



An  IXYS Company

Application Note

A Web Page Interface for the eZ80F91 MCU Using Java



AN017806-0810

Abstract

An Internet-enabled product built around the eZ80AcclaimPlus!TM microcontrollers/microprocessors using the Zilog TCP/IP stack (ZTP) involves developing web pages to control the product's functionality. This application note focuses on developing an application to remotely control the pins of the eZ80F91 MCU from a web page, and display the status of a pin on the web page. The details about how to write a Java applet, add the applet into a HTML code, use ZTP's HTTP-related APIs and integrate the complete system are discussed in this application note.

With this Java-based application, a two-way control mechanism is demonstrated wherein the user controls the LEDs on the eZ80[®] Development Platform via the buttons on the web page, and toggles the color of indicators (LED icons) on the web page using switches on the Development Platform.

This Java-Based Web Page Interface is thus another Java-enabled process control application that uses the Internet/Intranet. (See the related Zilog application note on a Thermostat Demo using the eZ80F91 MCU.)

- **Note:** *The source code (AN0178-SC01) associated with this application note has been tested with ZDS II—eZ80Acclaim! version 5.1.1 and is available on the Zilog web site.*

Zilog Product Overview

This section provides a brief overview of the Zilog products used in this application note, which include eZ80AcclaimPlus! Connectivity ASSP and the ZTP software suite.

eZ80AcclaimPlus! MCU Family Overview

The eZ80Acclaim family of MCU includes Flash and non-Flash products. The Flash-based eZ80AcclaimPlus! MCU, device is suited for designing high performance embedded applications. With execution speeds up to 50 MHz and an on-chip Ethernet MAC (eZ80F91 only), you can execute complex applications supporting networking functions quickly and efficiently. Combining on-chip Flash and SRAM, eZ80AcclaimPlus! device provides the memory required to implement communication protocol stacks and achieve flexibility when performing in-system updates of application firmware.

Zilog TCP/IP Software Suite Overview

The ZTP integrates a rich set of networking services with an efficient real-time operating system (RTOS). The operating system is a compact preemptive multitasking, multithreaded kernel with interprocess

communications (IPC) support and soft real-time attributes. [Table 1](#) lists the standard network protocols implemented as part of the embedded TCP/IP protocol stack in ZTP.

Table 1. Standard Network Protocols in ZTP

HTTP	TFTP	SMTP	Telnet	IP	PPP
DHCP	DNS	TIMEP	SNMP	TCP	UDP
ICMP	IGMP	ARP	RARP		

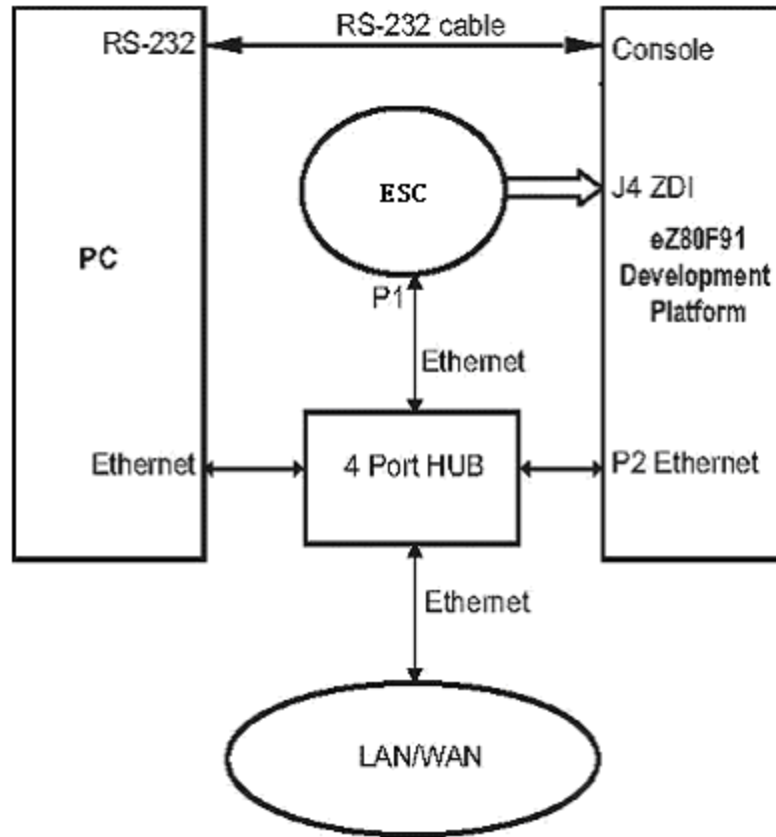
Many TCP/IP application protocols are designed using the client-server model. The final stack size is link-time configurable and determined by the protocols included in the build.

Discussion

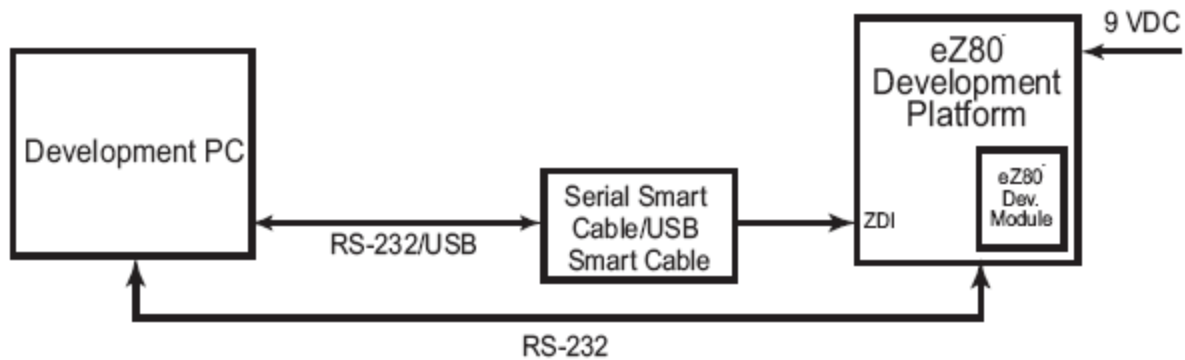
[Figure 1](#) on page 3 depicts the general data communication path using the eZ80F91 Development Kit, the ZPAKII, and an Ethernet Hub. With this hardware, the eZ80F91 MCU is ready to be used as an efficient web server when Zilog's ZTP software is downloaded on it. ZTP provides the software to drive the hardware used for TCP/IP connections. This hardware comprises SERIAL1 (UART1/UART2) for PPP connections and the Ethernet Media Access Controller (EMAC) for Ethernet connections among other peripherals.

