PTZ Robotic Camera
For Pioneer 2

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Introduction

The Pioneer Pan-Tilt-Zoom PTZ Robotic Camera System is a fully integrated accessory for Pioneer Mobile Robots. Developed by Kurt Konolige, Ph.D., of Videre Designs, the system consists of a Sony D30/31 pan-tilt-zoom color camera and PTZ System software for integration of the robotic camera with the Pioneer 2 Operating System (P2OS) and with client control applications, including Saphira.

We install the PTZ Robotic Camera System on a new robot, and you can easily add the system to your own Pioneer 2 Mobile Robot. The PTZ Camera supplies standard NTSC or PAL video, so it can be used for a variety of applications, from simple video surveillance to state-of-the-art vision sensing. The PTZ System software is a C-language library for use with all distributed Pioneer software and your own client applications, and comes with source code for custom modifications.

PTZ Components

The following items come with your PTZ Robotic Camera System. If you ordered the PTZ with your Pioneer 2 Robot, some items may already be attached to your Robot:

- ✓ Sony D30 (NTSC) or D31 (PAL) Pan-Tilt-Zoom Camera
- ✓ Remote Control Handset
- ✓ VISCA Control Cable
- ✓ Power Cable
- ✓ RCA Video Cable
- ✓ Mounting Screws
- ✓ Disk with WIN32 PTZ System Software
- ✓ Camera Manuals

PTZ Accessories

The PTZ Robotic Camera attaches and extends the capabilities of a variety of video and vision systems and applications. For instance, the PTZ system is approved for use with Newton Lab's Fast-Track Vision System (PTZ-Fast Track Vision System). And, either capture and digitize the video signal with an onboard frame grabber in your Pioneer 2 EBX computer (PTZ Custom Vision), or send it offboard with an audio/video (A/V) radio system to a frame grabber in a basestation for real-time video surveillance (PTZ Surveillance System) and for you own vision research. For more information about these and other options, browse our website (http://wwww.activmedia.com/robots) and/or contact us directly (sales@activmedia.com).

- ✓ Fast-Track Vision System
- ✓ A/V Pro Radios
- ✓ PCI-based High-Performance Frame Grabber
- ✓ PC-104+ PCI Frame Grabber

Where to get PTZ System Software

The Windows95/NT version of the PTZ System Software comes on disk with every Pioneer, included in the Saphira distribution software. Updates and other platform-based versions are available online from the *Activ*Media Robotics Internet website. The compressed archives contain the shared executables and accessory files you need to operate the PTZ System and integrate it with your own C-language programs. Note that the PTZ system software works with Saphira version 5.3 or later. Collect all software online from:

http://robots.activmedia.com

Be sure to choose the software version that matches your computer's operating environment; `ptzsys.EXE` for Windows95/NT computers or ptzsys_linux.tgz for Linux OS, for example.

Related Resources

The PTZ Robotic Camera for Pioneer depends on a working knowledge of your Pioneer Mobile Robot and the Pioneer 2 Operating System software (P2OS). Consult your *Pioneer 2 Operation Manual* for details. Obtain copies of the latest Pioneer manuals (this document, too) from our Internet website:

http://robots.activmedia.com/docs

We announce Pioneer software-related updates and new versions, as well as share ideas and code, through two main email-based newsgroups:

pioneer-users@activmedia.com

saphira-users@activmedia.com

To join—and please do join—simply send an email message (substitute `saphira-users` for `pioneer-users` to access that separate group):

> To: **pioneer-users-request@activmedia.com**
> From: ***<your return email address goes here>***
> Subject: <choose one command>
>   **help**   (returns instructions)
>   **lists**   (returns list of newsgroups)
>   **subscribe**
>   **unsubscribe**

Our SmartList-based listserver will respond automatically. Once subscribed, send your email comments, suggestions, and questions intended for the worldwide community of Pioneer users:

> To: **pioneer-users@activmedia.com**
> From: **<your return email address goes here>**
> Subject: **<something of interest to all members of pioneer-users>**

Access to the pioneer-users newslist is limited to subscribers, so your address is safe from spam. However, the list currently is unmoderated, so please confine your comments and inquiries to that concerning Pioneer operation and programming.

