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**Mini Project**

**Execution flow**

1. Understand V Project Development Lifecycle
2. Mini Project Requirement
3. Mini Project – Detailed Description and Steps
4. Mini Project – Connection
5. Mini Project Architecture and Design
6. Mini Project SRS
7. Mini Project Test Cases
8. V Model Life Cycle

A diagram of a stage

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1. Project Requirement
2. GPIO as Digital Output (interface with on onboard LEDs)
3. GPIOs as Digital Inputs (interface with onboard Switch)
4. Debound logic (interface with onboard Switch)/Interrupts
5. Timers (counts, timed delays)
6. PWM Control (frequency & duty cyccle variations)
7. Analog to Digital Conversion
8. Communication Protocal – UART

Case 1:

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Case 1 sequence:

* If ignition OFF->No operation.
* Ignition switch1 1st press -> Ignition Status ON -> 2nd press ->Ignition Status OFF (Toggle Mechanism on LED1).
* If ignition ON -> Ignition Status ON (on LED1).
* If Ignition ON (Switch 3 1st press -> Right Indicator Status ON -> 2nd press -> Right Indicator Status OFF).
* LED3 will blink contiously.
* Buzzer will indicate with a tone.
* Above status won’t work if both Left&Right Indicator Switches are ON.
* If Left Indicator ON (Switch4 1st press -> Left Indicator Status ON -> 2nd press -> Left Indicator Status OFF).
* LED4 will blink contiously.
* Buzzer will indicate with a tone (same as the Right Indicator tone).
* Above status won’t work if both Left&Right Indicator Switches are ON.
* Simulated Fuel Indicator status to be continously shown in Live Expression Window via POT1.

Case 2:

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Case 2 sequence:

* If Head Light switch is pressed (Switch2 1st press -> Light Low Beam -> 2nd press -> Light High Beam -> 3rd press -> Parking Light (both LED3&LED4) blink -> 4th press -> LEDs OFF.
* For Low Beam: LED2 with 10% PWM Duty Cycle.
* For High Beam: LED2 with 90% PWM Duty Cycle.
* For Parking Light: Both LED3&LED4 blink & Buzzer to indicate with different tone then indicator.
* Parking Light won’t operate if either Left or Right indicator is ON.

UART is continously passing a status message from Rx to Tx & the status to be shown on Live Expression Window.

1. Detailed Description and Steps
2. Use the STM32F405 Development Board (STM32F401 for Proteus demonstration).
3. It has 4 onboard User input Switches and 4 User configurable LEDs.
4. Configure the Switch ports as Input.
5. Configure the LED ports as Output.
6. Identify the LED connected with the PWM port and configure the PWM timers.
7. Configure the switch avoiding Consecutive key stroke.
8. Check for the Key and count the keystrokes.
9. If the Keystrokes match the required number, then perform the operation.
10. Connection

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Sr No | Item Type | IO | Type | Description |
| 1 | LED1 | PC6 | OUTPUT | Red Color |
| 2 | LED2 | PC7 | OUTPUT | Red Color |
| 3 | LED3 | PC8 | OUTPUT | Red Color |
| 4 | LED4 | PC9 | OUTPUT | Red Color |
| 5 | Switch1 | PB7 | INPUT | Switch input |
| 6 | Switch2 | PB3 | INPUT | Switch input |
| 7 | Switch3 | PB4 | INPUT | Switch input |
| 8 | Switch4 | PB5 | INPUT | Switch input |
| 9 | POT1 | PC2 | Analog | Input |
| 10 | Buzzer | PC10 | OUTPUT | Sound |
| 11 | UART Tx | PA2 | Transmiter | Status Message |
| 12 | UART Rx | PA3 | Receiver | Status Message |
| 13 | LCD RS | PA0 | OUTPUT | Send Data |
| 14 | LCD EN | PA1 | OUTPUT | Send Data |
| 15 | LCD D4 | PB12 | OUTPUT | Send Data |
| 16 | LCD D5 | PB13 | OUTPUT | Send Data |
| 17 | LCD D6 | PB14 | OUTPUT | Send Data |
| 18 | LCD D7 | PB15 | OUTPUT | Send Data |