The Zilog TCP/IP Software Suite (ZTP) contains a set of libraries that implement an embedded TCP/IP stack.

The ZTP Applications Programming Interface (API) allows programmers using any member of the eZ80[®] family of processors (including the eZ80Acclaim! product line) to rapidly develop internet-ready applications with minimal effort.



Hardware Setup for the ZTP Applications Using Ethernet Smart Cable



Hardware Setup for the ZTP Applications Using Serial Smart Cable/USB Smart Cable

Figure 1. General Setup with the eZ80F91 MCU as a Web Server

HTTP Server in ZTP

The implementation of Hyper Text Transfer Protocol (HTTP) in ZTP enables eZ80F91 microcontroller to work as an HTTP server. The eZ80F91 MCU-based products implemented as an HTTP server can store web

pages and provide them to browsers on demand. The HTTP layer also provides the facility of creating socket connections between networked products and allows them to interchange data reliably over the Ethernet.

For this Java-Based Web Page Interface application, a C program supports the web pages and helps the user interact with the web server.

Using the ZTP HTTP user interface primarily involves writing user application code that calls the appropriate ZTP HTTP API functions. It also involves integrating user web pages into the web server using ZDS II.

ZTP HTTP CGI Functions

Embedded systems typically do not contain a file system. The lack of a file system means that embedded systems cannot save CGI scripts as separate *.cgi files. Instead of saving CGI scripts as separate *.cgi files, ZTP uses C function calls, collectively called CGI functions. When a CGI function is called, the HTML code stored in the web server is sent to the web browser. It is in these function calls that a programmer writes code to read the information sent by a web browser. This information is then processed as required by the application. ZTP provides the following CGI functions to the user.

- `int http_output_reply(http_request *request, int reply)`
- `char *http_find_argument(http_request *request, char *arg)`
- `int _http_write(http_request *request, char *buff, int count)`

In each ZTP CGI function, the pointer to the `request` structure is used to keep the requests from different clients separate.

The `http_output_reply()` function is used to return an acknowledgement to the browser that made the request.

The `http_find_argument()` function is used to extract parameters from the received data in the parsed browser request.

The `_http_write()` macro is used to return data to the browser that sent the request that invoked the CGI function.

For detailed information about the protocols used in ZTP, refer to the *ZTP Programmer's Guide* (RM0008), available along with the ZTP software.

Java Applets and HTML HTTP

A Java applet is a program that adheres to a set of conventions that allow it to run on Java-compatible browsers. Most of the standard HTML browsers support Java applet execution. The standalone systems using Java applets must add a Java Virtual Machine (JVM) to run an applet.

Hypertext Markup Language (HTML) is used to display information in web browsers. A web page is basically coded in HTML, which is interpreted at run-time by the browser. A web page that can change its content depending on the information obtained by the server at run-time is called dynamic. A static web page on the other hand displays fixed information. Inserting an applet into the web page allows the web page to display dynamic information because the applet changes its content during run-time. The web browser creates the applet object when it encounters the `<applet>` tag in the HTML code; the `<applet>` tag provides the name of the Java class file (stored as Java byte code in the web server) from which the applet object is created. Visit www.java.sun.com for information about the Java language.

Developing the Java-Based Web Page Interface Application

This section discusses the implementation of the Java-Based Web Page Interface in detail. This section also explains the implementation of the operations that occur when a button is clicked on the web page and when a switch on the Development Platform is pressed. In addition, this section includes instructions about how to interface the application specific files to the standard ZTP files.

The block diagram of the eZ80F91 web server setup for the Java-Based Web Page Interface application is shown in [Figure 1](#) on page 3. The eZ80F91 MCU is configured to work as a web server, and a client PC with a browser is used to control the GPIO pins on the eZ80F91 MCU via the web pages. The switches SW1, SW2 and the LEDs DCD (D1), RX (D2) are on the Development Platform and are used to demonstrate the working of this application.

A browser is used to access the eZ80F91 web server to obtain the current status of different GPIO pins or to change the status of the pins and thereby control the system over the Ethernet. The locally networked devices are connected together in an intranet and are accessible to the outside world (Internet) through a gateway.

[Figure 2](#) displays an overview of the communication between eZ80F91 web server and an HTML browser.

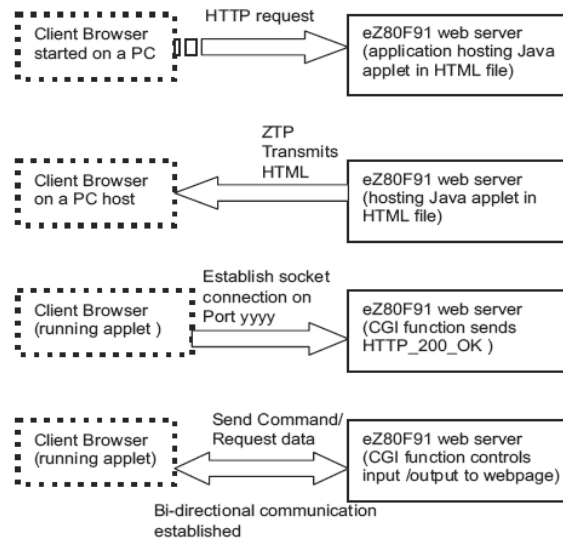


Figure 2. Communication Between Client Browser and the eZ80F91 Web Server

The web server transmits an HTML file (containing a link to the Java applet) to the client browser. The Java applet contains a graphical user interface (GUI) component that is displayed on the web page as shown in [Figure 3](#) and [Figure 4](#) on page 6. The web page displays the buttons that control the LEDs and the indicators (LED icons) that are controlled by the switches on the Development Platform.

