CS211 FINAL PROJECT DEMO Presentation

- PASSION -

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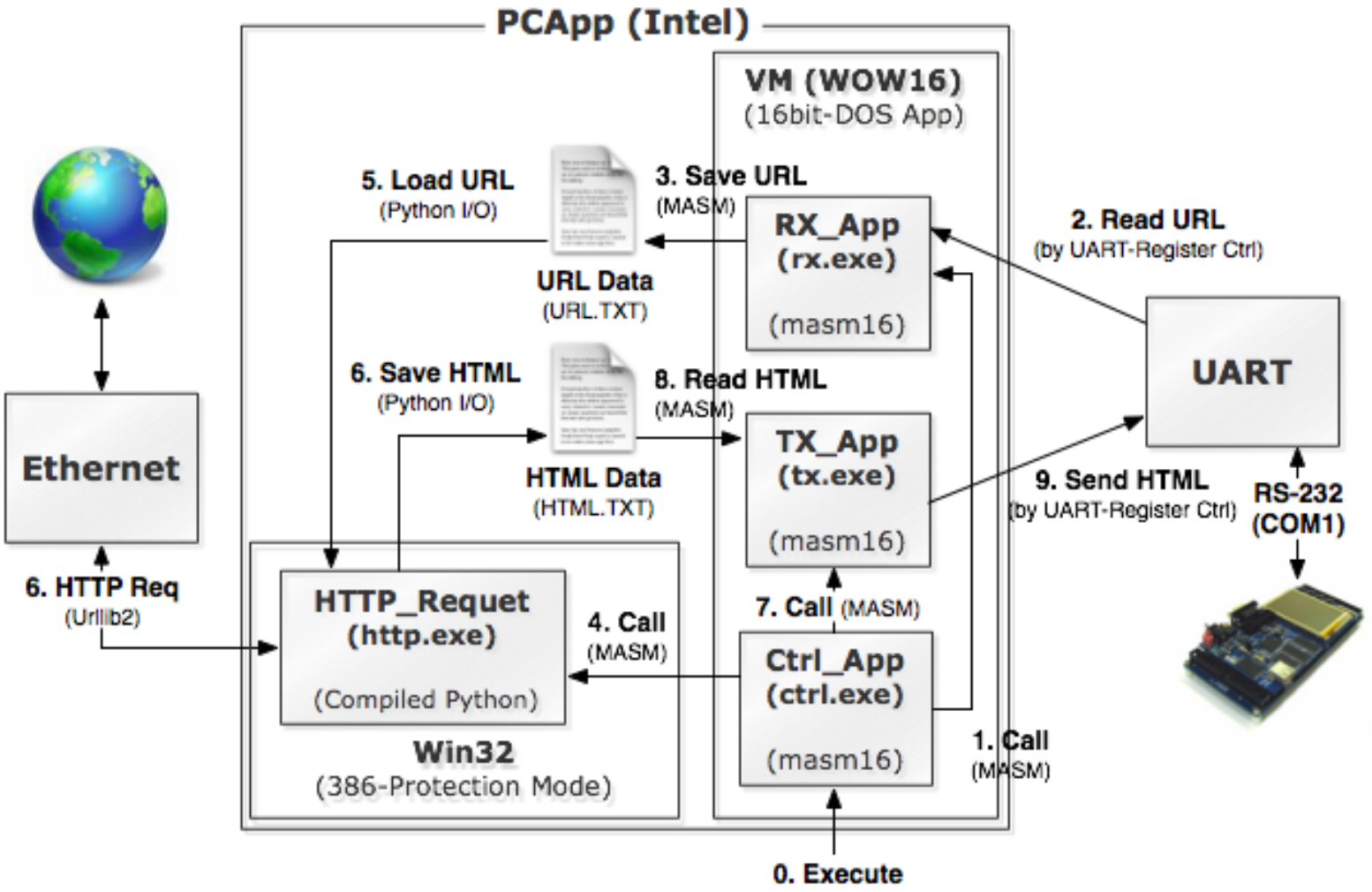
Project Introduction

- Development Environment
  - PC : Intel C2D 2.0GHz / 2G RAM / WinXP
  - Board : S3C2410x (ARM920T) / SMDK2410 (Board)
  - ADS 1.2, VS.NET 2005, Python 2.5.1, BitFontCreator
  - Serial Communication (USB-RS232 Converter Cable)

