

Programming Phase

Objectives:

The goal of this task is to practice working with digital and analog inputs on the STM32 microcontroller. You will use **push buttons** and a **potentiometer** as input components and learn how to read their signals using the *HAL_GPIO_ReadPin()* function and the *ADC interface*.

Main Tasks:

For the following subtasks, you are required to build a circuit on the breadboard from your KIT with two push buttons, PB1 (connected as active high), PB2 (connected as active low) and two LEDs, LED1 (connected as active high), LED2 (connected as active low), and one potentiometers all connected to the STM32 bluepill. To power on the STM32 bluepill, you may use the TTL cable provided in the KIT.

Send the circuit connection to your mentor before powering it on to make sure that the connections are correct and safe.

Subtask 1:

Read the signal from the PB1 and switch the LED1 ON or OFF based on the state of the button:

- If the button is pressed, → LED ON.
- If the button is released, → LED OFF.

Subtask 2:

Read the signal from the PB2, then whenever the button is pressed toggle the LED2. Pressing the button PB2 will change the state of the LED2:

- If the LED is ON, turn it OFF.
- If the LED is OFF, turn it ON.

TASK 4



Subtask 3:

Write a short documentation about how Analog-to-digital converter (ADC) works, explain about each of the ADC elements:

- Voltage reference
- Resolution
- Sampling Time

Fully AI documentations won't be accepted. Support your documentation with visualized content and list all resources used (websites, youtube videos, ...).

Subtask 4:

Read the analog value from the **potentiometer** using the **ADC** and use it to adjust the blink speed of the **LED1**. The LED should toggle with a frequency that changes between **1 Hz (slow)** and **10 Hz (fast)** depending on the potentiometer position.

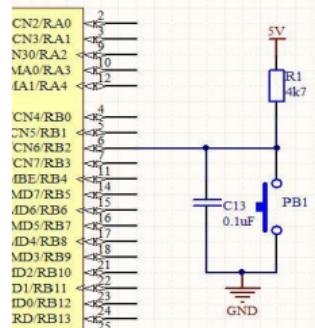
Optional Task:

- Repeat subtask 2 using external interrupt.
- Repeat subtask 4 using ADC interrupts.

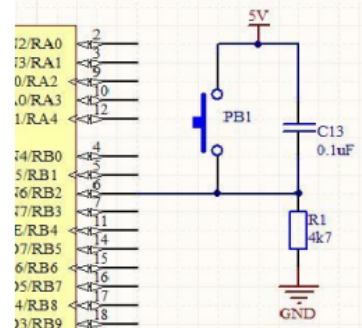
TASK 4

Hints:

- The push buttons connections:

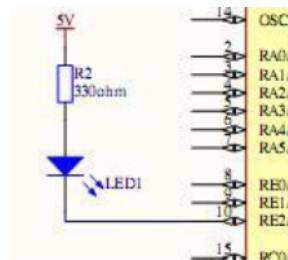


Active low

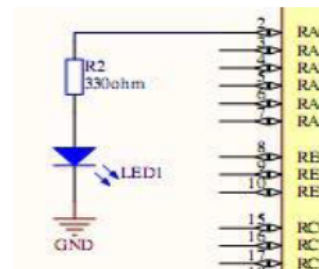


Active high

- The LEDs connections:



Active low



Active high

- As part of our encouragement for you to not fully rely on AI to complete your tasks, the following are some helpful resources to help you to complete the task:
 - <https://deepbluembedded.com/stm32-gpio-pin-read-lab-digital-input/>
 - <https://youtu.be/YVbZR3-EoKM?si=HfIAW3qBo2AbW-Hz>
 - <https://deepbluembedded.com/stm32-potentiometer-read-examples-single-multiple-potentiometers/#more-12909>
 - https://youtu.be/deMF2xu_ASQ?si=Tk3VY_hxN_LpIBqf
 - <https://youtu.be/EsZLgghqfO0?si=pc07LvnPtD6V9SH9>

Note: these are not the only available resources to help you complete the tasks. Also, they are not necessarily explaining the exact requirements of the task, but they contain some helpful information

TASK 4



- For **Subtask 2**, you will face a challenge that the STM32 is so fast in reading the data which will make it read your single button press tens of times, you need to find a way to make sure that no matter how long you hold the button, the STM32 will read it as one press.

Submission:

- Record a video explaining the circuit connections and the code and send it to your mentor.
- Send the main.c file to your mentor.
- Complete and submit this task in one PDF file for both main and optional (if done) tasks.
- Add a picture of your circuit connections to the PDF file.
- Add a screenshot of the configurations of IOC to the PDF file.
- Add a screenshot of the code of each subtask to the PDF file (only what you have modified in the generated code).
- Name the PDF files with **task4_groupx_your_name**, (replace x with your group number).
- This task should be submitted before **21st Aug 10:00pm (Malaysia time), 05:00pm (Makkah time)**.
- Your mentor must approve your task answer file before submission.
- Submit the PDF file to the Google form.