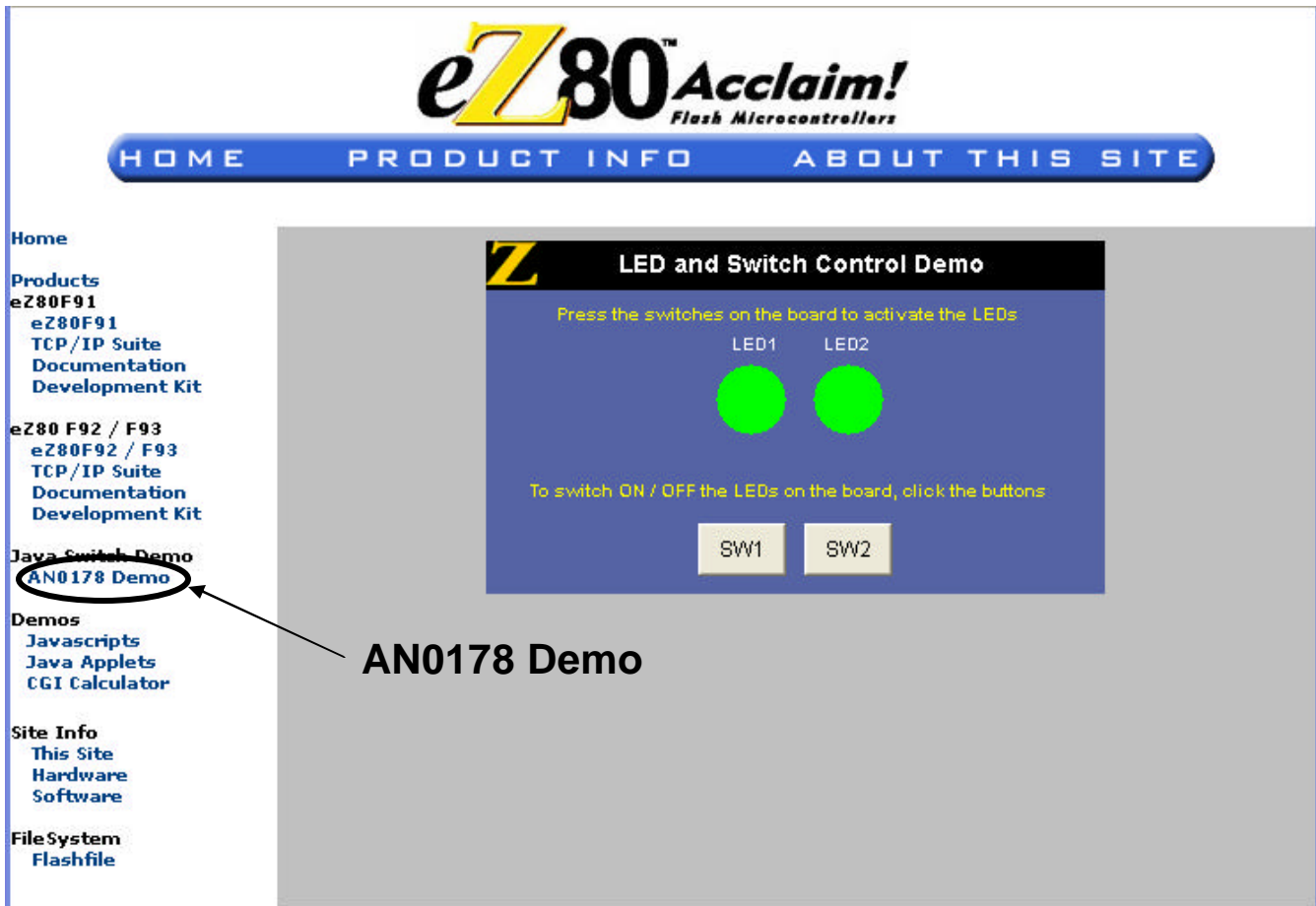


Figure 3. LED and Switch Control Demo Web Page

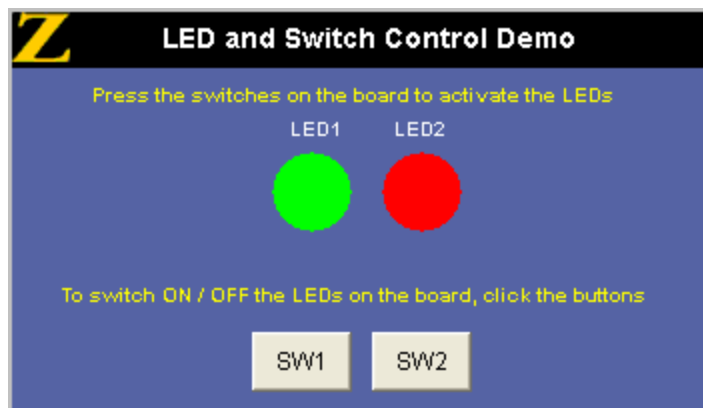


Figure 4. Java Applet Component on HTML Web Page

► *Note: By default, the HTTP server closes the TCP connection as soon as the HTTP request is processed, and, therefore, persistent connections are not possible.*

The software implementation can be divided into the following sections:

- Designing the web page, which includes coding the Java applet for the GUI.
- Developing the functionality, which comprises the following:
 - Implementing the functionality to control the LEDs on the Development Platform
 - Implementing the functionality to effect a change in the indicators (LED icons) on the web page using the switches on the Development Platform

Creating the Web Page

The source code of for the HTML file `Switch.htm` displays the web page as shown in [Figure 3](#) on page 6. The HTML script contains a link to the Java applet using the following lines of code:

```
<applet width="340" height="250" code="SwitchCtrl.class">
<param name="bgcolor" value="#FFFFFF">
</applet>
```

The applet is executed from the Java class file `SwitchCtrl.class`, which is previously stored in the eZ80F91 web server in the form of ASCII characters. The `SwitchCtrl.class` file is obtained upon compiling the `SwitchCtrl.java` file. The Java file `SwitchCtrl.java` is coded as detailed in this application note. The entire Java source code is available in `AN0178-SC01.zip`.

Importing Relevant Java Packages

In the `SwitchCtrl.java` file, the relevant packages that the main program uses are imported in the beginning of the file. The packages are similar to the `*.lib` and `*.h` files of the C language. In the program for the applet, the following packages containing the relevant classes are defined as imported:

```
import java.applet.Applet;
import java.awt.*;
import java.io.*;
import java.net.*;
import java.awt.event.*;
```

The imported packages are part of the core Java APIs that every Java program uses in the Java run-time environment. The `java.applet` package contains classes that are essential for Java applets. The `java.awt` package contains the most frequently used classes in the Abstract Window Toolkit (AWT), which provides the Java graphical user interface (GUI) properties.

A subclass to extend the properties provided to the applet by the packages is implemented next, with the following lines of code:

```
public class SwitchCtrl extends Applet implements Runnable ,
ActionListener{
...
}
```

The `extends` keyword indicates that `SwitchCtrl` is a subclass of the `Applet` class.

From the `Applet` class, applets inherit a great deal of functionality, the most important of which is the ability to respond to browser requests. When a Java-capable browser loads a page containing an applet, the browser

sends a request to the applet telling the applet to initialize itself and start executing.

