

**Conference Room Camera Control Interface  
Project Report**

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## **Abstract.**

The Computer Science Conference Room is home to a plethora of audio/visual equipment which is centralized amidst a jumble of wires in the front of the room. The controls for this equipment are located on a number of different remote controls placed helter skelter around aforementioned room and a series of convoluted knobs and dials on the equipment itself. The purpose of this project was to provide an easy to use interface on a website from which the majority of this equipment could be accessed and controlled. These items initially included two cameras, two projectors, and a picture-in-picture unit. Due to unforeseen circumstances the goal of the project had to be slimmed down to a modest interface for the camera units, from which the user could control the pan, tilt, and zoom functions. To this degree the project was a complete success.

## **Methods.**

The goal of the project was to make the web interface as much like a desktop application as possible. This meant that the controls for the camera would have to be updated and controlled dynamically, in real time (refresh button not allowed). AJAX was my initial first choice for the majority of the website but as it turned out it was only needed in certain parts. Professor Schulzrinne's suggestion of using Yahoo Widget slider bars instead of the previously implemented AJAX bars proved to be an important turning point in the development of the site. The Yahoo bars provided much more documentation and user-friendliness; and while it took a good deal of tweaking to get them to fit the needs of the site perfectly, there was never a point when I felt they would not be suitable for the job. In addition the code behind them was straightforward Javascript code rather than AJAX, making it much easier to make

modifications to.

Once the layout and slider bars were operational it was time to actually link the web front-end to the camera software back-end. In this endeavor the Ron Sacham was immensely helpful; in fact, without him the project would never have been finished. Using his C-code for the pan, tilt, and zoom functions of the camera we were able to successfully link the Javascript code to the hardware itself.

Fortunately the link between the two ends of the project was carried out in a modular fashion. The Javascript and HTML code run the front-end solely, while the C-code runs the actual hardware. AN intermediary level of PHP socket code was used to call the camera when the slider is moved; this code is very easy to manipulate and tinker with for future additions to the functionality of the site. Included in the code are, obviously, the pan, tilt, and zoom variables which can also be utilized/saved for other purposes.

## **Results & Conclusion.**

The web interface allows the user to effectively communicate with the camera in a simple, straightforward manner. It is also compliant with most browsers (including IE, Firefox, and Safari) mainly because of the support of the Yahoo Sliders. However the project is still just a stepping stone that can be built upon a great deal; a link on the site points to two more modules that were not able to be completed due to outlying circumstances.

Professor Schulzrinne made a good point in suggesting that there be user presets where the camera will

immediately go to a predetermined location, such as the head of the table, or the doorway. This would keep the user from having to use the sliders unless absolutely necessary. In addition there could also be a button that returns the camera to its starting home position (refreshing the page does this as of now but that is kind of a sloppy solution). However these changes are fairly trivial and can be easily addressed when the project is continued at a later date.

**Appendix A.**  
**Camera Control Interface**

COLUMBIA UNIVERSITY CS CONFERENCE ROOM

### Cameras

Front Camera  On  Off

Side Camera  On  Off

The interface features two columns of controls. The left column is for the 'Front Camera' and the right for the 'Side Camera'. Each column has three sliders: PAN, TILT, and ZOOM. The PAN sliders have a scale from 0 to 100, with the Front Camera slider currently at 61. The TILT and ZOOM sliders have a scale from 0 to 100, with all sliders currently at 0. Each slider has a blue knob and a numerical display box. Below the sliders, the text 'Debug Mode On/Off' is displayed, with 'On' in red.

