

Todd's Home Automation Project

History

In 1992, when I bought my current home, I researched and found several controllers that used the Power Line Carrier or PLC technology founded by the X10 Company. I selected the Enerlogic 1400e controller and installed numerous wall switches and other devices, which served me well for over ten years. After Y2K, I learned that I could set the internal date as 1989, to keep it working a few more years. A couple of years later the unit finally died. I immediately was in trouble, as I was used to timed events, total lighting control, and special "what-if" type conditions controlling my home environment. I went out and bought the Active Home CM11A controller from my local hardware store and reprogrammed my house to get it working again. But I missed all the special features that I had before, so I started researching other options.

Finding A Controller

I started with my old sources and found that Enerlogic and Home Automation Labs were both out of business. So, I did a Google search for Home Automation, and found several online HA stores. I started researching the new technology and found out that my old X10 PLC devices were still supported, but many more options were available. Things like IR (Infra-Red) control, touch screens, thermostat interfacing, and Analog and Digital I/O were all available. My first step was to find a controller that would allow me to program the "what-if" scenarios. Things like "if the garage door opens, and it's dark, then turn on lights" were minimum requirements for my new controller, since my CM11A already had timed events and dusk to dawn tracking. After many hours of reading about the various controllers and browsing the Applied Digital user forums, I decided to try the Applied Digital Ocelot controller. <http://www.appdig.com/>

The **Ocelot** controller has a very capable X10 feature set, as well as IR learning and control, which would greatly enhance my whole house audio system. It also has a Serial interface bus for expansion and there are several add-on modules available to enhance your home automation project.



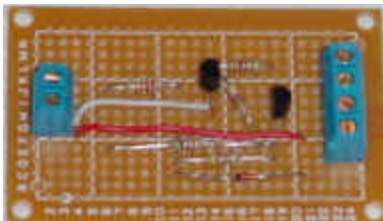
Planning the System

My main goals were as follows:

- X10 PLC Lighting Control with scenes, timed events, and conditional events
- Control my Audio system with X10 wall transmitters
- Enhance my Xantech IR system for more features
- Connect and control my old P3-900 computer as a MP3 Jukebox

The **Ocelot** met all these requirements, with the help of a few third party solutions.

The **Ocelot** would handle all of the PLC lighting and timed events easily. I simply had to configure the included C-Max software for all of my house codes and unit codes. It also can provide IR control and has IR input and output jacks on the unit. But I needed to connect it to my existing Xantech IR system.



I went to the Applied Digital user forums <http://www.appdigsupport.com/> and found a solution that involved creating a small circuit to convert the 5vdc IR signal from the Ocelot, to my 12vdc Xantech IR system. This interface connected my Ocelot to my Audio system and provided IR control. Now I could have an X10 wall keypad, send an IR command to change the channel on my FM Tuner. Pretty cool!
(See details section for more information.)

Next was the MP3 Jukebox. I recently upgraded our home computer, so my old P3 would become our music server. But how would I control it? From the Ocelot forums, I found a nice interface that included an IR to Serial adapter, and software that could control most Windows applications. The **IRA-2** interface from Home-Electro <http://www.home-electro.com/> came bundled with a software package called **Girder**, <http://www.girder.nl/> which takes the IR "triggers" and does something like start a new playlist in my Musicmatch software. So, I connected an IR emitter to the IR adapter, and used the Girder software to control various functions of the computer. So, now I can press an X10 wall button, and load a MP3 playlist, switch my stereo to "aux" input, and start playing my favorite tunes! Very cool!!



With all this hardware and software in place, many things are possible.

- When I get home, the garage door opens, lights are turned on, the stereo is turned on, and my favorite FM channel is selected.
- When I go to bed, I press “good night”, my garage door is checked “if open”, the living room lights are turned off (after a timer allows me to set the house alarm, and walk to the back of the house) and the stereo volume is reduced for easy bedtime listening.
- When I wake up, a few “wake-up” lights are turned on, and when I leave, my motion sensor turns off any forgotten lights!
- Press the “dinner time” button and the lights dim and a play list with soft dinner music starts playing...

