
Embedded System Development and Applications

Lecture 01: Introduction

Bei Yu

Course Administration

❑ Instructor: YU, Bei
Office: SHB 907

❑ TA: ZOU, Lancheng
JI, Yuhao
LI, Mingjun

❑ URL/newsgroup:
<https://www.cse.cuhk.edu.hk/~byu/CENG4480/2024Fall/index.html>

Email: byu@cse.cuhk.edu.hk

Grading Scheme

❑ This is a hands-on, lab-oriented course: **Learning by doing!**

❑ Grading scheme

- | | |
|---------------------------------------|-----|
| ● Assignment & in-class exercises | 15% |
| ● Lab (Starting from Week 3) | 20% |
| ● Quiz (on Oct. 28) | 25% |
| ● Final Project | 40% |
| ◆ Proposal presentation on xx (10%) | |
| ◆ Final demo on xx (30%) | |

Academic Honesty

1. Zero Tolerance

Plagiarism, cheating, misconduct in test/exam will be reported to the Faculty Disciplinary Committee for handling.

2. Penalty

Zero marks for the concerned assignments/test/exam/whole course, reviewable demerits, non-reviewable demerits, suspension of study, dismissal from University.

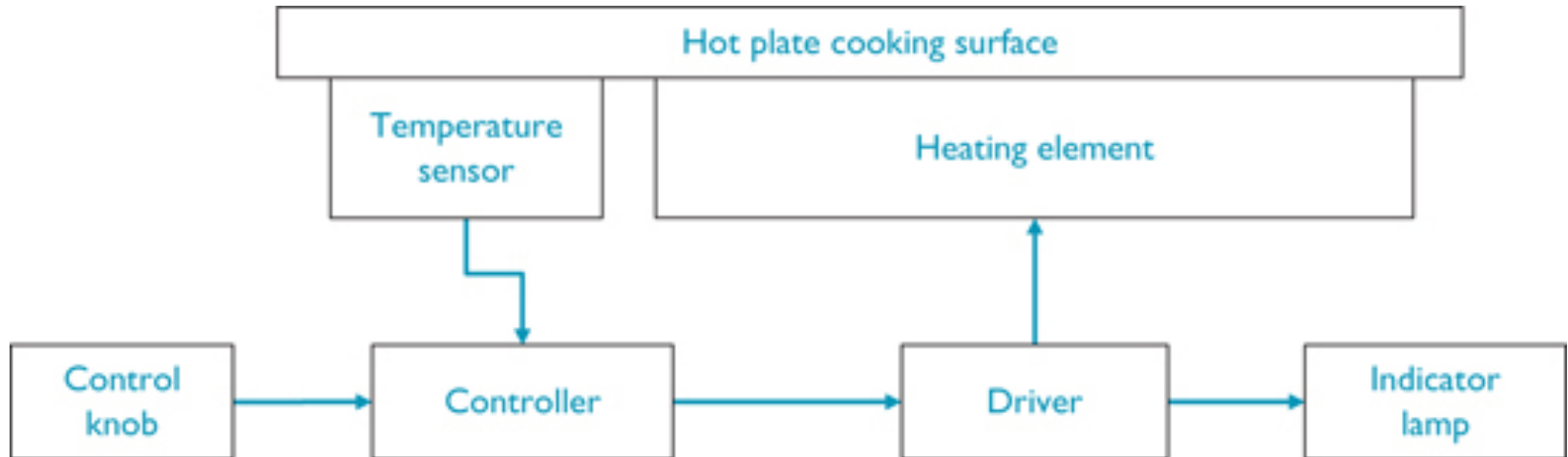
3. University Guidelines to Academic Honesty

