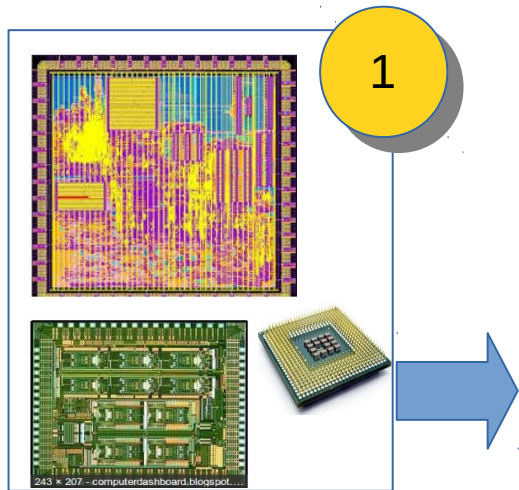
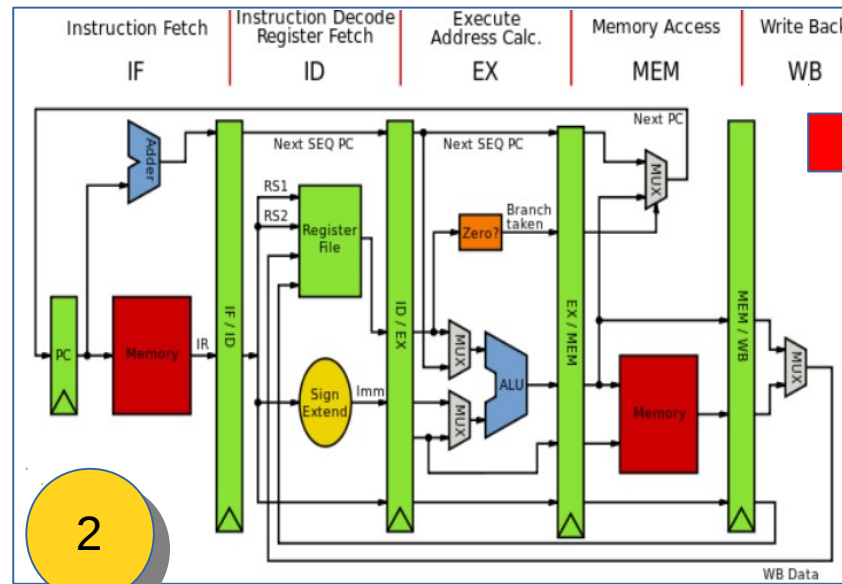


# Scope of the Advanced Microprocessor Systems



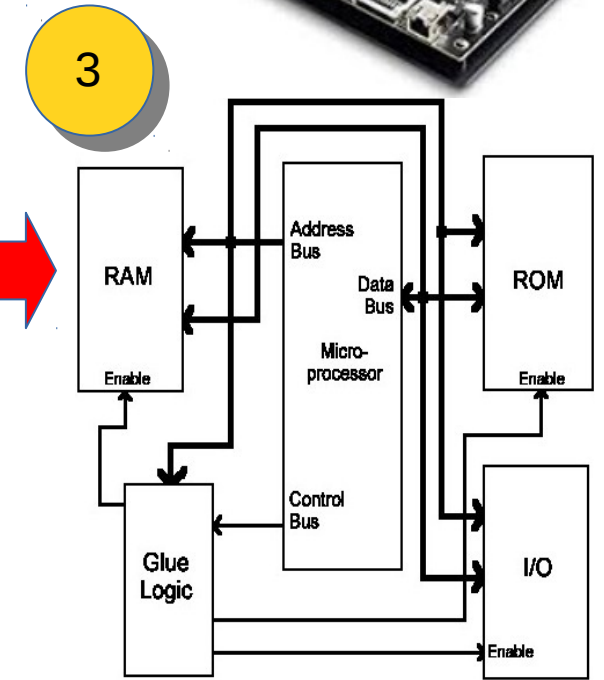
## Physical:

VLSI Design, place and route, bonding and packaging  
Tools: Cadence CAD design tools, Verilog language and VHDL language



## Architecture:

ALU, Memory Hierarchy, Pipeline, Register Files, Cache etc.  
Tools: C, System C, Verilog, VHDL, FPGA for prototyping



## Systems:

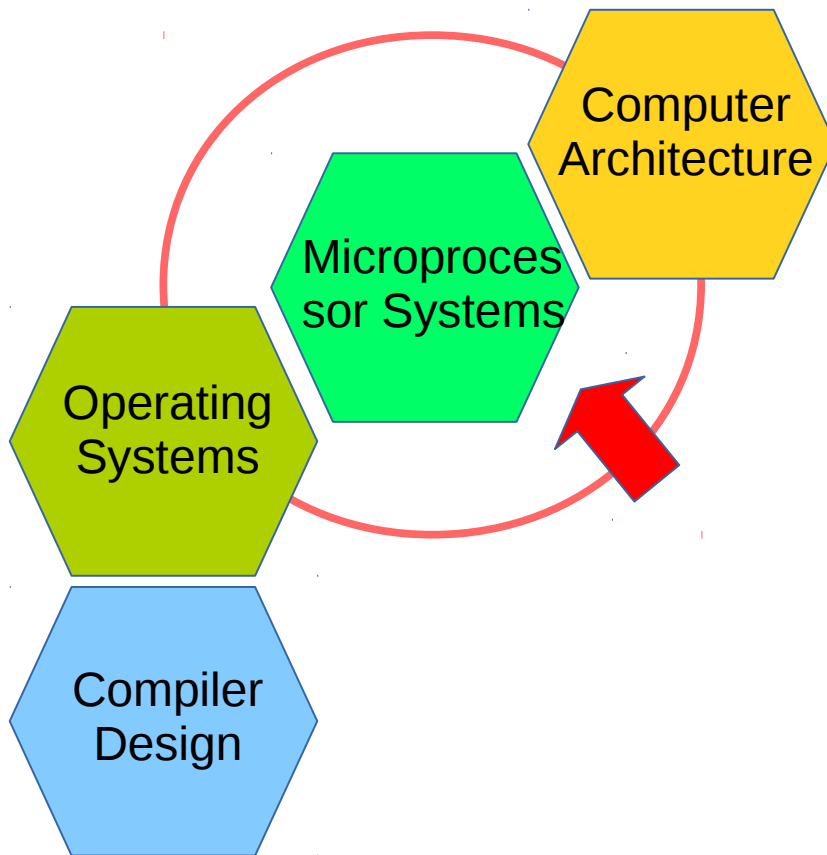
CPU, bus systems, memory unit, I/O interface peripheral controllers and the design for its optimized operations  
Tools: Assembly (more on the compiler design), C/C++, and higher programming language

# Emphasis On System Aspects

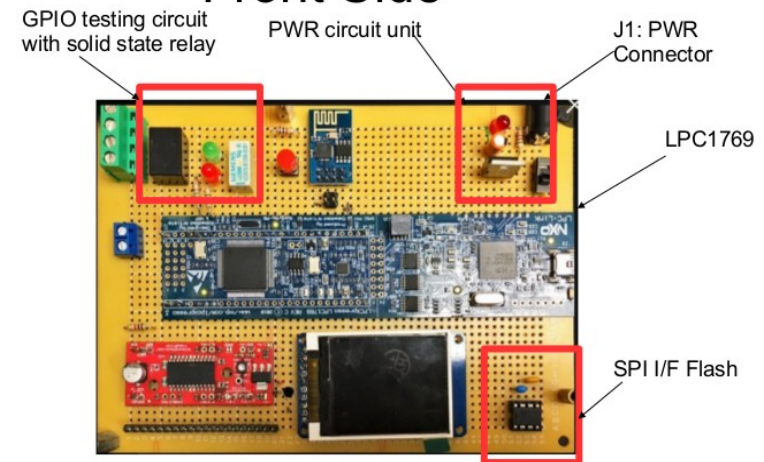
## For Advanced Microprocessor Systems

Selection Criterion: (1) Focus on the system aspects; (2) with good understanding of architecture, but not architecture design course, not designing sub-systems and basic building blocks, such memory management unit, bus controller, pipeline etc.

