**EECS 388 – Embedded Systems**  
**4 Credit Hours – Fall 2020**

**Course Description**

An embedded system is a smart system with special-purpose computation capabilities. You can see examples of embedded systems every day in smart appliances, cars, medical devices, etc. In this course, you are going to learn about the hardware and software architecture of embedded systems. At the end of the course, you will learn how to program a microprocessor to interact with the physical world through sensors and actuators. This course is divided into two parts: lectures and labs. Lectures will teach you the theory about embedded systems, and in the labs you will implement what you learned during the lectures. Here is a (tentative) list of the topics that we will cover in the lectures:

1. Introduction to embedded systems: what is an embedded system and the differences between embedded systems and general-purpose computers.
2. Embedded software echo-system: Introduction to tools and environment for developing embedded software (build toolchain, GNU make, IDEs, git).
3. C programming refresher: a brief introduction to C.
4. RV32 ISA: a brief introduction to RISC-V assembly language.
5. Microprocessor's memory address space.
6. I/O (sensors and actuators): how to interact with the physical world using sensors and actuators.
7. Interrupt: Difference between interrupt and polling, how to use them, and the implications of using them.
8. Concurrency and threads: how to utilize the available parallelism in the hardware and develop concurrent embedded software.
11. CPU and memory architecture: Learn how instructions get executed in the hardware. Studying the micro-architecture of a basic RISC-V, single-cycle processor.

**Class Meetings**

**Lecture**  
*Note: One in-person and one online session*

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<thead>
<tr>
<th>Days</th>
<th>Time</th>
<th>Classroom</th>
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<tbody>
<tr>
<td>Tuesdays and Thursdays</td>
<td>11:00 AM – 12:15 PM</td>
<td>LEEP2 G415</td>
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**Labs**  
*Note: Students attend only one session (online or in-person)*

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<tr>
<th>Days</th>
<th>Time</th>
<th>Rooms</th>
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<tbody>
<tr>
<td>Mondays</td>
<td>8:00 – 9:45AM (Yiju) or 2:00 – 3:45PM (Earving)</td>
<td>EATN 3002</td>
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<td>Tuesdays</td>
<td>8:00 – 9:45AM (Eric) or 1:00 – 2:45PM (Yiju)</td>
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<td>Wednesdays</td>
<td>8:00 – 9:45AM (Eric) or 2:00 – 3:45PM (Earving)</td>
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<td>Thursdays</td>
<td>8:00 – 9:45AM (Eric)</td>
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<tr>
<td>Fridays</td>
<td>8:00 – 9:45AM (Yiju)</td>
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Course Staff

Instructor
Dr. Mohammad Alian
Email: alian@ku.edu
Office: 2022 EH
OH: Tu 2:00 – 3:00 PM, Th 2:00-3:00 PM

Graduate Teaching Assistants (GTAs)
Jose Earving Morales
Email: earving_08@ku.edu
Office: EATN 3013
OH: W 12:00PM - 1:00PM, F 10:00AM - 11:00AM

Eric Seals
Email: ericseals@ku.edu
Office: EATN 3013
OH: M 2:00 – 3:00 PM, W 2:00 – 3:00 PM

Yiju Yang
Email: y150y133@ku.edu
Office: EATN 3013
OH: M 10:00 – 11:00 AM, Tu 3:00 – 4:00 PM

Supplemental Instructors (SIs)
Chauncey Deone Hester
Email: chaunceydhesterjr@ku.edu
Fares Elattar
Email: fareselattar@ku.edu

Office Hours Policy
Students need to book a timeslot with the instructor or GTAs if they want to meet in person.

Course Website and Discussion Forum
We use Microsoft Teams for online discussion. Lecture notes and announcements will be posted on the course website, Teams, and Blackboard.

Teams link
Http://eecs388.ku.edu

Homework and Grading
Before some of the lectures, there are a few questions that you should answer and upload them to Blackboard. We are going to answer the questions during the lecture and provide a rubric for the answers. You should grade yourself by the next lecture. If your grade is less than 50%, you have an opportunity to resubmit your answers again for 50% of the final grade. We randomly grade 10% of your homework at the end of the semester. If the GTA's score is less than the student's score, then we grade all your homeworks and penalize you for 20% of your final score. Therefore, if there is confusion in the rubric, please check with the instructor/GTAs before grading yourself.

Homework: 10%
Midterm: 20%
Final: 30%
Lab: 40%
Attendance: 0%* (please see attendance policy for more info)
Lab Instructions
In EECS388 labs, you will learn how to use microcontrollers and embedded processors for interacting with the physical environment using I/O devices. This is the (tentative) labs topics:

- Introduction with the embedded software development environment
- C-programming
- UART
- Sensor reading
- Servo motor control
- Timers
- Introduction to embedded Linux
- Linux scheduler
- Real-time DNN inference
- Self-driving car

Each student needs to attend one lab session every week. Online students and students who have COVID related issues can attend their lab section remotely. Please check with the instructor/GTAs if you need to attend a lab session remotely.

Academic misconduct
Students should not share their homework, lab code, and lab report with others or copy other students' code or report. In the case of plagiarism, we follow the university policy for academic misconduct:
http://provost.ku.edu/memos/20090814

Attendance policy
Due to the Covid-19 pandemic, we do our best to implement asynchronous learning. The lectures are going to be broadcasted over zoom and uploaded to the course website. Students are not required to attend the lectures physically, but if you decided to attend, you must wear a mask and practice social distancing. You should not physically attend the lectures, labs, and office hours if you feel sick, have tested positive for COVID, or have been around someone who has tested positive. Please check with the instructor or GTAs for remote lab attendance.

Late submission
You have 72 hours in the whole semester to use for late homework submission. You can also miss one of the homework during the semester. The late submission policy for the lab assignments will be included in the lab handouts.