61 PAN

0 PAN

0 TILT

0 TILT

0 ZOOM

0 ZOOM

Debug Mode **On/Off**

**Appendix B.**  
**control.php**  
**Main Interface File**

```
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01//EN"
"http://www.w3.org/TR/html4/strict.dtd">
<html>
<head >

    <meta http-equiv="content-script-type" content="text/javascript">
    <meta http-equiv="content-type" content="text/html; charset=windows-1252">

<script language="javascript" type="text/javascript">
    var request = false;
    try {
        request = new XMLHttpRequest();
    } catch (trymicrosoft) {
        try {
            request = new ActiveXObject("Msxml2.XMLHTTP");
        } catch (othermicrosoft) {
            try {
                request = new ActiveXObject("Microsoft.XMLHTTP");
            } catch (failed) {
                request = false;
            }
        }
    }

    if (!request)
        alert("Error initializing XMLHttpRequest!");

    function bug() {
        if (request.readyState == 4) {
            if (request.status == 200) {
                document.getElementById("bug").innerHTML = db;
            } else
                alert("Status is " + request.status);
        }
    }

    function clearPage() {
        if (request.readyState == 4) {
            if (request.status == 200) {
                var response = request.responseText.split("|");
                document.getElementById("debugdata").innerHTML =
                    "";
```

```
    } else
      alert("Status is " + request.status);
  }
}
```

```
function updatePage3() {
  if (request.readyState == 4) {
    if (request.status == 200) {
      var response = request.responseText.split("|");
      document.getElementById("debugdata").innerHTML =
        response[0].replace(/\n/g, "");
    } else
      alert("Status is " + request.status);
  }
}
```

```
function onC1() {
  var k1 = document.getElementById("kramerOn").value;
  var url = "cameraOneOn.php"
  request.open("GET", url, true);
  request.onreadystatechange = updatePage;
  request.send(null);
}
```

</script>

```
<title>CS Conference Room</title>
<style type="text/css" media="screen">
```

```
body {
  color:#333;
  background-color:#eee;
  margin:20px;
  padding:0px;
  font:11px verdana, arial, helvetica, sans-serif;
}
h1 {
  margin:0px 0px 15px 0px;
  padding:0px;
  font-size:28px;
  font-weight:900;
  color:#ccc;
}
h2 {
  font:bold 12px/14px verdana, arial, helvetica, sans-serif;
  margin:0px 0px 5px 0px;
```



```

padding:0px;
}
p {
font:11px/20px verdana, arial, helvetica, sans-serif;
margin:0px 0px 16px 0px;
padding:0px;
}
.Content>p {margin:0px;}
.Content>p+p {text-indent:30px;}

a {
color:red;
font-size:11px;
font-family:verdana, arial, helvetica, sans-serif;
font-weight:600;
text-decoration:none;
}
a:link {color:red;}
a:visited {color:#red;}
a:hover {background-color:white;}

/* All the content boxes belong to the content class. */
.content {
position:relative; /* Position is declared "relative" to gain control of stacking order (z-index). */
width:auto;
min-width:120px;
margin:0px 210px 20px 170px;
border:1px solid black;
background-color:white;
padding:10px;
z-index:3; /* This allows the content to overlap the right menu in narrow windows in good
browsers. */
}

#pageHeader h1 {
position:absolute;
background: transparent url(main.jpg) no-repeat top left;
border:0px dashed grey;
left:50%;
margin-left:-350px;
margin-top:0px;
width: 700px;
height: 50px;
}
#pageHeader h1 span {
display:none

```

```
    }

#debugdata {
    background-color:#eee;
    max-width:650px;
}

#navAlpha {
    position:absolute;
    left:50%;
    width:700px;
    margin-top:60px;
    margin-left:-350px;
    height: auto;
    border:0px dashed grey;
    background-color:white;
    /*padding:10px;*/
    z-index:2;
```

/\* Here is the ugly brilliant hack that protects IE5/Win from its own stupidity. Thanks to Tantek Celik for the hack and to Eric Costello for publicizing it. IE5/Win incorrectly parses the "\}"" value, prematurely closing the style declaration. The incorrect IE5/Win value is above, while the correct value is below. See <http://glish.com/css/hacks.asp> for details. \*/

```
    voice-family: "\}"";
    voice-family:inherit;
    width:700px;
}
```