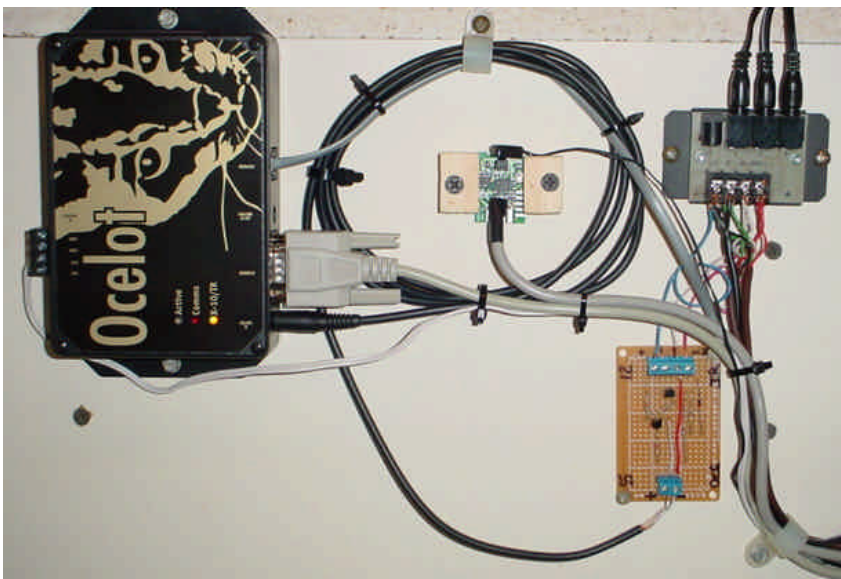
So, you can see all the flexibility created by a reasonably priced system.

Future Expansion

The Ocelot has many features that I hope to someday implement. It has RSC thermostat control built in and several expansion modules for integrating serial devices, as well as a speaking module for audible voice response. With the I/O modules, I hope to setup Irrigation control for the yard, and will someday purchase an RSC thermostat for controlling the house temperature based on events.

The Details

This is the nitty-gritty part, which some may find interesting, or boring, depending on your interests! The basic mounting and connections for the Ocelot/Xantech/IRA-2 system is shown below. They are mounted to the side of a small rack that holds my Carver audio system components. Not pretty, but VERY effective!