IA32-Based Application (PC)

- Communicate with Internet (HTTP Request)
  - Low-Level Ethernet Control (C - winsock2)
  - **High-Level Ethernet Control (Python - Urllib2)**
- Communicate with Board (Serial RS-232)
  - **Low-Level UART Control (16bit MASM - Rx/Tx)**
  - High-Level UART Control (C - Windows API)

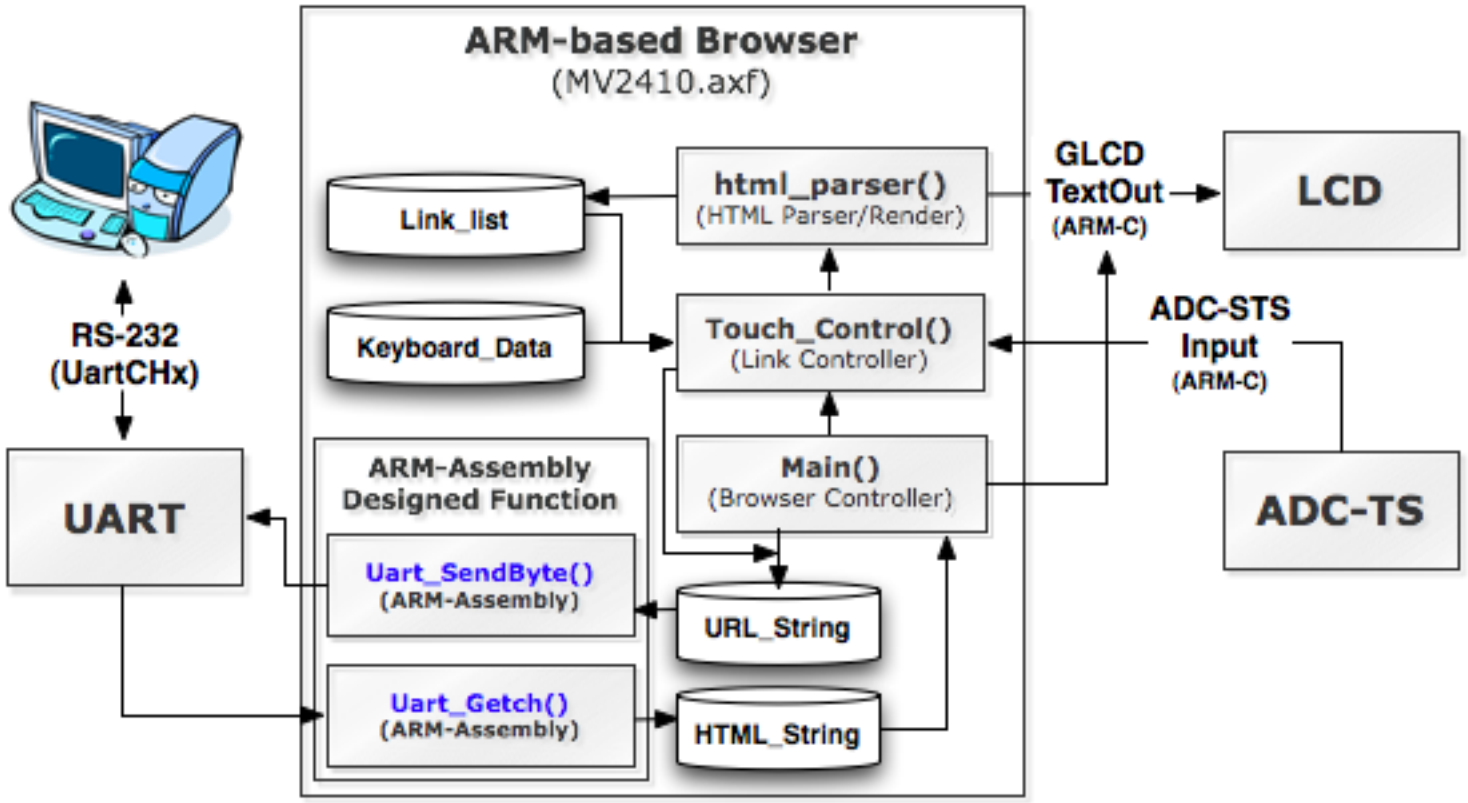
Detail Diagram (PC)



ARM-Based Application (Board)