<http://www.cuhk.edu.hk/policy/academichonesty/>

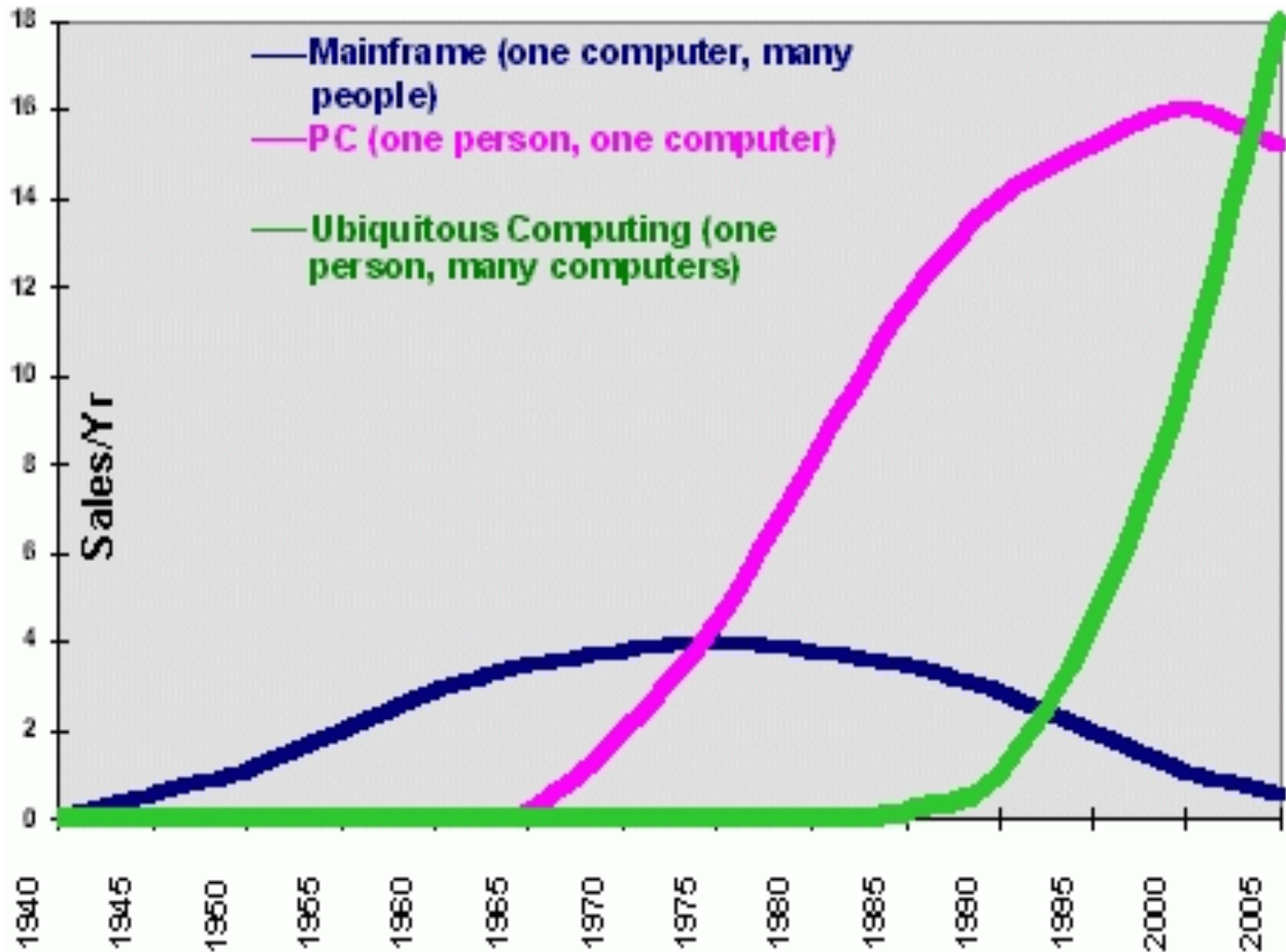
What You Should already Know

- ❑ Electronic theory and digital logic
 - Basic circuit laws and theorems
 - Number system
 - Boolean algebra
- ❑ Basic embedded system design
 - MCU/memory architecture
 - Interfacing techniques
 - Low-level C programming

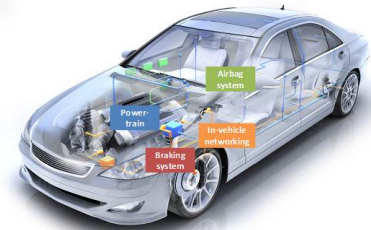
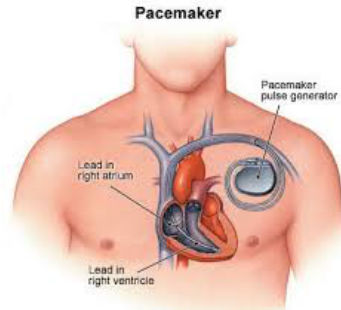
Embedded Systems