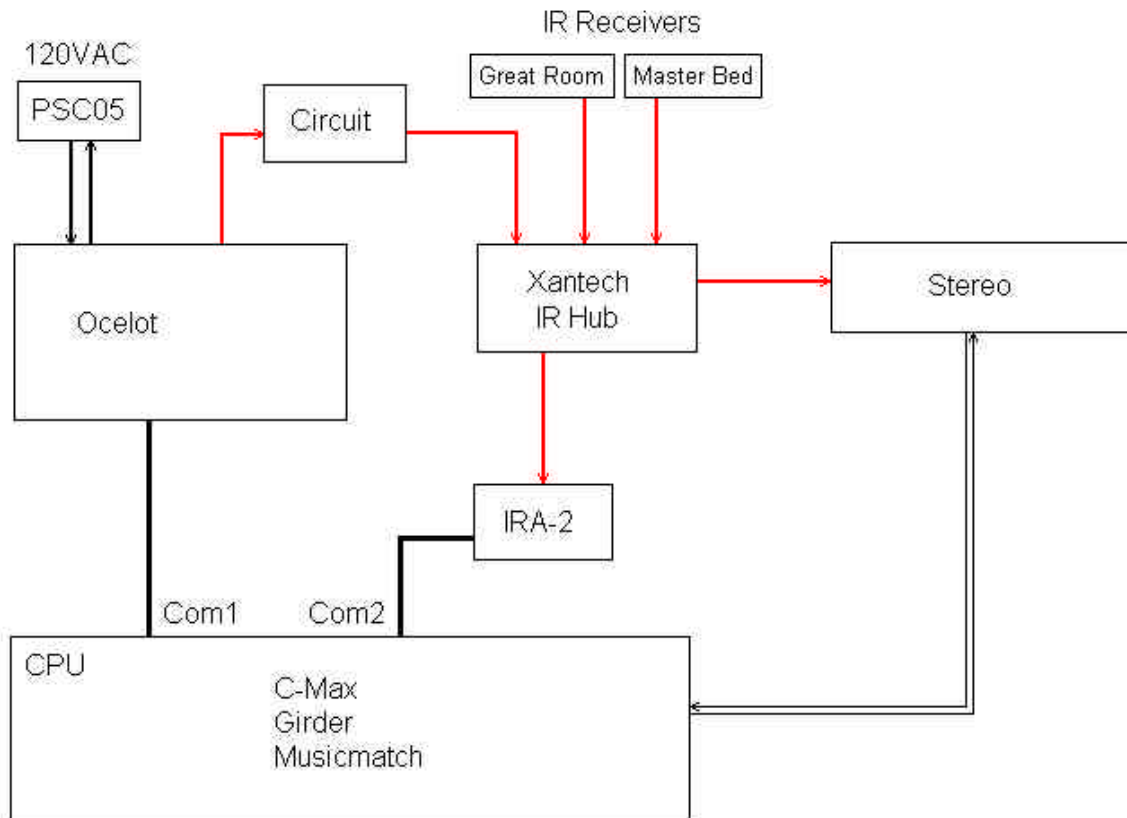
The upper right is the Xantech IR connecting hub which is connected to several emitters and two shelf top receivers. Below it is the circuit I built using the schematic found on the Applied Digital user forum. Center top is the IRA-2 OEM version with an emitter attached on top. Finally, on the left is the Ocelot unit.

My wife wanted an invisible system, so the complete system is mounted in a 36” coat closet with only in-wall speakers visible in the great room. A subwoofer is mounted in a loft so you can’t see it. The rack has a fan to help it stay cool and additional plugs and a switched light mounted over the door.



The System

I have also created a basic schematic of the system for a better understanding of how it all goes together.



Hardware Used

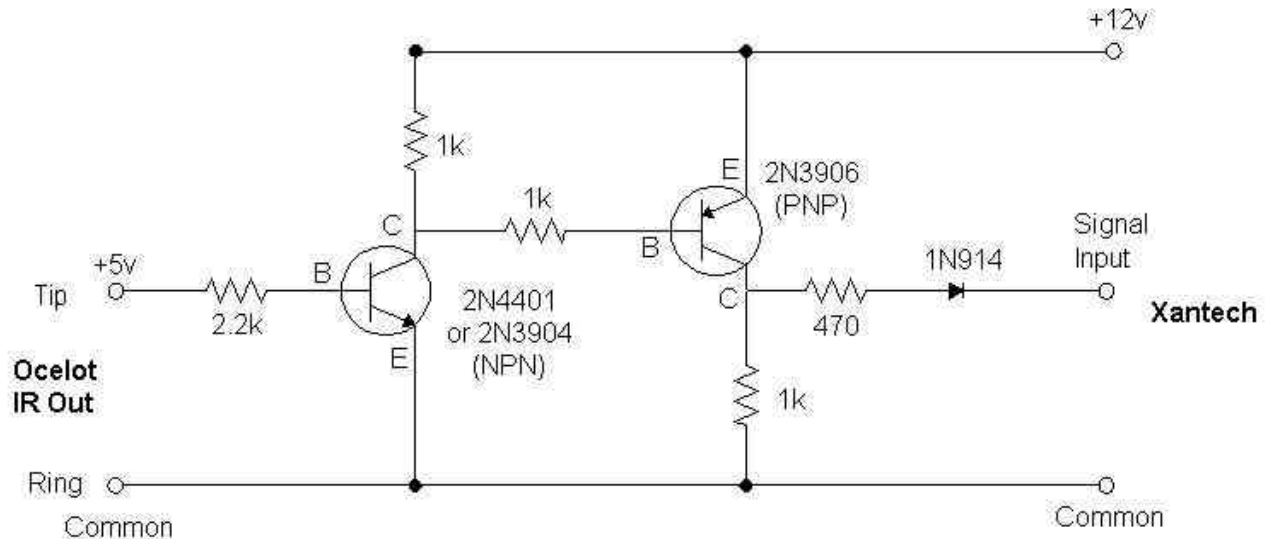
- Ocelot controller with PSC-05 interface module
- Xantech IR distribution hub, receivers and emitters
- Custom Circuit board
- IRA-2 serial interface
- Computer with (2) serial ports
- Stereo gear

