Midoriya Home Terminal (EH-7104G)

SI Guide

Version 1.1

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1. Introduction

EH-7104-MD is an NS Geode GX1 CPU based Home Terminal. The product featuring 10.4" LCD display, a built-in CCD camera and a handset is developed for a Japanese customer, Midoriya. EH-7104-MD project is an ODM business that Advantech defines the product specifications based on the customer's Home Automation system requirements and develops the electronics, mechanism and Win CE 3.0 (Japanese version) embedded software kernel of the HT.

EH-7104-MD plays as the key of a rental apartment automation solution. It connects the service/emergency calls and sensor signals of an apartment unit through the LAN to the administration center. The handset of HT can pick up the door phone and inter-phone calls through RS422 and analog audio signals.

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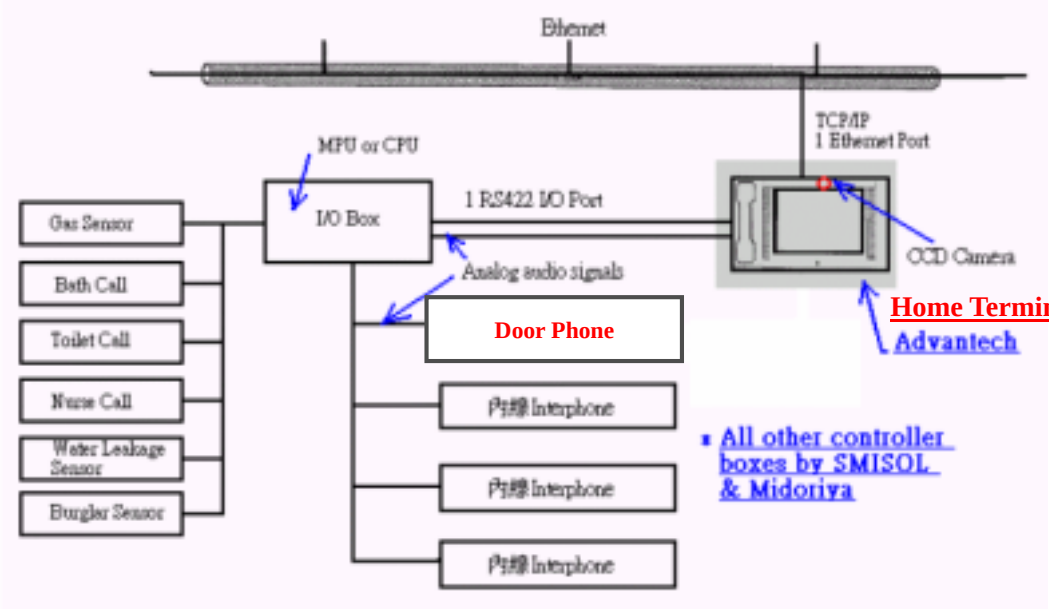
2. System Configuration

The block diagram of the EH-7104-MD based Home Automation environment is as follows:



Advantech is in charge only for the Home Terminal. This diagram shows clearly the interconnection of the EH-7104-MD, an I/O Box, Door Phone, Inter-Phones, Sensors and service call actuators.

