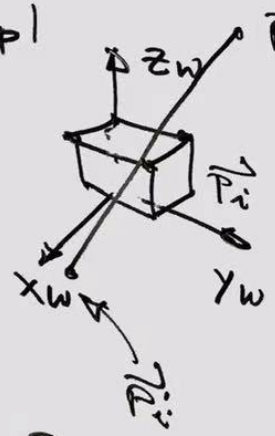
CMPE240
May 2nd 22

1) Final Exam In-Person.

Please Bring Your Laptop & Prototype Board.

Step1



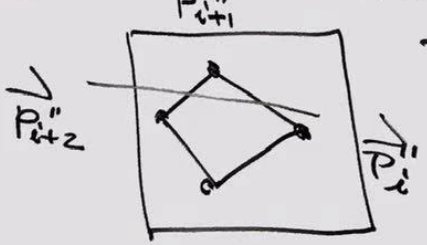
$\vec{P_S}(x_S, y_S, z_S)$

"Z-Buffer"

i° In x_w-y_w-z_w.

ii° Post-Processing Technique

Step2.



Transformation Pipeline

Boundary Diffuse Reflection.

i Bilinear Interpolation for Diffuse Reflection.

ii D.D.A.

$ay = bx + C$

$y = \frac{b}{a}x + \frac{C}{a}$

Full Adder { Half Adders / Carry Look-Ahead

$\vec{A} \cdot \vec{X}$

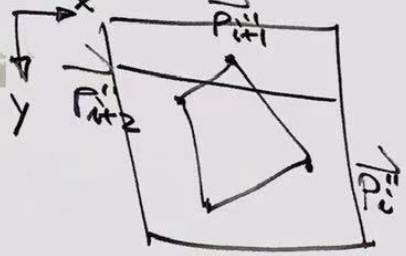
32 bits.

$a_{31}a_{30}\cdots a_2a_1a_0$

$\times\ x_{31}x_{30}\cdots x_2x_1x_0$

$a_1x_1\ \ a_0x_0$

Step3. Interior Point



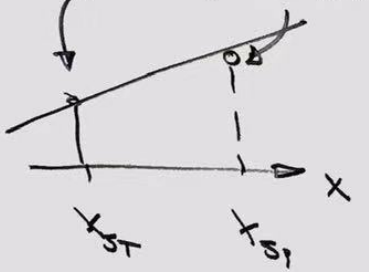
First. Find A pair of Intersection Points. Then Define the Starting pt & Ending Point.

$\vec{P_{ST}}$, $\vec{P_{SP}}$

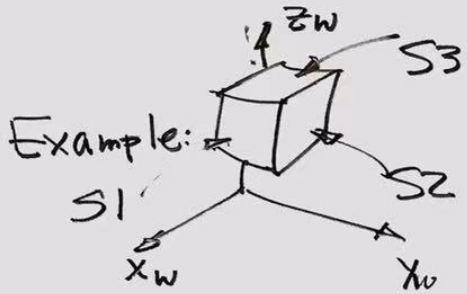
Secondly, Find the Diffuse Reflection from the previous calculation.

NO

$I_{diff,ST}$, $I_{diff,SP}$



Use Eqn(3), pp.17.



FONT

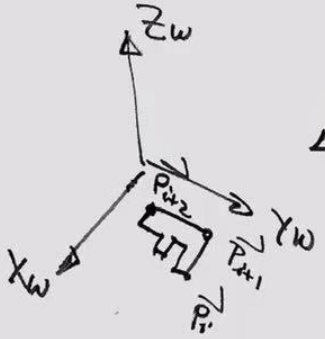
30 F.P.S

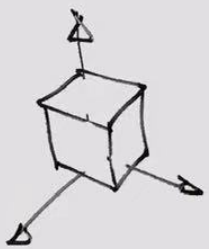
Step1.

$\{\vec{P_i}(x_i,y_i)\,|\,i=1,2,\cdots,N\}$ ... (1)

Design A FONT/Letter } Size ≈ 80.

Step2.





Establish A mapping from 2D to 3D

$\{\vec{P_i}(x_i,y_i,z_i)\,|_{z_i=0}\}$ ... (2)

Step3. Decorate Surface S3. By Elevating Z.