Software Used

- C-Max 2.00e (comes with Ocelot)
- Girder (bundled with IRA-2)
- Musicmatch (free download)

The Custom Circuit Board

This board came from the Ocelot user forum, and I added the screw terminals and the circuit board itself. With the Radio Shack parts it was about \$15. The reason for this circuit, was to interface the Ocelot 5vdc to the Xantech 12vdc. It prevents the Ocelot from drawing down the Xantech voltage and causing problems with the Xantech IR receivers. If you don't have an existing IR system, you could simply plug a dual emitter into the Ocelot IR Out jack and place one end over the ITA-2 IR receiver and the other end over a stereo receiver IR port.

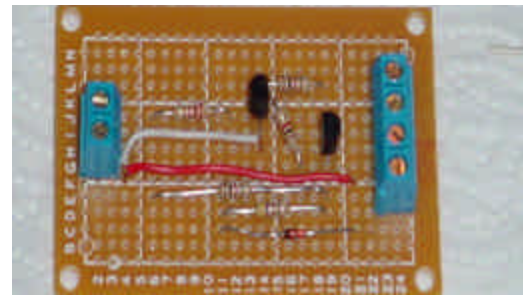


| Component | RS Part No. |
|-----------------------|-------------|
| 2.2k resistor | 271-1325 |
| 1k resistor (3) | 271-1321 |
| 470 resistor | 271-1317 |
| 1N914 diode | 276-1122 |
| 2N4401 NPN transistor | 276-2058 |
| 2N3906 PNP transistor | 276-1604 |
| 2 Position Terminals | 276-1388 |
| PC Board 2" x 3" | 276-149 |

The Parts



Completed



To test the circuit, simply short the "tip to ring" on the Ocelot side and the voltage just to the left of the diode should be at or very near zero. Apply a voltage, 5vdc to 12vdc, then it should jump to 12vdc on the Xantech side. In other words, 0vdc in = 0vdc out, and 5vdc in = 12vdc out. **Note:** I used (2) of the twin screw terminals, so I made both of the center terminals common. (Matches the Xantech IR hub)

Putting It All Together

This is where you need to sit down with a cup of coffee and think about how you want to live. All the time and energy is about to payoff, you just need to decide how you want the system to work for you. What do you want to do with the system, and what controls do you have or need to buy to, do what you want?

Timed Events

These are very simple and are limited only by the number of modules you have installed. I have timed events happening throughout the day to turn things on and off, but also to bypass certain functions, like bypassing the motion detect early in the morning. Use the dawn to dusk time settings for things like welcome lights and porch lights.

Wall Mounted Control

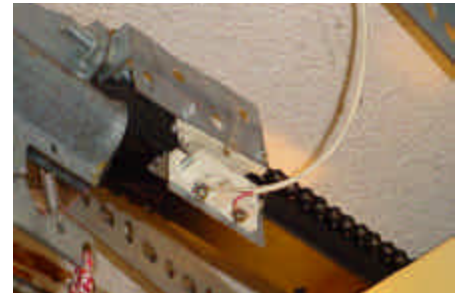
I have several wall controls located in the main rooms. They are 4 button transmitters designed to send only, and are set for unique house codes that do not control anything directly. That way, if I want to change things around, I can reprogram the Ocelot, and not have to go around the house changing codes on each device. One of my challenges is to find an attractive keypad that has an easy way to properly label them!



