

S.M.A.R.T.

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ENGR 844

September 30, 2008

The S.M.A.R.T. home automation system is a complete package solution for future generation homes. It comes complete with audio, lighting, HVAC and home appliance control from an easy to use remote. The system goes beyond conventional home automation devices on the market today by storing user history and suggesting future use. The remote control features an LCD display screen and a touchpad along with a locator beeper for when it's lost between one of your sofa cushions. The remote also stores behavioral information for audio, lighting and HVAC so it can predict what you'll want before you want it. For this project the S.M.A.R.T. production will be focused on the remote control, Winamp playback and lighting control with power management. Users can waste countless hours creating playlists unnecessarily. To switch a light off and on one shouldn't have physically move room to room and manually flip a switch. Power usage should be easily known and not a mystery until next month's bill. Losing your remote should never be a worry. One shouldn't always have to be in range of every device with a remote but let each module multi-hop the signal to its required destination. A "smart" solution should solve all these problems.

Other companies market similar products such as Insteon (www.insteon.net), x10 (www.x10.com) and Eaton (www.homeheartbeat.com). The S.M.A.R.T. home attempts to take the advantages of each system to build a superior product. Eaton has a low power zigbee solution but can only read the status, not control, the devices. X10 and Insteon both have a robust product line but don't employ S.M.A.R.T. remote technology that saves device history and makes recommendations for future use.

There will be three main devices (computer interface, remote, and light module) to describe for architecture and software.

Remote Control	
Board	AVR RAVEN, Cypress CapSense Eval Board
Processor	ATMEL86RF230, ATMEGA3290PV, ATMEGA1284PV
Platform	Custom board connecting an AVR Raven, LCD screen and touchpad
Other Components	LCD character screen, NVRAM
Computer Interface	
Board	AVR Raven, AT91SAM-EK
Processor	AT91SAM7X-256, ATMEL86RF230, ATMEGA3290PV, ATMEGA1284PV
Platform	Evaluation board connected to an AVR Raven
Other Components	Computer
Light Module	
Board	AVR Raven, STeval-ILL004V2
Processor	ATMEL86RF230, ATMEGA3290PV, ATMEGA1284PV
Platform	Light dimmer evaluation board connected to an AVR Raven
Other Components	Hall effect and temperature sensor, TRIAC

Computer Interface - Software Components	
Python	Open/close Winamp, play, pause, stop, next track, prev. track, create playlist, load playlist, delete playlist, Change Volume
Windows	Store current song to file, store temperature to file, store power use by device to file, find files in folder and store to array, activate/disable locator beeper on remote
Board	Uart TX/RX, SPI TX/RX, set Zigbee Channel, relay Zigbee messages, TX/RX to/from Zigbee, process received packets
Remote Control - Software Components	
Zigbee	Set channel, lease channels, store channel and device info
Capacitive Sensor	Read voltage from sensors, calc slider position and movement, touch button, switch between display functions
Music	Select song, play, pause and stop playback, change volume
NVRAM	Partition memory space and create tables for music, temperature and power data. Track usage history by times skipped, played, time of day, record temperature history, record power history
Temperature	Calc. average temperature for all devices
Power	Calc. total power for all devices, test if max power exceeds recommended, shut down devices based on power history if too much power being used
LCD	Switch between display functions, display current song, next song and previous song, display power by device, display temperature by device
Misc	Sleep mode, start/stop locator beeps
Lighting - Software Components	
Zigbee	Lease channel from remote, TX/RX to/from zigbee, relay zigbee messages
Temperature	Read temperature sensor, calculate temperature, TX temperature to remote
Power	Read hall effect sensor, calculate power, TX power to remote
Dimmer	Read phase of neutral line, create functions for predefined dimmer states from 0-90% power in intervals of 10, turn on/off triac
Remote Control	Process commands from remote, turn on/off light, set light dimmer to predefined state
Misc	15 minute timer to read temperature and power, sleep mode, spi tx/rx

Most of the software components will have to be developed except for the lcd display and sections of the computer interface. The coding on the computer will be in python and php in a windows environment.

The final project will consist of a remote control, computer interface and a light module. The computer will control the use of winamp, store history of the songs played, temperature and power information beyond the storage capacity of the remote. The light module will send temperature and power information to the remote, relay packets outside the range of the remote, and control the state of the light. The remote will store usage history and patterns for music and lights, employ an LCD screen for a viewable output, a touch pad for user selection and have a locator feature.