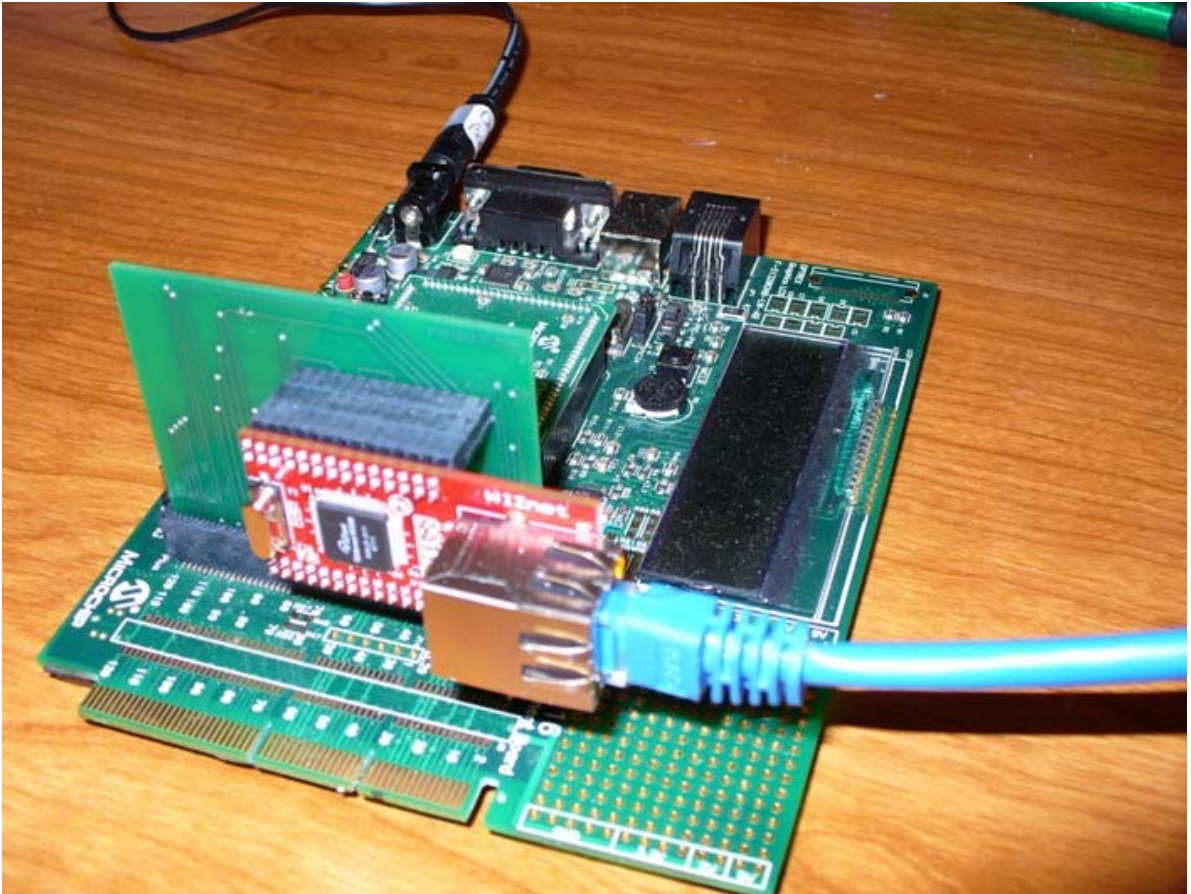


Travel WIZard

PROJECT NUMBER: 001130

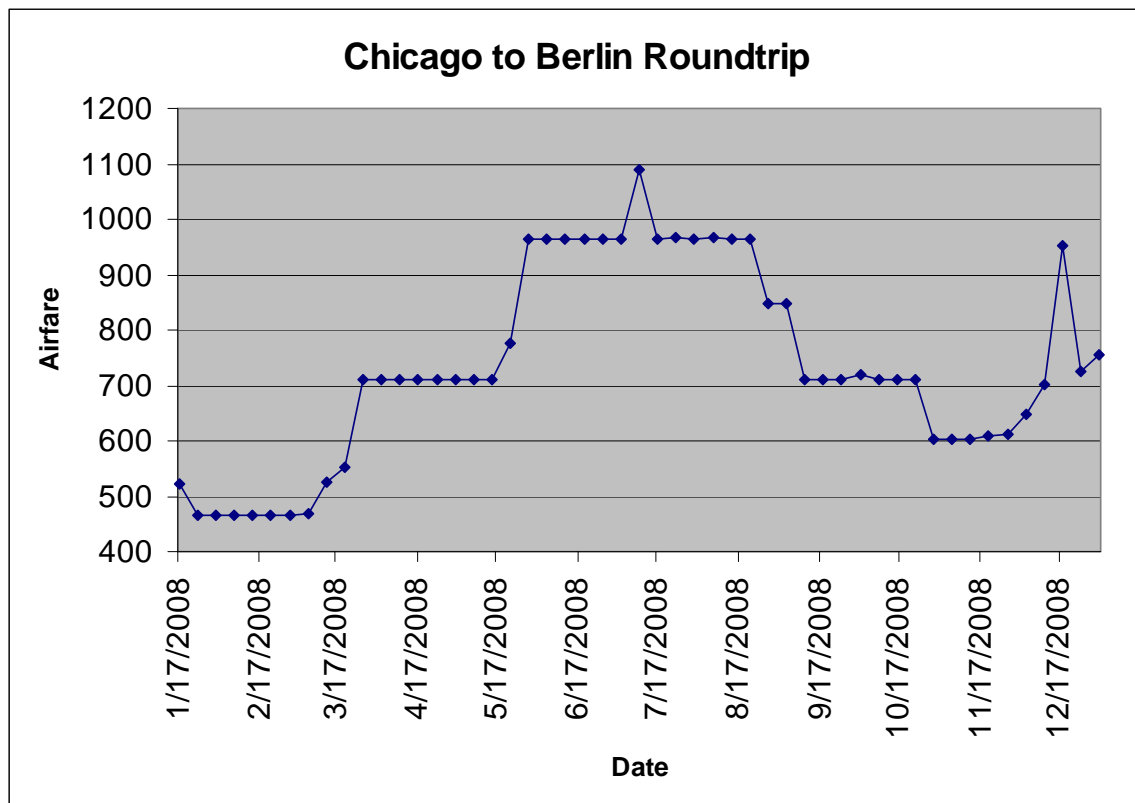


WIZnet iEthernet Design Contest

January 31, 2008

Overview

The Travel WIZard is an embedded server application which uses the online travel search engine 'Kayak' to scour the internet for airfare deals and return data which can be easily graphed to reveal the cheapest time of year to get away from it all. Given a set of search criteria submitted via HTTP, the Travel WIZard server interacts with the online search engine to acquire one year's worth of airfare data. After the search completes, the data can be retrieved from the server in .csv format using FTP. After retrieving the data via FTP, it can be easily graphed as in the example below revealing seasonal trends in ticket price.



Description

The Travel WIZard system features a WIZnet W5100 Ethernet controller on a WIZ810MJ network module. The system is controlled by a PIC24FJ128GA010 MCU residing on Microchip's Explorer 16 Development Board. The development board includes a 32K x 8 serial EEPROM, LEDs, buttons, and a 2 x 16 LCD display.

Hardware

A WIZ810MJ network module was acquired from WIZnet which includes a W5100 and all supporting hardware in a DIP configuration for easy prototyping. The Explorer 16 board includes a 120 pin card-edge connector which makes many of the MCU's pins available. To adapt the WIZ810MJ to the Explorer 16, we designed a custom circuit board using Eagle PCB layout software and had it fabricated by Advanced Circuits. The board has provisions for using both the SPI and parallel bus configurations of the W5100. A schematic is shown in Appendix E.