(3) Focus on the system aspects but staying on the microprocessor side of the study with little or no discussion of OS, to leave the OS aspects out for separate subject to discuss.



### System Layout Design Front Side



Dimension: 16 x 11 mm or 6.25 x 4.50 inch

Harry Li, Ph.D.

# Advanced Aspects: GPU

## of Microprocessor Systems

1

ARM

Combines an ARM Cortex-A8 CPU with a PowerVR GPU. Apple's iPad, iPhone and Apple TV



Produced	From September 9, 2015 to Present
Designed by	Apple Inc.
Common manufacturer(s)	TSMC; Samsung
Max. CPU clock rate	1.85 GHz (iPhone 6s, iPhone 6s Plus, iPhone SE, iPad 9.7 2017)

2

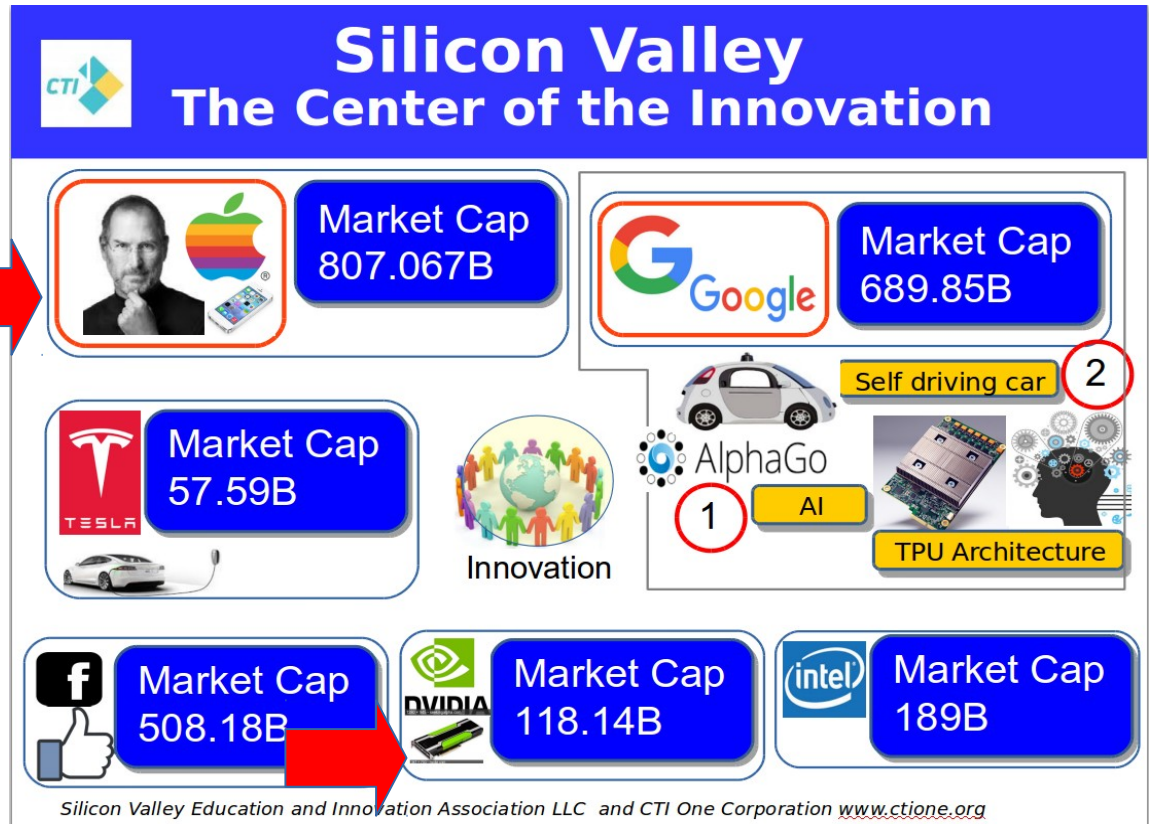


GPU

3



Microprocessor+GPU



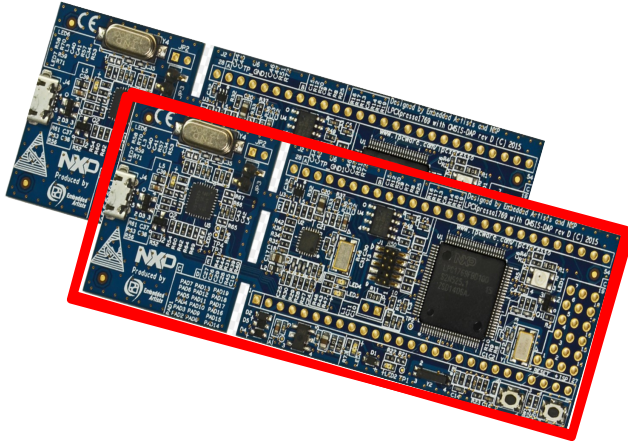
[www.ctione.com](http://www.ctione.com) And [www.ctione.org](http://www.ctione.org)



# Enhance MCU With Graphics Processing Engine

GE To GPU

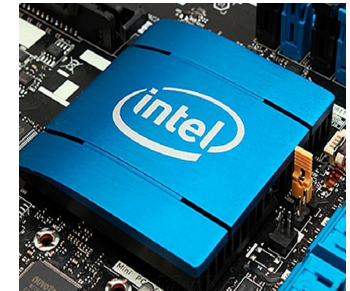
Use LPC 1769



Compare to Desktop or Laptop GPU

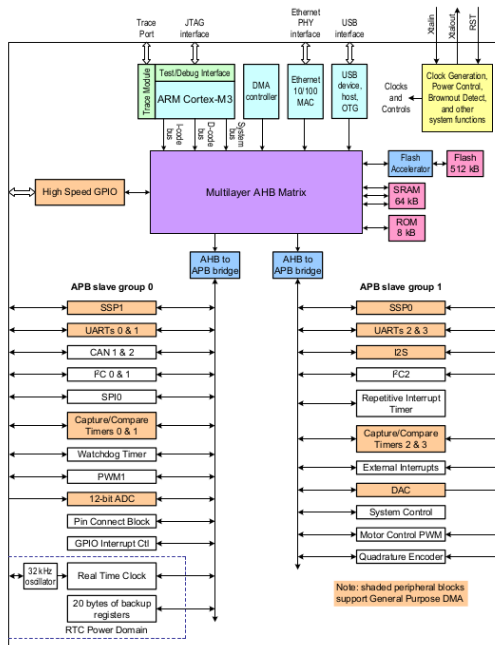
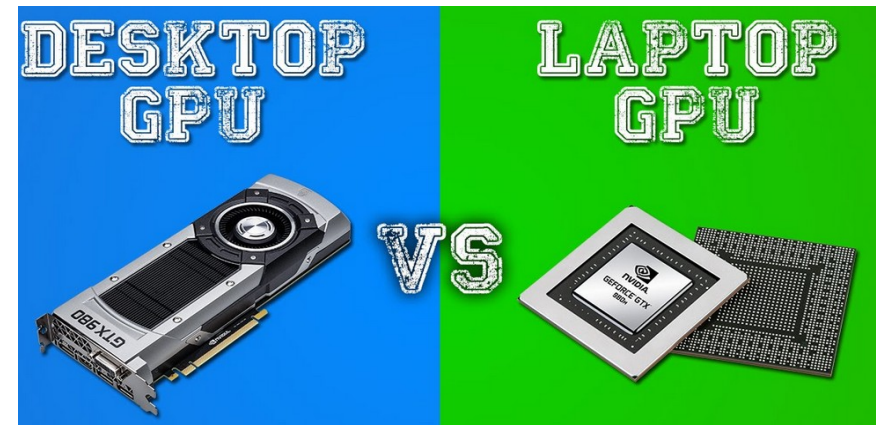