Weiser's 3 waves of computing



Embedded Systems

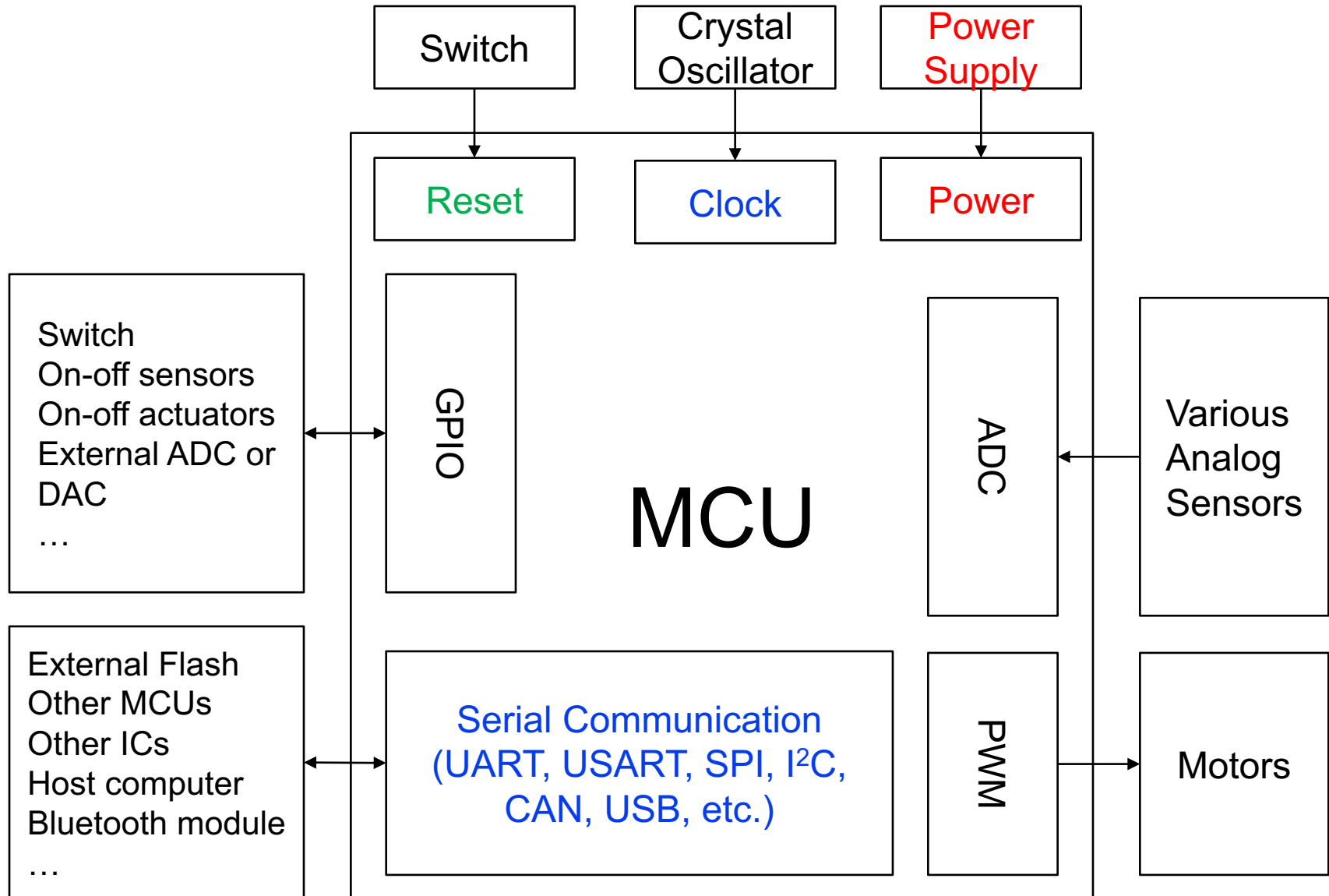


What separates them from general-purpose computers?

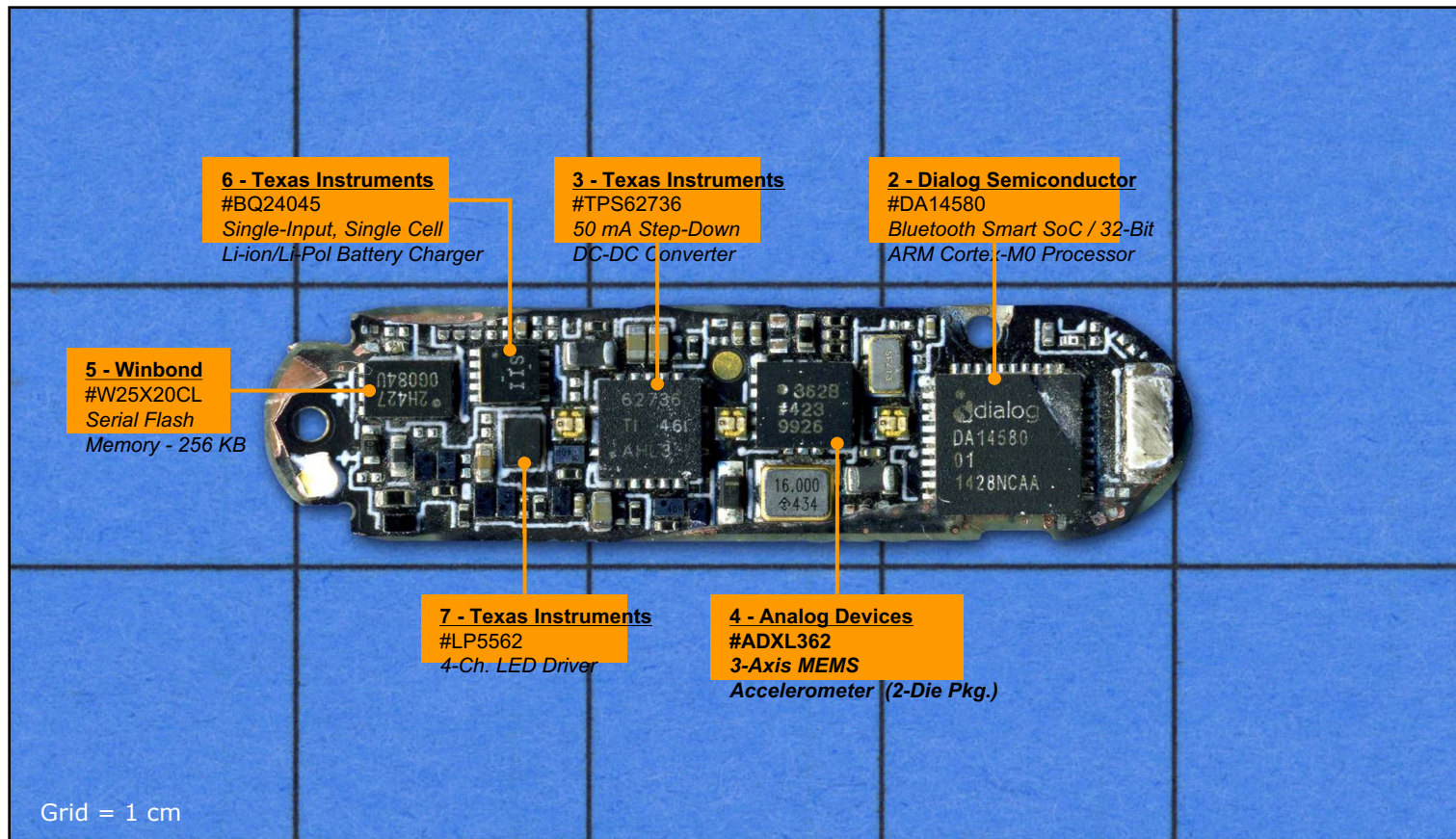
CENG2400 – Revisit Questions

- ❑ What is MCU? What components does it include?
- ❑ Name two serial communication protocols used in embedded systems.
- ❑ Compare interrupt- with polling-based designs.

