



Embedded Systems and IoT - Moving Ahead

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3rd Year BTech (E&E)

NITK Surathkal

9 May 2020

Outlines

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- WHOAMI

2 Intro

- What is an Embedded System?
- Why Embedded Systems?

3 How do I learn all this?

- Learning

4 Architecture

- Computer Architecture

5 IoT

6 General Tips

WHOAMI

WHOAMI I

- 1 2021 Batch, Electrical and Electronics Engineering
- 2 Memberships in NITK -
 - ACM - Vidyut and Sanga, also SIGARCH
 - IRIS NITK - Product Team
 - Flying and Robotics Club
 - Technites (Engi' 17 and 18)
 - eYantra Lab Setup Initiative (eLSI), CSD NITK
- 3 Interests -
 - Computer Architecture
 - Digital Design
 - Embedded Systems (obviously :P)
 - Digital VLSI

WHOAMI II

4 Internships

- Upcoming Research Assistant at Computer Aided Design Lab (CADL), SERC, IISc Bengaluru
- Student Developer, Free and Open Source Silicon Foundation (FOSSi), Under Google Summer of Code (GSoC) 2020
- Summer (2019) Intern at Wadhvani Electronics Lab, Dept. of EE, IIT Bombay

5 Projects

- Remote Triggered Hardware Learning Platform - CSD NITK
- eYantra Robotics Competition (2018 and 2019)
- Smart RFID Cards - IRIS

PS: whoami is a unix command too :)

**Yeah that was just to
convince you to listen :P
now let's get started**

What is an Embedded System?

What is an Embedded System?

Definition

“An embedded system is a computer system—a combination of a computer processor, computer memory, and input/output peripheral devices—that has a dedicated function within a larger mechanical or electrical system. It is embedded as part of a complete device often including electrical or electronic hardware and mechanical parts. Because an embedded system typically controls physical operations of the machine that it is embedded within, it often has real-time computing constraints. Embedded systems control many devices in common use today. Ninety-eight percent of all microprocessors manufactured are used in embedded systems.”

copy pasted from wikipedia hehe

Why Embedded Systems?

Why Embedded Systems?

- Popular? yes
- Extensively used in industry? yes
- A great choice for industry career? yes
- A great choice for academia? yes*

What fields in the industry?

- Internet of Things (IoT) (buzzword uk)
- Consumer Electronics
- Robotics
- Process Control
- Automotive
- Your phones too!

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Research themes in Embedded Systems

- Architecture (my favourite :D)
- Power and Energy (most important!)
- Security (very crucial)
- Machine Learning on the Edge (inference at least)
- Reconfigurability - FPGAs et al.
- Communication - IoT, 5G, WAN
- Innovative software stacks - RTOS

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How do I learn all this?

"Choose a path to find a way" - S.P. (2020)

Learning I

Disclaimer - Do I know everything? Definitely not!

- First step - Your SMP
 - Arduino
 - Communication Protocols
 - IoT - Basics of Internet
 - Embedded C

- Now the quote - Embedded Systems is fairly vast

- Coursera - UC Boulder, UC Irvine

- Real hands on projects - copy pasting is also learning, if you want to

Learning II

- Few great websites/communities for product based projects and knowledge:
 - Hackster.io
 - Arduino Playground
 - element14 community
 - TinyML
 - eYantra
 - TI IICDC - Competition and Resources
- Few cool boards to start with:
 - Arduino - Uno / Nano / Mega
 - NodeMCU - ESP32 / ESP8266 - IoT buddy
 - STM32 - for serious ARM based work
 - SiFive boards - not very popular yet, but interesting stuff

Let's talk architecture now

cause I like it what else

Computer Architecture

- Computer is a slave - of the ISA
- Intel (x86) sucks!
- RISC vs CISC
- RISC-V
- My GSoC Project
- Want to learn? CS250 (NITK), CS61C (UCB EECS)

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Some gyaan on IoT

IoT

- Areas involved:
 - Understanding embedded systems
 - Understanding the internet - protocols, HTTP
 - Web Development - GET/POST, frontend, backend
 - The future? Cloud! - AWS, Azure Sphere, GCP
- Very important for Edge ML - Edge Impulse
- Tensorflow Lite for uC
- More about cloud

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General Tips

Random advices from a to-be final year

General Tips

- For real world embedded - forget Arduino
- On your PC - abandon Windows - now!
- Software-less work is a myth
- Many times - presentation matters more, than the work itself
- Opportunities exist everywhere - you have to find them
- Network, ask, interact - LinkedIn is a blessing
- Look outside the box

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Now Let's Talk

Thank You!

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