Or



+

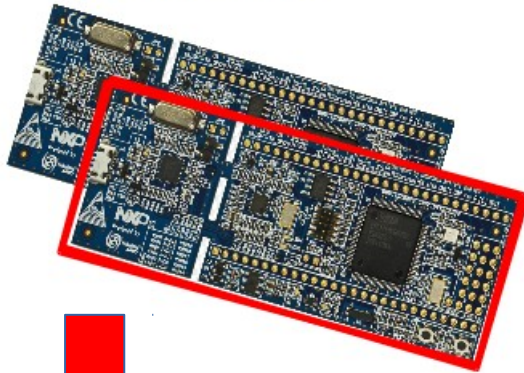
+



# MCU With GE Or (GPE)

## Build Its Capability Now

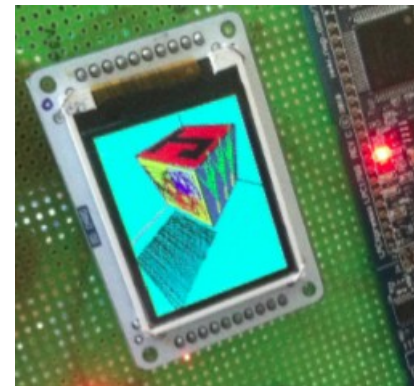
Use LPC 1769



Display Driver



3D GE or (GPE)



2D GE or (GPE)



### System Layout Design Front Side

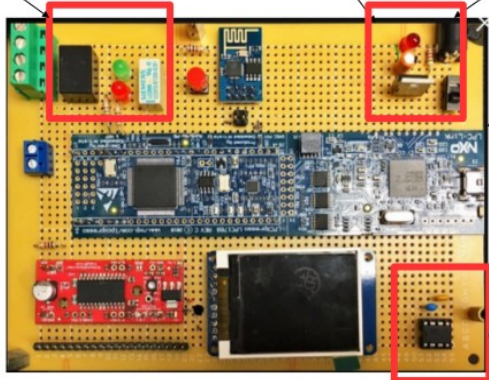
GPIO testing circuit  
with solid state relay

PWR circuit unit

J1: PWR  
Connector

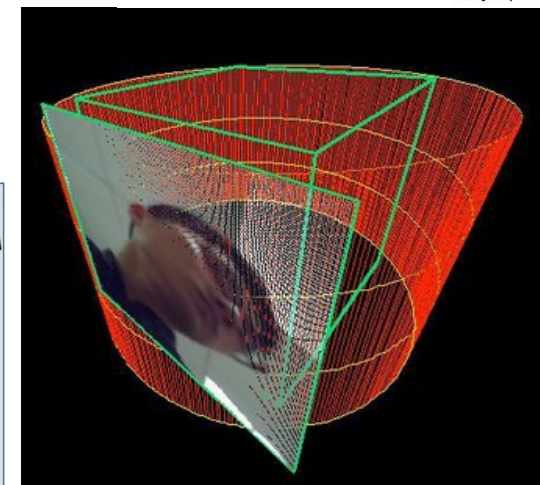
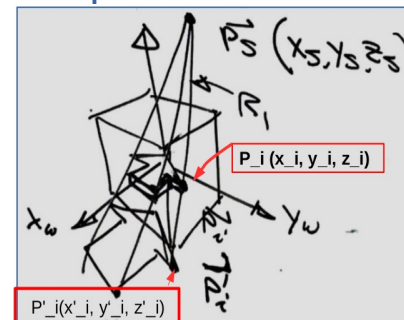
LPC1769

SPI I/F Flash



Dimension: 16 x 11 mm or 6.25 x 4.50 inch

AR



(1) Define a  
single point  
light source  
 $P_s(x_s, y_s, z_s)$

(2) Build 3 floating  
cubes, each  
different size and  
different  
orientation

