

THAT Home Automation Topology

Project Progress Report

Chris Miller | Nick Viera

Advisors: Dr. Irwin | Dr. Malinowski

Introduction

THAT System describes a new, comprehensive, automation and control system targeted towards residential and light commercial buildings.

THAT System Design Goals

- Cost effective
- Modular and Scalable
- Emphasis on design integrity
- Form follows function
- Standardized communication using IP/Ethernet with PoE
- “Freemium” distribution model
- Not reliant on proprietary hardware or software

Temperature / Humidity Sensor	Digital Thermostat Module	Relay / TRIAC Module (Wired)
Proximity / Motion Sensor	Electronic Access Control Module	Relay / TRIAC Module (PoU)
Light / Infrared Sensor	System Display / Control Module	Electricity Metering Module
Smoke / Carbon Dioxide Detector	THAT – X10 Bridge Module	Water / Gas Metering Module
Door / Window Sensor Module	THAT – INSTEON Bridge Module	HVAC Control / Driver Module
Generic Push Button / Keypad Module	THAT – Serial Bridge Module	Annunciator / Siren Module
Rain / Water / Flood Sensor	THAT – IR Bridge Module	Irrigation Control Module

Project Organization

THAT System: A set of common hardware, firmware, software, and communication protocols being co-developed by Nick Viera and Chris Miller.

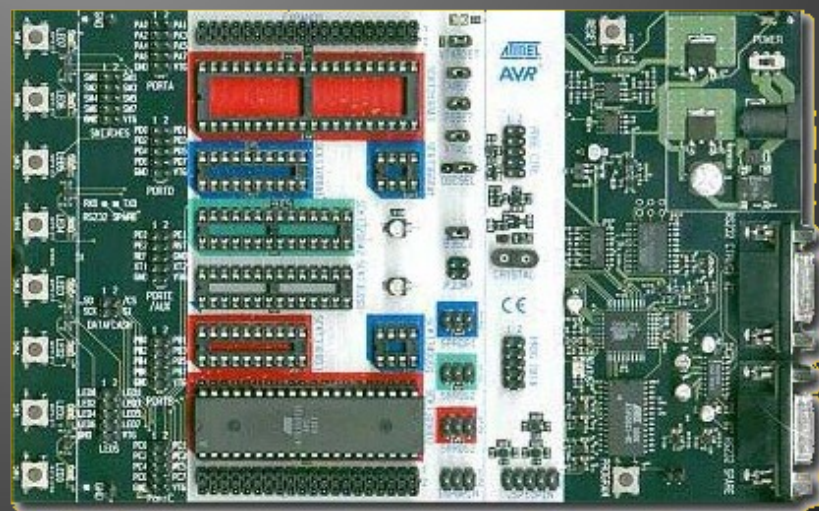
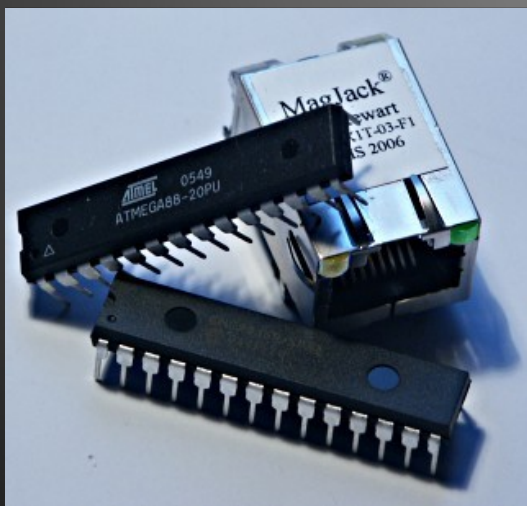
Digital Thermostat Module: An advanced, programmable, digital thermostat module for use with THAT System or stand-alone. Developed by Nick Viera.

Electronic Access Module: An advanced, flexible entry and security system for use with THAT System or with additional UI module. Developed by Chris Miller.