Declaring the Variables

After creating the Applet class, the variables that can be used by any function or subclass are declared within the SwitchCtrl class as follows:

```
...
Socket rwSocket;
Socket inSocket;
Thread readThread;
String ipaddr=null;
String ip=null;
int portNumber;
int port;
Button xButton;
Button yButton;
DataOutputStream os;
DataInputStream is;
Image image1;
Color firstBulbColor = Color.green;
Color secondBulbColor = Color.green;
```

Initializing the Applet

The applet is initialized using the public void `init()` method. The `init()` method is called when the applet is first created and loaded by the underlying software (the web browser). This method performs all the one-time operations that the applet requires for its operation such as creating the user interface or setting the font or displaying the logo.

```
...
public void init(){
...
}
```

The file formats *.gif and *.jpg are used to load and display images on the browser screen. Images are stored as an instance of the Image class. The applet method `getImage()` returns an instance of these files:

```
image1 = getImage(getDocumentBase(), "logo.gif");
```

Setting the Applet Background Color

The following piece of code is used to set the background color of the applet based on the color value received from the HTML page:

```
...
String s3 = getParameter("bgcolor");
if(s3 != null)
try{
    setBackground(new Color(Integer.parseInt(s3.substring(1),16)));
}
...
}
```

The `catch()` method that is used to handle errors and exceptions in Java is used to handle invalid color values. The error message is displayed on the Java Console that can be opened from the web browser.

- **Note:** *The Java Console is available as an option under the Tools menu in the web browser when the Java Runtime Environment (JRE) is installed on the client PC. The JRE can be downloaded from the website, <http://www.java.sun.com>.*

```
...
catch(NumberFormatException _ex){
System.out.println("Invalid format for bgcolor: " + s3);
}
setLayout(null);
...
```

Creating the Buttons

To create buttons with text, the new `Button()` method is used. The `setBounds()` method specifies the area (the X and Y axis) where the button is to be placed on the web page and also specifies its width and height.

The `add()` method adds the new button to the Applet. The `setEnabled()` method either activates or disables the button. The button is activated only when the `setEnabled()` method is true and disabled when it is false. The following code illustrates the methods explained to create buttons:

```
...
xButton = new Button("D1");
xButton.setBounds(120, 160, 50, 30);
xButton.addActionListener(this);
add(xButton);
yButton = new Button("D2");
yButton.setBounds(180, 160, 50, 30);
yButton.addActionListener(this);
add(yButton);
xButton.setEnabled(true);
yButton.setEnabled(true);
...
```

Obtaining the Host IP Address

The applet is started using the `public void start()` method. The IP address of the host where the applet is run must be obtained so that a socket can be opened for a communication channel to be set up between the client and the web server. The following code is used to set the port number and obtain the host IP address, which is then sent to the web server (see the “Adding and Integrating Application-Specific Files to ZTP” section on page 14):

```
...
public void start(){
System.out.println("Enter Start");
ipaddr = getCodeBase().getHost();
System.out.println("IP Addr " + ipaddr.toString());
portNumber = 80;
System.out.println("PortNumber=" + portNumber);
}
```

The following code handles the error due to a connection failure:

```
try{
    rwSocket = new Socket(ipaddr.toString(), portNumber);
}catch(UnknownHostException _ex){
    System.out.println("An error occurred while establishing the communication
with the server");
}catch(IOException _ex){
    System.out.println("Couldn't get I/O for the connection to: " +ipaddr);
}catch(Exception e){
    System.out.println("An error occurred while reading the response.Try
reloading the page. ");
}
}
```

A new thread is then created and started with the following lines of code:

```
if(readThread == null){
    readThread = new Thread(this);
    readThread.start();
}
}
```

Creating the Applet Heading

The text or the heading for the Applet is printed using the `paint(Graphics)` method of the `java.awt.Graphics` package. The `paint(Graphics)` method is coded as follows:

```
public void paint(Graphics g) {
    System.out.println("Enter Graphics"+g);
    g.setColor(Color.black);
    g.fillRect(0,0,400,28);
    g.drawImage(image1,0,0, this);
    g.setColor(Color.white);
    g.setFont(new Font("Arial", 1, 14));
    g.drawString("LED and Switch Control Demo", 75, 18);
    g.setColor(Color.yellow);
    g.setFont(new Font("Arial", 1, 10));
    g.drawString("Press the switches on the board to activate the
LEDs below", 40, 45);
    g.setColor(Color.white);
    g.setFont(new Font("Arial", 1, 10));
    g.drawString("LED1", 139, 62);
    g.drawString("LED2", 191, 62);
    g.setColor(firstBulbColor);
    g.fillOval(130,70,40,40);
    g.setColor(secondBulbColor);
    g.fillOval(185,70,40,40);
    g.setColor(Color.yellow);
    g.setFont(new Font("Arial", 1, 10));
    g.drawString("To switch ON / OFF the LEDs on the board, click
the buttons", 25, 145);
    System.out.println("Exit Graphics");
}
}
```

The `setFont()` method is used to set the font. The `drawString()` method prints the specified text on the

browser. The `fillOval()` method paints the LED icons (labeled as LED1 and LED2 on the web page) on the screen according to the position (X and Y axis) and size (width and height) as specified. The `setColor()` method is used to specify the color for the LED icon.

Synchronizing Independent Threads

To run the main thread and obtain the IP address of the client at Port 5000 (user specified), the following code is used. The `synchronized` keyword tells the applet to synchronize all the threads.

```
synchronized public void run() {
    System.out.println("Enter RUN");
    ip = getCodeBase().getHost();
    System.out.println("IP Addr " + ip.toString());
    port = 5000;
```

Reading and Parsing the Data from the Port

When the applet runs, the browser displays the indicators (LED icons, LED1 and LED2) and buttons (SW1 and SW2) on the screen.

The `Socket` class is used to set up Port 5000 for input. The data on the port is then read and parsed to obtain the proper string value after eliminating `&` and `\n` characters. This value is then passed to the `updateBulbStatus()` method.

```
...
try{
    inSocket = new Socket(ip.toString(),port);
    is = new DataInputStream(inSocket.getInputStream());
    System.out.println("InStream is:>> " +is);
    while(true) {
        str = "";
        while((b = is.readByte()) != '&') { }
        while ((b = is.readByte()) != '\n') {
            str = str + (char)b; //read bytes, not Unicode characters
        }
        System.out.println("Input read is:>>" +str);
        updateBulbStatus(str);
    }
}catch(Exception e) {
    System.out.println("An error occurred while reading the
    response.Try reloading the page. ");
}
...