1. Project Architecture and Design

Architecture:

A diagram of a computer process

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LLD – Data Flow

A diagram of a system

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1. Project SRS

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Sr. No | SRS ID | Requirement Description | Type | Testsbility | Test ID | Remarks |
| 1 | SRS01 | Use Onboard Switch SW1, SW2, SW3, SW4 | Non-Functional | NT | ST01->ST10 | Working properly |
| 2 | SRS02 | Use Onboard LEDS LED1, LED2, LED3, LED4 | Non-Functional | NT | ST01->ST11 | Working properly |
| 3 | SRS03 | Count the Key Press/Stauts of each switch | Non-Functional | UT | ST01->ST11 | Working properly |
| 4 | SRS04 | Deactivate the multiple switch press of each switch | Non-Functional | NT | ST01->ST11 | Uncertain that the multiple switch is working or not because the simulation is lag |
| 5 | SRS05 | If the Ignition key is Off, Then No LEDs & no Switch will work | Functional | ST, UT, IT | ST01 | Working properly |
| 6 | SRS06 | Toggle Ignition status to High or Low based on Ignition Switch press | Functional | ST, UT, IT | ST01, ST02 | Working properly |
| 7 | SRS07 | When Ignition Status is High, ADC (simulated Fuel Level) shuld be continously displaying on the Debug Live Expression Window | Functional | ST, UT, IT | ST02->ST11 | Working properly |
| 8 | SRS08 | When Ignition Status is High, UART transmission & receive status to be displayed on the Debug Live Epression Window for every 500msec | Functional | ST, UT, IT | ST02->ST11 | Display status only when the operation mode change not every 0.5sec |
| 9 | SRS09 | When Ignition Status is High: If the Right Indicator switch is pressed once, then blink corresponding LED&Buzzer with 0.5Hz frequency | Functional | ST, UT, IT | ST03 | Need frequnency adjustment |
| 10 | SRS10 | When Ignition Status is High: If the Right Indicator switch is pressed 2nd time, then turn off the Buzzer & LED | Functional | ST, UT, IT | ST04 | Working properly |
| 11 | SRS11 | When Ignition Status is High: If the Left Indicator switch is pressed once, then blink corresponding LED&Buzzer with 0.5Hz frequency | Functional | ST, UT, IT | ST05 | Need frequnency adjustment |
| 12 | SRS12 | When Ignition Status is High: If the Left Indicator switch is pressed 2nd time, then turn off the Buzzer & LED | Functional | ST, UT, IT | ST06 | Working properly |
| 13 | SRS13 | When Ignition Status is High: If the Light Switch is pressed once, then Low Beam Light to be activated with 10% Duty Cycle | Functional | ST, UT, IT | ST07 | Working properly |
| 14 | SRS14 | When Ignition Status is High: If the Light Switch is pressed 2nd time, then Low Beam Light to be activated with 90% Duty Cycle | Functional | ST, UT, IT | ST08 | Working properly |
| 15 | SRS15 | When Ignition Status is High: If the Light Switch is pressed 3rd time, then Parking Light (Left & Right Indicator LEDs) to blink at 2Hz frequency along Buzzer | Functional | ST, UT, IT | ST09 | Need frequnency adjustment |
| 15 | SRS16 | When Ignition Status is High: If the Light Switch is pressed 4th time, then High&Low Beam, Parking Light & Buzzer to be off | Functional | ST, UT, IT | ST10 | Working properly |