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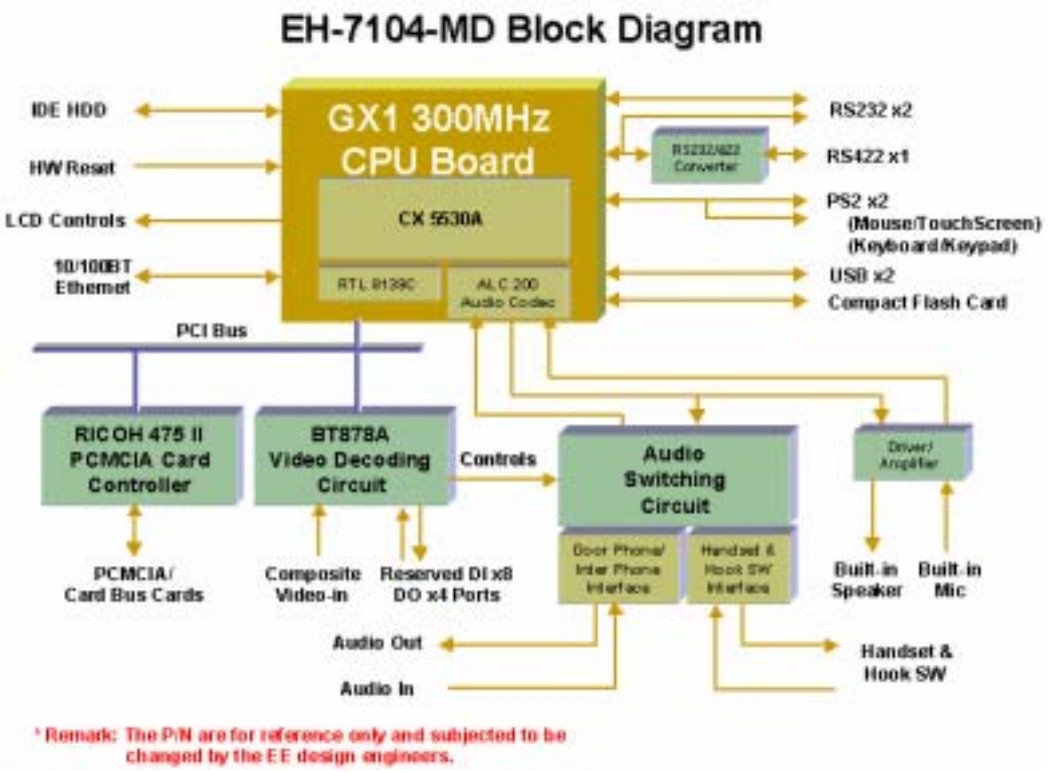
3. System Block Diagram



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4. External Connectors & I/O Mapping

4.1. External Connector & Terminals for RS-422 & Audio Signals

Stage	RS-422 (COM2)			Audio		
ES	TxD+	Pin1	DB9	Mic In		Audio Jack
	TxD-	Pin2		Audio In		RCA Jack
	RxD+	Pin3		Audio Out		RCA Jack
	RxD-	Pin4				(edge of the PCBA)
CS	TxD+	Pin1	Terminals	Mic In	Pin1	Terminals
	TxD-	Pin2		Audio In	Pin2	
	RxD+	Pin3		Audio Out	Pin3	
	RxD-	Pin4		GND	Pin4	
MP	TxD+	Pin1	Terminals	Audio In	Pin1	Terminals
	TxD-	Pin2		GND	Pin2	
	RxD+	Pin3		Audio Out	Pin3	
	RxD-	Pin4		GND	Pin4	

Remark: COM1 is assigned to the RS232C DB9 connector port.

4.2. BT878A GPIO Mapping

Port ID	Pin Definition	Active Logic Level
GPIO0	Reserved LED	"1" (Turns LED on)
GPIO1	Intrusion LED	"1"
GPIO2	Emergency Call LED	"1"
GPIO3	Gas Leakage LED	"1"
GPIO4	Fire Alarm LED	"1"
GPIO5	Water Leakage LED	"1"
GPIO6	(Not Connected)	-
GPIO7	Message LED	"1"
GPIO8	Handset Hook Status	TTL Input
GPIO9	Digital Input 1	TTL Input
GPIO10	Digital Input 2	TTL Input
GPIO11	Digital Input 3	TTL Input
GPIO12	Digital Input 4	TTL Input
GPIO13	Digital Input 5	TTL Input
GPIO14	Digital Input 6	TTL Input
GPIO15	Digital Input 7	TTL Input
GPIO16	Speaker Shut-Down	"1" shut down the speaker amplifier
GPIO17	Digital Output 1	TTL Output
GPIO18	Digital Output 2	TTL Output
GPIO19	Digital Output 3	TTL Output
GPIO20	CCD_ON	"1" (Turns on CCD Camera)
GPIO21	RDI1	"1"
GPIO22	RDI2	"1"
GPIO23	RDI3#	"0"

Remark: Please look into the sample codes in the CD to get the device ID of BT878A.

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4.3. Audio Path Control Relay Switch Setting

		Relay SW Selection Control		
Audio Path	Hook Switch Status	RDI3# (GOIP23)	RDI2 (GPIO22)	RDI1 (GPIO21)
Door Phone <-> Handset	Off Hook SWhk ON	0 SW3 ON	0 SW2 OFF	0 SW1 OFF
Door Phone <-> HT	On Hook SWhk OFF	0 SW3 ON	1 SW2 ON	0 SW1 OFF
Handset <-> HT	Off Hook SWhk ON	1 SW3 OFF	0 SW2 OFF	1 SW1 ON
Default Setting	On Hook SWhk OFF	0 SW3 ON	0 SW2 OFF	0 SW1 OFF

Remark: SW3 is normal-closed type relay switch. It is ON by default after the machine having been powered on.

