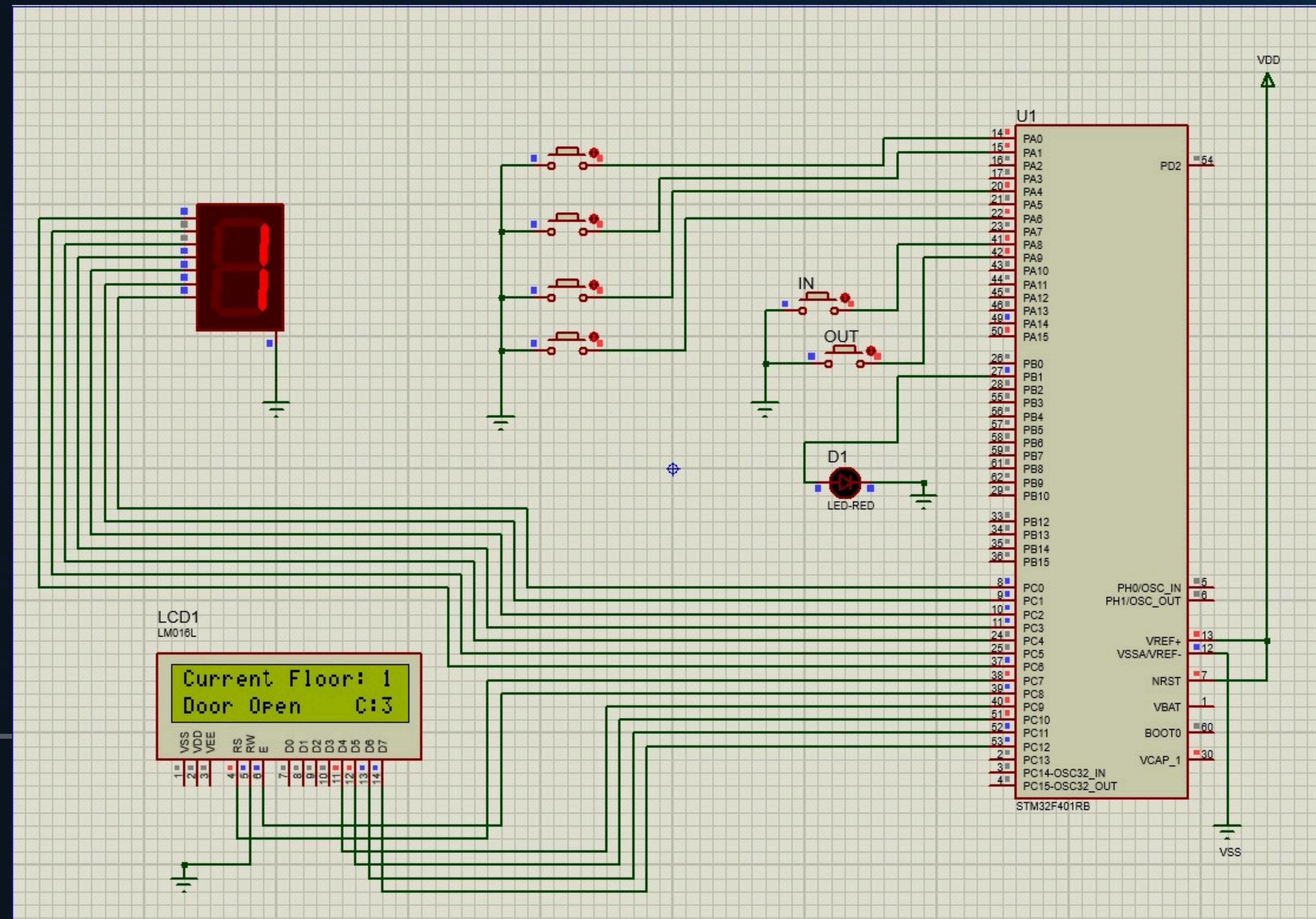
Implementation of Automated Lift Control System Using STM32 MCU

Objective:

- Design and develop an embedded system that simulates an automated lift (elevator) control
- system using an STM32 microcontroller. The system should allow users to request floors via push-buttons, display the current floor position on a 7-segment display, and provide real-time status updates on an LCD screen. A relay will simulate lift movement, and a buzzer will generate alerts for door open/close, floor arrival, and emergency conditions.