Embedded Systems



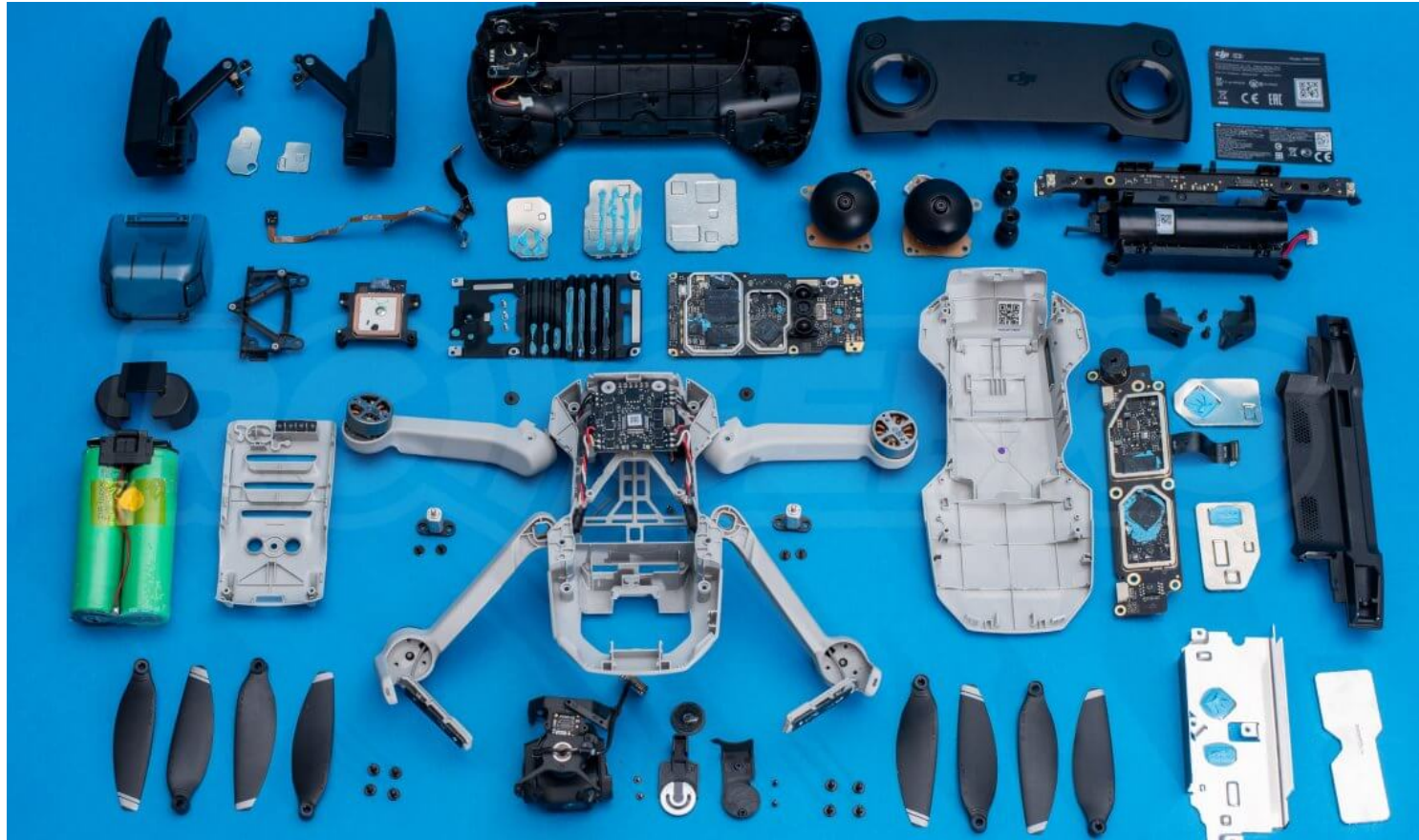
Mi Band System



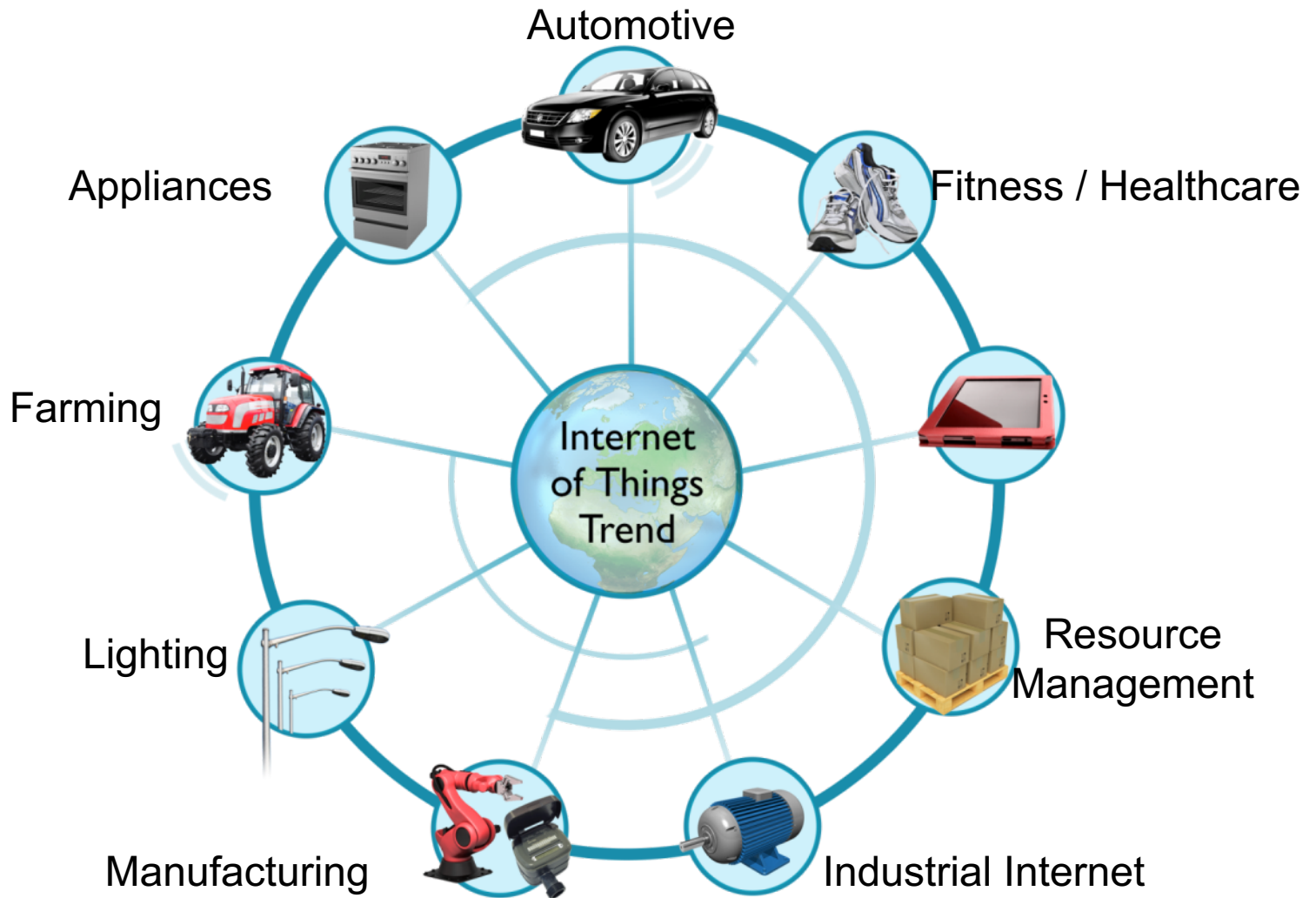
DJI Mavic Mini