$\{\vec{P_i}(x_i,y_i,z_i)\,|_{z_i=110}\}$ ... (3)

After Before

$$\begin{cases} x_i' = x_i \\ y_i' = y_i \\ z_i' = C \end{cases} \quad \cdots (4)$$

Note: Mapping Principle: Indep-Indep. Function—Function Before & After.

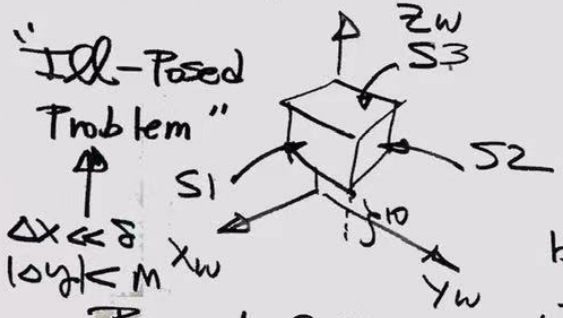
Now for S1: Y_w-Z_w plane

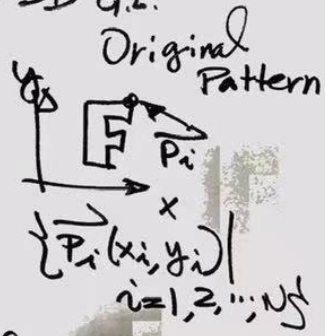
After Befor

$$\begin{cases} Y_i' = X_i \\ Z_i' = y_i \\ X_i' = C = 100 \end{cases} \quad \cdots (5)$$

May 4 (Wed).

Decoration Technique (For 3D G.E. Emulation).





Principle for Mapping: $\begin{cases} \text{Indp.} - \text{Indp.} \\ \text{Function} - \text{Func.} \end{cases}$ (Right Hand)

before After

S2: First, Find the Parallel plane: z_w-x_w

Secondly: From $\{P_i(x_i, y_i) \mid i=1,\cdots,N_f\}$ Indp. Func.

After, Before

Indp: $z_i' = x_i$

Function: $x_i' = y_i$

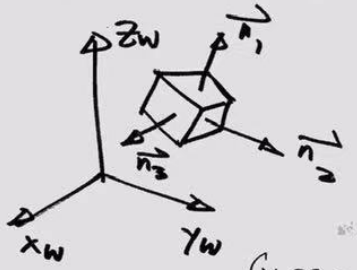
After Before

$y_i' = C$ ...(1)

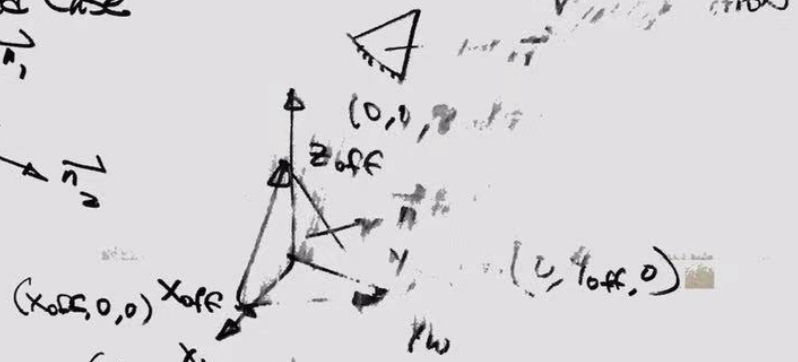
Optional Option A (Not Required)

plane Eqn: $Ax+By+Cz+D=0$ → Smaller

Generalized Case



Option 2



$(V_{y\text{-off}} - V_{x\text{-off}}) \times (V_{z\text{-off}} - V_{x\text{-off}})$ ...(2)

Last Project Due May 16th. (Monday) a. Shadow; (Intersection pts)