If something seems (or clearly is) broken with the software, your Pioneer robot, and/or PTZ System, send an email message

> To: **pioneer-support@activmedia.com**

and a team of experts will leap to the rescue.

Hardware Installation

The PTZ Robotic Camera System requires some assembly, even if you had ordered it with a new Pioneer 2 Mobile Robot.

Mounting the Camera

The PTZ camera comes detached from the robot for safe shipment. We recommend mounting the camera to the front of the robot, centered on top of the Console (Figure 2-1). We have prepared the Pioneer 2 Console with mounting holes, and include the mounting screws with the PTZ camera installation kit. But do not feel obliged to mount it there—the camera may be mounted to any convenient location on the robot.
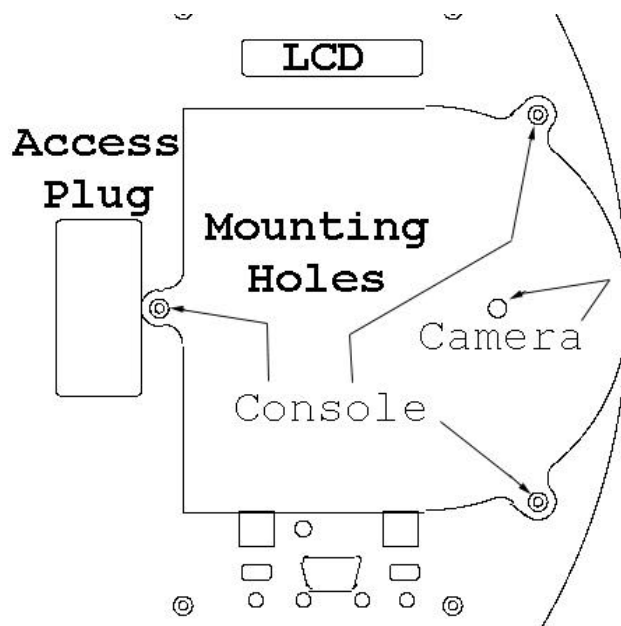
Figure 2-1. PTZ Robotic Camera mounting plate and position

To mount the camera, use the hex wrenches that came with your Pioneer. If need be, remove the two front-most screws that hold the front sonar array to the Console Plate. Then line up the three screw holes on the mounting plate on the bottom of the PTZ camera with those two frontmost screw holes and with the one screw hole just in front of the access plug in the middle of the Top Plate. Insert the screws that came with the PTZ Camera and fasten tightly.

Power/Signal Cables and Connectors

Came with Robot

If your PTZ camera came with your new Pioneer 2—with or without the optional Surveillance Video or Fast Track Vision System—the signal, power, and VISCA control cabling, and optional Video/FTVS Side Panel already should be attached. They need only to be plugged in.

Cabling for the installed PTZ camera should be hanging loosely out of the access plug in the center of the robot's Top Plate. Insert the yellow-tipped power plug into the camera's DC IN socket; the RCA-style plug into the yellow VIDEO OUT socket; and the 8-pin mini-DIN plug into the VISCA IN socket. All done.

If you purchased your PTZ Camera sometime after you had received your robot, and depending on the optional video or vision package, you may have to install the FTVS/Video Side Panel (Figure 2-2).
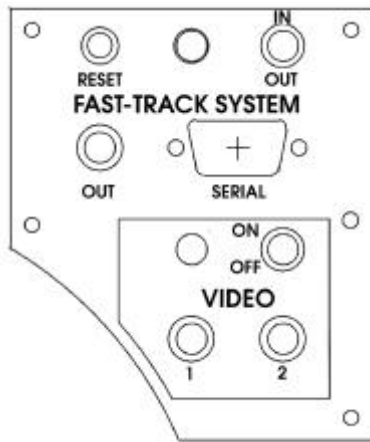
Figure 2-2. FTVS/Video Side Panel

Using the hex wrenches that came with your robot, remove the blank side panel from the left side of your Pioneer 2 (four screws; save them). Also, with strong fingertips or aided by a flat-bladed screwdriver, pry up and remove the access plug from the center of the Pioneer 2 Top Plate (Figure 2-1).

Carefully feed all the FTVS/Video Side Panel cabling through the panel hole and up through access portal that you just unplugged. Screw mount the new side panel and attach the cables as described in the section above.