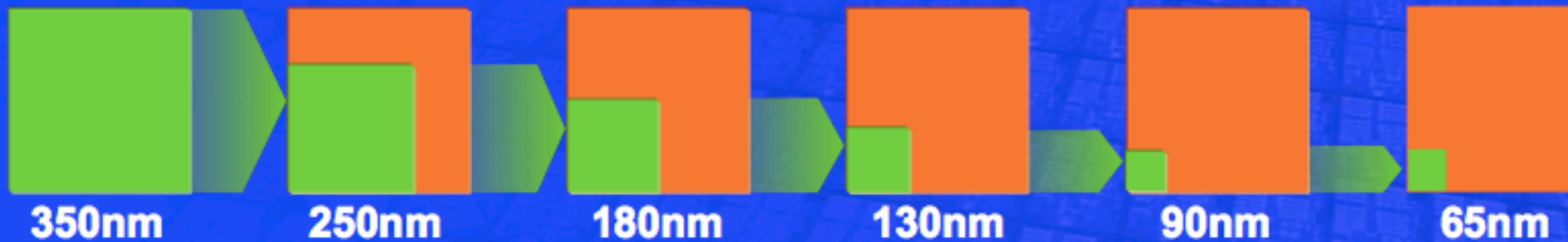
DJI Mavic Mini Teardown



Internet-of-Things (IoT)



Main driver: device scaling ...