Software

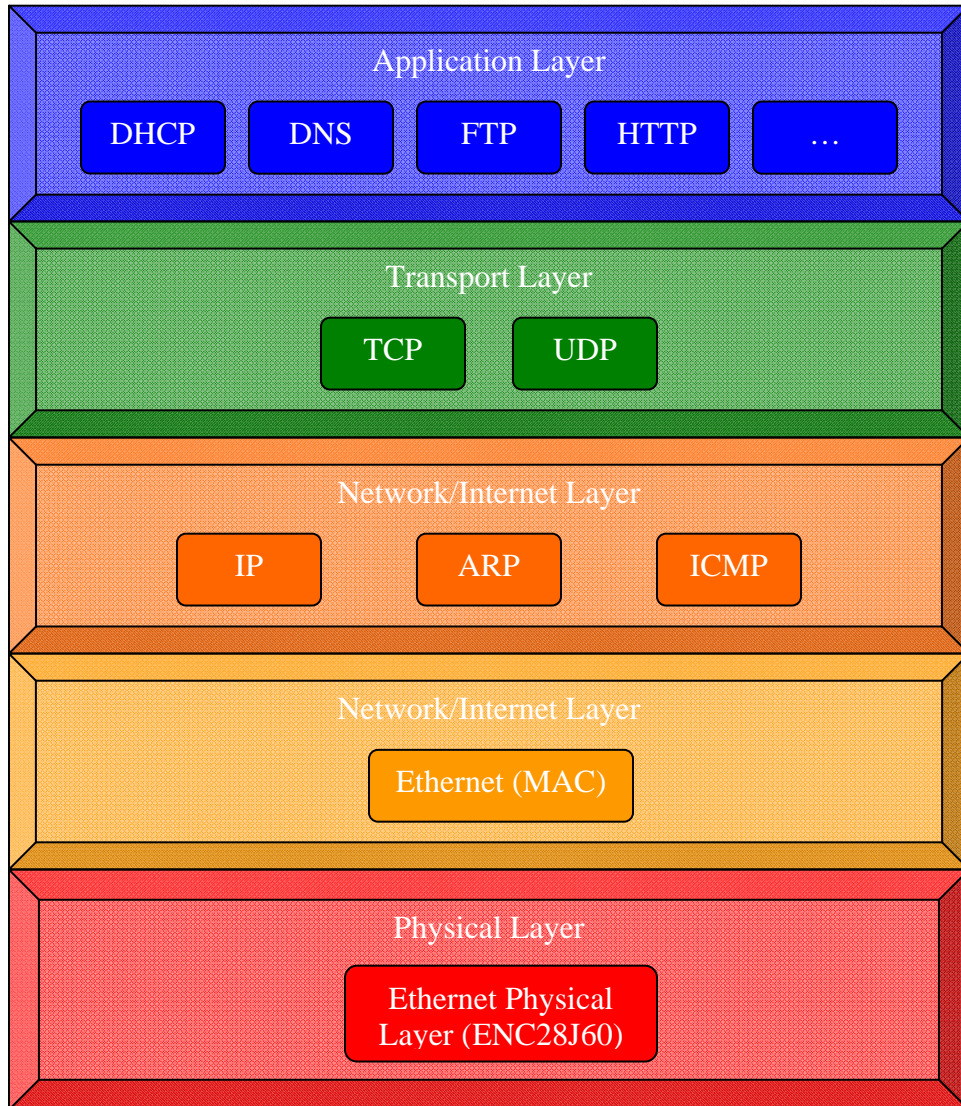
We used Microchip's freely available TCP/IP software stack as a starting point. The stack was originally designed to interface with Microchip's ENC28J60 Ethernet controller. It is a modular software implementation of the five-layer TCP/IP model (Appendix A). We ripped out the guts of the stack and replaced it with socket software to interface with the WIZnet W5100 (Appendix B). The W5100 implements everything below the application protocol layer in hardware. By switching from a software stack to a hardware stack, valuable code space and run time are saved. The modular design of the software stack allowed us to surgically replace the inner-workings of the stack functions with W5100 socket code - without disturbing the application layer. By keeping the same "black box" functionality of Microchip's existing TCP/IP interfaces, we were able to utilize Microchip's application layer software with only trivial changes.

To the existing stack we added a custom TCP client software package for retrieving airfare information from a remote server. The client software uses our W5100 socket driver interface to communicate over Ethernet.

