Presidential Initiative for Artificial Intelligence and Computing (PIAIC)

https://www.piaic.org

Artificial Intelligence of Things (AIoT) Specialist Program

Course Syllabus

Quarter I:

IoT-101 Intro to IoT and Fundamentals of Programming using Rust

First Quarter in Islamabad 2019 (12 Weeks)

Teaching Team: Imran Ali, Hassan Naseer

Shah Lateef Bhittai Auditorium:
Sunday -- 09:00 AM to 12:00 PM
Sunday -- 06:45 PM to 09:45 PM

Course Description: In this course, we will start by introducing AIoT and embedded systems and move on to learn the Rust systems programming language. We'll learn about basic programming concepts using Rust 2018, then we will explore key Rust concepts in depth, such as ownership, the type system, error handling, and fearless concurrency. You'll also learn how to make your programs interactive and how to test your code safely before adding it to a project. It is a fast-paced, thorough introduction to programming with Rust 2018 that will have you writing programs, solving problems, and making things that work in no time. In this quarter we will also learn Git, the distributed version control system. We will also review Git based GitHub services.

Please bring a Laptop with you for the Classes (Required, but not mandatory)

Textbooks:

1. The Book: https://doc.rust-lang.org/nightly/book/
   You can *rustup doc --book* and *rustup doc* to read the book in HTML form locally.
   Coding Practice: https://github.com/rust-lang/rustlings
2. Learn Version Control with Git: A step-by-step course for the complete beginner by Tobias Günther

Reference books:

1. Programming Rust: Fast, Safe Systems Development by Jim Blandy, Jason Orendorff
2. Git Essentials by Ferdinando Santacroce

PIAIC Announcements Facebook Group:https://www.facebook.com/groups/piaic/
Course Facebook Group:https://www.facebook.com/groups/aiot.edu/

Portal for online and onsite students:
https://portal.piaic.org/

Ask Questions:
https://ask.piaic.org/

Chat on Slack:
https://piaic-iot.slack.com

Facebook Group:
https://www.facebook.com/groups/aiot.edu/

Grading:
Students will be graded based on Percentile
https://en.wikipedia.org/wiki/Percentile
https://en.wikipedia.org/wiki/Percentile_rank

A-Grade: 78- 99 Percentile
B-Grade: 41- 77 Percentile
C-Grade: 23- 40 Percentile
D-Grade: 1 - 22 Percentile
F-Grade: Anyone who doesn't appear in two or more exams

Note: Anyone who receives a F-Grade will be removed from the program. Students who receive a D-Grade will be put on probation, and be required to earn a grade of C or above in the next quarter, to remain in the program. Anyone absent from an exam will be deemed to have received a score of zero.

Course Outline:

1. **Introduction to Internet of Things and Embedded Systems** (Week 1 and 2)
   https://docs.google.com/presentation/d/14OcW4HfS2i1Db1uKOU6SrckFEFjhSLMgfnHYB3XlEZo/edit?usp=sharing
   What is the Fourth Industrial Revolution?
   What is IoT?
   Embedded Systems
   Hardware and Software for IoT
   Edge and Cloud Computing
   The future of IoT is AI
   Blockchain in the Internet of Things?
   IoT + AI + Blockchain: The Fourth Industrial Revolution has begun

   Mid-Term I: Introduction to Internet of Things (IoT) Quiz in Week 3
   Total Questions: 46, Total Time: 60 minutes

2. **Additional and Supplementary Material: Fundamentals of Version Control with Git**
   (Videos and reading material available on Student Portal to help students learn Git, this material will not be covered in class to save class time)
   Chapters 1, 2, 3, and 4 Learn Version Control with Git: A step-by-step course for the complete beginner by Tobias Günther

   We will also covers these readings:
   https://help.github.com/articles/markdown-basics/
   http://stackoverflow.com/questions/5009600/difference-between-fork-and-branch-on-github
   http://stackoverflow.com/questions/3329943/git-branch-fork-fetch-merge-rebase-and-clone-what-are-the-differences
   https://git-scm.com/book/en/v2/Git-Branching-Rebasing
   http://git-scm.com/book/en/v2/Git-Branching-Remote-Branches#Tracking-Branches

   For practice: https://try.github.io/levels/1/challenges/1

   Homework:
   https://www.datacamp.com/courses/introduction-to-git-for-data-science

Git Quiz in Week 1 of Quarter 2
Total Questions: 60, Total Time: 75 minutes
Note: Git study material and videos are being made available in the first quarter so that students are able to use Git immediately. The Git Quiz will be conducted in the first week of the next quarter i.e. second quarter and not in this first quarter.

3. **Rust Programming Part 1** (Weeks 3B, 4 and 5)
   Read and Watch: https://hub.packtpub.com/rust-is-the-future-of-systems-programming-c-is-the-new-assembly-intel-principal-engineer-josh-triplett/
   Chapter 3 of https://doc.rust-lang.org/nightly/book/

   Programming Assignments will also be given.

4. **Rust Programming Part 2** (Weeks 6 and 7)
   Topics 4.1 and 4.2 of https://doc.rust-lang.org/nightly/book/

   Programming Assignments will also be given.

5. **Rust Programming Part 3** (Weeks 8-9)
   Chapter 5 and topic 10.2 (Traits) of https://doc.rust-lang.org/nightly/book/

   Programming Assignments will also be given.

   Mid-Term II: Rust Programming Quiz 1 in Week 9
   Total Questions: 62, Total Time: 75 minutes

6. **Rust Programming Part 4** (Weeks 10-11)
   Topics 6.1 and 6.2 of https://doc.rust-lang.org/nightly/book/
   https://doc.rust-lang.org/nightly/rust-by-example/custom_types/enum.html

   Chapters 7, 8, and 9 of https://doc.rust-lang.org/nightly/book/

   Programming Assignments will also be given.

7. **Rust Programming Part 5** (Weeks 12)
   Topics 10.1 of https://doc.rust-lang.org/nightly/book/
   https://doc.rust-lang.org/nightly/book/ch10-02-traits.html#traits-as-parameters
   Topics 10.3, 13.1, and 16.1 of https://doc.rust-lang.org/nightly/book/

   Programming Assignments will also be given.

   Final: Rust Programming Quiz 2 in Week 13
   Total Questions: 54, Total Time: 75 minutes

The speed of the class will depend on how much students are able to absorb the material. If some material is left after the end of the first quarter it will be taught in the second quarter but the sequence will remain exactly as above.

Important Notice: In the next quarter i.e. PIAIC IoT Specialist Program Quarter 2 we will be learning Rust Embedded Programming. In order to practice embedded programming using Rust every student will need to buy an STM32F3 Discovery Board. The F3 boards are in short supply in Pakistan due high demand from our students. Therefore, all students should order the F3 boards during the first quarter ASAP because it will take about 30 days to reach Pakistan.

The STM32F3 Discovery Board Details:

https://www.st.com/en/evaluation-tools/stm32f3discovery.html

You may order the F3 boards from these or other sources:

https://www.digikey.com/product-detail/en/stmicroelectronics/STM32F3DISCOVERY/497-13192-ND/3522185

https://www.aliexpress.com/item/1-pcs-x-STM32F3DISCOVERY-Development-Boards-Kits-ARM-STM32F3-Discovery-32-Bit-ARM-M4-72MHz/32336381671.html