1. Test Cases

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sr. No | SRS ID | Test ID | Test Scenario | Pre-condition | Expected Result | Actual Result | Test Status | Remark |
| 1 | SRS01-SRS05 | ST01 | Press the Ignition Key 1st time | Board Power up:   * Program running * Ignition Status Off | Ignition Status to High & Ignition LED to be ON, ADC Value & UART statuts to be shown on DLEW\* | As Expected | Tested | Working properly |
| 2 | SRS01-SRS05, SRS07, SRS08 | ST02 | Press the Ignition Key 2nd time | Board Power up:   * Program running * Ignition LED ON * ADC Value & UART shown on DLEW\* | Ignition Status OFF  All other operations off | As Expected | Tested | Working properly |
| 3 | SRS01-SRS04, SRS07- SRS09 | ST03 | Press the Right Indicator Key 1st time | Board Power up:   * Program running * Ignition LED ON * ADC Value & UART shown on DLEW\* | Right Indicator LED & Buzzer to blink with 0.5Hz frequency | LED & Buzzer Blink but not at 0.5Hz | Tested | Need frequnency adjustment |
| 4 | SRS01-SRS04, SRS07, SRS08, SRS10 | ST04 | Press the Right Indicator Key 2nd time | Board Power up:   * Program running * ADC Value & UART shown on DLEW\* * Right indicator LED & Buzzer to blinking with 0.5Hz fequency | Right Indicator LED & Buzzer to be Off | As Expected | Tested | Working properly |
| 5 | SRS01-SRS04,  SRS07, SRS08, SRS11 | ST05 | Press the Left Indicator Key 1st time | Board Power up:   * Program running * Ignition LED ON * ADC Value & UART shown on DLEW\* | Left Indicator LED & Buzzer to blink with 0.5Hz frequnecy | LED & Buzzer Blink but not at 0.5Hz | Tested | Need frequnency adjustment |
| 6 | SRS01-SRS04, SRS07, SRS08, SRS12 | ST06 | Press the Left Indicator Key 2nd time | Board Power up:   * Program running * ADC Value & UART shown on DLEW\* * Left indicator LED & Buzzer to blinking with 0.5Hz fequency | Left indicator & Buzzer to be off | As Expected | Tested | Working properly |
| 7 | SRS01-SRS04, SRS07, SRS08, SRS13 | ST07 | Press the Light Switch Key 1st time | Board Power up:   * Program running * Ignition LED ON * ADC Value & UART shown on DLEW\* * Low Beam Light ON | The Low Beam Light to be activated in LED with 10% Duty Cycle | As Expected | Tested | Working properly |
| 8 | SRS01-SRS04, SRS07, SRS08, SRS14 | ST08 | Press the Light Switch Key 2nd time | Board Power up:   * Program running * Ignition LED ON * ADC Value & UART shown on DLEW\* * High Beam Light ON | The Low Beam Light to be activated in LED with 90% Duty Cycle | As Expected | Tested | Working properly |
| 9 | SRS01-SRS04, SRS07, SRS08, SRS15 | ST09 | Press the Light Switch Key 3rd time | Board Power up:   * Program running * Ignition LED ON * ADC Value & UART shown on DLEW\* * Left/Right indicator Led & Buzzer to blinking woth 0.5Hz frequency | The Parking Light to be activated i.e Left & Right Indicator LED & Buzzer to blink with 2Hz frequency | Both LEDs & Buzzer blink but not at 2Hz | Tested | Need frequnency adjustment |
| 10 | SRS01-SRS04, SRS07, SRS08, SRS16 | ST10 | Press the Light Switch Key 4th time | Board Power up:   * Program running * Ignition LED ON * ADC Value & UART shown on DLEW\* * Parking LEDs & Buzzer OFF | The Parking Light to be deactivated i.e Left & Right Indicator LED & Buzzer to be OFF | As Expected | Tested | Working properly |
| 11 | SRS01-SRS04, SRS07, SRS08, SRS15 | ST11 | If the Left/Right Indicator is ON: Light Switch is pressed 3rd time | Board Power up:   * Program running * ADC Value & UART shown on DLEW\* * Left/Right indicator Led & Buzzer to blinking woth 0.5Hz frequency | The Indicator status LED & Buzzer continues to work & Parking doesn’t get activated | If Switch2 is pressed when Left/Right indicator is on, the Left/Right indicator will be set Off. But the Parking light is not ON | Tested | NOT Working  properly |

\*Description: DLEW -> Debug Live Expression Window