Robothon trainer guide

This is a guide for the trainers of Robothon by Electronix ENSTABC. It represents the overall structure of the event and the most important topics and details to mention and keep in mind throughout the event.

General guides

You are faced with people who have no prior experience with embedded systems, you should keep in mind this point throughout the event, and remember that they are not aware of the criticality of the mistakes (short circuits, reverse polarity, …).

- Make them aware of how expensive the hardware they are going to work with is,
- Remind them that they're not allowed to power up their circuits before it gets checked by you,
- Let them work as a team, answer their questions, and let them know that software is a tool! They are here to engineer a solution, not to write code solely,
- Focus on the theory behind why we wrote the code the way we did, not the code itself,
- Have fun!

Workshop ZERO

This workshop is meant to introduce them to the world of embedded systems, why do they exist, and how do they work from a high-level perspective. Remember that you will be diving into the details in later workshops, so you just briefly go through the main points.

Workshop ONE

Here, you start diving into the details of microcontrollers, focusing on the Arduino board. This workshop must cover:

- Digital I/O → Blink example.
- Analog VS Digital and the **Arduino Uno** pinout.
- Fade example and a brief intro to **PWM** (as a gateway to the next workshop).

Points to keep in mind:

- Explain how VCC = + = 5V = RED WIRE
- Explain how GND = - = 0V = BLACK WIRE

- Explain why we need a **current limiting resistor** in series with each LED
- Explain how the **Vin** pin on the Arduino board is the input voltage pin, whereas **5v**, and **3.3V** pins are **outputs**

Workshop TWO

In this workshop, it is more important for them to understand what an actuator is, and how can we exert programmable actions with code.

Topics that must be covered:

- What is a motor (a little bit of induction physics).
- What is an **H-Bridge**, and how does it work → Turn a single motor forward and backward with code
- What is the difference between Torque (moment) and speed (Omega) and **how do gears increase Torque by decreasing speed**.
- Relationship between Torque and current consumption.
- Back to **PWM**, and **varying motor speed in general** →Two motors example.

Points to keep in mind (all the above points must be retained at all time):

- The **L298N** motor driver must share a common ground with the Arduino board for them both to have the same reference (remember, voltage is a difference in potential).
- Do not use pins **0** and **1** when downloading the code to the board, else it will not download.

Workshop THREE

At this point, the attendees are familiar with most basic concepts of Arduino programming, so now we go even deeper with the theoretical concepts.

Topics that must be covered:

- What is a sensor.
- How does an IR (Infrared) sensor work, and how can we employ the difference in reflectivity of black and white surfaces to differentiate between them → Two IR sensors example
- How can we use IR sensors to make simple line following robots → simple line follower example.
- How does an ultrasonic sensor work and how can we use the speed of sound in air to calculate distances → measure distance example.

Points to keep in mind:

- You have a lot to cover here, so do not let them code anything from scratch, just explain to them how the code works.
- All sensors must be powered up appropriately for them to operate, so make sure they do not screw things up.

Workshop FOUR

This workshop is not meant to be a lengthy one. You are going to talk about the benefit of remotely controlling robots and how we need a medium to communicate with them through in order to control it. Topics that must be covered:

- What is a communication protocol (suggestion for a good analogy: language for us humans).
- What is the Serial communication protocol (briefly, no details about packets and timing)
- How do we receive data with our Arduino board through Bluetooth → RC robot example.

References

- Source code: https://github.com/Rad-hi/Robothon

Consult the README of the above reference.

End of document,

Radhi SGHAIER, 19/11/2021.