**Twice the
circuitry in the
same space
(architectural
innovation)**

OR

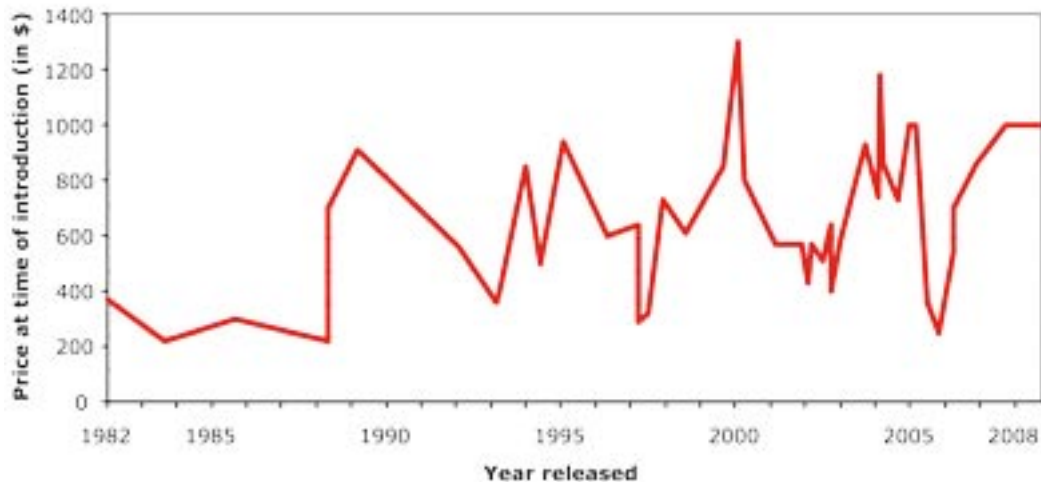
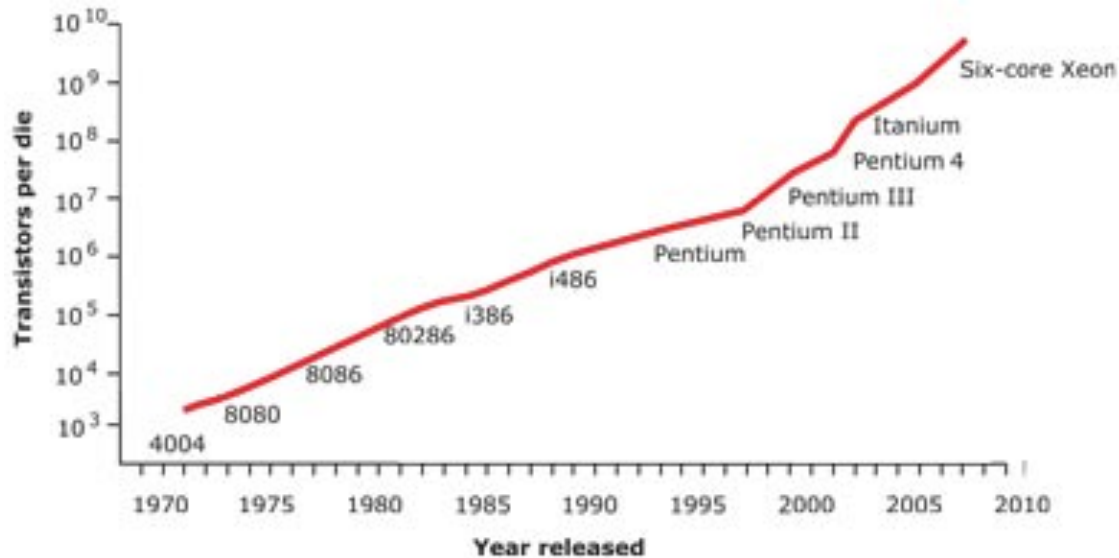
**The same
circuitry in half
the space
(cost reduction)**

=

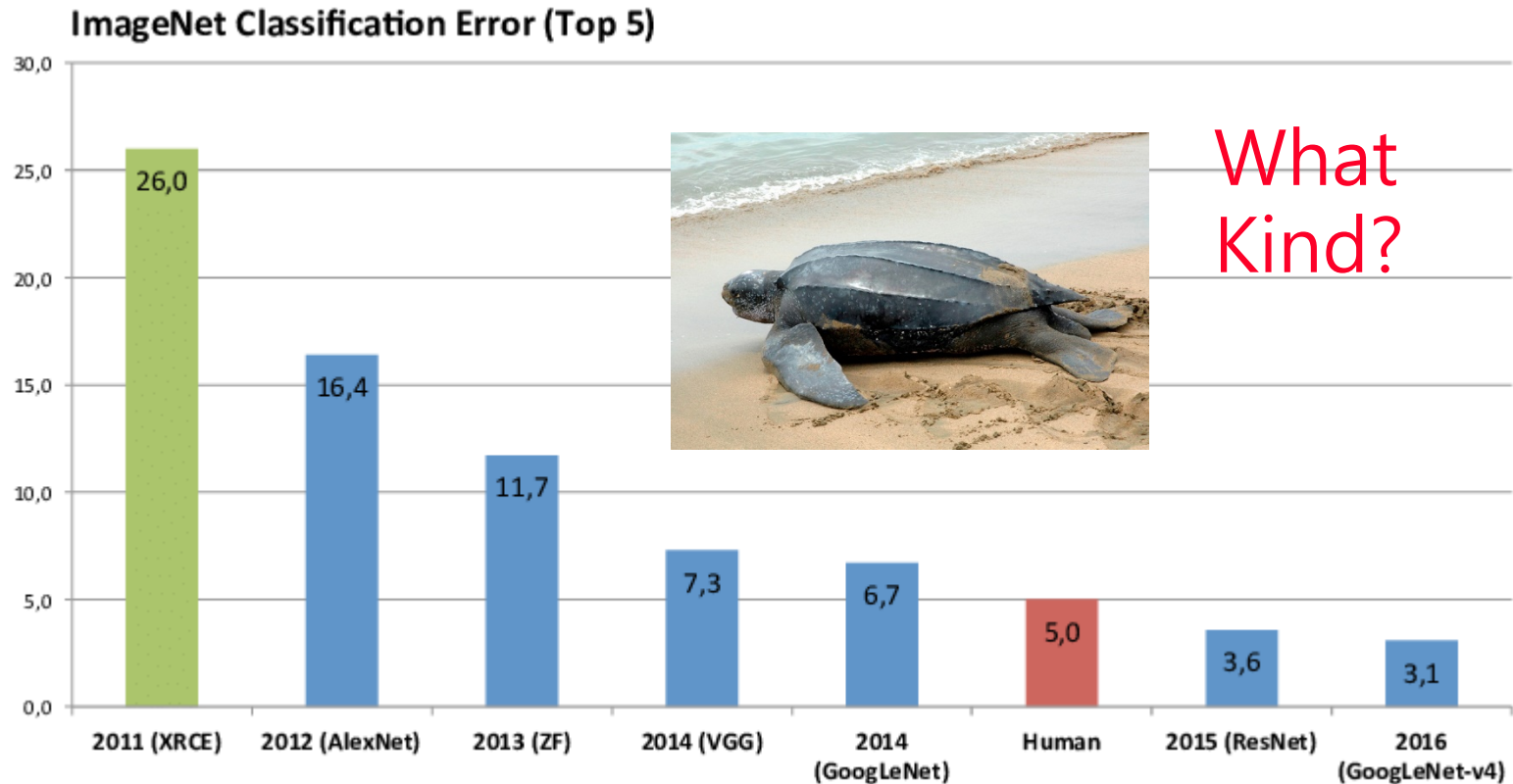
**Half the die size
for the same
capability than
in the prior
process**

From: "Facing the Hot Chips Challenge Again", Bill Holt, Intel, presented at Hot Chips 17, 2005.