/\* I've heard this called the "be nice to Opera 5" rule. Basically, it feeds correct length values to user agents that exhibit the parsing error exploited above yet get the CSS box model right and understand the CSS2 parent-child selector. ALWAYS include a "be nice to Opera 5" rule every time you use the Tantek Celik hack (above). \*/

```
#navAlpha { width:700px; }
```

```
#projector {
    position:absolute;
    left:50%;
    width:250px;
    top:10px;
    margin-left:-300px;
    height: auto;
    border:1px dashed grey;
    background-color:white;
    /*padding:10px;*/
    z-index:2;
```

```
/* Again, the ugly brilliant hack. */
    voice-family: "\}\"";
    #voice-family:inherit;
    width:250px;
}
/* Again, "be nice to Opera 5". */
#projector {width:250px;}

#kramer {
    position:absolute;
    left:50%;
    width:auto;
    min-width:200px;
    top:10px;
    margin-left:+50px;
    height: auto;
    border:1px dashed grey;
    background-color:white;
    /*padding:10px;*/
    z-index:2;

/* Again, the ugly brilliant hack. */
    voice-family: "\}\"";
    #voice-family:inherit;
    width:auto;
}
/* Again, "be nice to Opera 5". */
#kramer { width:auto;}

#navBeta {
    position:absolute;
    left:50%;
    width:700px;
    top:60px;
    margin-left:-350px;
    border:0px dashed grey;
    background-color:white;
    z-index:1;
/* Again, the ugly brilliant hack. */
    voice-family: "\}\"";
    voice-family:inherit;
    width:700px;
}
/* Again, "be nice to Opera 5". */
#navBeta { width:700px;}
</style>
```

```

    <link rel="stylesheet" type="text/css" href="css/screen.css">
    <link rel="stylesheet" type="text/css" href="slider.css">
</head>

<body>

<div id="pageHeader">
    <a href="control.php"><h1><span>conf</span></h1></a>
</div>

<div id="navBeta">
<br>
    <center><h2>Cameras</h2>
    <p>

        <div id="horizWrapper">
<center>Front Camera<br>
<form action="POST">
<input type="radio" name="camera1" id="camOneOn" onChange="updatePage3()" value="1"> On
<input type="radio" name="camera1" id="camOneOff" value="0" checked> Off<br>
</form></center>
</div>

<div id="horizWrapper">
<center>Side Camera<br>
<form action="POST"><center>
<input type="radio" name="camera2" id="camTwoOn" onChange="onC2()" value="1"> On
<input type="radio" name="camera2" id="camTwoOff" value="0" checked> Off<br>
</form></center>
</div><br>

    <div id="horizWrapper">
    <div
        id="horizBGDiv"
        name="horizBGDiv"
        tabindex="0"
        x2:role="role:slider"
        state:valuenow="0"
        state:valuemin="-100"
        state:valuemax="100"
        onkeypress="return handleHorizSliderKey(this, YAHOO.util.Event.getEvent(event))" >
    <div id="horizHandleDiv" ></div>
    </div>

<div id="horizValueDiv">
    <form name="formH" onsubmit="return updateHoriz()">

