CmpE240

F2023

Nov. 6th (Monday).

Note1. Midterm Exam is scheduled on Next Monday.

Review Session in-class is scheduled on Wednesday.

Today's Topics:

1° SSPInit Code.

2° Hardware Design for LCD/CPU Interface Design.

Example: Line 210-246.

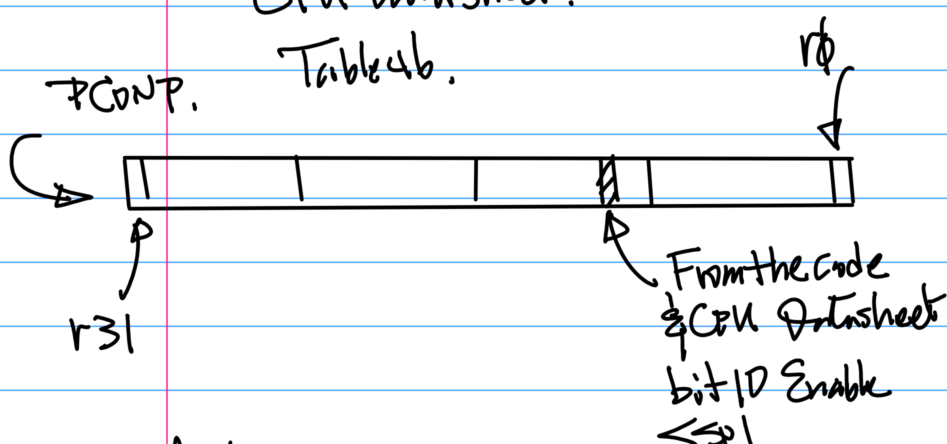
Line 224 Naming Convention

LPC_SC -> PCONP

Section 4.8.5. pp61

CPU Datasheet.

Table 46.



Line 227.

LPC_SC -> PCLKSEL

Line 229

Line 230

LPC_SC -> PINSEL0.

pp.58, Table 42.

Section 4.7.3. pp57.

Note: Draw a 32Bit SPR illustration.

Connect to CPU Datasheet (Tables for the SPR).

The memory Bank holding this SPR.

Code Implementation.

Note: The Sequence to Init & Config SPRs for SSP Interface. (SPI)

PCONP -> PCLKSEL -> PINSEL0

Line 233/234 CS (Chip select: e.g. Select/Enable my LCD Display module)

Line 238

SSP1 CR0.

pp.431. Table 371

Use Case Leads to Design Requirements, for Example, 2D G.E. Design. Frame Rate, Resolution of the Display -> Carry out the Design By Using CPU Datasheet, and formula

$$f_{PWM} = \frac{PCLK}{CPSDVSR * (SCR+1)}.$$

then, Coding.

Homework: Due Nov. 19th (Sunday).

1° Requirements:

a) Based on the Homework of Drawing A Wireframe Cube in X_w-Y_w-Z_w, Add a point light source, such as $\vec{P_s}(x_s, y_s, z_s) = (-5, 50, 250)$,

b) Use the vertices from the Top Surface of the cube to generate 4 Ray Equations, then Compute the intersection Points on X_w-Y_w plane

Note: Computation is Carried out Before the Transformation pipeline, e.g., in X_w-Y_w-Z_w Coordinate.

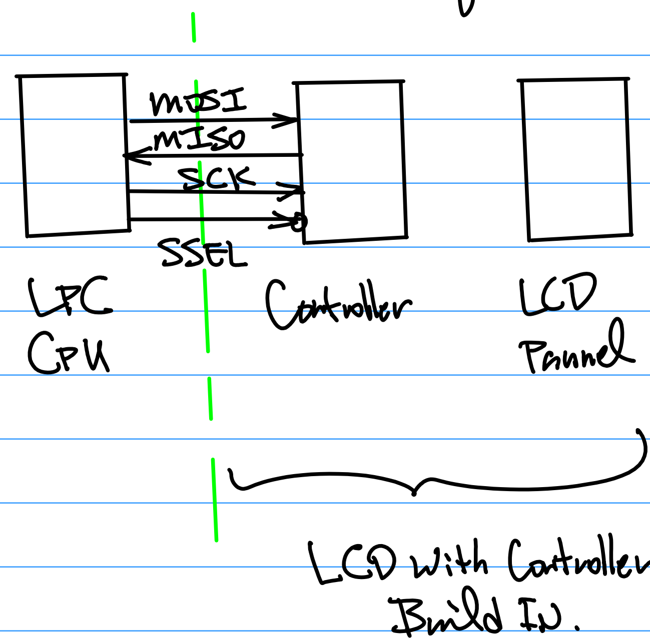
c) Draw the shadow first Before Drawing the Cube.