Serial Communications

External control of the PTZ Robotic Camera occurs through its serial VISCA port. We provide cabling and software support so that when connected to the auxiliary (AUX) serial communication port on the microcontroller, you may send control commands along Pioneer 2's normal serial control channel (HOST) through P2OS, thereby enabling client-side camera control. Currently, communications along that channel is only one-way.

You may also connect the PTZ Robotic Camera to another serial port for external control by the onboard computer or laptop, for instance.

Testing the Connections

Switch on the PTZ Robotic Camera, as well as the MAIN POWER of the Pioneer 2 Mobile Robot. The camera should run through a pan and tilt initialization cycle while the robot starts its systems.

With a separate cable, plug into the RCA Video signal connector 1 or 2 on the side panel and the other end into a NTSC or PAL (respective of the camera) monitor. You should see a full-color image. Use the hand-held controller that comes with the camera to test the pan, tilt, and zoom features.

The ptzsys software comes with a ptzdemo.act Colbert activity. It needs to be installed with a version of Saphira 6.1e or later (see following sections of this manual). When executed, it exercises the camera via a shared Saphira library.

PTZ System Software

The PTZ Robotic Camera comes with software support for controlling the pan, tilt, and zoom features of the camera through the Pioneer 2 Operating System (P2OS). In addition, we provide C-language-based libraries and source code for integration of the PTZ System with your Pioneer client applications.

PTZ P2OS Commands

Integrated control of the PTZ Robotic Camera happens through a single P2OS command with a string argument containing camera commands. P2OS automatically packages the argument and shunts it through the AUX serial port on the Pioneer 2 microcontroller to the VISCA Input port of the camera. Currently, communications is one-way—command-only—there is no way to verify camera position or to take advantage of the camera's built-in tracking algorithms through P2OS.

The P2OS command number is 42 followed by a string argument which comprises the camera control command. A complete list of Sony VISCA control commands for the PTZ Robotic Camera (D30/31) can be found through:

http://www.sony.co.jp/soj/BizPartners/ISP/dtp

See the *Pioneer 2 Operation Manual* for P2OS command formats.

Client Software Installation

The PTZ client-side software (ptzsys) works with the Saphira robotics applications development environment, version 6.1e or later. Consult the included header and source files for guidelines on integration of the embedded P2OS commands with your own programs.

WIN32 Systems

Download from the online website or locate on the included 3.5-inch diskette the `ptzsys.EXE` file to your boot Windows95 or NT disk. Double-click the program icon to execute the self-extracting archive of PTZ System programs and files. Choose the top-level directory where you have previously installed Saphira; `C:\Saphira\ver61`, for example.

These are the WIN32 files when extracted relative to the Saphira top-level path ($SAPHIRA):

$SAPHIRA\path	Description
colbert\ptzsys.dll	Saphira/Colbert shared library
\ptzdemo.act	Colbert activity demo
devices\ptzsys\ptzsys.c	Shared library source file
\ptzsys.mak	DLL makefile (MS VC++4.x)

Linux/Unix Systems

Download from the online website the ptzsys_*system*.tgz file that matches your computer. Copy the tar and compressed archive file the top-level directory where you have previously installed Saphira; `/usr/local/Saphira/ver61`, for example. Then uncompress and untar the files. For example,

```
% uncompress ptzsys_sunos.tgz
% tar -xvf ptzsys.tar
```

or simply

```
% tar -zxvf ptzsys.tgz
```

These are the Linux/Unix files when extracted relative to the Saphira top-level path ($SAPHIRA):

$SAPHIRA/path	Description
colbert/ptzsys.so	Shared object library for Saphira/Colbert
/ptzdemo.act	Colbert demo of PTZ software
devices/ptzsys/ptzdoc.c	Shared library source file
/makefile	Library makefile

PTZ with Saphira

The Saphira C-language-based application development environment automatically manages Pioneer communications and P2OS command packets. The PTZ System software includes Saphira functions and related arguments to create Saphira-mediated client applications for control of the PTZ Robotic Camera (Table 3-1). Inspect the $(SAPHIRA)/devices/ptzsys/ptzsys.c source file for details.