- Communicate with PC (Serial RS-232)
  - **Low-Level UART Register Control (ARMasm)**
  - High-Level UART Command Control (ARM-C)
- Communicate with Peripheral Device in S3C2410
  - Low-Level Peripheral Device Interrupt Control (ARMasm)
  - **High-Level Device Control (ARM-C)**

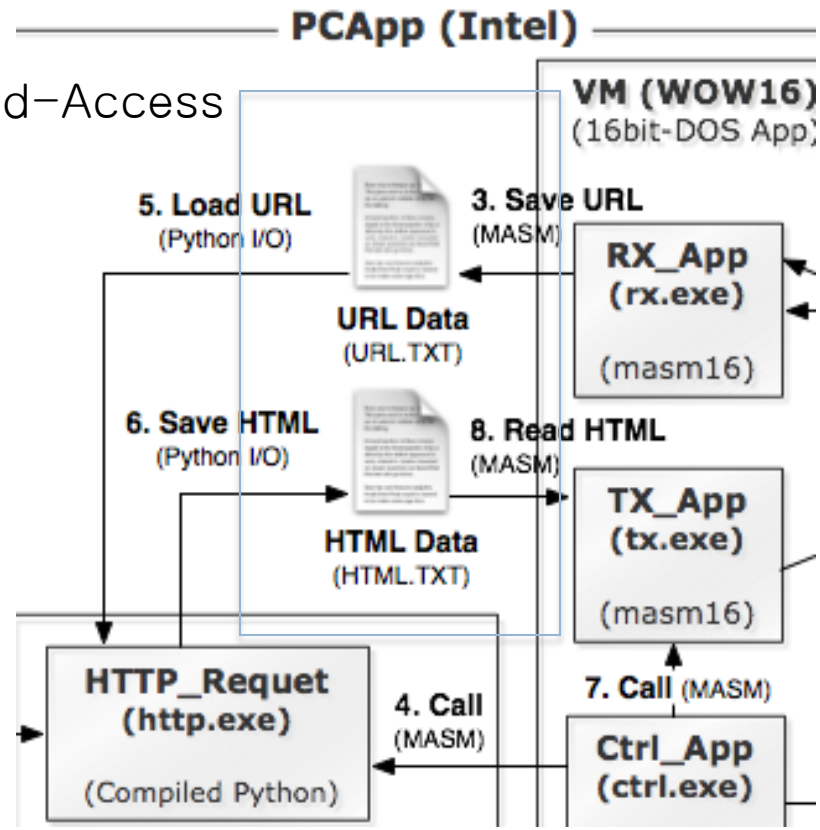
Detail Diagram (Board)



Issue of Project (1)

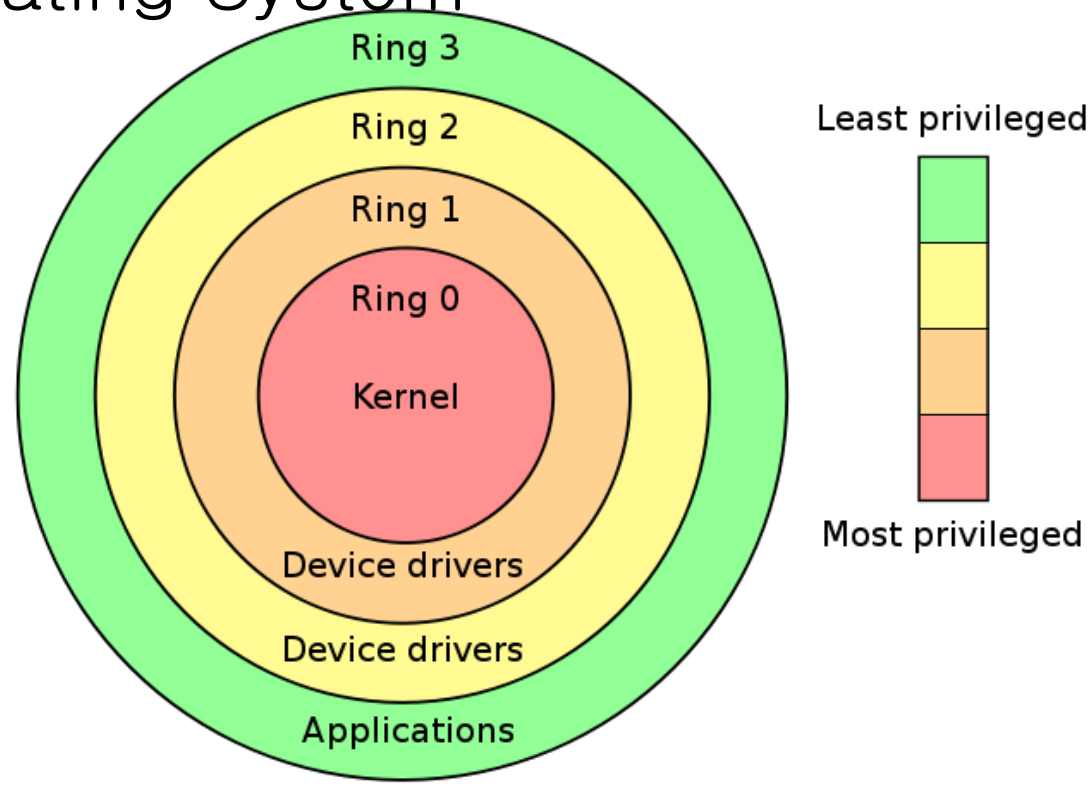
- Transfer data from Python-App to MASM App