```

Changing the Color of the Indicators

The `updateBulbStatus()` method, which toggles the color of the indicators (LED icons) on the web page between red and green, is constructed as follows:

```
public void updateBulbStatus(String msg){
    System.out.println("Enter UpdateBulbStatus");
    System.out.println("Received String" +msg);
    if (msg.equals("LED1on")) {
        redraw(1,Color.red);
    }
}
```

```

else if (msg.equals("LED1off")){
redraw(1,Color.green);
}
else if (msg.equals("LED2on")){
redraw(2,Color.red);
}
else if (msg.equals("LED2off")){
redraw(2,Color.green);
}
System.out.println("Exit updateBulbStatus");
}
...

```

Controlling the LEDs on the Development Platform

When the button SW1 or SW2 is clicked on the web page, the `actionPerformed()` method is invoked, and a data string corresponding to the clicked button is stored in variable `s`.

```

...
public void actionPerformed(ActionEvent ev) {
System.out.println("Enter Action Performed");
String label = ev.getActionCommand();
String s = new String();
if(label.equals("D1")){
s = "command=1&dummy=0";
sendData(s);
}else if(label.equals("D2")){
s = "command=2&dummy=0";
sendData(s);
}
System.out.println("Exit Action Performed");
}
}

```

The data in the string `s` is sent to the socket by the `sendData()` method with an alert for any error that may occur. After sending the data, the socket is closed to complete the communication. The HTTP layer of the web server listening on Port 5000 parses and interprets this data and provides the requisite value to the CGI function `switchinput_cgi`.

```

...
public void sendData(String s) {
System.out.println("Enter SendData");
String s1 = null;
s1 =s;
s1 = "GET /switch_cgi?" + s1 + " HTTP/1.1\r\n";
s1 = s1 + "Host: " + ipaddr.toString() + "\r\n\r\n";
System.out.println("Data to send =" + s1);
try{
System.out.println("rwSocket::"+rwSocket);
Socket outSocket = new Socket(ipaddr, portNumber);
os = new DataOutputStream(outSocket.getOutputStream());
os.flush();
os.write(s1.getBytes());
outSocket.close();
}catch(IOException _ex){

```

```

System.err.println("Write exception"+_ex);
}
System.out.println("Exit Send Data");
}

```

The Java source code construction for the applet is now complete. To compile this code, the Java compiler version 1.1 must be installed on the PC (PCs with a web browser such as Mozilla Firefox or Netscape already contain the Java Virtual Machine that contains the Java compiler). The following command, at the DOS prompt, is used to compile the Java code:

```
Javac -deprecation -target 1.1 SwitchCtrl.java
```

After successful compilation, a class file `SwitchCtrl.class` is created. This class file is further converted to a `SwitchCtrl_class.c` file (where the contents of the file are stored in the form of an array) when the project is compiled using the Zilog's ZDS II compiler.

Controlling the LEDs on the Development Platform

In the Java-Based Web Page Interface application a CGI function, `switchinput_cgi()` is used to call the ZTP HTTP CGI functions in order to read the user input from the HTML web page when the button SW1 or SW2 is clicked on the web page, and to transmit that input data to the Development Platform. For more details, see the "ZTP HTTP CGI Functions" section on page 4.

The `switchinput_cgi()` function is declared as follows:

```
INT16 switchinput_cgi(struct http_request *request)
```

This CGI function initially calls the ZTP HTTP API `http_init()` function to initialize the web server, makes a TCP connection on the specified port and waits for a client request. On receiving a request from the client, the web server provides a response according to the web server configuration.

The CGI function then calls the ZTP HTTP CGI function, `http_output_reply()` to send an acknowledgement to the client browser. The `http_find_argument()` is called to search for the string command indicating which of the buttons (SW1 or SW2) is pressed; the respective LED on the Development Platform is then switched ON/OFF. [Figure 5](#) on page 20 shows the sequence of events.

Controlling the LED Icons on the Web Page

The Port B of the eZ80F91 MCU is initialized with PB0 and PB1 as input pins and PB3 and PB4 as output pins (see the `Switch.c` file in the `AN0178-SC01.zip` file available on the Zilog web site). Port B is continuously polled for any change in status in ZTP's `main.c` file.

When the SW1/SW2 switch on the Development Platform is pressed, the change in the switch status is captured by the `Switch_Input()` function (a flag is set or reset to indicate the status of the switches) and an appropriate string is written for the switch. The strings `LEDOn` or `LEDOff` are used to indicate whether the LED icons on the web page must be displayed in green (OFF) or red (ON). These strings are sent as arguments in the `switchinput_cgi()` function. See the "Controlling the LEDs on the Development Platform" section on page 12 for details of this CGI function.

The ZTP HTTP API `http_find_argument()` is called within the `switchinput_cgi()` function to

search for the string (LED1on/LED1off). This string is sent to the browser where the color of the indicators (LED icons, LED1/LED2) on the web page turns green or red. [Figure 6](#) on page 21 shows the sequence of events.

Adding and Integrating Application-Specific Files to ZTP

The Java-Based Web Page Interface application described in this application note requires the eZ80[®] Development Platform with the eZ80F91 module, and the Zilog TCP/IP stack (ZTP). To execute this application, the files specific to the application must be added and integrated to the ZTP stack before the stack is downloaded onto the eZ80F91 MCU. This section contains the details of adding the application specific files to the ZTP stack.

The Java-Based Web Page Interface files are in the AN0178-SC01.zip file available on the Zilog web site. The application files are of the following types:

- C (*.c) files
- Header (*.h) files
- HTML (*.htm/*.html) files
- Java (*.class) files
- Image (*.gif) files

The ZTP stack is available on the Zilog website and can be downloaded to a PC with a user registration key. ZTP can be installed in any location as specified by the user; its default location is C:\Program Files\ZiLOG.