(3) Decorate  
each surface of  
the cube just  
like in lab 2

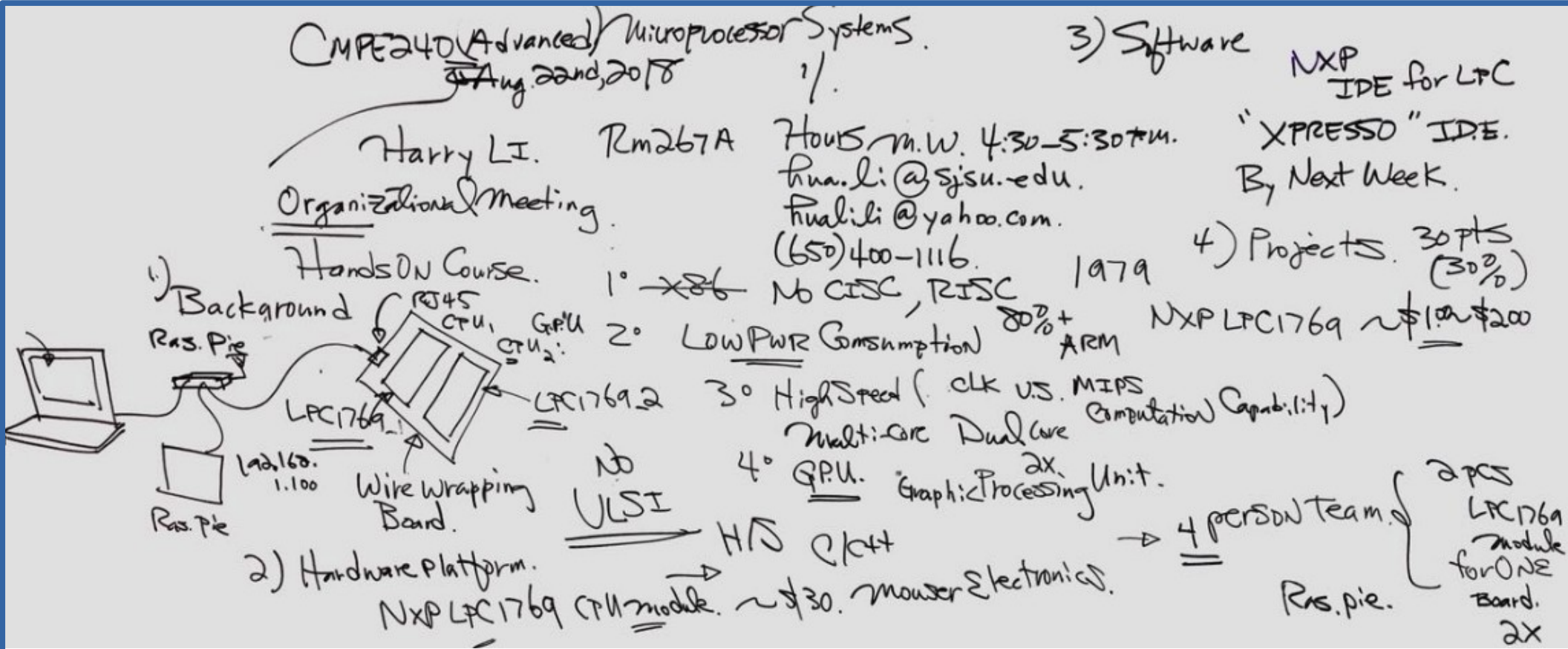
(4) Compute  
and then paint  
the shade of  
each cube on  
xw-yw plane

Harry Li, Ph.D.