```

```
<input name="horizVal" id="horizVal" type="text" value="0" size="4" maxlength="4" />
<input type="button" value="PAN" onclick="updateHoriz()" />
</form>
</div>
</div>
```

```
<div id="horizWrapper">
  <div
    id="h2"
    name="h2"
    tabindex="0"
    x2:role="role:slider"
    state:valuenow="0"
    state:valuemin="-100"
    state:valuemax="100"
    onkeypress="return handleHorizSliderKey(this, YAHOO.util.Event.getEvent(event))" >
    <div id="horiz2" ></div>
  </div>
```

```
<div id="horizValueDiv">
  <form name="formH2" onsubmit="return updateHoriz2()">
    <input name="h2Val" id="h2Val" type="text" value="0" size="4" maxlength="4" />
    <input type="button" value="PAN" onclick="updateHoriz2()" />
  </form>
</div>
</div>
```

```
<br><br><br><br><br><br>
```

```
<div id="horizWrapper">
  <div
    id="h3"
    name="h3"
    tabindex="0"
    x2:role="role:slider"
    state:valuenow="0"
    state:valuemin="-25"
    state:valuemax="25"
    onkeypress="return handleHorizSliderKey(this, YAHOO.util.Event.getEvent(event))" >
    <div id="horiz3" ></div>
  </div>
```

```
<div id="horizValueDiv">
  <form name="formH3" onsubmit="return updateHoriz3()">
    <input name="h3Val" id="h3Val" type="text" value="0" size="4" maxlength="4" />
```

```
    <input type="button" value="TILT" onclick="updateHoriz3()" />
  </form>
</div>
</div>
```

```
<div id="horizWrapper">
  <div
    id="h4"
    name="h4"
    tabindex="0"
    x2:role="role:slider"
    state:valuenow="0"
    state:valuemin="-100"
    state:valuemax="100"
    onkeypress="return handleHorizSliderKey(this, YAHOO.util.Event.getEvent(event))" >
    <div id="horiz4" ></div>
  </div>
```

```
<div id="horizValueDiv">
  <form name="formH4" onsubmit="return updateHoriz4()">
    <input name="h4Val" id="h4Val" type="text" value="0" size="4" maxlength="4" />
    <input type="button" value="TILT" onclick="updateHoriz4()" />
  </form>
</div>
</div>
```

```
<br><br><br><br><br><br>
```

```
<div id="horizWrapper">
  <div
    id="h5"
    name="h5"
    tabindex="0"
    x2:role="role:slider"
    state:valuenow="1"
    state:valuemin="1"
    state:valuemax="1023"
    onkeypress="return handleHorizSliderKey(this, YAHOO.util.Event.getEvent(event))" >
    <div id="horiz5" ></div>
  </div>
```

```
<div id="horizValueDiv">
  <form name="formH5" onsubmit="return updateHoriz5()">
    <input name="h5Val" id="h5Val" type="text" value="0" size="4" maxlength="4" />
    <input type="button" value="ZOOM" onclick="updateHoriz5()" />
  </form>
```

```
</div>
</div>
```

```
<div id="horizWrapper">
  <div
    id="h6"
    name="h6"
    tabindex="0"
    x2:role="role:slider"
    state:valuenow="0"
    state:valuemin="-100"
    state:valuemax="100"
    onkeypress="return handleHorizSliderKey(this, YAHOO.util.Event.getEvent(event))" >
    <div id="horiz6" ></div>
  </div>
```

```
<div id="horizValueDiv">
  <form name="formH6" onsubmit="return updateHoriz6()">
    <input name="h6Val" id="h6Val" type="text" value="0" size="4" maxlength="4" />
    <input type="button" value="ZOOM" onclick="updateHoriz6()" />
  </form>
</div>
</div>
```

```
<br><br><br><br><br><br>
<br><br><br><br>
```

```
Debug Mode &nbsp;&nbsp;<a onClick="debug()">On</a><a onClick="debug2()">Off</a>
```

```
<div id="debugdata"></div>
<br>
<br>
</center>
<br>
Click <a href="devel.php">here</a> for a glimpse of works-in-progress.
</div>
</div>
```

```
<br><br><br>
```

```
<script type="text/javascript" src="js/YAHOO.js" ></script>
<script type="text/javascript" src="js/log.js" ></script>
<script type="text/javascript" src="js/color.js" ></script>
<script type="text/javascript" src="js/key.js" ></script>
<script type="text/javascript" src="js/event.js" ></script>
```

```
<script type="text/javascript" src="js/dom.js" ></script>
<script type="text/javascript" src="js/animation.js" ></script>
<script type="text/javascript" src="js/dragdrop.js" ></script>
```

```
<script type="text/javascript" src="js/slider.js" ></script>
```

```
// JAVASCRIPT SLIDER CODE STARTS HERE
```

```
<script type="text/javascript">
```

```
    var gLogger;
    var scaleFactorTilt = 4;
    var scaleFactorZoom = .1955034213;
```

```
    function init() {
        if (typeof(ygLogger) != "undefined") {
            ygLogger.init(document.getElementById("logDiv"));
            gLogger = new ygLogger("slider.php");
        }
    }
```

```
    standardSliderInit();
```

```
}
```

```
    window.onload = init;
```

```
    var db = 0;
    function debug() {
        db = 1;
        updatePage3();
    }
```

```
    function debug2() {
        db = 0;
        clearPage();
    }
```

```
// SLIDERS 'N STUFF
```

```
    var slider1, slider2, slider3, slider4, slider5, slider6;
    function standardSliderInit() {
```

```
        slider1 = YAHOO.widget.Slider.getHorizSlider("horizBGDiv", "horizHandleDiv", 100, 100);
```

```
        slider1.onChange = function(offsetFromStart) {
            document.getElementById("horizVal").value = offsetFromStart;
```

```
        var p = document.getElementById("horizVal").value;
```



```

var t = document.getElementById("h3Val").value;
var z = document.getElementById("h5Val").value;

var url = "cameraOneOn.php?p=" + escape(p) + "&t=" + escape(t) + "&z=" + escape(z);
request.open("GET", url, true);
if (db == 1) {
    request.onreadystatechange = updatePage3;
}
request.send(null);
}