Moore's Law on Intel Processor



Deep Learning – Exceeds Human Performance



Source of image: https://www.researchgate.net/figure/Winner-results-of-the-ImageNet-large-scale-visual-recognition-challenge-LSVRC-of-the_fig7_324476862

nature

THE INTERNATIONAL WEEKLY JOURNAL OF SCIENCE

At L
can't

ALL

CONSERVATION

SONGBIRDS A LA CARTE

*Illegal harvest of millions
of Mediterranean birds*

PAGE 452

Raw Observations

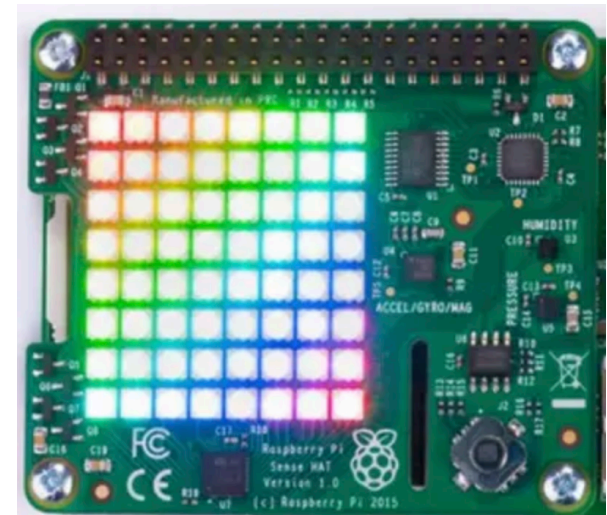
Neural

The figure illustrates the StarCraft II environment and the AlphaStar agent. The top left shows the 'Render of Agent's view' from AlphaStar. The top right shows the 'MaNa' (Map and Network) interface. The bottom left shows 'Raw Observations' (a grayscale map) and 'Neural Network Activations' (three heatmaps). The bottom right shows 'Outcome Prediction' (a bar chart) and 'Considered Build/Train' (a list of units/builds).