Circuit Diagram



Code

```
int main(void)
{
    HAL_Init();
    __HAL_RCC_GPIOA_CLK_ENABLE();
    __HAL_RCC_GPIOC_CLK_ENABLE();
    __HAL_RCC_GPIOB_CLK_ENABLE();
    GPIO_InitTypeDef GPIO_InitStruct = {0};
    // LCD
    GPIO_InitStruct.Pin = LCD_RS_Pin | LCD_EN_Pin |
        LCD_D4_Pin | LCD_D5_Pin |
        LCD_D6_Pin | LCD_D7_Pin;
    GPIO_InitStruct.Mode = GPIO_MODE_OUTPUT_PP;
    GPIO_InitStruct.Speed = GPIO_SPEED_FREQ_LOW;
    HAL_GPIO_Init(LCD_PORT, &GPIO_InitStruct);
    // 7-Segment
    GPIO_InitStruct.Pin = GPIO_PIN_0|GPIO_PIN_1|GPIO_PIN_2|
    GPIO_PIN_3|GPIO_PIN_4|GPIO_PIN_5|GPIO_PIN_6;
    HAL_GPIO_Init(GPIOC, &GPIO_InitStruct);
    // Switches
    GPIO_InitStruct.Pin = SW_G_Pin | SW_1_Pin | SW_2_Pin | SW_EM_Pin;
    GPIO_InitStruct.Mode = GPIO_MODE_INPUT;
    GPIO_InitStruct.Pull = GPIO_PULLUP;
    HAL_GPIO_Init(SW_PORT, &GPIO_InitStruct);
    // Buzzer
    GPIO_InitStruct.Pin = BUZZER_Pin;
    GPIO_InitStruct.Mode = GPIO_MODE_OUTPUT_PP;
    HAL_GPIO_Init(BUZZER_PORT, &GPIO_InitStruct);
    HAL_GPIO_WritePin(BUZZER_PORT, BUZZER_Pin,
    GPIO_PIN_RESET);
    // Relay
    GPIO_InitStruct.Pin = RELAY_Pin;
    GPIO_InitStruct.Mode = GPIO_MODE_OUTPUT_PP;
    HAL_GPIO_Init(RELAY_PORT, &GPIO_InitStruct);
    HAL_GPIO_WritePin(RELAY_PORT, RELAY_Pin, GPIO_PIN_RESET);
    // Initially OFF
```