Note: Design/Select A proper dark color for the shadow.

Note: please work/Discuss this homework with your team. But coding has to Be individually, No code can be shared.

Note: Please Bring Your Board for show & Tell, Demo ON Monday, Nov. 20 (monday).

Consider Hardware Design for LCD Controller Interface.



Note: please provide Clear indication of the Signal Flow By Drawing Arrow on Each Signal line.

Also, place a circle "o" for Active Low Signal.

Nov. 8 (Wed).

Note 1. Midterm Exam is Next Monday.

a) Please Bring your Prototype System;

b) Bring Blank Papers for the exam hand Calculation;

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Homework 53

c) use "printf" to print your First Name, Last Name and SID, while executing Program During the example.

d) There are 3 Questions.

Question in the CPU Architecture, memory, SPRs. Memory Bank,

Question on the subject of Building A prototype System. SCH, pin Connectors, functionality of the pins. and interface to LCD.

Question in the Area Design. Debugging, hand Calculation.

e) Naming Convention of the Zip.

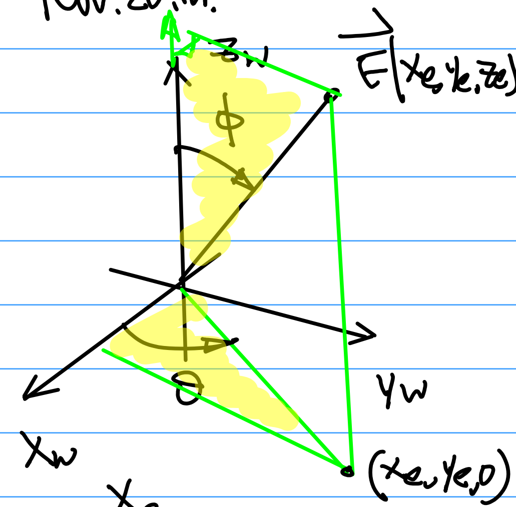
FirstName_LastName_SID_Cmpe240_mid.zip

One pdf (integration of All pdf files)

f) Resolution of the photos. Not too high, Not too low Resolution, 1 ~ 4 MB.

g) Submission on CANVAS. No Late Submission, No E-mail Submission

Note: Shadow Computation Due Nov 19 (Sun). Please Bring your Board for Demo on Monday. Nov. 20 th.



$$\cos\theta = \frac{x_e}{\sqrt{x_e^2 + y_e^2}}$$

$\sin\theta$

$$\cos\phi = \frac{z_e}{\rho} = \frac{z_e}{\sqrt{x_e^2 + y_e^2 + z_e^2}}$$

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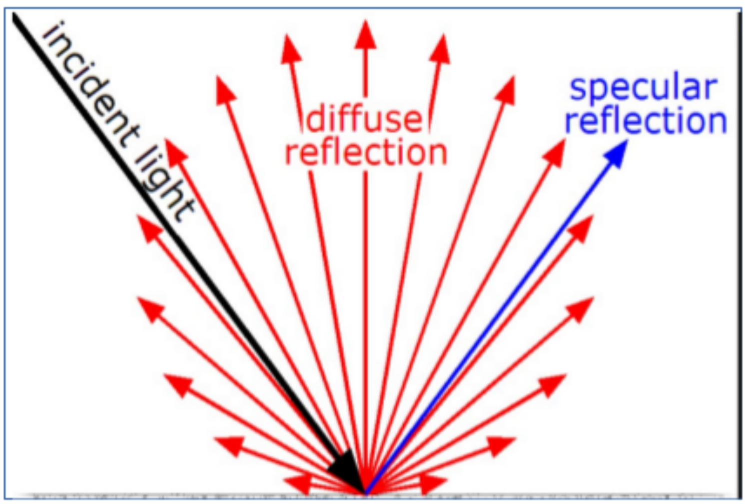
F2023 Part II

Nov.15 (Wed).