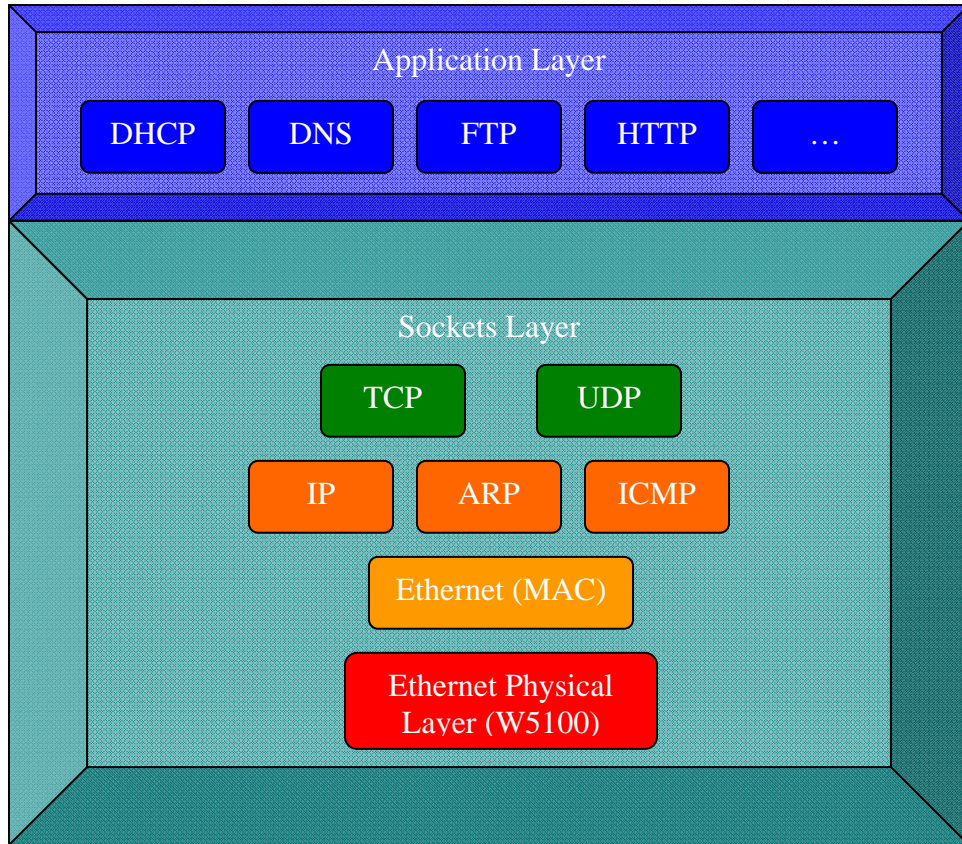
System

A webpage(Appendix F) is stored on the 32K x 8 EEPROM. One of the W5100 sockets is in a dedicated HTTP server configuration. Navigating to the IP address (acquired via DHCP) of the development board retrieves the webpage from EEPROM and allows the user to input flight search criteria via HTTP. The search criteria are put into an appropriate format for communicating with the internet flight search engine www.kayak.com. The board opens a TCP client connection with the Kayak server, retrieves airfare information over a one year period of possible departure dates, and stores the data in on-chip RAM. When the search completes, data may be retrieved in .csv format over FTP (Appendix C) and finally, graphed in Excel. See Appendix D for a system block diagram.