Wall keypads with a stereo volume control.

Special Control Modules

In the garage, I created a magnetic contact for a door sensing module, and connected it to a universal X10 module. This contact closes when the door is fully open, and sends a signal to the Ocelot, which does several things depending on the time of day. When the door closes, an off signal is sent, which also triggers several things. One of which is to turn off the garage light (so it does not stay on all night!)



My alarm system has a set of contacts that are connected to another universal module, and if the alarm is triggered, then the main house lights turn on using an "All On" command.



In the master bath, I installed an X10 Occupancy sensor (motion detection) that I use only to turn off the lights in the back part of the house. It senses motion, and if it stops seeing motion after 16 minutes (programmable), then it issues an off command to turn off the lights in that part of the house.

Remote Control

Lastly, the remote controls are critical. I am still working in this area to find the best combination. I want the maximum control from my easy chair, without the clutter of 3 or 4 remotes lying around! To help this, I have configured basic audio control from my wall keypads, so the hand held IR remotes are an added convenience.

I currently use an X10 RF remote, my Carver stereo remote, and the X10 6-in-1 remote. In the back yard I have a two button RF remote that I use for the pool filter, and the back yard fountain.

I plan on going to a Pronto remote for everything, but I like the RF remote, because there is no pointing to find the IR receiver.

The Software

The current software I am using is the C-Max software that comes with the Ocelot, the Girder software that I use for the Computer IR interface, and Musicmatch Jukebox for playing the music from my MP3 library. You can use Winamp, or Windows Media Player, or any MP3 Player.

C-Max

www.appdig.com

The C-Max software is ladder logic software, which translates to using “If-Then” type commands to make things happen. You create a list of conditions and events that the Ocelot processes as a large loop. It scans the loop several times each second to find “true” conditions, and then processes the “then” actions that you create. See the samples below.

Timed Events

```
0001 - IF Time of Day becomes = Sunrise offset -15 minutes // 15 min before Sunrise
0002 - THEN X-10-E1-Front-Porch, Turn OFF // so porch lights off
0003 - IF Time of Day becomes = 05:00 // Daddy wakeup at 5:00AM
0004 - AND Day of Week is NOT = Sunday (0) // Daddy sleep in!
0005 - AND Day of Week is NOT = Saturday (6) // Daddy sleep in!
0006 - THEN X-10-M3-Mbath-Shower, Turn ON // Shower light on
0007 - IF Time of Day becomes = 05:15 // 5:15AM time to get ready!
0008 - THEN X-10-A5-Sink-Cans, Turn ON // Kitchen lights on
0009 - IF Time of Day becomes = 07:00 // 7:00 AM or
0010 - OR Time of Day becomes = 16:30 // 4:30PM - Twice a day!
0011 - THEN X-10-E7-Fountain, Turn ON // Fountain On
0012 - IF Time of Day becomes = 09:30 // Off at 9:30AM
0013 - OR Time of Day becomes = 19:00 // and again at 7:00PM
0014 - THEN X-10-E7-Fountain, Turn OFF // Fountain Off
0015 - IF Time of Day becomes = 10:00 // Master bedroom lights off
```