Ref: Pp.1. Definition/Concept of Diffuse Reflection.

2018S-23-lec7-DiffuseReflection-v6-2018-4-25.pdf

Diffuse Reflection



Two Key Characteristics:

1. The surface with reflectivity as K_d = (k_r, k_g, k_b), e.g., diffuse coefficients;

2. The decay of incident light is inverse proportional to its distance from the source to the surface point. e.g., 1/(r*r), where r is bing the distance from the light source to the surface.

Specular vs. diffuse reflection

https://en.wikipedia.org/wiki/Diffuse_reflection

Diffuse Reflection: the reflection of light uniformly in all different directions, the surface of this reflection exhibits Lambert reflection, e.g., equal luminance when viewed from all directions.

Harry Li, Ph.D.

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Nov.14,22

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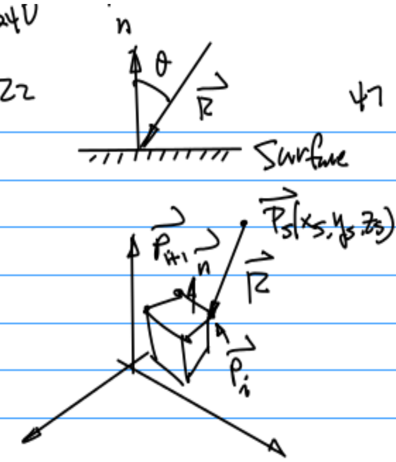

Fig.1.

Note:

1° Definition: PP.54. Reflection Uniformally in All different Directions.

Ref2: on the Class github.

2022F-101-notes-cmpe240-2022-11-30 (1).pdf

Example: Background On Diffuse Reflection.

Ref3: Pp54.

2021F-101b-notes-cmpe240-2021-12-1 (2).pdf

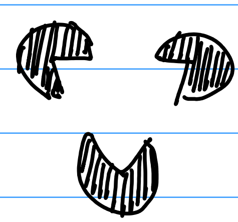

Fig.2

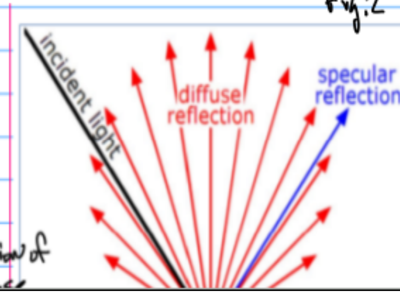

Illustration of Diffuse

Brief Introduction, And 3 Lighting models.

Three models. see Ref3. pp.54

$$I(x,y) = I_1(x,y) + I_2(x,y) + I_3(x,y)$$

I_1: Diffuse Reflection, I_2: Specular Reflection, I_3: Ambient Light

Note: Specular ... (2)

Definition of Diffuse Reflection.
Ref.1. Pg1.

Reflection Uniformly Reflects the Incoming light in All Different Direction.

Note1. $\vec{P_s}(x_s, y_s, z_s)$ Incident Light, White Color. for example $r=g=b=255$

Diffuse Reflection

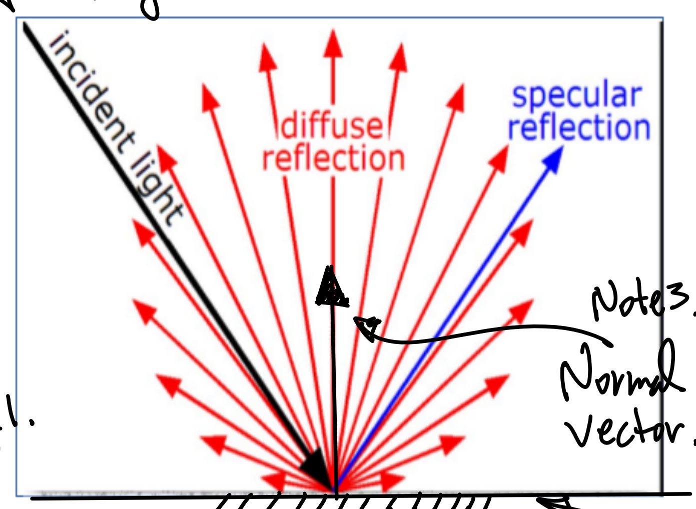

Fig1.