Table of Saphira PTZ System Functions

void sfPTZCamInit(void)	Initialize the camera and reset to center
void sfPTZCamPan(int deg)	Pan to an absolute position +-95 degrees
void sfPTZCamTilt(int deg)	Tilt to an absolute position +-20 degrees
void sfPTZCamPanTilt(int pan, int tilt)	Pan and tilt to an absolute position
void sfPTZCamZoom(int val)	Zoom to 0 (longest) - 1023 (closest)

PTZ with Colbert

To use the PTZ System software with your Saphira clients and interactively through the Colbert command window, load the shared PTZ System object library into the Colbert interpreter that comes with Saphira versions 6.1 and later. With Linux/Unix systems, the shared library is called ptzsys.so; it's called ptzsys.dll for use with Windows95/98 and WindowsNT. They are kept in the $(SAPHIRA)/colbert directory of Saphira.

To use the Saphira commands listed in the Table above from the Colbert command line or from within a Saphira client program, first start up the Saphira client. Then, either draw down the Saphira File menu and select to load the shared library, or give the Colbert direct command:

```
> load ptzsys.dll
```
or
```
> load ptzsys.so
```

The following is ptzdemo.act example Colbert program that exercises the PTZ camera. To run it, simply load it from the Saphira colbert/ directory. It automatically loads the ptzsys.so (or .dll) library of commands and starts itself.

```
/* First load the basic PTZ functions */
load ptzsys;

act PTZDemo()
{
      if (!sfIsConnected){        /* Are we connected? */
            sfMessage("Connect with Pioneer. I'll do the rest...");
            waitfor(sfIsConnected);
      }

      sfMessage("Starting up the camera ...");
      sfPTZCamInit();
      wait 20;

      sfMessage("Pan clockwise ...");
      sfPTZCamPan(95);
      wait 20;

      sfMessage("Pan counter-clockwise ...");
```

```
        sfPTZCamPan(-95);
        wait 20;

        sfMessage("Tilt up ...");
        sfPTZCamTilt(20);
        wait 20;

        sfMessage("Tilt down ...");
        sfPTZCamTilt(-20);
        wait 20;

        sfMessage("Reset and zoom in ...");
        sfPTZCamPanTilt(0,0);
        wait 10;
        sfPTZCamZoom(1023);
        wait 20;

        sfMessage("Zoom out ...");
        sfPTZCamZoom(0);
        wait 20;

        sfMessage("Bye!");
}

/* Here's where ptzdemo begins... */

start PTZDemo;              /* Run the demo */
```

Appendix A
Sony D30/31 Camera Specifications

Image Sensor	1/3" IT CCD
Effective Pixels	768(H) x 494(V) NTSC; 752(H) x 585(V) PAL
Horizontal Resolution	460 TV lines NTSC; 450 TV lines PAL
Vertical Resolution	350 TV lines NTSC; 400 TV lines PAL
Lens	12X Zoom, f=5.4 - 64.8 mm; F=1.8 - 2.7
Angle of View (H)	48.8 degrees (wide angle) - 4.3 degrees (telephoto)
Angle of View (V)	37.6 degrees (wide angle) - 3.3 degrees (telephoto)
Minimum illumination	7 lux / F1.8
Pan Angle	+-100 degrees; max 80 degrees / second
Tilt Angle	+-25 degrees; max 50 degrees / second
Weight	1,200 g

Warranty & Liabilities

Your Pioneer is fully warranted against defective parts or assembly for one year, and the PTZ System for 90 days after it is shipped to you from the factory. This warranty explicitly *does not include* damage from shipping or from abuse or inappropriate operation, such as if the robot is allowed to tumble or fall off a ledge, or if it is overloaded with heavy objects.

The developers, marketers, and manufacturers of Pioneer shall bear no liabilities for operation and use of the robot or any accompanying software and accessories except that covered by the warranty and period. The developers, marketers, or manufacturers shall not be held responsible for any injury to persons or property involving the Pioneer Mobile Robot in any way. They shall bear no responsibilities or liabilities for any operation or application of the robot, or for support of any of those activities. And under no circumstances will the developers, marketers, or manufacturers of Pioneer take responsibility for support of any special or custom modification to Pioneer or its software.

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