Appendix A: Microchip's TCP/IP Software Stack



Appendix B: TCP/IP Hardware Stack Featuring WIZnet W5100



Appendix C: Code Sample – FTP Data Retrieval

```
switch(**cmd)
{
  case '1':
    /* Send flight search results in .csv format */
    SearchResult = FlightSearchGetResult();

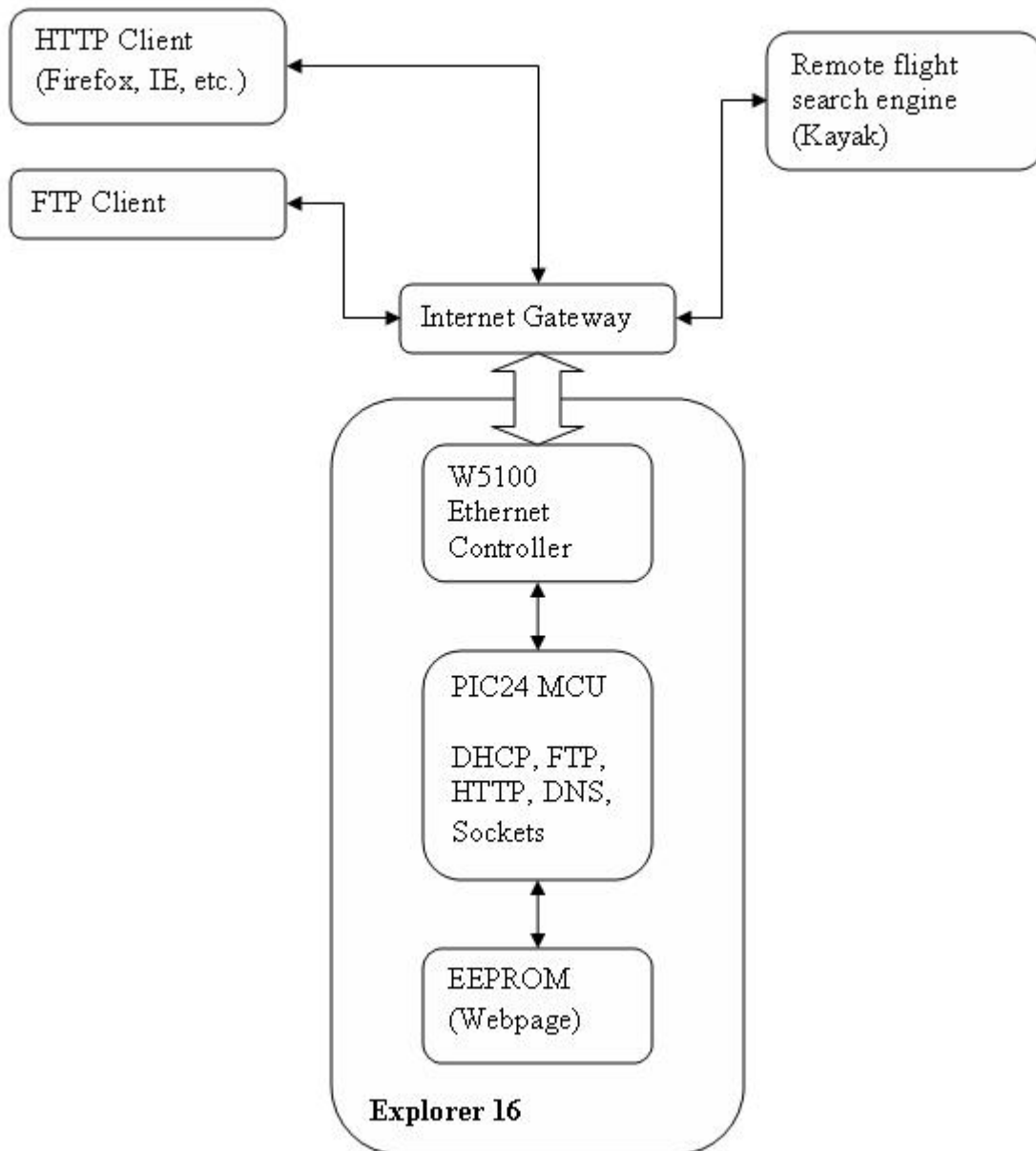
    if(SearchResult != 0)
    {
      TCPPutString(FTPDataSocket,(BYTE*)SearchResult->Date);
      TCPPut(FTPDataSocket,',');
      TCPPutString(FTPDataSocket,(BYTE*)SearchResult->Carrier);
      TCPPut(FTPDataSocket,',');
      TCPPutString(FTPDataSocket,(BYTE*)SearchResult->Price);
      TCPPut(FTPDataSocket,',');
      TCPPutROMString(FTPDataSocket,(ROM BYTE*)"r\n");
      TCPFlush(FTPDataSocket);

      /* Print hash characters on FTP client display */