Note3. Normal vector.

Note2: Surface of Reflection

https://en.wikipedia.org/wiki/Diffuse_reflection

Color of A surface: physical Characteristic.

Definition of Reflectivity to Describe the Characteristics of A surface Color.

Reflection of the color leads to the perception of the color.

Two Key Characteristics:

1. The surface with reflectivity as K_d = (k_r, k_g, k_b), e.g., diffuse coefficients; ... (1)

diffuse Reflection

2. The decay of incident light is inverse proportional to its distance from the source to the surface point. e.g., 1/(r*r), where r is bing the distance from the light source to the surface.

Specular vs. diffuse reflection

Where K_r: Reflectivity for red

K_g: " " green

K_b: " " blue

Normalized, so

$$K_r \in [0,1],$$
$$K_g, K_b \in [0,1] \quad \ldots (2)$$

for Example for the Blue Chair,

$$K_r = 0, \; K_g = 0, \; 0 < K_b < 1$$

Consider the Normal $\vec{n}$ and its Angle formed by the incident light

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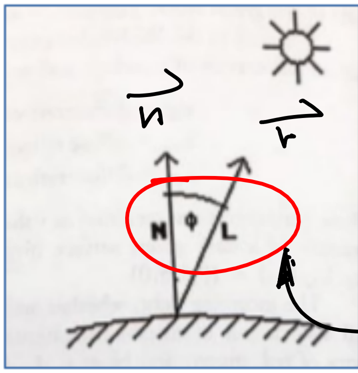
PP.3. Ref. 1.

e, then
(x,y,z) can



Reference: Computer Graphics, C. K. Pokorny, C. F. Gerald, pp. 514

$$\vec{n} \cdot \vec{r} = \|\vec{n}\| \|\vec{r}\| \cos\phi$$

$$\cos\phi = \frac{\vec{n} \cdot \vec{r}}{\|\vec{n}\| \|\vec{r}\|} \quad \ldots (3)$$

$$\phi = \cos^{-1}\left(\frac{\vec{n} \cdot \vec{r}}{\|\vec{n}\| \|\vec{r}\|}\right)$$

Instead, use $\cos\phi$.

$$I_d(x, y) \sim K_d \cos\phi$$

$$= K_d \frac{\vec{n} \cdot \vec{r}}{\|\vec{n}\| \|\vec{r}\|} \quad \ldots (4)$$

intermediate Result in Eqn (4).

TP.3. Ref. 1. Note 1. Regarding Angle ϕ

$$\boxed{I_r = K_{d_r} \frac{\vec{n} \cdot \vec{r}}{\|\vec{n}\| \|\vec{r}\|} \frac{1}{\|\vec{r}\|_2^2}} \quad \ldots (1.1)$$

where

$$\boxed{\|\vec{r}\|_2^2 = x_r^2 + y_r^2 + z_r^2}$$

$$\boxed{I_g = K_{d_g} \frac{\vec{n} \cdot \vec{r}}{\|\vec{n}\| \|\vec{r}\|} \cdot \frac{1}{\|\vec{r}\|_2^2}} \quad \ldots (1.2)$$

$$\boxed{I_b = K_{d_b} \frac{\vec{n} \cdot \vec{r}}{\|\vec{n}\| \|\vec{r}\|} \cdot \frac{1}{\|\vec{r}\|_2^2}} \quad \ldots (1.3)$$

Use Vector Dot Product.

$\vec{n}$: Normal Vector.

$\vec{r}$: Ray Equation (Reformulated. To Point to P_s, to get rid of Negative Sign.)