

PIAIC IoT Hackathon: Embedded Rust

Timing: 9:00 am to 9: pm Sunday, November 17, 2019

Location: PIAIC HQ, Karachi

All PIAIC IoT Faculty will participate in the hackathon in the PIAIC HQ in person. PIAIC students or others may also participate from home, if they show performance they may get selected as PIAIC faculty. Everyone will have to show his or her work at PIAIC HQ in person.

1. Project Blinky: To light all the LEDs on the STM32F3 Discovery board
The colored LEDs on STM32F3 should all light up in succession, and once they're all lit, they should then go off in the same order in the first cycle. In the second cycle they show go off in the reverse order. This first and second cycle should repeat continuously.
2. Project Sensor Data Display: Show the outputs of the following sensors on the STM32F3 board in real-time:
 - a. Motion sensor
 - b. 3-axis digital output gyroscope
 - c. 3D digital linear acceleration sensor
 - d. 3D digital magnetic sensor

Note: The output should be shown in real time like on this video:

<https://www.youtube.com/watch?v=488qheY73ic>

3. Using the 6D/4D-orientation detection sensor (LSM303DLHC) on STM32F3 report in real-time when the board is in face-up or face-down positions.
4. Write a program using the e-compass sensor that one of the eight LEDs should light up to indicate the direction of the north (Keep the board in a horizontal position). Tilt the board and the eight LEDs should blink again and again.
5. Programming GPIO Interrupts with Embedded Rust
 - a. Implement the code and run it on your STM32F3 board using the PAC (Peripheral Access Crate) exactly as show in this article:
<https://flowdsp.io/blog/stm32f3-01-interrupts/>
 - b. Implement the same functionality as demonstrated in the article using the HAL (Hardware Abstraction Layer) crate.
 - c. Check out the comments in this article:
https://www.reddit.com/r/rust/comments/b2hxay/programming_gpio_interrupts_on_the_stm32f3/
In the comments it is mentioned that: "You're better off polling in a timer ISR or any other deterministic time slot." You are required to implement the same solution as done in parts a and b above using this approach.
6. Timer queue using RTFM
Use the RTFM Rust framework and follow the example below in the link, schedules two tasks from init: foo and bar. foo is scheduled to run 8 million clock cycles in the future. Next, bar is scheduled to run 4 million clock cycles in the future. Thus bar runs before foo since it was scheduled to run first.
<https://rtfm.rs/0.5/book/en/by-example/timer-queue.html>

7. IoT Weather Station Project

Due: Saturday, Nov 23rd at 7pm in Axiom IoT Lab

You are required to build a weather station project in Rust as shown in the following article:

<https://hackmag.com/coding/creating-weather-station-on-the-basis-of-stm32f3discovery-and-wizfi220-wi-fi-module/>

You can use any Wifi module you want, however we would suggest that you use ESP8266 for this purpose because it is easily and cheaply available in the Pakistani market. It also works well with any microcontroller and in this case it will be used as a 'dumb' Serial-to-WiFi bridge.

You can buy from Daraz but don't know how good it is:

<https://www.daraz.pk/products/esp-8266-wifi-module-for-arduino-diy-stem-projects-esp8266-i3134720-s12480344.html>

<https://www.daraz.pk/products/096-inch-4pin-blue-iic-i2c-oled-display-module-12864-i100732558-s1246084794.html>

The only requirement for this project is that it should be programmed in Embedded Rust.

If the screen is not available you can use semi-hosting to show output.

References:

<https://www.youtube.com/watch?v=Sd7xE52zL5U>

<https://circuitdigest.com/microcontroller-projects/interfacing-esp8266-with-stm32f103c8-stm32-to-create-a-webserver>

https://www.youtube.com/watch?v=JgY_9Al4ZjU

<https://community.platformio.org/t/esp8266-stm32f4-advice-is-needed-before-i-waste-more-time/6458/2>

<https://www.youtube.com/watch?v=z07zjf0Hb8E>

http://www1.futureelectronics.com/mailling/etechs/Murata/etech_MurataSN8200Series/Murata_Quick%20Start%20Guide.pdf

If you need funding to buy any equipment it is available please just contact me.

Notes:

You can access the internet during the hackathon. You can even talk to other participants, but sharing your code is not allowed.

You may use this, or some other method to print your output and show it to the graders:

<https://rust-embedded.github.io/book/start/semihosting.html>

If you have a question call Zia Khan at 0300-826-3374