File Mediated-Access



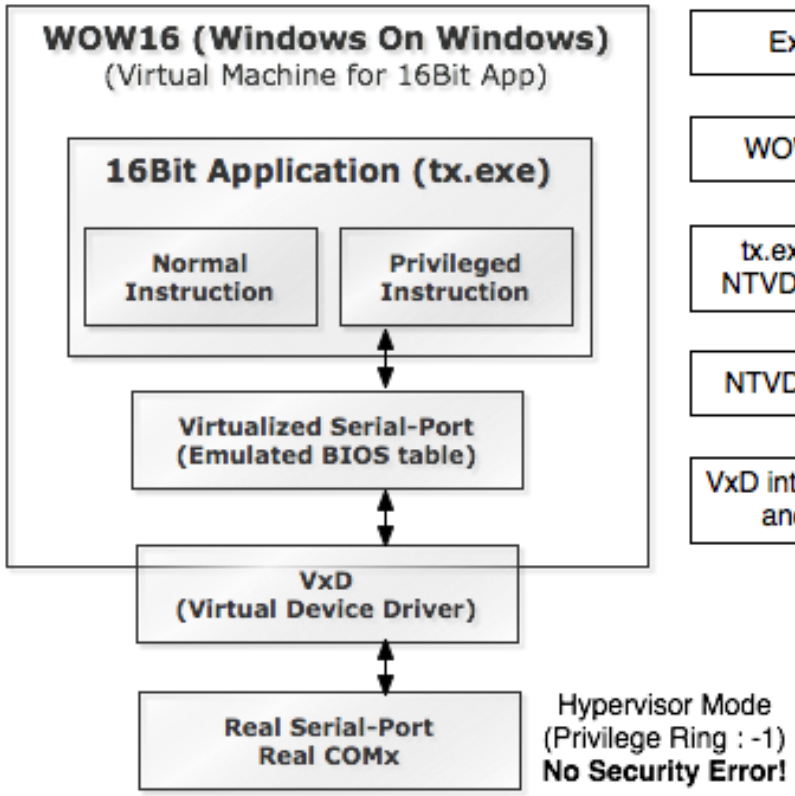
Issue of Project (2)

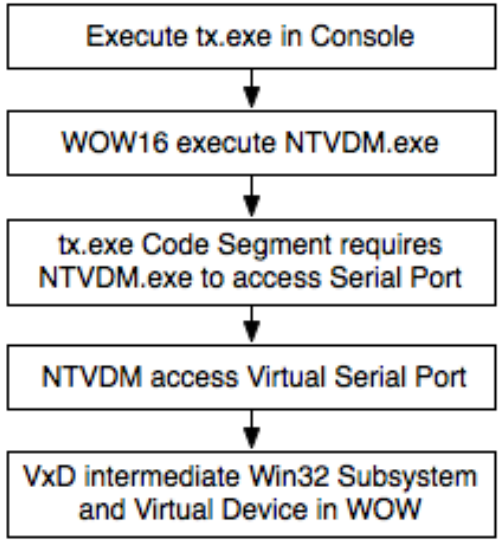
- Privileged Instruction Protection in Operating System



Issue of Project (2)

