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Hardware Description
Web Enabled Home Automation
ETec 474
May 04, 2010
**Introduction and Overview:**

This document describes the hardware that used to implement the web enable home automation (WEHA) device and its system. The WEHA is a network accessible device that monitors and controls home devices over the web. It has 19 IO ports to monitor and control home devices/appliances and RJ45 Ethernet connector to access the network. This document along with the schematic (WEHA schematic) will describe the WEHA’s parts with their relevant uses.

This project consists of 5 main parts: the power supply, Microcontroller, IO ports, physical layer transceiver and the isolation transformer/RJ45 Ethernet connector.

**Power Supply:**

The power supply used to power the WEHA is a wall AC adapter with an input of 110VAC and output of 5VDC with current of 1Amper. This provides a power to the device via a standard barrel connector. A Rectifier diode (“D1” on the schematic) at the input will protect any wrong polarity of a DC input. All of the components in The WEHA device run on 3.3 volts, so the LD29080 voltage regulator (U2 on the schematic) converts the 5VDC input to 3.3VDC and regulates voltage fluctuation.

**Microcontroller:**

The microcontroller being used for the WEHA is the MCF52259 Coldfire V2. This microcontroller was chosen because it has plenty of memory for the software, enough IO ports for monitoring controlling devices, its speed, and 10/100 BaseT/TX Ethernet support.
The microcontroller has different power source inputs for different functions and resources but I do not need all of the resource for my project, so the VDD and VDDA pins are connected to 3.3 volts and the VSS and VSSA pins are connected to the ground. All power input have 0.1uF bypass capacitor connected between the VDD to the ground to filter noise. The VRL (voltage reference low) and VRH (voltage reference high) pins are the reference levels voltage for the ATD converter. The jumper 1 and 2 gives the option for user to select reference level from 0 to 3.3 volts or the users can just disconnect those jumpers and apply voltage reference level to the pin # 39 and #40 of the IO port connector. The MCF52259 run from an external 48 MHz crystal oscillator connected to EXTAL and XTAL pins. The JTAG Header (“J3” on the schematic) can be used in order for the microcontroller to be programmed. The reset pin (RSTOUT_L) is connected to pin #5 of the JTAG header and it is also connected to 3.3 volts through the pull-up restore.

**IO ports:**

There are 19 IO ports available for this device. Eight of these ports (AN0 to AN7) can be use for analog input. The last two pins, pins #39 and #40, of the IO ports header are the reference levels voltage as explained in the above section. All of one side of the IO port header is grounded because if the user wants to use only one port, they can just plug two male connector pins between any IO ports to the ground across to it on the IO port header. If they want to add more connector, two pin connectors will stack next to each other.

**Physical layer transceiver:**
In order to transmit and receive data across the internet, a physical layer transceiver would be necessary. The MCF52259 microcontroller has a Fast Ethernet controller (FEC) but it requires an external transceiver interface to complete the physical layer media. The KSZ8041NL ("U3" on the schematic) is a 10Base-T/100Base-Tx physical layer transceiver. A 25MHz crystal oscillator connected to XO (pin #8) and REFCLK (pin #9). It is used to provide the reference clock for the KSZ8041NL. It uses a PLL clock synthesizer to generate faster clock from an external crystal oscillator for system timing to meet the 100Mbps fast Ethernet operation standard (IEEE802.3u, 100Base-TX standard). LED2, a network status indicator, is connected to pin# 30 through a pull-up resistor to 3.3volts. It will blink when there is an Ethernet activity in addition to ON and OFF to show that Ethernet link is available. The Physical layer transmit or receive differential signals pins, RX-, RX+, TX-, and TX+, (pin # 4 to #7) on the KSZ8041NL are connected to an isolating transformer ("T1" on the schematic).

**Isolation Transformer/RJ45 Ethernet connector:**

The JFM2410("T1" on the schematic) is a package of isolation transformer and RJ45 connecter. It is designed specifically for 10base-T/100base-Tx physical layer transceiver interface. It gives isolation to the KSZ8041NL chip from network and protects power surges. It is also works as band pass filter.