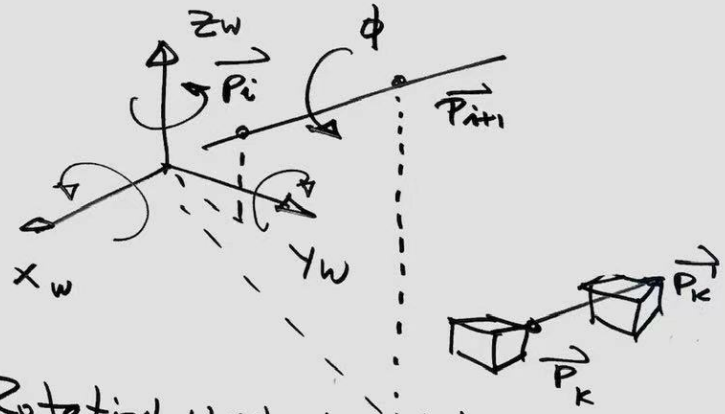
b. Diffuse Reflection (1st. 4 vertices — Post Processing)

2nd, Boundaries. 3rd. Interior Points) C. Decoration.

a. Initial ON A Surface; b. Trees ON A Surface; C. Rotating Squares).

3D arbitrary rotation is optional

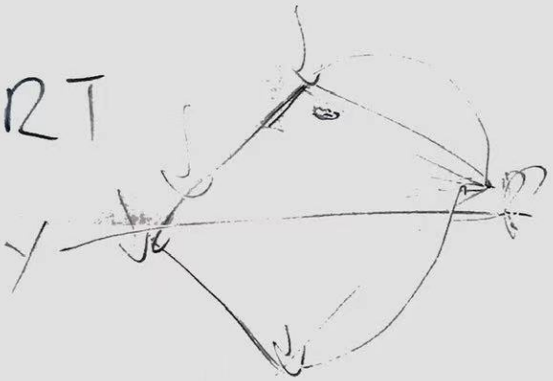
Optional



Rotation w.r.t. An Arbitrary Vector in the Figure.

$$R_{xw} = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & \cos\alpha & -\sin\alpha & 0 \\ 0 & \sin\alpha & \cos\alpha & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}, \quad R_{yw} = \begin{pmatrix} \cos\alpha & 0 & \sin\alpha & 0 \\ 0 & 1 & 0 & 0 \\ -\sin\alpha & 0 & \cos\alpha & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

$$\begin{pmatrix} x \\ y \\ z \end{pmatrix} \quad T^{-1}RT$$



Tool 1: Translation.

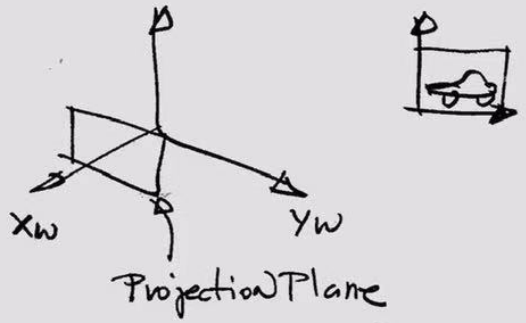
$$T_{4\times4} = \begin{pmatrix} 1 & 0 & 0 & \Delta x \\ 0 & 1 & 0 & \Delta y \\ 0 & 0 & 1 & \Delta z \\ 0 & 0 & 0 & 1 \end{pmatrix} \cdots (3)$$

Tool 2: Rotation

$$R_{4\times4,z} = \left(\begin{array}{ccc:c} \cos\alpha & \sin\alpha & 0 & 0 \\ \sin\alpha & \cos\alpha & 0 & 0 \\ 0 & 0 & 1 & 0 \\ \hdashline 0 & 0 & 0 & 1 \end{array}\right) \cdots (4)$$

3D projection of digital photo is optional

Optional



May 9 (Monday).

Topics: 1° Ethernet I/F Design.
2° Graphics Engine Design.

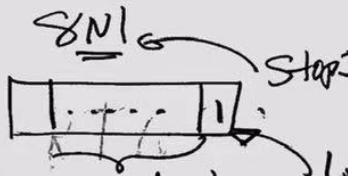
Example: Ref: Class Github.

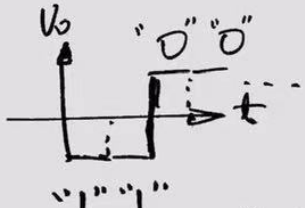
Step 1. From the Schematic Design of LPC1769. Identify the pins for Ethernet I/F. 4 pins. Rx { RxN (Negative), RxP (Positive) }, Tx

Note: Differential Signal Pairs.