Basic X10 Control

```
0104 - IF X-10-C2-Alarm-Contact, Turns ON // ALARM!!!!!!!
0105 - THEN Transmit X10, A - All Lights ON (18) // All living and Master bedroom lights on
0106 - THEN Transmit X10, M - All Lights ON (18) //
0107 - IF X-10-L8-Night/Bye, ON Command Pair // GOODBYE
0108 - THEN Transmit X10, M - All Lights OFF (23) // Master bedroom lights off
0109 - THEN Transmit X10, F - All Lights OFF (23) // Fans off
0110 - THEN X-10-C4-Stereo-Plug, Turn OFF // Stereo off
0111 - THEN Exit-timer = 1 // Start 90 second exit timer
0112 - IF Exit-timer becomes > 90 //
0113 - THEN Exit-timer = 0 // Turn off timer
0114 - THEN Transmit X10, A - All Units OFF (17) // Turn off Living room lights
0115 - THEN X-10-E3-Garage, Turn OFF // Turn off Garage light
more ...
0136 - IF X-10-L5-Relax/Cook, ON Command Pair // RELAX SCENE
0137 - THEN X-10-A4-Kitchen-Cans, Turn OFF //
0138 - THEN X-10-A6-Dining, Turn OFF //
0139 - THEN X-10-A2-GR-Cans, Turn ON //
0140 - THEN X-10-A5-Sink-Cans, Turn ON //
0141 - THEN X-10-A10-Sconce-Lights, Turn ON //
0142 - THEN Transmit X10, A - 2 //
0143 - THEN Transmit X10, A - 5 //
0144 - THEN Transmit X10, A - Dim (21), 4 time(s) // Dim A-2 and A-5 to 65%
0145 - IF X-10-L5-Relax/Cook, OFF Command Pair // COOKING SCENE
0146 - THEN X-10-A4-Kitchen-Cans, Turn ON //
0147 - THEN X-10-A5-Sink-Cans, Turn ON //
```

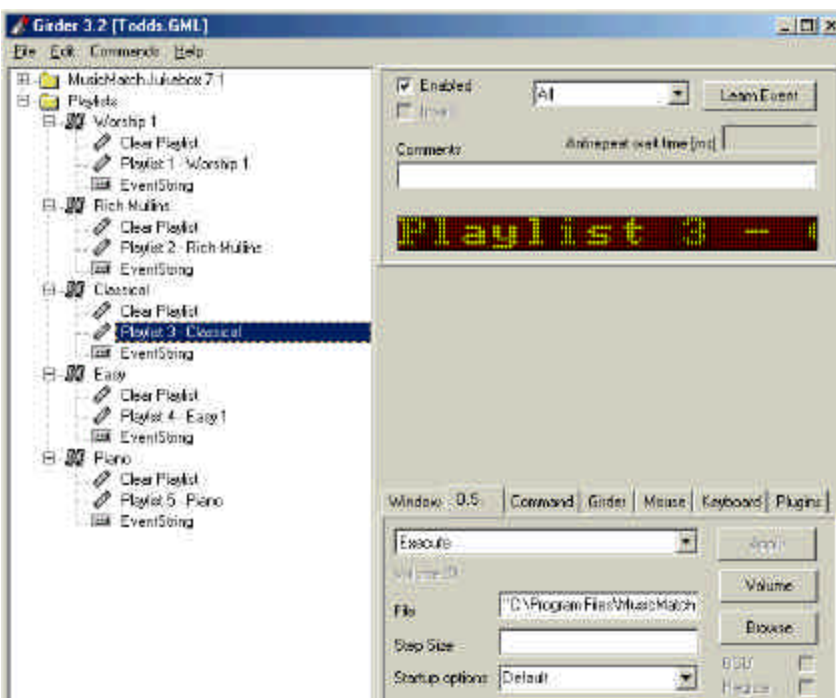
IR Control

```
0073 - IF X-10-L1-Stereo-On/Mute, OFF Command Pair //
0074 - THEN Ocelot, Zone 0 IR Mute //
0075 - IF X-10-L2-Stereo-FM1/FM2, ON Command Pair // KLOVE station
0076 - THEN Ocelot, Zone 0 IR Tuner //
0077 - THEN Ocelot, Zone 0 IR KLOVE //
0078 - THEN Var-#3-MP3-Playlist-Counter = 0 //
0079 - IF X-10-L2-Stereo-FM1/FM2, OFF Command Pair // KARM station
0080 - THEN Ocelot, Zone 0 IR Tuner //
0081 - THEN Ocelot, Zone 0 IR KARM //
0082 - THEN Var-#3-MP3-Playlist-Counter = 0 //
0083 - IF X-10-L3-Stereo-MP3/Next, ON Command Pair // MP3 PLAYLIST 1
0084 - THEN Ocelot, Zone 0 IR Aux //
0085 - THEN Var-#3-MP3-Playlist-Counter = 1 //
0086 - IF X-10-L3-Stereo-MP3/Next, OFF Command Pair // NEXT PLAYLIST
0087 - THEN Var-#3-MP3-Playlist-Counter + 1 // INCREMENT COUNTER
0088 - IF Var-#3-MP3-Playlist-Counter becomes = 1 //
0089 - THEN Ocelot, Zone 0 IR Playlist1 //
0090 - IF Var-#3-MP3-Playlist-Counter becomes = 2 //
0091 - THEN Ocelot, Zone 0 IR Playlist2 //
0092 - IF Var-#3-MP3-Playlist-Counter becomes = 3 //
0093 - THEN Ocelot, Zone 0 IR Playlist3 //
0094 - IF Var-#3-MP3-Playlist-Counter becomes = 4 //
0095 - THEN Ocelot, Zone 0 IR Playlist4 //
0096 - IF Var-#3-MP3-Playlist-Counter becomes = 5 //
0097 - THEN Ocelot, Zone 0 IR Playlist5 //
0098 - IF Var-#3-MP3-Playlist-Counter becomes = 6 // RESET IF >5
0099 - THEN Var-#3-MP3-Playlist-Counter = 1 //
0100 - IF X-10-L4-Stereo-vol+/-, ON Command Pair // VOLUME DOWN
0101 - THEN Ocelot, Zone 0 IR Volume-Down //
0102 - IF X-10-L4-Stereo-vol+/-, OFF Command Pair // VOLUME UP
0103 - THEN Ocelot, Zone 0 IR Volume-Up //
```