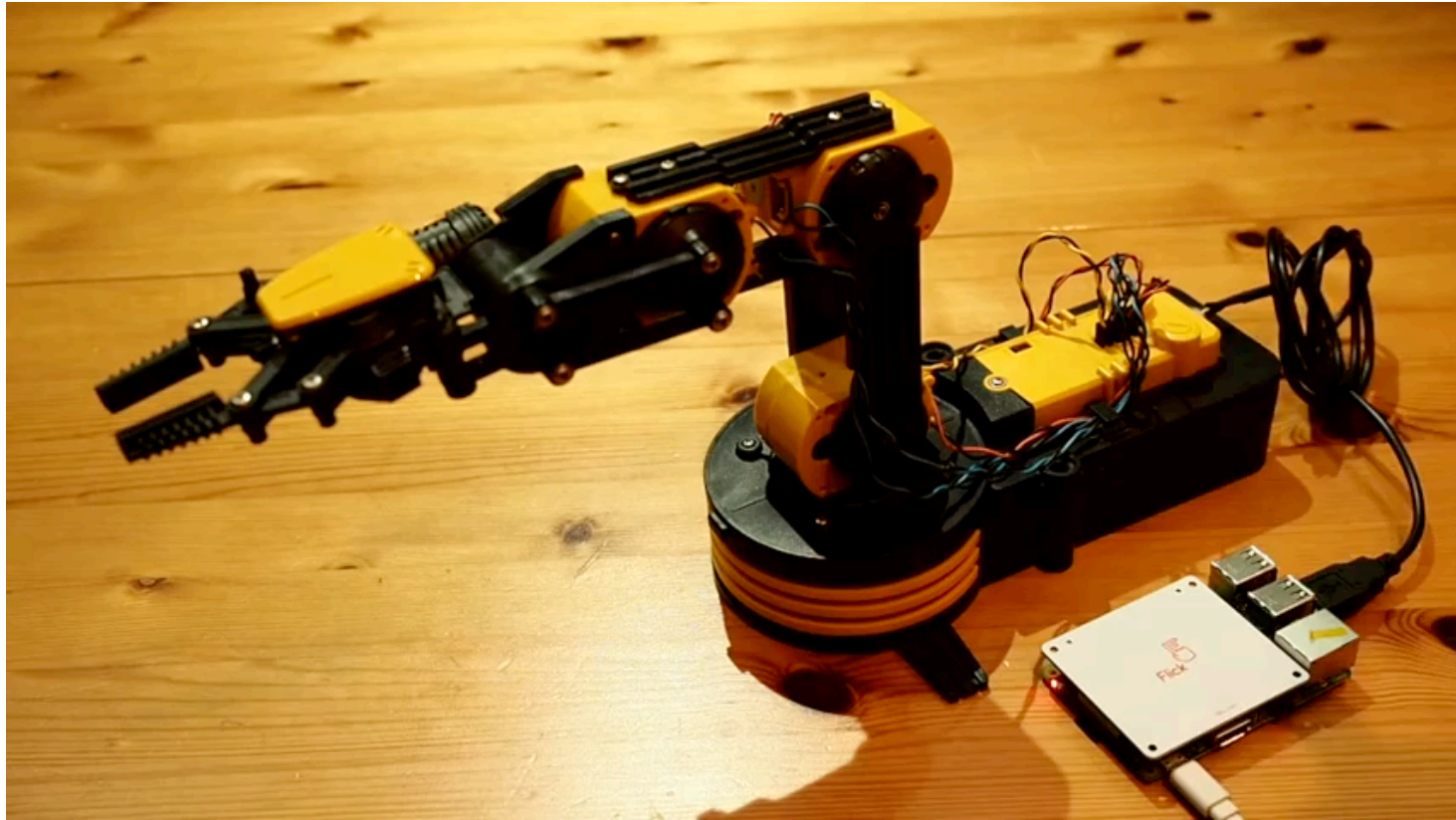
Course Contents

- ❑ Embedded system development
 - Embedded programming
 - OS and real-time concepts
 - Sensors and actuators
 - Embedded AI
- ❑ Hands-on labs
- ❑ Final projects

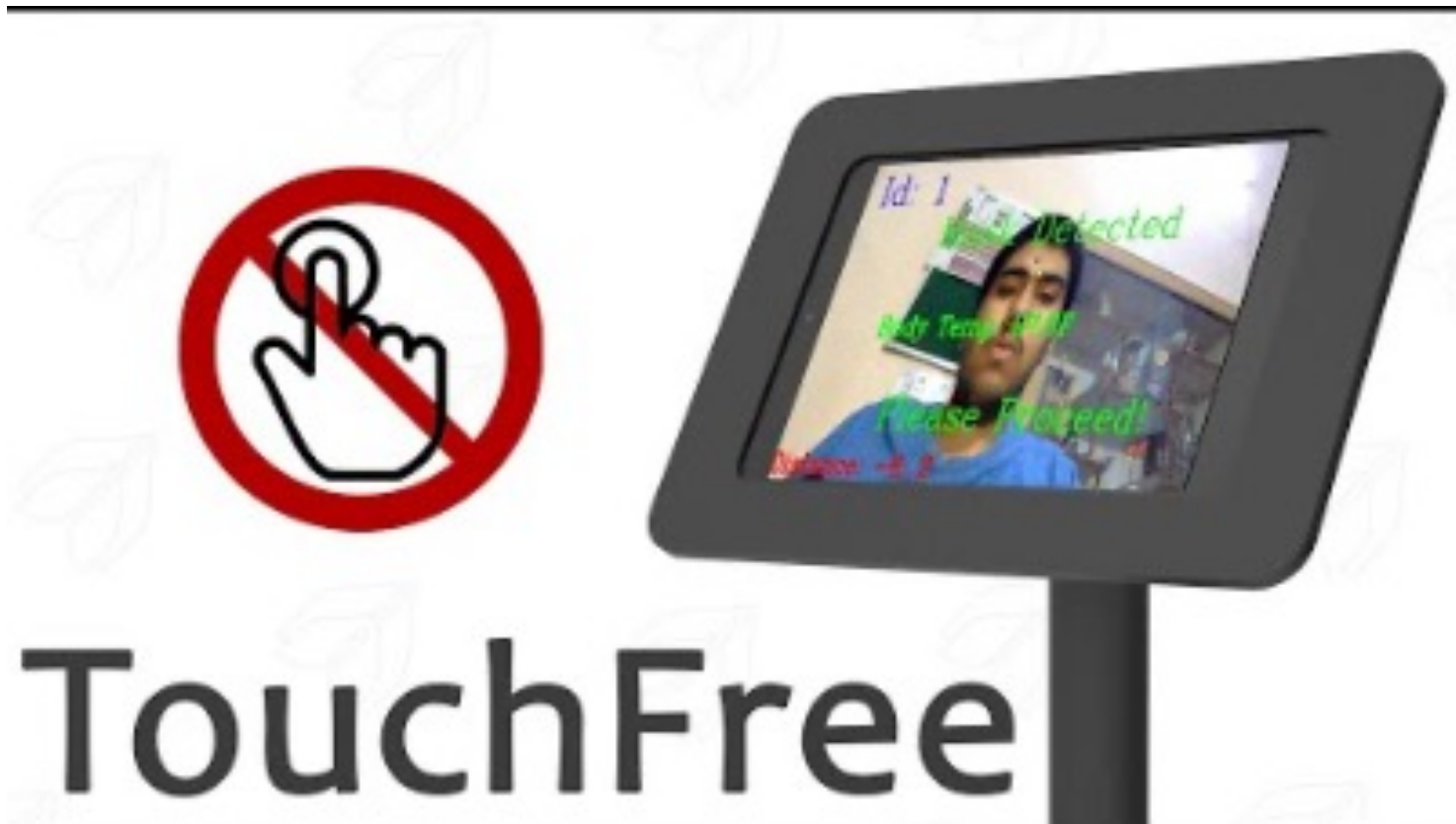
Development Board – Raspberry Pi



What can be Done with Pi?



What can be Done with Pi?



What can be Done with Pi?



What can be Done with Pi?