4.4. AD1881/ALC200 Audio Codec Signals

Codec Pin	Direction	External Connection
MIC1	Input	Built-in Mic
LINOUTR	Output	LINE OUT to the right channel of amplifier circuit. Reserved for stereo music application.
LINOUTL	Output	LINE OUT (Door Phone & Handset) Also through left channel of amplifier circuit to Built-in Speaker
LINEINL	Input	LINE IN (Door Phone & Handset)

Remark: The AP program developer should control the LINOUTR, LINOUTL, LINEINL and MIC1 of AD1881/ALC200 as well as the GPIO pins directly.

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5. Audio Signal Path Control

5.1. Operational Theory

The audio signals between the handset, the door phone, the built-in Microphone/speaker and the Audio Codec (ALC-200 and AD1881) are controlled by the GPIO pins (GPIO16, GPIO21, GPIO22 & GPIO23) and the Audio Codec signals (LINOUTR, LINOUTL, LINEINL & MIC1).

When there is a call signal being sent from I/O Box via RS-422 port. The home terminal will beep to inform the user to pick up the Door Phone or Inter-phone calls.

- ✓ If the Handset is on-hooked the door/inter phone audio signals will be connected to the microphone/speaker of the home terminal. The user can press a soft key on the touch screen to answer the in-coming calls via the microphone/speaker.
- ✓ If the Handset is off-hooked, the door/inter phone audio signals are connected directly to the handset. The user can just pick up the handset to answer the call directly.

When the user would like to record or play messages from the home terminal, AP program should show a soft key. The user can

- ✓ Press down the soft key to use built-in microphone/speaker, or
- ✓ Pick up handset for message recording and playback.

5.2. Home Terminal Built-in Mic/Speaker Operation

Relay SW Selection Control

Audio Path	Hook Switch Status	RDI3# (GOIP23)	RDI2 (GPIO22)	RDI1 (GPIO21)
Default Setting after POR	On Hook SWhk OFF	0 SW3 ON	0 SW2 OFF	0 SW1 OFF

Audio Code Signal Status

MIC1	Enabled to get the voice from built-in microphone.
LINOUTR	Enabled. Be routed to the right channel of amplifier. Reserved for stereo application.
LINOUTL	Enabled. Be routed trough the left channel of amplifier to the built-in speaker.
LINEINL	Disabled.

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BT878A Port ID	State
GPIO16	"0" Turn on built-in speaker amplifier.

After the machine has been powered on, the SW3 is ON and SW2 & SW3 are OFF. Without picking up the handset, the user can record the voice using the built-in microphone and then play it from the built-in speaker.

The Audio Record & Play program have to control the MIC1 of Audio Codec to get the digitized microphone input. And the voice data have to be sent to the LINOUTL output signal of Audio Codec. Please make sure GPIO16 is at "0" to turn on the amplifier of built-in speaker.

The internal loop-back paths of ALC-200 or AD1881 mixer circuitry will route the received voice data from MIC1 to LINOUTL and make the user hear voices from built-in speaker.

5.3. Voice Communication between Door Phone and Handset

Relay SW Selection Control

Audio Path	Hook Switch Status	RDI3# (GOIP23)	RDI2 (GPIO22)	RDI1 (GPIO21)
Door Phone <-> Handset	Off Hook SWhk ON	0 SW3 ON	0 SW2 OFF	0 SW1 OFF

Audio Code Signal Status

MIC1	Disabled.
LINOUTR	Disabled.
LINOUTL	Disabled. The SW2 will also isolate this signal from the handset signals.
LINEINL	Disabled. The SW2 will also isolate this signal from the handset signals.

BT878A Port ID	State
GPIO16	"1" shut down speaker amplifier.

Remark: The Hook switch controls the power of the amplifier circuits for handset Microphone and Ear Speaker.

The default usage of handset is to pick up the Door/Inter Phone calls being routed from the I/O Box.

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After the machine has been powered on, the SW3 is ON and SW2 & SW3 are OFF. The Audio In and Audio out signals from I/O Box are routed to the handset.

Without any program control, the user can pick up the handset from its hook position to answer the Door/Inter Phone calls from I/O Box.