```

```

slider2 = YAHOO.widget.Slider.getHorizSlider("h2", "horiz2", 100, 100);

```

```

slider2.onChange = function(offsetFromStart2) {
    document.getElementById("h2Val").value = offsetFromStart2;
var p = document.getElementById("h2Val").value;
var t = document.getElementById("h4Val").value;
var z = document.getElementById("h6Val").value;

var url = "cameraTwoOn.php?p=" + escape(p) + "&t=" + escape(t) + "&z=" + escape(z);
request.open("GET", url, true);
if (db == 1) {
    request.onreadystatechange = updatePage3;
}
request.send(null);
}

```

```

slider3 = YAHOO.widget.Slider.getHorizSlider("h3", "horiz3", 100, 100);

```

```

slider3.onChange = function(offsetFromStart) {
var actualValue = parseInt(offsetFromStart/scaleFactorTilt);
    document.getElementById("h3Val").value = actualValue;

```

```

var p = document.getElementById("horizVal").value;
var t = document.getElementById("h3Val").value;
var z = document.getElementById("h5Val").value;

```

```

var url = "cameraOneOn.php?p=" + escape(p) + "&t=" + escape(t) + "&z=" + escape(z);
request.open("GET", url, true);
if (db == 1) {
    request.onreadystatechange = updatePage3;
}
request.send(null);

```

```

    }

    slider4 = YAHOO.widget.Slider.getHorizSlider("h4", "horiz4", 100, 100);

    slider4.onChange = function(offsetFromStart) {
        var actualValue = parseInt(offsetFromStart/scaleFactorTilt);
        document.getElementById("h4Val").value = actualValue;
    }
    var p = document.getElementById("h2Val").value;
    var t = document.getElementById("h4Val").value;
    var z = document.getElementById("h6Val").value;

    var url = "cameraTwoOn.php?p=" + escape(p) + "&t=" + escape(t) + "&z=" + escape(z);
    request.open("GET", url, true);
    if (db == 1) {
        request.onreadystatechange = updatePage3;
    }
    request.send(null);
}

    slider5 = YAHOO.widget.Slider.getHorizSlider("h5", "horiz5", 0, 200);

    slider5.onChange = function(offsetFromStart) {
        var actualValue = parseInt(offsetFromStart/scaleFactorZoom);
        document.getElementById("h5Val").value = actualValue;
    }

    var p = document.getElementById("horizVal").value;
    var t = document.getElementById("h3Val").value;
    var z = document.getElementById("h5Val").value;

    var url = "cameraOneOn.php?p=" + escape(p) + "&t=" + escape(t) + "&z=" + escape(z);
    request.open("GET", url, true);
    if (db == 1) {
        request.onreadystatechange = updatePage3;
    }
    request.send(null);
}

    slider6 = YAHOO.widget.Slider.getHorizSlider("h6", "horiz6", 0, 200);

    slider6.onChange = function(offsetFromStart) {
        var actualValue = parseInt(offsetFromStart/scaleFactorZoom);
        document.getElementById("h6Val").value = actualValue;
    }
    var p = document.getElementById("h2Val").value;
    var t = document.getElementById("h4Val").value;
    var z = document.getElementById("h6Val").value;