► **Note:** *Before adding and integrating the application specific files to ZTP, ensure that all the settings for the ZTP stack are at default values.*

Perform the following steps to add and integrate the Demo files to the ZTP stack:

1. Download ZDS II Acclaim 5.0.0 with ZTP 2.3.0 and install, browse to the location where ZTP was installed and open the following directories:
`... \ZTP\ZTP2.3.0_Lib\ZTP\SamplePrograms\ZTPDemo`
`... \ZTP\ZTP2.3.0_Lib\ZTP\SamplePrograms\Website.Acclaim`
2. Download AN0178-SC01.zip and extract its contents to a directory on your PC. There are two extracted folders within AN0178-SC01:
`\JWC_Demo`
`\JWC_website.acclaim`
3. Select and copy all the *.htm (or *.html), *.gif files, and *.class files located in the `\JWC_website.acclaim` directory to the `... \ZTP\ZTP2.3.0_Lib\ZTP\SamplePrograms\Website.Acclaim` directory. Copy the *.c and *.h files located in the `\JWC_Demo` directory to the `... \ZTP\ZTP2.3.0_Lib\ZTP\SamplePrograms\ZTPDemo` directory.
4. Launch ZDS II-eZ80Acclaim! 5.0.0 and open the `website.zdsproj` project located in the `... \ZTP\ZTP2.3.0_LIB\ZTP\SamplePrograms\Website.Acclaim` directory.
 - a) Add all the *.htm (or *.html) and *.class and *.gif files located in the `... \ZTP\ZTP2.3.0_LIB\ZTP\SamplePrograms\Website.Acclaim` directory to the `website.zdsproj` project. To do so, click **Project** and then click **Add Files**.

- The *.htm file to be added is: switch.htm
 - The *.class file to be added is: SwitchCtrl.class
 - The *.gif file to be added is: Logo.gif
- b) Open the website.c file from within ZDS II and add the following prototype declarations to it:
- ```
// Java-Based Web Page Interface Demo pages
extern const struct staticpage switch_htm;
// Java Applets
extern const struct staticpage SwitchCtrl_class;
// CGI functions
extern int switchinput_cgi (struct http_request *request);
// Pictures: JPG, GIF
extern const struct staticpage logo_gif;
```

- c) The website.c file contains an array, Webpage website [ ], that provides information about the HTML pages. Replace the last line of the array {0, NULL, NULL, NULL} with the following lines of code:

```
{HTTP_PAGE_STATIC, "/SwitchCtrl.class", "application/octet-stream",
&SwitchCtrl_class},
{HTTP_PAGE_STATIC, "/switch.htm", "text/html", &switch_htm},
{HTTP_PAGE_DYNAMIC, "/switch_cgi", "text/html", (struct staticpage *)
&switchinput_cgi},
{HTTP_PAGE_STATIC, "/logo.gif", "image/gif", &logo_gif},
{0, NULL, NULL, NULL}
```

- d) From within ZDS II–Acclaim 5.0.0, open the left.htm file located in the \Web Files directory. Search for the Demos<br> statement and add the following piece of HTML code above the Demos<br> statement to create a link from the default eZ80Acclaim!® web page to the Java Switch Applet web page:

```
Java Demo

 AN0178 Demo


```

- e) Build the website.zdsproj project to obtain the new library file Acclaim\_website.lib.
- f) Copy this Acclaim\_website.lib from the ... \ZTP\ZTP2.3.0\_LIB\ZTP\SamplePrograms\Website.Acclaim directory to the ... \ZTP\ZTP2.3.0\_LIB\ZTP\Lib directory where it will replace the existing one.

► **Note:** *The ... \ZTP\ZTP2.3.0\_Lib\ZTP\Lib folder already contains an Acclaim\_website.lib file, and it must be replaced with the newly generated file. Click Yes to replace the file.*

- g) Close the website.zdsproj project.
5. From within ZDS II, open the ZTPDemo\_F91.zdsproj file available in the ... \ZTP\ZTP2.3.0\_LIB\ZTP\SamplePrograms\ZTPDemo directory.
- a) Add the \*.c file located in the ... \ZTP\ZTP2.3.0\_LIB\ZTP\SamplePrograms\ZTPDemo directory to the ZTPDemo\_F91.zdsproj project. To do so, click **Project** and then click **Add Files**. The \*.c file to be added is: switch.c
- b) For this application, DHCP (Dynamic Host Configuration Protocol) is disabled; therefore, ensure that the following is set in the ZTPConfig.c file:
- ```
UINT8 b_use_dhcp = FALSE;
```

- c) Look for the following structure definition in the ZTPConfig.c file:

```
struct commonServers csTbl={
    "172.16.6.48",    /* Default Timer Server */
    "",              /* Default Network Timer Server( NTP ) */
    "",              /* Default rfs server */
    "",              /* Default File Server - Not currently Used */
    "172.16.6.194"   /* Default Name Server */
};

struct If ifTbl[MAX_NO_IF]= { /*interface 0 -> Ethernet Configurattion*/
{
    &usrDevBlk[0],    /* Control block for this device*/
    ETH,              /* interface type */
    ETH_MTU,          /* MTU */
    ETH_100,          /* Speed ETH_100, ETH_10, ETH_AUTOSENSE */
    "172.16.6.203",   /* Default IP address */
    "172.16.6.1",     /* Default Gateway */
    0xffffffff00UL    /* Default Subnet Mask */
},
};
```

- **Note:** *The Bootrecord variable contains network parameters and settings (in the four-octet dotted decimal format) specific to the local area network at Zilog, by default. Modify the above structure definition with appropriate IP addresses within your local area network (For details about modifying the structure definition, refer to the ZTP 2.3.0 documents.)*

- d) Open the emac_conf.c file and change the default MAC address (provided by ZTP) such that each eZ80[®] Development Platform on the LAN contains a unique MAC address. For example,

```
INT8 f91_mac_addr[ETHPKT_ALEN] = {0x00,0x90,0x23,0x00,0x04,0x04};
```

In the 6-byte MAC address shown above, the first three bytes must not be modified; the last three bytes can be used to assign a unique MAC address to the eZ80Acclaim![®] Development Platform.

- e) Open the main.c file of the ZTPDemo_F91.zdsproj project and add the following given include file:

```
#include "switch.h"
```

Add the following line:

```
RZK_THREADHANDLE_t g_hdl_T1;
```

- f) Add the following lines of code above the return(OK) statement located at the end of the ZTPAppEntry function in main.c file:

```
PortBInit();
g_hdl_T1 = RZKCreateThreadEnhanced((RZK_NAME_t *)"THREAD1",
    (RZK_PTR_t)AcceptClient,
    NULL,
    T1_STACK,
    T1_PRIO,
    T1_TICKS,
    RZK_THREAD_PREEMPTION | RZK_THREAD_ROUNDROBIN,0);

if (g_hdl_T1 == NULL)
    xc_fprintf(CONSOLE,"Can't create the thread (INVALID handle)");
else
    RZKResumeThread(g_hdl_T1);
```


- g) Comment out the following line in the `main.c` file:

```
Initialize_FileSystem(); ? //Initialize_FileSystem();
```

 Also comment the `Initialize_FileSystem()` function description in the `main.c` file
 - h) In the `ZTPInit_Conf.c` file, comment out the following line:

```
Init_DataPersistence(); ? //Init_DataPersistence();
```
 - i) In the `ZTPConfig.c` file, make the following change:

```
g_ShellLoginReqd = FALSE
```
6. Save the files and close the `ZTPDemo_F91.zdsproj` project.