5.4. Communication between Handset and Audio Codec

Relay SW Selection Control

Audio Path	Hook Switch Status	RDI3# (GOIP23)	RDI2 (GPIO22)	RDI1 (GPIO21)
Handset <-> HT	Off Hook SWhk ON	1 SW3 OFF	0 SW2 OFF	1 SW1 ON

Audio Code Signal Status

MIC1	Disabled.
LINOUTR	Disabled.
LINOUTL	Enabled. Send the voice data to ear speaker of handset.
LINEINL	Enabled. Get the voice data from handset microphone.

BT878A Port ID	State
GPIO16	"1" shut down speaker amplifier.

When in this mode, the SW3 needs to be turned off by setting the GPIO23 to be "1", SW2 is kept off and SW1 must be turned on by setting GPIO21 to be "1". The voice being recorded by the microphone of handset will be sent to the Audio Code through LINEINL pin. The voice data being played is sent from the LINOUTL pin of Audio Codec to the ear speaker of handset.

There is an internal voice loop-back in between the microphone and the ear speaker of the handset. This feature enables the user to hear what he speaks while speaking. The built-in speaker should be turned off by setting the GPIO16 to be "1".

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5.5. Communication between Built-in Microphone/Speaker and Door Phone

Relay SW Selection Control

Audio Path	Hook Switch Status	RDI3# (GOIP23)	RDI2 (GPIO22)	RDI1 (GPIO21)
Door Phone <-> HT	On Hook SWhk OFF	0 SW3 ON	1 SW2 ON	0 SW1 OFF

Audio Code Signal Status

MIC1	Enabled. Get the recorded voice data from the built-in Mic.
LINOUTR	Enabled. Will be used when using stereo speakers.
LINOUTL	Enabled. Send the voice data to Door/Inter Phone through I/O Box and play the voice from Door/Inter Phone on the built-in speaker.
LINEINL	Enabled. Get the voice data of Door/Inter Phone through I/O box.

BT878A Port ID	State
GPIO16	"0" turn on speaker amplifier.

The voice signal from the door phone is routed to the LINEINL pin of the Audio Codec and must be sent through LINOUTL to the built-in microphone immediately for playing the voice. The voice being recorded by the built-in microphone will be got from the MIC1 pin and then sent to LINOUTL without delay. The internal mixer circuitry of Audio Codec handles the audio signal routing between LINEINL and LINOUT as well as that between MIC1 and LINOUTL automatically.

6. Audio Codec Control Registers

The EH-7104-MD BIOS provides a Sound Blaster (SB16) compatible interface for the AP program to configure the Audio Codec in a simplified way. Whenever there is Codec IC change, the BIOS will be modified to handle the details of the Codec controls and keep the same interface for AP programs. This makes it not necessary to change the AP program due to the hardware change.

The AP program must first send to Port 224 H an 8-bit address of the control register whose content will be changed. Then, send to Port 225H the updated content of the control register.

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The Address Mapping and the allowable range of content for the control registers are shown as in the following table:

Register	D7	D6	D5	D4	D3	D2	D1	D0
00	Reset Mixer							
30	Master volume L (00..C8)							
31	Master volume R (00..C8)							
32	Voice volume L (00..F8)							
33	Voice volume R (00..F8)							
38	Line In volume L (00..C8)							
39	Line In volume R (00..C8)							
3A	Mic volume (00..A0)							
3C	Output switches (1=on, 0=off & unused bits)							
				Line In L	Line In R	CD-Audio L (not used)	CD-Audio R (Not used)	Mic
3D	Input switches L (1=on, 0=off & unused bits)							
	PC Speaker (Not supported)	MIDI L (not used)	MIDI R (not used)	Line In L	Line In R	CD-Audio L (not used)	CD-Audio R (not used)	Mic
3E	Input switches R (1=on, 0=off & unused bits)							
	PC Speaker (not supported)	MIDI L (not used)	MIDI R (not used)	Line In L	Line In R	CD-Audio L (not used)	CD-Audio R (not used)	Mic

These Control Registers control mainly the internal Mixer functions of the Audio Codec. To configure the paths of the audio signals, AP must set up the switches of Mixer inputs and outputs via control registers, 3C, 3D and 3E. To get optimized loudness of the voices from different sources, the control registers, 30, 31, 32, 33, 38, 39 and 3A must be set to suitable values.

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