Note: UART → RS232 → RS485 (Optics)

Data Frame:





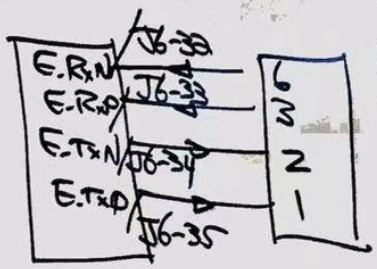
Electrical Characteristics.

Table 1. Signal Pins for Ethernet

CPU Pin	Conn. Pin	RJ45 (8 Pos)
Eth_RxN	J6-32	6/8
Eth_RxP	J6-33	3/8
Eth_TxN	J6-34	2/8
Eth_TxP.	J6-35	1/8

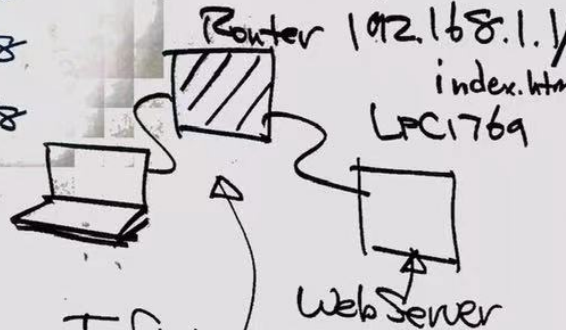
Step 2. Design I/F to RJ-45 Connector. (Diagram)

Step 3. Build Schematics. LPC1769



Testing Software.

1. System Set up:

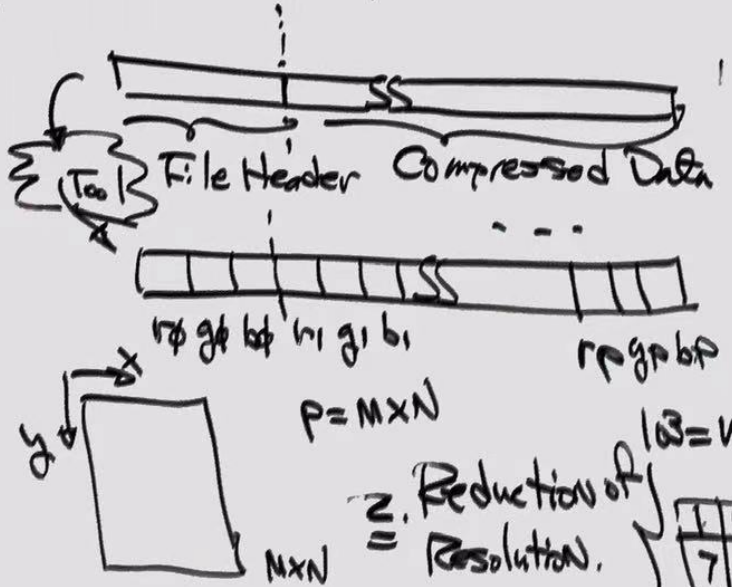


To find the IP Addr. of Your LPC1769, Log into the Router (AP) to find its IP Address.

RJ-45

Example: Project A Digital Photo On A Virtual Projection Plane.

Conditions: Take a photo from your phone. → On-Line Tool to produce R, G, B Raw Data Photo.



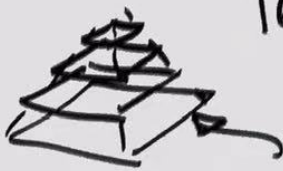
P = M x N

2. Reduction of Resolution.

$I(3) = \max\{1, 7, 9, 10\}$ Max pooling.

OR, Average: $\frac{1}{4}(1+7+9+10)$

160x120

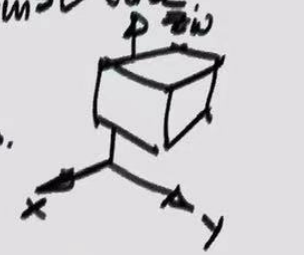


Original Image

Pyramid Image

Note:

3. From 3D Cube



Note: Use Existing Decoration Formula.

$I(x,y) \rightarrow \{(x_i, y_i, z_i) \mid i = 1, 2, \ldots\}$ 160x120

3% Bonus