      TCPPut(FTPSocket, '#');
      TCPFlush(FTPSocket);

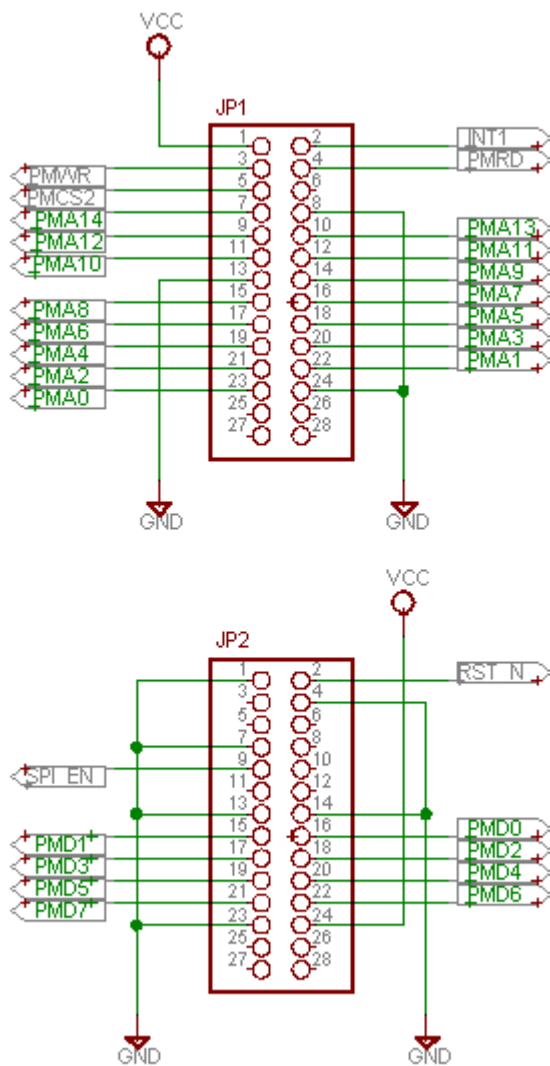
      /* Assume there is still more data to retrieve */
      return(FALSE);
    }

    break;
  case '2':
    Searching = FlightSearchIsSearching();
    if(Searching)
    {
      SearchCount = FlightSearchCurrentCount();
      TCPPutROMString(FTPSocket, (ROM BYTE*)"Search in progress. ");
      TCPPutROMString(FTPSocket, (ROM BYTE*)"Current search count: ");
      TCPPutString(FTPSocket,SearchCount);
      TCPPutROMString(FTPSocket,(ROM BYTE*)"r\n");
      TCPFlush(FTPSocket);
    }
    else
    {
      TCPPutROMString(FTPSocket, (ROM BYTE*)"Search not in progress.");
      TCPPutROMString(FTPSocket,(ROM BYTE*)"r\n");
      TCPFlush(FTPSocket);
    }
    break;
}
```