Project Equipment

THAT (Common):

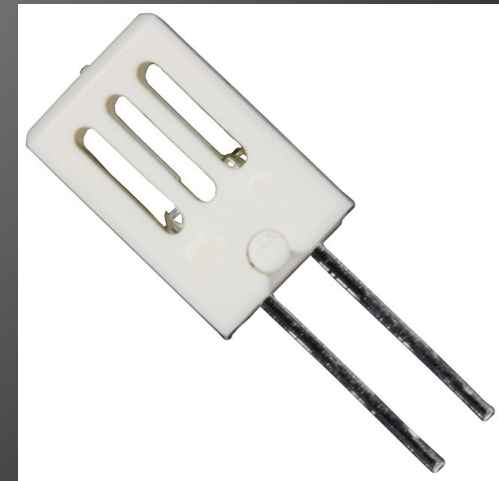
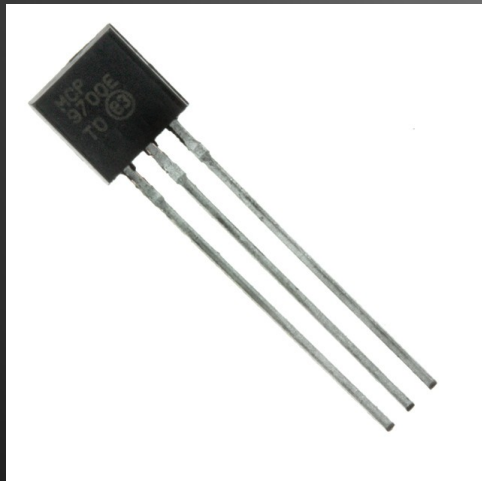
- Embedded Microcontroller [Atmel AVR platform]
- Microcontroller firmware [AVR assembly or C]
- Ethernet controller hardware [Microchip ENC28J60]
- TCP/UDP/IP stack [by Guido Socher and tuxgraphics.org]
- Onboard TCP Server functionality
- Power over Ethernet (PoE) regulator and controller
- THAT master control hardware [Computer]
- THAT master control software [Python]



Project Equipment

Digital Thermostat Module:

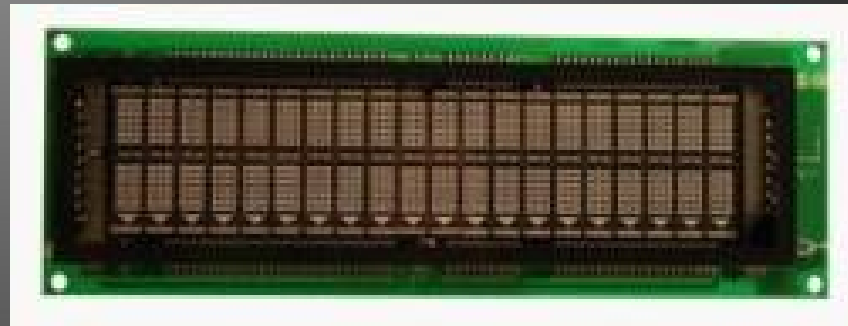
- Backlit, grayscale 128x128 pixel LCD screen
- Six (6) pushbutton switches
- Five (5) LED indicators
- Infrared demodulator/receiver
- Four (4) HVAC-compatible relays
- Temperature Sensor (-40 – 125 °C)
- Humidity Sensor (10 – 95 %RH)



Project Equipment

Electronic Access Module:

- Two (2) electronic door strike compatible relays
- Vacuum Fluorescent Display (20x2 character)
- Wireless transceiver (2.4GHz)
- Ten (10) passcode pushbuttons
- One (1) doorbell pushbutton
- Three (3) LED indicators



Completed Work

THAT (Common):

- Initial module hierarchy
- Preliminary communication framework
- Simple TCP server and client software [using Python]
- Functional IP/Ethernet stack and embedded TCP server
- Functional “generic” THAT module prototype

Digital Thermostat Module:

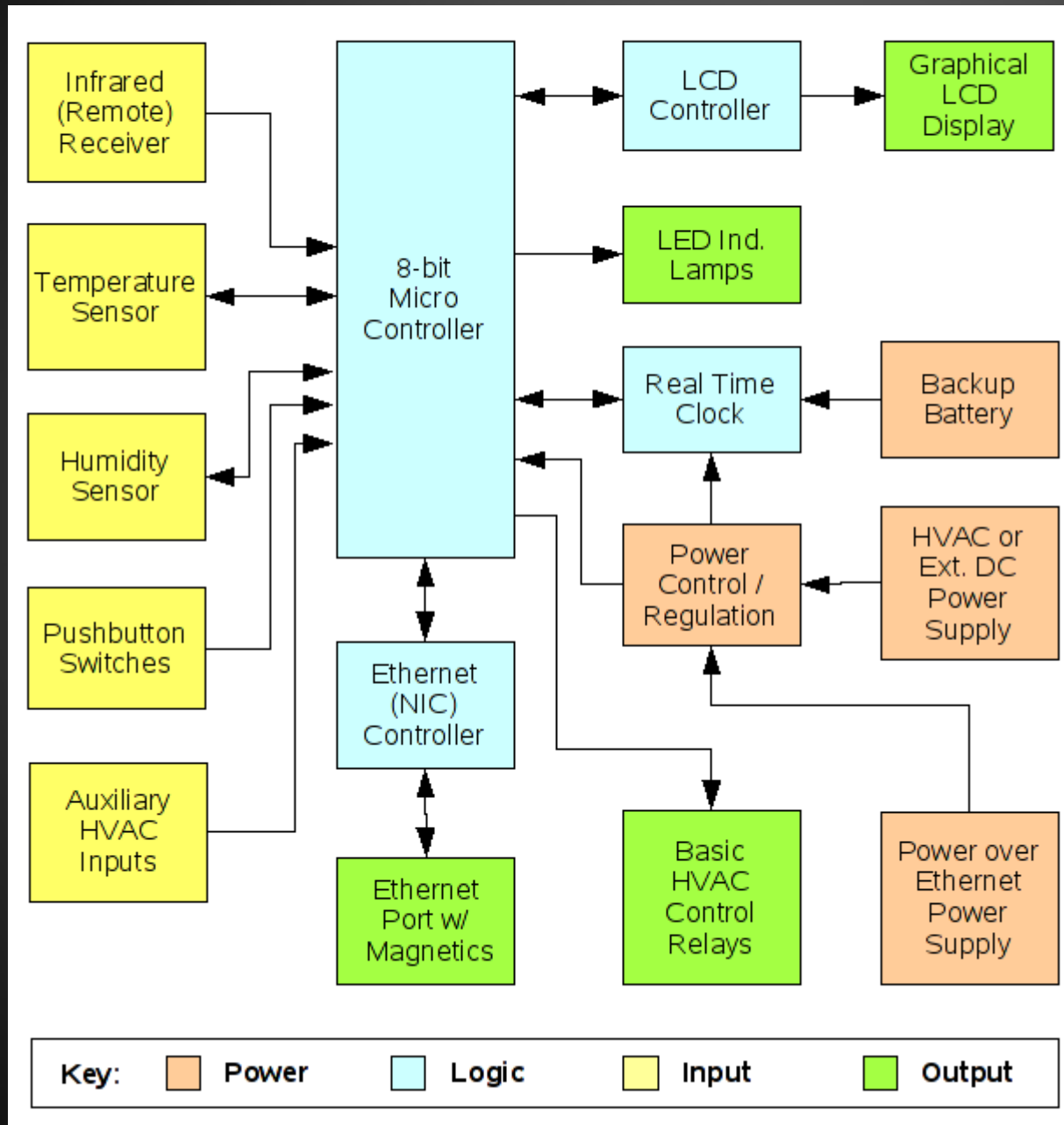
- Physical / UI design concept
- Hardware I/O map and initial components list

Electronic Access Module:

- Physical / UI design concept
- Hardware I/O map and initial components list

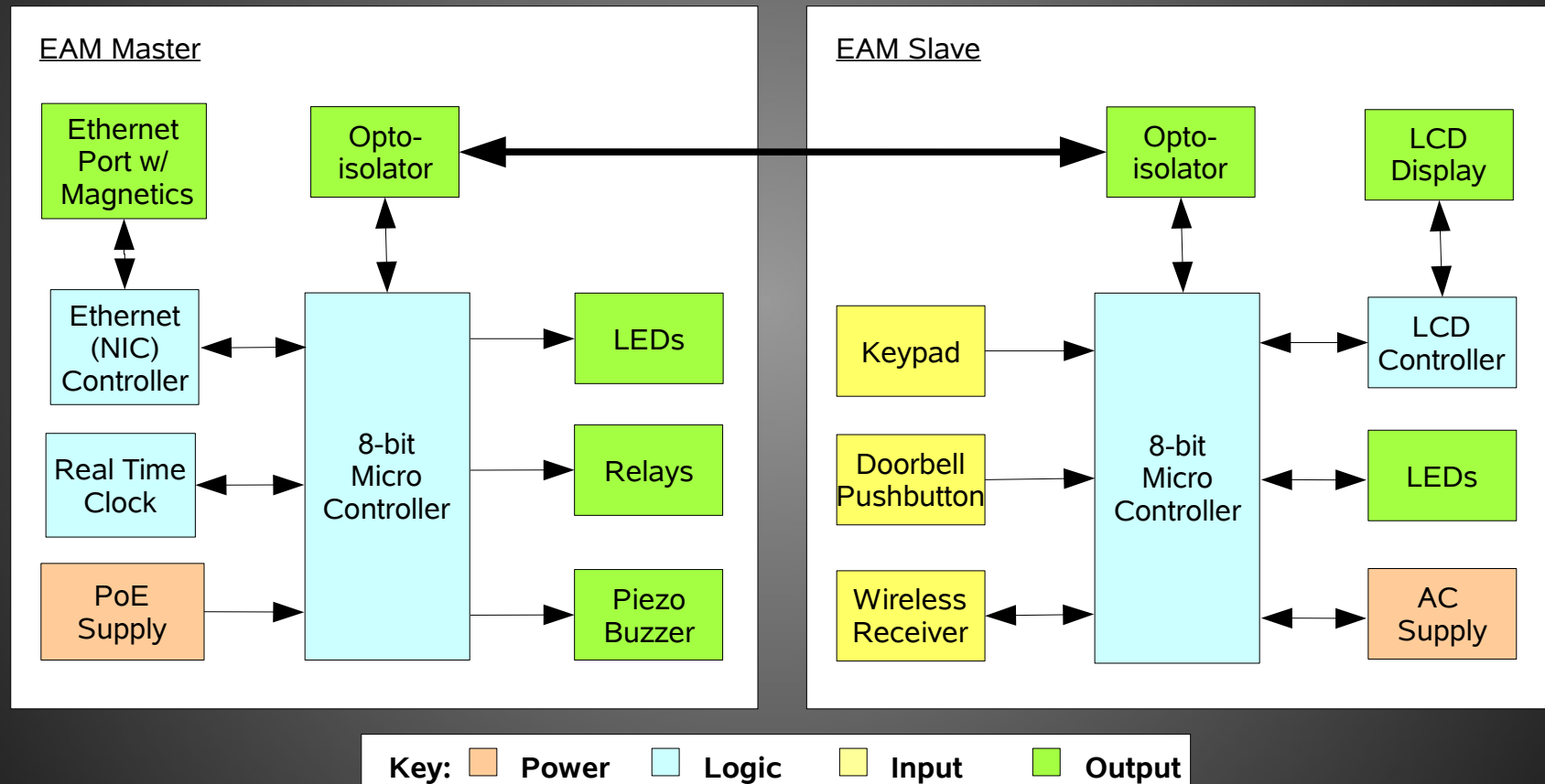
System Block Diagram

Digital Thermostat Module:

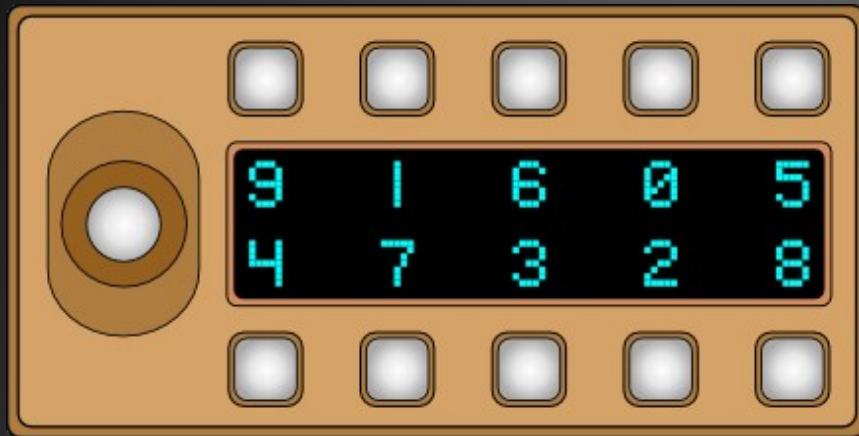


System Block Diagram

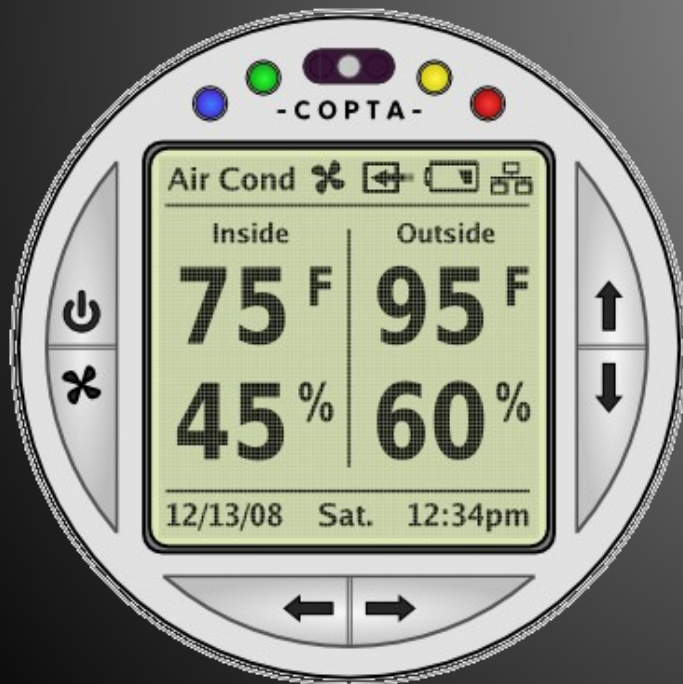
Electronic Access Module:



Completed Work

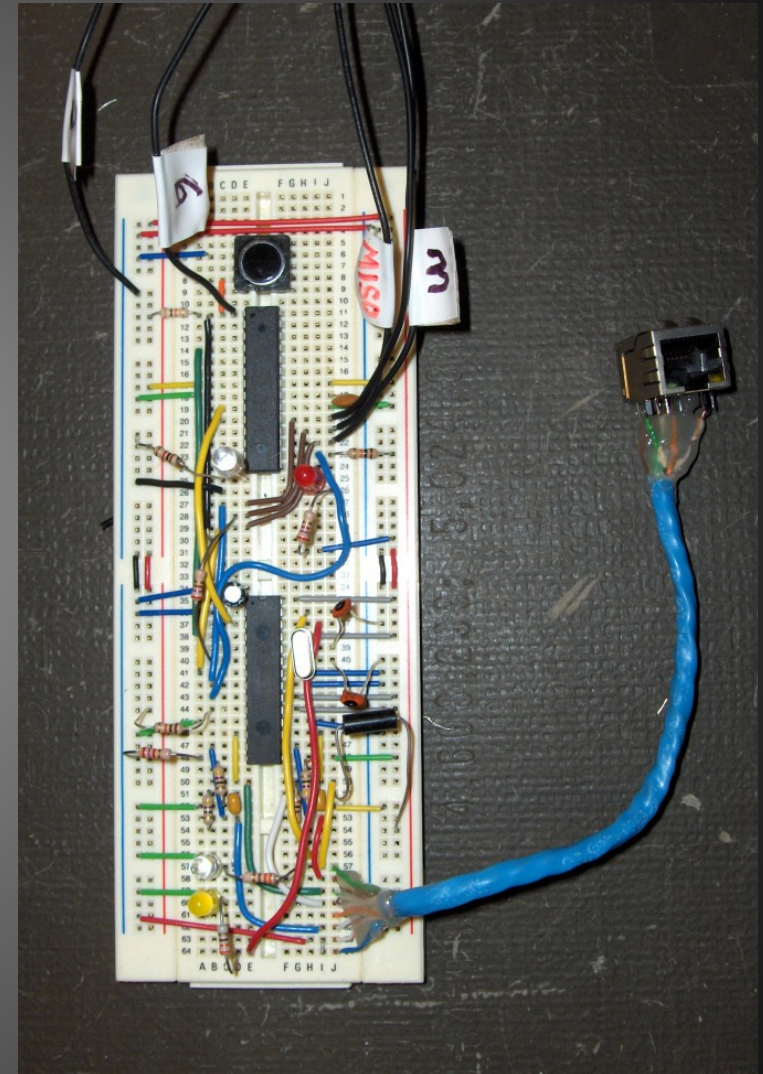


Electronic Access
Module Design
Concept



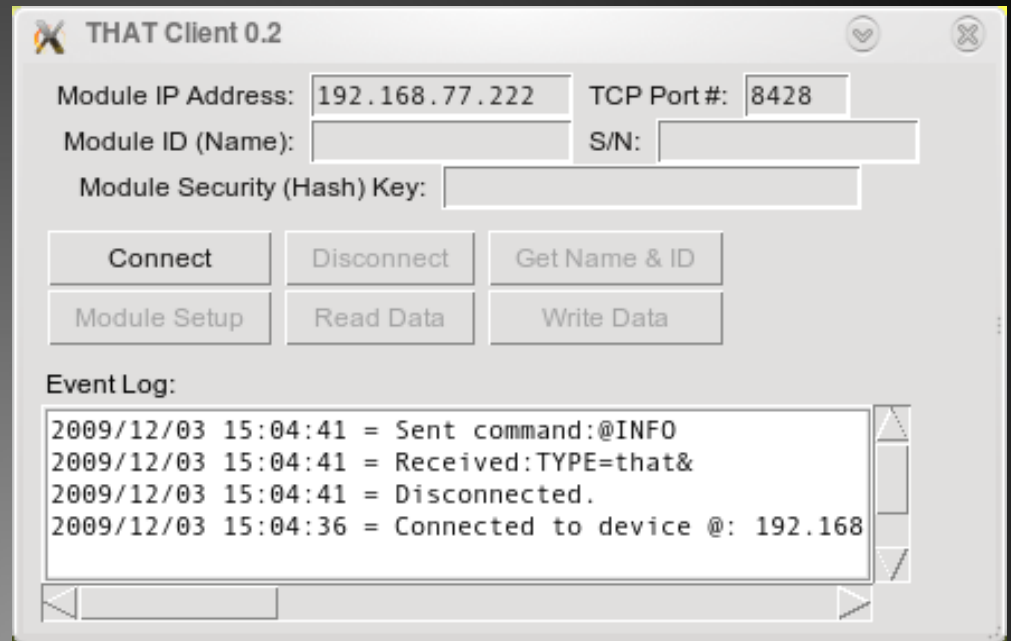
Digital
Thermostat Module
Design Concept

“Generic” THAT Module Prototype



Completed Work

THAT Client Software 0.2
Functional GUI (right)
and terminal interface
components



```
tcp_client_0.4 : python
File Edit View Scrollback Bookmarks Settings Help
nick@shitserv:~/that_software/tcp_client_0.4> python gui_client_0.4.py
Connecting to address: 192.168.77.222
Connecting on port: 8428
Sending @INFO...
Received @INFO
Data is from a THAT module:
Type: that
NAME: copta
ID: 12ea23-eb012b
FUNC: io

```

Future Tasks

- **Finish THAT communication framework**
- **Order components for prototyping**
- **Built, test, and debug prototype modules**
- **Continue development of THAT master control software**
- **Design and manufacture printed circuit boards for modules**
- **Build actual modules on PCBs**
- **Finish all firmware**
- **Continued development of THAT software**

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