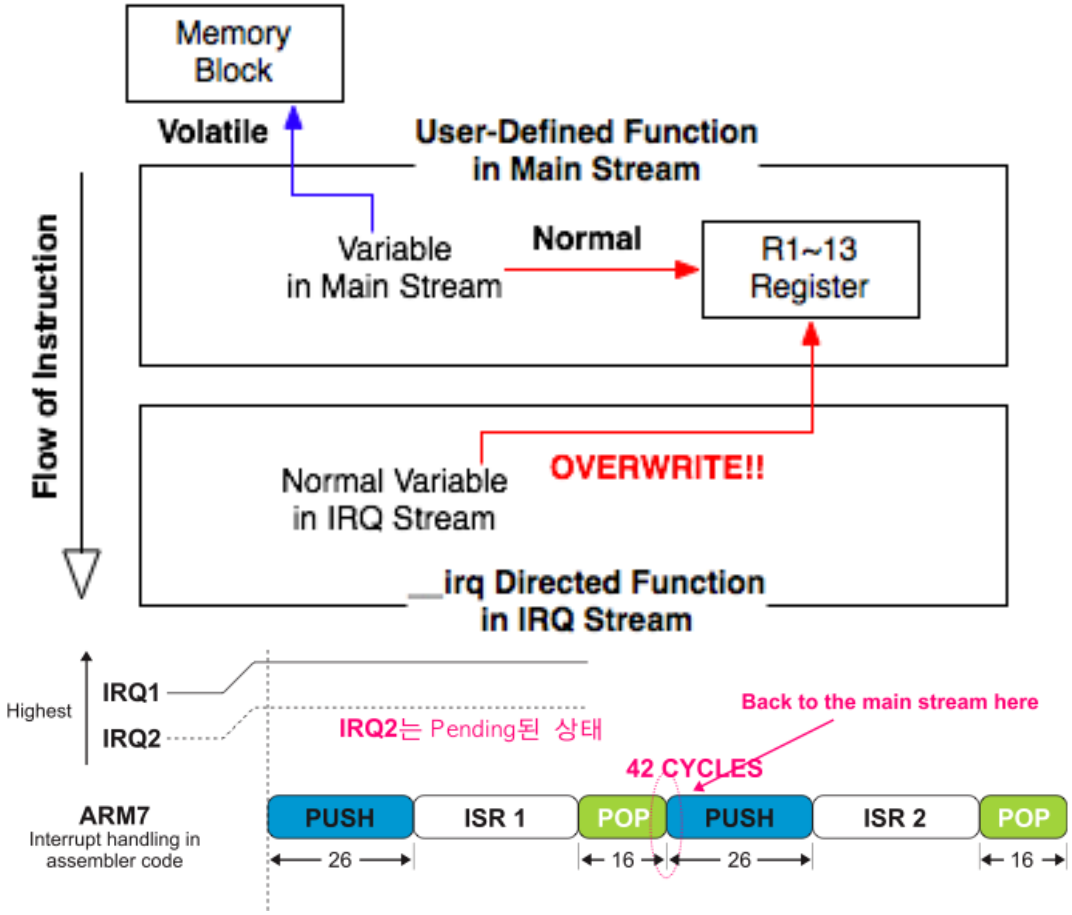
- Use NTVDM to overcome protection of port control





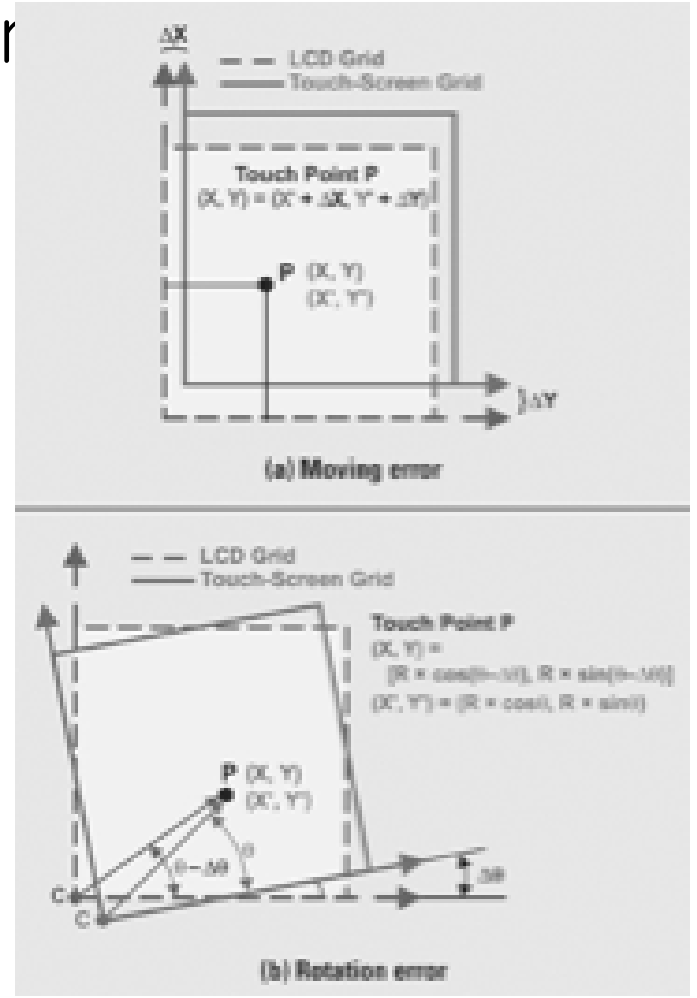
Issue of Project (3)