Demonstration

This section contains the requirements and instructions to set up the Java-Based Web Page Interface Demo and run it.

Requirements

There are hardware and software requirements.

Hardware

- eZ80F91 Development Kit
- eZ80Acclaim*Plus!*-based evaluation board
- PC with an Internet browser (Mozilla Firefox) with the Java Virtual Machine.

Software

- Zilog Developer Studio II—IDE for eZ80Acclaim! 5.0.0 (ZDS II 5.0.0)
- Zilog's TCP/IP stack (ZTP 2.3.0)

Setup

The basic setup to assemble the Java-Based Web Page Interface demo is illustrated in [Figure 1](#) on page 3. This setup illustrates the connections between the PC, Smart Cable, LAN/WAN/Internet and the eZ80F91 Development Kit.

Settings

HyperTerminal Settings

Set the HyperTerminal to 57.6 Kbps Baud and 8-N-1 with no flow control.

Additional Settings for the eZ80[®] Development Platform

- Connect PB3 of J6 Header to Pin6 of the J9 Connector (Count Pin6 starting from the J9 marking). Or connect an LED to PB3 of J6 Header with respect to ground.
- Connect PB4 of J6 Header to Pin7 of the J9 connector (Count Pin7 starting from the J9 marking). Or connect an LED to PB4 of J6 Header with respect to ground

Procedure for Setting up the Java-Based Web Page Interface Demo

The procedure to build and run the Java-Based Web Page Interface Demo is described in this section.

1. Ensure that the required Java-Based Web Page Interface Demo files are added and integrated to ZTP before proceeding. See the “Adding and Integrating Application-Specific Files to ZTP” section on page 14.
2. Make the connections as shown in [Figure 1](#) on page 3. Connect the power supply of the eZ80F91 Development Kit.



3. Connect the eZ80 development platform to the PC with a crossover Ethernet cable. This connection is made by means of the orange-colored cable. This Ethernet connection can also be made via a hub or switch.
4. Launch ZDS II for eZ80Acclaim! and open the Java-Based Web Page Interface Demo project file (ZTPDemo_F91.zdsproj) located in the
`... \ZTP\ZTP2.3.0_LIB\ZTP\SamplePrograms\ZTPDemo` directory.
5. Build the project and download the resulting file ZTPDemo_F91_FLASH.hex file (located in the
`... \ ZTP\ZTP2.3.0_LIB\ZTP\SamplePrograms\ZTPDemo` directory) into an eZ80F91 module that is attached to the eZ80 development platform. Push the Reset button on the platform. After reset, the eZ80 development platform is ready to work as a web server gateway. The programming is performed using Zilog's ZDS II Flash Loader utility (Tools > Flash Loader).
6. Connect either the port marked CONSOLE with a straight-through cable to a PC port used by a terminal program such as HyperTerminal.
7. Once IP assigned to the gateway is known, user can use the IP address in the Mozilla Firefox and run the Web Page Interface for the eZ80F91 MCU Using Java application Demo. Refer to the next section.

Running the Running the Java-Based Web Page Interface Demo

Use the following procedure to run the Java-Based Web Page Interface Demo:

1. Launch the Internet browser on the PC. Enter the IP address for the eZ80[®] Development Platform specified in ZTPConfig.c. The Index.html page is displayed. The LEDs (labeled DCD and RX) on the Development Platform light up to indicate an active link between the eZ80F91 web server and the PC-based client browser.
2. Click on the Switch link under Java Switch Demo located in the left side of the screen. A new web page (LED and Switch Control Demo) opens displaying the buttons and the indicators (LED icons).
3. Click on the SW1 button on the Switch Control Demo Website. Notice that the LED (labeled DCD) on the Development Platform is switched off and this on/off feature toggles on every mouse click. The same procedure is performed on the SW2 button for the LED (labeled RX).
4. Press the SW1/SW2 switch on the eZ80[®] Development Platform. The color of the indicator (LED icons) changes from red to green. Subsequent clicking of the switches toggles the color of the LED icons on the web page.

Summary

The eZ80F91 microcontroller is used for building Internet-enabled products that are controlled over an Internet or intranet using web pages. This Application note demonstrates how the current status of a pin on the eZ80F91 MCU can be remotely viewed and controlled by using a Java applet in a web page. This type of simple interface utilizes the HTTP component of Zilog's ZTP stack, which provides reliable transfer and control of data. The details provided in this application note can be used to build more complex user interfaces for real-world applications.

References

The following documents are associated with the eZ80[®], eZ80Acclaim![®], and eZ80AcclaimPlus![™] family of products:

- eZ80F91 Product Specification (PS0192)
- Zilog TCP/IP Software Suite Programmer's Guide Reference Manual (RM0008)
- Zilog Developer Studio II—eZ80Acclaim! User Manual (UM0144)
- eZ80AcclaimPlus![™] Connectivity ASSP eZ80F91 ASSP Product Specification (PS0270)



- eZ80AcclaimPlus!TM ASSP Product Brief (PB0220)
- eZ80F91 Mini Enet Module for eZ80AcclaimPlus!TM Product Specification (PS0271)
- Zdots SBC for eZ80AcclaimPlus!TM Connectivity ASSP Product Specification (PS0261)

Appendix A—Flowcharts

This appendix contains the flowcharts for the Java-Based Web Page Control Interface implementation using the eZ80F91 MCU.

Figure 5 displays the flowchart for toggling the LEDs on the eZ80[®] Development Platform using the D1 and D2 buttons on the web page.