# 8-22-2018 Introduction

## Organizational Meeting



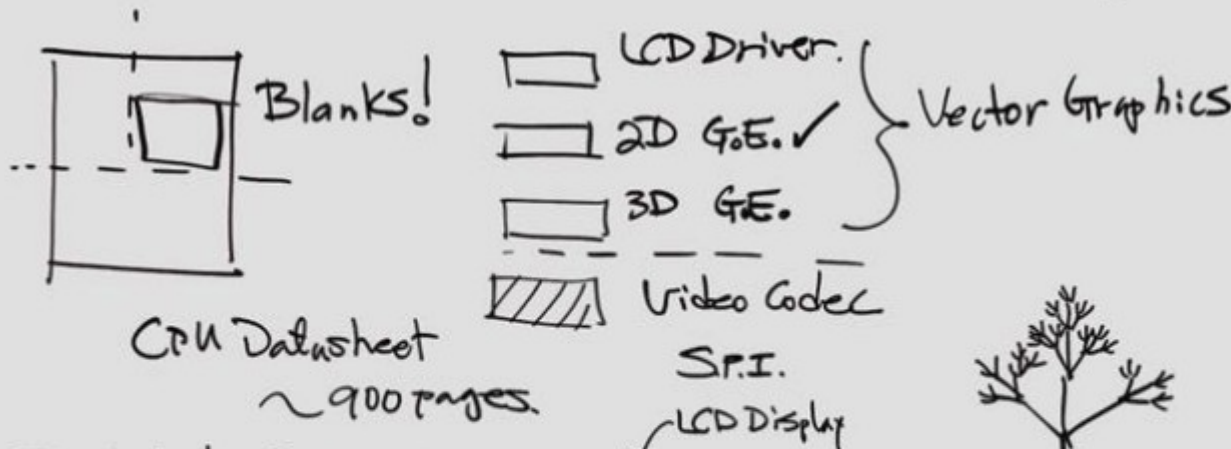
# 8-22-2018 Introduction

## ARM + Multi-core + Graphics Processing Unit

CMRE240 August 22nd, 2018 2/.

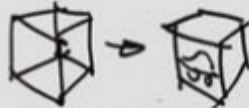
Grading Policy: 1° Projects 30pts. (30%)  
2° Midterm 30pts (30%)  
3° Final (Comprehensive) (40%)  
40pts.

Online:  
github/hualili



Project 1. 2D G.E.

Project 2. 3D G.E.



Project 3.

Diffuse Reflection.

# 8-27-2018 Introduction

## CPU Block Diagram And Prototype Board (1)

CMPE240 Advanced Microprocessor Systems  
Aug 27, 2018 Harry Li y.

Today's Topics:


- 1° Architecture Overview.

Objectives: Investigate, Design, Build  
An Advanced Microprocessor Systems.

GPU      RISC-ARM      Prototype of System.

CPU Datasheet. 1) Datasheet As Base Line Reference. → CPU

Example: Architecture Block Diagram.



peripheral controllers.

Example: L6C1769 master  
L6C1769 slave.  
S.P.I.  
② L6C1769 CPU module.  
① Wire Wrapping Board (for 2 CPU modules)  
4-person Team.  
4" x 4"

Homework: ① Download CPU Datasheet  
② Clock Rate?

Advanced Features: 1° LCD Driver  
2° 2D G.E. 3° 3D G.E.  
4° Video Codec (Encoder/Decoder)



# 8-27-2018 Introduction

## Spec For prototype Board (2)

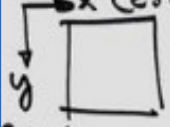
CMPE240 Adv. Micro.

Table 1. (Spec for the Prototype Board)

No.	Description	Notes
1. Board	Prototyping Board/Wire Wrapping.	
2. CPU module	LPC1769 ARM Cortex-M CPU module	x2 ONE master ONE AS G.B.
3. PWR.	LM7805 Regulator	Input
4. Adapter	Wall-wart 7.5VDC or higher Input 110/220AC	~1500mA
5. Debugging unit	I/P test via GPP I/P test via GPP	LED for O/P S/W

No.	Description	Note
6. LCD Color	SPI. Colour LCD	philips/stm ST7735R
7. SPI. Device		

240x320. Resolution.



Note: SPI (Fast) 66mbps — 100+ Mbps

3+1"