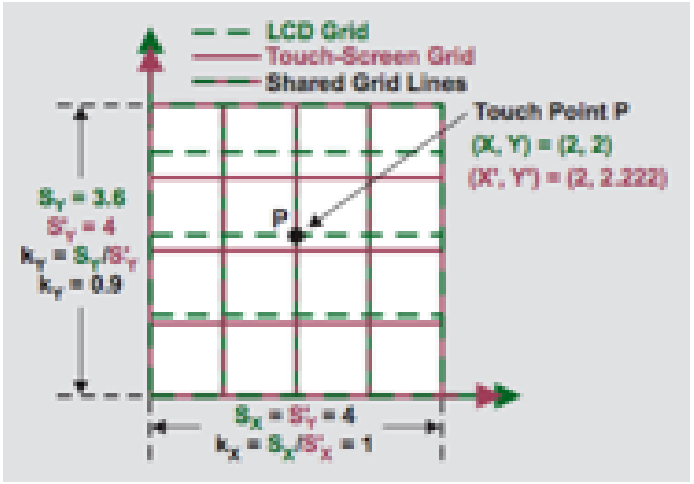
- CPU Latency during IRQ Function Execution Time



Issue of Project (4)

- Touch Screen Calibration
  - Scaling Factor
  - Moving Error
  - Rotation Error





Issue of Project (4)

- Calculation of Calibration Equation with Matrix

1. Definition of Moving/Rotation Factor

$$
\begin{aligned}
X &= k_X \times R \times \cos(\theta - \Delta\theta) + \Delta X \\
&= k_X \times R \times \cos\theta \times \cos(\Delta\theta) + k_X \times R \times \sin\theta \times \sin(\Delta\theta) + \Delta X \\
&= k_X \times X' \times \cos(\Delta\theta) + k_X \times Y' \times \sin(\Delta\theta) + \Delta X \qquad (1) \\
&= \alpha_X \times X' + \beta_X \times Y' + \Delta X,
\end{aligned}
$$

α_X, β_X is Rotation Factor of X ΔX is Moving Factor of X

$$
\begin{aligned}
Y &= k_Y \times R \times \sin(\theta - \Delta\theta) + \Delta Y \\
&= k_Y \times R \times \sin\theta \times \cos(\Delta\theta) - k_Y \times R \times \cos\theta \times \sin(\Delta\theta) + \Delta Y \\
&= k_Y \times Y' \times \cos(\Delta\theta) - k_Y \times X' \times \sin(\Delta\theta) + \Delta Y \qquad (2) \\
&= \alpha_Y \times X' + \beta_Y \times Y' + \Delta Y,
\end{aligned}
$$

α_Y, β_Y is Rotation Factor of Y ΔY is Moving Factor of Y

2. 3-Point Calibration

Non-Linear Properties of 3

3. Matrix Conversion & Calculation

$$
\begin{aligned}
X_1 &= \alpha_X \times X_1' + \beta_X \times Y_1' + \Delta X \\
X_2 &= \alpha_X \times X_2' + \beta_X \times Y_2' + \Delta X \\
X_3 &= \alpha_X \times X_3' + \beta_X \times Y_3' + \Delta X
\end{aligned}
$$