```

```

var url = "cameraTwoOn.php?p=" + escape(p) + "&t=" + escape(t) + "&z=" + escape(z);
request.open("GET", url, true);
if (db == 1) {
    request.onreadystatechange = updatePage3;
}
request.send(null);

    }

}

function updateVert() {
    var v = parseFloat(document.forms['formV']['vertVal'].value, 10);
    if ( isNaN(v) ) v = 0;
    slider7.setValue(Math.round(v));
    return false;
}

function updateHoriz() {
    var v = parseFloat(document.forms['formH']['horizVal'].value, 10);
    if ( isNaN(v) ) v = 0;
    slider1.setValue(Math.round(v));
    return false;
}

function updateHoriz2() {
    var v = parseFloat(document.forms['formH2']['h2Val'].value, 10);
    if ( isNaN(v) ) v = 0;
    slider2.setValue(Math.round(v));
    return false;
}

function updateHoriz3() {
    var v = parseFloat(document.forms['formH3']['h3Val'].value, 10);
    if ( isNaN(v) ) v = 0;
    slider3.setValue(Math.round(v*scaleFactorTilt));
    return false;
}

function updateHoriz4() {
    var v = parseFloat(document.forms['formH4']['h4Val'].value, 10);
    if ( isNaN(v) ) v = 0;
    slider4.setValue(Math.round(v*scaleFactorTilt));
    return false;
}

```

```

function updateHoriz5() {
    var v = parseFloat(document.forms['formH5']['h5Val'].value, 10);
    if ( isNaN(v) ) v = 0;
    slider5.setValue(Math.round(v*scaleFactorZoom));
    return false;
}

function updateHoriz6() {
    var v = parseFloat(document.forms['formH6']['h6Val'].value, 10);
    if ( isNaN(v) ) v = 0;
    slider6.setValue(Math.round(v*scaleFactorZoom));
    return false;
}

// accessibility keypress test
function handleHorizSliderKey(slider, ev) {
    if (gLogger) gLogger.debug("horizontal slider keypress");

    // Firefox 1.5+ only at this point
    if (!slider.getAttributeNS) {
        return true;
    }

    // var valueNow = parseInt(slider.getAttributeNS("http://www.w3.org/2005/07/aaa",
"valuenow"));

    var valueNow = slider2.getValue();

    var valueMin = parseInt(slider.getAttributeNS("http://www.w3.org/2005/07/aaa", "valuemin"));
    var valueMax = parseInt(slider.getAttributeNS("http://www.w3.org/2005/07/aaa", "valuemax"));

    var delta = 0;

    var kc = ev.keyCode;

    if (gLogger) gLogger.debug("keycode: " + kc);

    if (kc == YAHOO.util.Key.DOM_VK_LEFT) {
        delta = -25;
    } else if (kc == YAHOO.util.Key.DOM_VK_RIGHT) {
        delta = 25;
    } else if (kc == YAHOO.util.Key.DOM_VK_HOME) {
        delta = -( valueNow - valueMin );
    } else if (kc == YAHOO.util.Key.DOM_VK_END) {
        delta = valueMax - valueNow;
    } else {

```

```
        return true;
    }

    valueNow += delta;

    slider2.setValue(valueNow, true);

    slider.setAttributeNS("http://www.w3.org/2005/07/aaa", "valuenow", valueNow);

    // displaySlider(slider);

    return false;
}

</script>
</body>
</html>
```

## Appendix C.

### cameraOneOn.php

#### Socket Code

```
<?php

// set some variables
$pan = $_GET['p'];
$tilt = $_GET['t'];
$zoom = $_GET['z'];

echo "Camera One<br>";
echo "pan: $pan, tilt: $tilt, zoom: $zoom\n";

$port = 60000;

$addr = my_ip();
echo "my ip address is $addr\n";

function my_ip($dest='64.0.0.0', $port=80)
{
    $socket = socket_create(AF_INET, SOCK_DGRAM, SOL_UDP);
    socket_connect($socket, $dest, $port);
    socket_getsockname($socket, $addr, $port);
    socket_close($socket);
    return $addr;
}

// don't timeout!
set_time_limit(0);

// create socket
$socket = socket_create(AF_INET, SOCK_STREAM, 0) or die("Could not create socket\n");

$result = socket_connect($socket, $addr, $port) or die("Could not connect\n");

$in = "$pan,$tilt,$zoom\n";

    $result = socket_write($socket, $in, strlen($in));
socket_close($socket);
?>
```