Girder

www.girder.nl

Use this with an IR interface (IRA-2) to control your computer from a remote location using IR and any standard remote.



On the left is a list of commands, grouped together. The “EventString” is the learned IR command that triggers the action. In my case, the following sample explains how Girder works to play a Musicmatch MP3 playlist.

The “Classical Group” has two commands and a trigger EventString. The first commands clears the current playlist, then the second command reloads Musicmatch by opening the “name.M3U” playlist file.

Girder is a powerful tool that can control almost any PC program, and can use various input triggers, including IR, Timers, Keystrokes, Mouse clicks, etc...

Check out their web page from the above link.

Musicmatch

Rip your CD collection to your hard disk, and set up your favorite play lists to enjoy several hours (or days) worth of music without interruption. Create and save Playlists, which you can use with the above techniques to automate you music, using X10, the Ocelot, and the IRA-2 interface.

The Magic

On the previous page you can see how a button press on an X10 wall transmitter (X10-L3 Off Command) can trigger the Ocelot to increment a counter (MP3 Playlist Counter) and send a matching IR command (IR Playlist XX) to the IRA-2 interface and to Girder (an EventString) for one of the Girder "Multigroups".

When my wife gets home after school, the Garage door opens and the "open" contact sends an X10 command to the Ocelot, that starts the entire "Stereo On" sequence. That sequence turns on the X10 plug, then using IR it turns on the Preamp and Tuner on the stereo, then selects Tuner as the source, and selects our favorite Christian station, KLOVE!

Very cool stuff, mostly limited by your imagination.

Conclusion

Home automation doesn't have to be complicated or expensive. It can provide the needed security, energy conservation, and many other useful features, and can be a lot of fun as well. Start small and grow your system as your needs and desires change.

Visit some of the links below for more information about home automation products.

www.smarthome.com X10 and Home Automation parts

www.smarthomeusa.com X10 and Home Automation parts

www.x10pro.com X10 parts

www.appdig.com Home for Ocelot controller and also a touchscreen version! User forums

www.worthdist.com Distributor for HA parts and accessories

www.home-electro.com IR interface units, Serial and USB versions

www.girder.nl PC Control software, User forums

www.evation.com IR interface