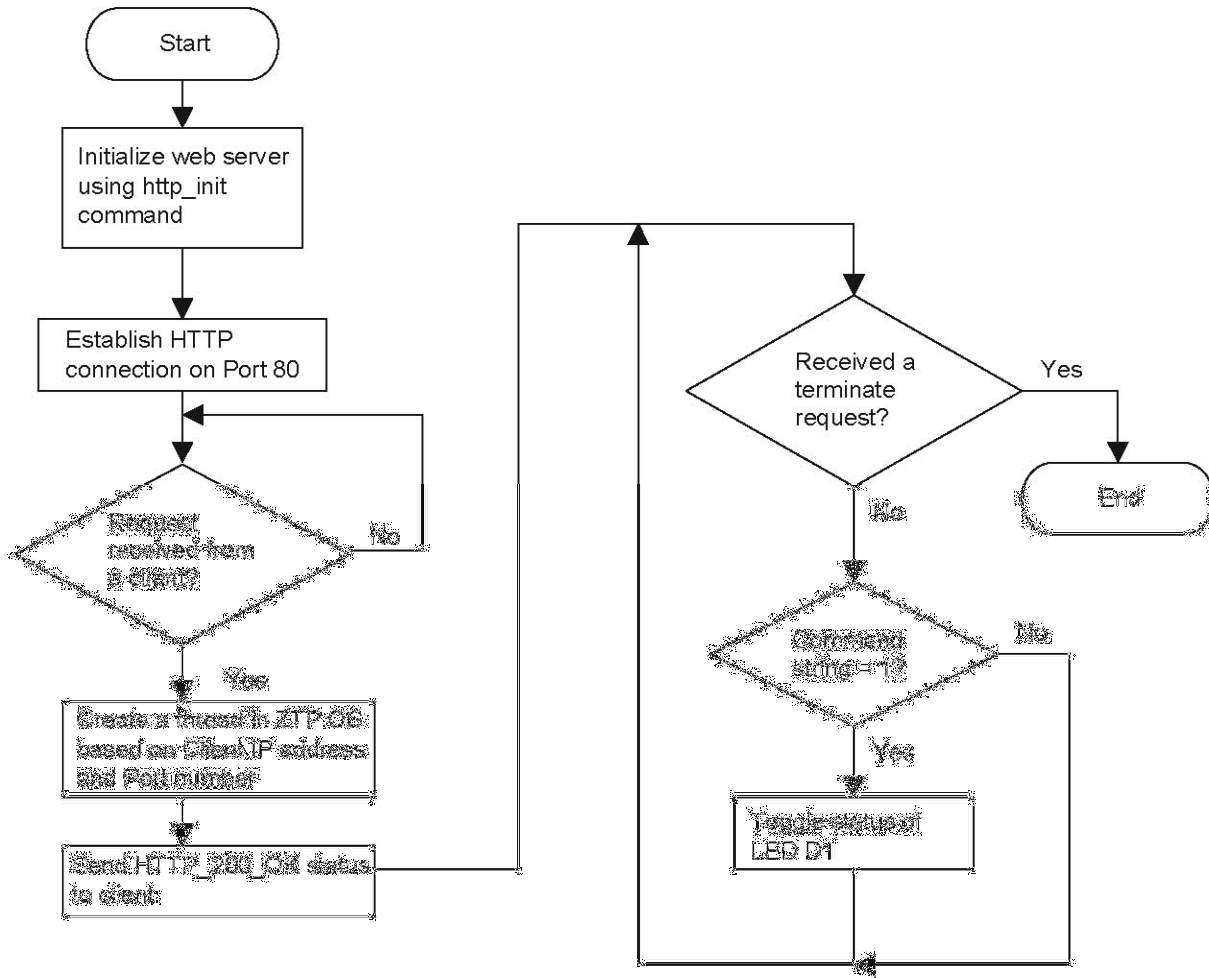


Figure 5. Flowchart to Toggle the LEDs on Development Platform Using Buttons

Figure 6 displays the flowchart for changing the color of the LED icons (LED1 and LED2) on the web page using the SW1 and SW2 switches on the eZ80[®] Development Platform.

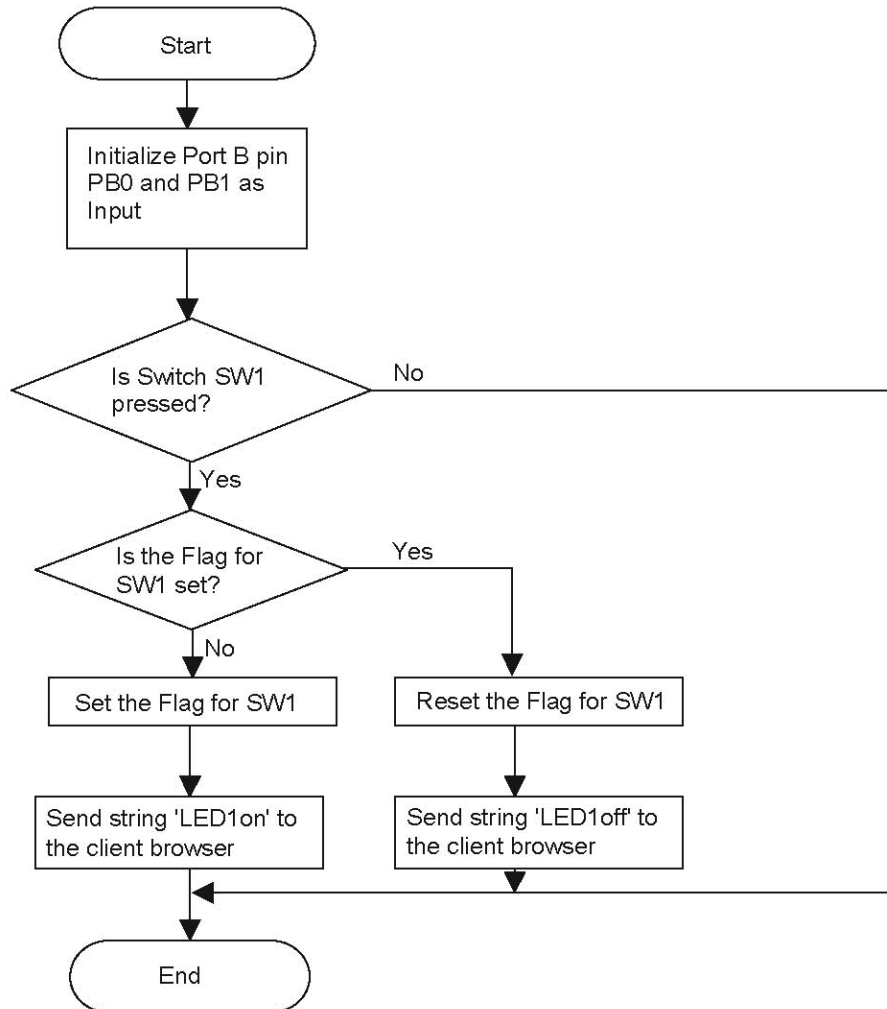


Figure 6. Flowchart to Change the Color of LED Icons on Web Page Using Switches

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