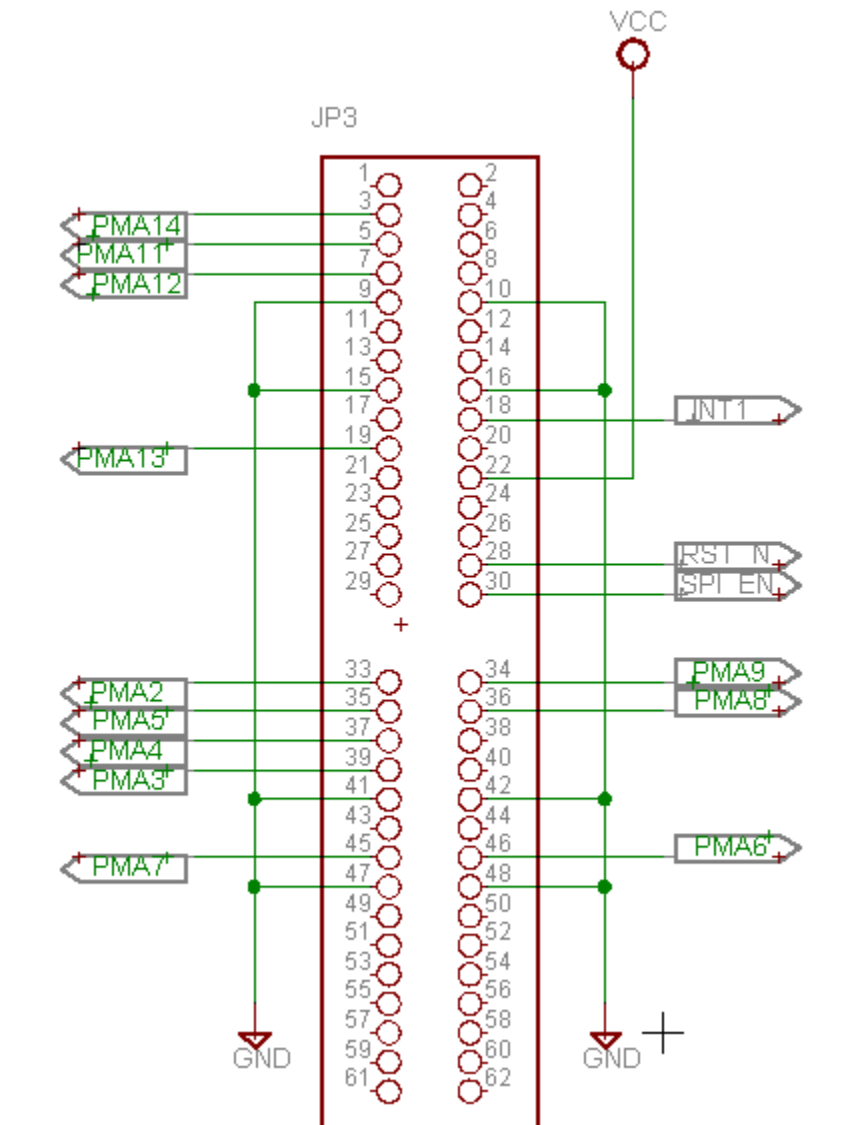
Appendix D: System Block Diagram



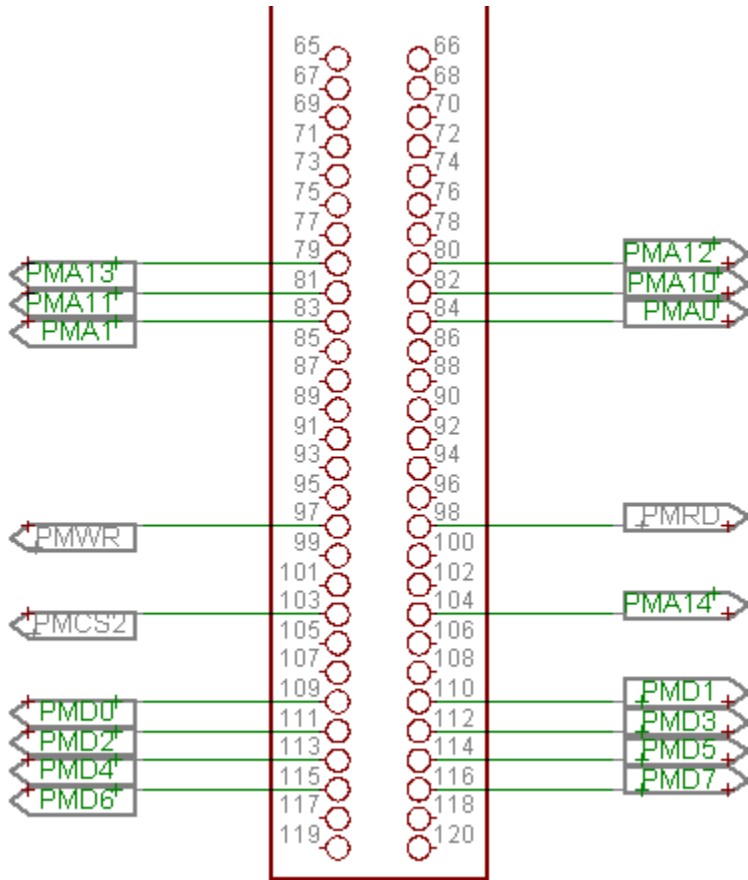
Appendix E: Schematic



These two jumpers are located on the WIZ810MJ development board. This schematic shows connections from the WIZ810MJ 28 pin connectors to PIC24 processor pins.



This schematic shows the top half of the Explorer 16 board's 120 pin card edge connector. These pins go directly to the PIC24 processor.



This schematic shows the bottom half of the Explorer 16 board's 120 pin card edge connector. These pins go directly to the PIC24 processor.

Appendix F: Embedded Webpage

The screenshot shows the Travel WIZard Home webpage in Mozilla Firefox. The browser's address bar displays `http://travelwiz/`. The page has a blue header with the "TRAVEL WIZARD" logo and navigation links for Home, Features, and Architecture. A "Welcome!" message is followed by a "Search Criteria" section with input fields for Departure Airport (ORD), Destination Airport (MIA), Departure Date (02/15/2008), Return Date (02/18/2008), Departure Time (Anytime), Return Time (Anytime), Travelers (1), and Cabin (Economy). A "Search" button is located below the form. To the right, a text block describes the application's function. Below the text is a line graph titled "Chicago to Berlin Roundtrip" showing airfare prices from 1/17/2008 to 12/17/2008. The Y-axis represents "Airfare" (400-1200) and the X-axis represents "Date".

Date	Airfare
1/17/2008	450
2/17/2008	450
3/17/2008	500
4/17/2008	650
5/17/2008	700
6/17/2008	950
7/17/2008	1050
8/17/2008	950
9/17/2008	700
10/17/2008	650
11/17/2008	600
12/17/2008	750

A screenshot of our embedded webpage being served in Firefox