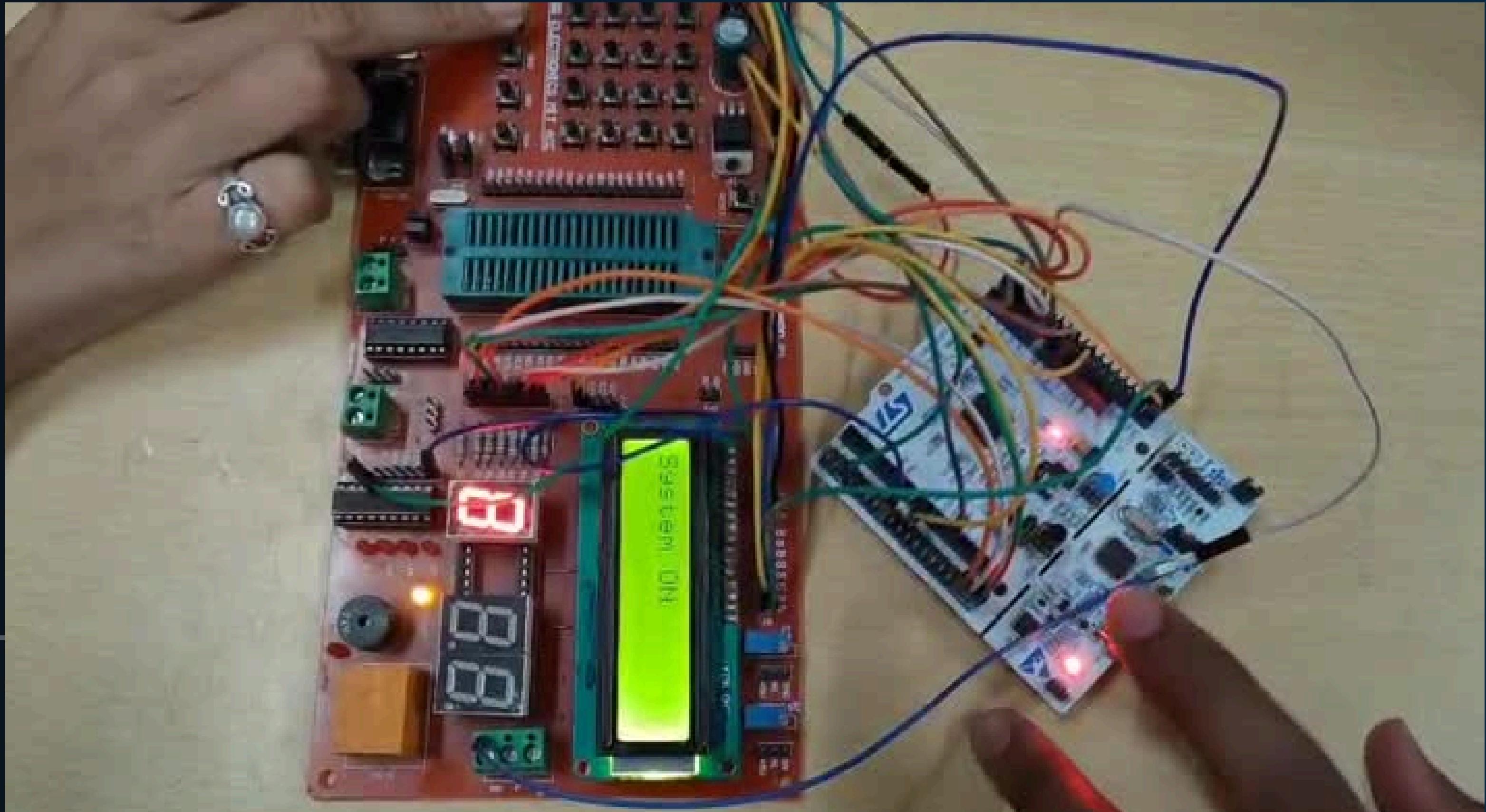
```
// Master Switch (Blue button on PC13)
GPIO_InitStruct.Pin = MASTER_SWITCH_Pin;
GPIO_InitStruct.Mode = GPIO_MODE_INPUT;
GPIO_InitStruct.Pull = GPIO_PULLUP;
HAL_GPIO_Init(MASTER_SWITCH_PORT, &GPIO_InitStruct);
lcd_init();
lcd_set_cursor(0, 0);
lcd_print("Press Blue Btn");
int last_button_state = 1;
while (1)
{
    // Toggle system ON/OFF using master switch (PC13)
    int button_state = HAL_GPIO_ReadPin(MASTER_SWITCH_PORT,
    MASTER_SWITCH_Pin);
    if (button_state == GPIO_PIN_RESET && last_button_state ==
    GPIO_PIN_SET) {
        system_active = !system_active;
        HAL_GPIO_WritePin(RELAY_PORT, RELAY_Pin, system_active ?
    GPIO_PIN_SET : GPIO_PIN_RESET);
        lcd_clear();
        lcd_set_cursor(0, 0);
        lcd_print(system_active ? "System ON" : "System OFF");
        if (!system_active) {
            HAL_GPIO_WritePin(BUZZER_PORT, BUZZER_Pin,
    GPIO_PIN_RESET);
            while (HAL_GPIO_ReadPin(MASTER_SWITCH_PORT,
    MASTER_SWITCH_Pin) == GPIO_PIN_RESET);
        }
        HAL_Delay(300);
    }
}
```

Code

```
last_button_state = button_state;
if (!system_active) continue;
if (emergency_mode) {
    HAL_GPIO_WritePin(BUZZER_PORT, BUZZER_Pin, GPIO_PIN_SET);
    continue;
}
if (HAL_GPIO_ReadPin(SW_PORT, SW_EM_Pin) == GPIO_PIN_RESET) {
    emergency_mode = 1;
    show_emergency_message();
} else if (HAL_GPIO_ReadPin(SW_PORT, SW_G_Pin) == GPIO_PIN_RESET) {
    update_lift_status(0);
    HAL_Delay(300);
} else if (HAL_GPIO_ReadPin(SW_PORT, SW_1_Pin) == GPIO_PIN_RESET) {
    update_lift_status(1);
    HAL_Delay(300);
} else if (HAL_GPIO_ReadPin(SW_PORT, SW_2_Pin) == GPIO_PIN_RESET) {
    update_lift_status(2);
    HAL_Delay(300);
}
}
```



Output



Challenge Faced

All the peripherals were not properly integrating with STM board.

Solution

For these issue we decided to integrate all the pheipherals one by one.

Firstly we integrate LCD screen with STM board and then add push button to that.

Then we integrate 7 segment display to the overall setup and then added buzzer in final setup.

And because of these solution we were enable to solve our problem statement succesfully.



THANK YOU...