Aplicações Avançadas de Instrumentação MIEF/MIEB

1st Semester - 2023/2024

Universidade Nova de Lisboa - Faculdade de Ciências e Tecnologia

Lab 6 – M5Stick

Contents

Previous Requirements

Learn about M5Stick

The M5StickC an edge module designed by m5stack (https://m5stack.com/), powered ESP32 processor and it is a portable, easy-to-use, open-source IoT development board. The M5StickC incorporates various hardware resources within its compact body, including a 3-axis accelerometer, 3-axis gyroscope, red LED, infrared transmitter, real-time clock (RTC), microphone, user buttons, 0.96-inch LCD display, and power/reset button. Additionally, it is equipped with a 120mAh lithium battery for portable operation. The device also offers expansion interfaces, making it compatible with a wide range of modules and units, allowing for further customization and versatility.

You will all the needed information about the M5StickC in:

https://docs.m5stack.com/en/core/m5stickc_plus

Install Arduino IDE and M5StickC Libraries

To develop custom application in the M5StickC, you are going to use the Arduino IDE. If you do not yet have Arduino IDE installed in PC, please get it from (install version 1.8###):

https://www.arduino.cc/en/software

The M5StickC needs a set of libraries and drivers installed in Arduino IDE. To do that follow the tutorial in: https://docs.m5stack.com/en/quick_start/m5stickc_plus/arduino

Important Note: Install the following versions: Arduino IDE version 1.8.## and with M5Stack Board version 2.0.6. Pay attention to select the correct versions.

At the end of the tutorial, there is an example to display “Hello World” in the display of the M5StickC. Try it, to check that all the necessary resources are properly installed.

For more examples that you can run try in M5Stic, check:

https://github.com/m5stack/M5StickC-Plus/tree/master/examples

To access the M5StickC functions library go to:

http://docs.m5stack.com/en/arduino/arduino_home_page?id=m5stickc_api

and select STICKC tab. For example, you can find the information how to control the LCD screen.

The First Programs

Try the following examples and analyse them in a critical way. Try to do some changes in the program to see the results.

Hello World

- Copy to the Arduino IDE the program found in:
  - https://github.com/m5stack/M5StickC-Plus/blob/master/examples/Basics/HelloWorld/HelloWorld.ino
- Compile and download it to the M5StickC.
- Try to change size, position, and colour of the text.

Buttons

- Copy to the Arduino IDE the program found in:
  - https://github.com/m5stack/M5StickC-Plus/blob/master/examples/Basics/Button/Button.ino
- Compile and download it to the M5StickC.
- See the result of its execution.

Inertial Sensors

- Copy to the Arduino IDE the program found in:
  - https://github.com/m5stack/M5StickC-Plus/blob/master/examples/Basics/IMU/IMU.ino
- Compile and download it to the M5StickC.
- Move the M5Stick and see the change of the results in data.

Microphone

- Copy to the Arduino IDE the program found in:
  - https://github.com/m5stack/M5StickC-Plus/blob/master/examples/Basics/Micophone/Micophone.ino

- Increase the GAIN_FACTOR to 20
- Compile and download it to the M5StickC.
- Try the microphone and see the result in its display.

Challenge

Develop a program with the following characteristics.

1. When the button A is pressed once
    a. Read the 3 axis of accelerometer at a rate of 10 samples/sec
    b. Print in the LCD 3 lines, with different colours, one for each axis.
2. When the button A again
    a. Stop the IMU acquisition.
    b. Print in the LCD 'System Standy. Press A to start'

Communicate with RPI through BLE

The M5Strick as BLE (Bluetooth Low Energy) communication built in. We are going to use this communication mode, to send bidirectional data form M5Stack to the RPI.

There are two files in the Github of this course, with example codes how to do this communication.

- Lab6_M5Stick_BLE.ino – Run it in the M5Stick
- Lab6_RPI_BLE.py – Run it in the RPI

Some important notes:

- Settings name and UUID's of your device
    - Before you try to execute the software, you need to give specific id's to your M5Stack, otherwise you will not know to which one are you trying to connecting to. To do that you must edit the following lines.
        - #define DEVICE_NAME "m5-stack"
        - #define SERVICE_UUID "94039c15-338f-4297-9014-aaba7d760713"
        - #define CHARACTERISTIC_UUID "94039c15-338f-4297-9014-aaba7d760713"

And

- DEVICE_NAME = "m5-stack"
- SERVICE_UUID = uuid.UUID("94039c15-338f-4297-9014-aaba7d760713")
- CHAR_UUID = uuid.UUID("94039c15-338f-4297-9014-aaba7d760713")

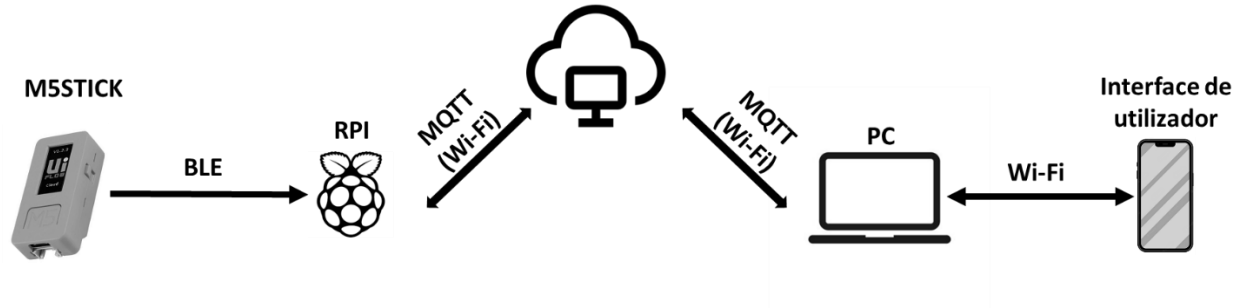
  - DEVICE_NAME is a name of your choice.
  - Use https://www.uuidgenerator.net/ to generate a new UUID. Use UUID version 4 format.

- Start first the M5Stick software. From this moment it will be in standby to accept a communication from the RPI.
- Start the RPI software. It will start searching for the M5Stick.
  - The connection can take some time to complete. You will see “Retrying …” showing up in you console. That is the normal behaviour.
- After successful connection you can:
  - Press button A of M5Stick to do a single data acquisition.
  - Press button B of M5Stick to do a continuous data acquisition.
  - In both situation you should see the results in the RPI console
- To end connection, press any key in the RPI.
- If you wish to do a new connection with the M5Stick you need to reboot it. To do that:
  - Press button C for 7 seconds. Display goes black. Press button C again and system should restart.

Final Challenge

At this moment of the course, you have all the tools necessary to:

- Acquire data from the M5Stick, transmit it to the RPI though BLE (Lab6).
- Transmit data from the RPI to the PC through MQTT (Lab 4).
- Visualise the data in a web interface developed in streamlit (Lab 5).



Your challenge is, starting from the software that you already have from previous Labs, modify it, so you can see the inertial data acquired by the M5Stick, in a plot in the streamlit running in your PC.