Representation to Matrix

$$
\begin{aligned}
Y_1 &= \alpha_Y \times X_1' + \beta_Y \times Y_1' + \Delta Y \\
Y_2 &= \alpha_Y \times X_2' + \beta_Y \times Y_2' + \Delta Y \\
Y_3 &= \alpha_Y \times X_3' + \beta_Y \times Y_3' + \Delta Y
\end{aligned}
$$

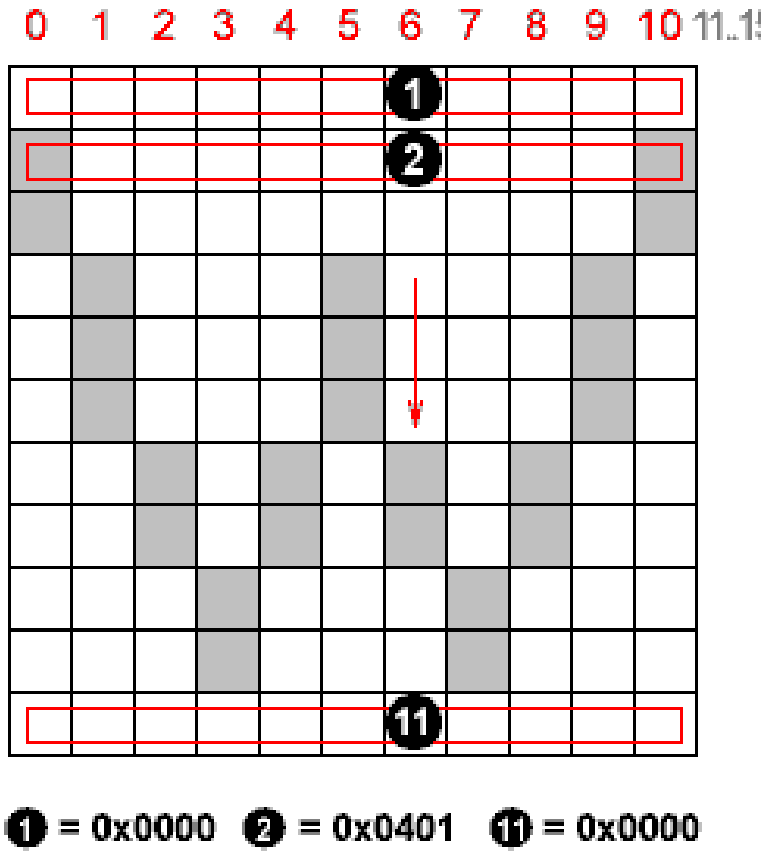
$$
\begin{pmatrix} X_1 \\ X_2 \\ X_3 \end{pmatrix} = A \times \begin{pmatrix} \alpha_X \\ \beta_X \\ \Delta X \end{pmatrix} \text{ and } \begin{pmatrix} Y_1 \\ Y_2 \\ Y_3 \end{pmatrix} = A \times \begin{pmatrix} \alpha_Y \\ \beta_Y \\ \Delta Y \end{pmatrix}, \quad A = \begin{pmatrix} X_1' & Y_1' & 1 \\ X_2' & Y_2' & 1 \\ X_3' & Y_3' & 1 \end{pmatrix}.
$$

$$
\begin{pmatrix} \alpha_X \\ \beta_X \\ \Delta X \end{pmatrix} = A^{-1} \times \begin{pmatrix} X_1 \\ X_2 \\ X_3 \end{pmatrix} \text{ and } \begin{pmatrix} \alpha_Y \\ \beta_Y \\ \Delta Y \end{pmatrix} = A^{-1} \times \begin{pmatrix} Y_1 \\ Y_2 \\ Y_3 \end{pmatrix},
$$

Calculate Factor with Inversion Matrix

Issue of Project (5)

- Text Output to LCD



Result of Project

- PC Application
  - **RX.exe : Receive URL from UART and Save(MASM)**
  - HTTP.exe : Receive HTML from Ethernet and Save (PY)
  - **TX.exe : Send HTML to UART (MASM)**

- ARM Application
  - Stack-based HTML Parser
  - Touch-Screen Keyboard
  - **TX/RX Communication Module (in ARM Assembly)**

DEMO

THANK YOU!!

Reference Documents:

- S3C2410X User Manual
- S3C2410X Application Note
- ARM Architecture Reference Manual
- ARM920T Technical Reference Manual

Reference Code:

- MS MASM32 Sample Code
- AVR GLCD Control Sample Code
- UART-Communication TASM Sample Code

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