

# **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.

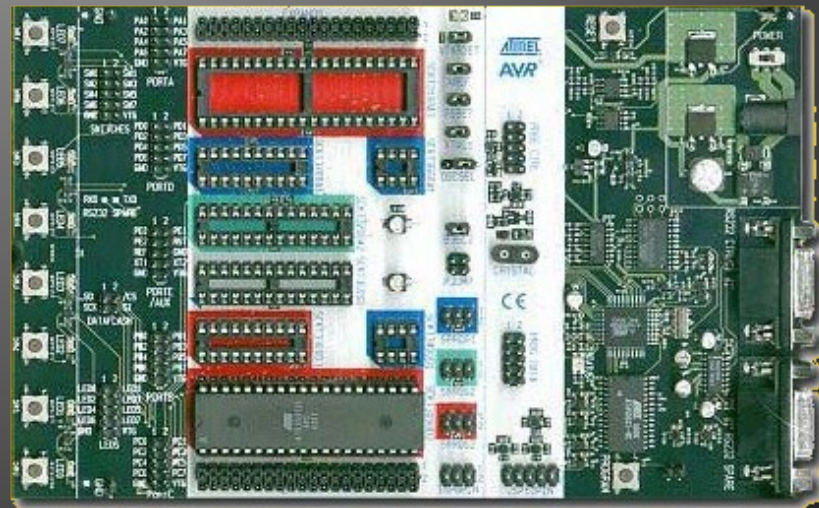
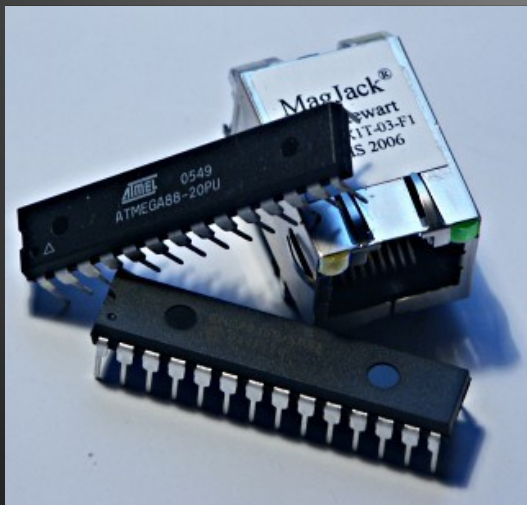
Digital Thermostat Module: An advanced, programmable, digital thermostat module for use with THAT System or stand-alone. Developed by Nick Viera.

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):

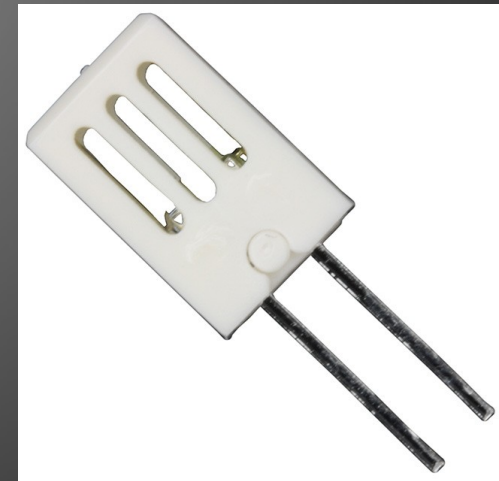
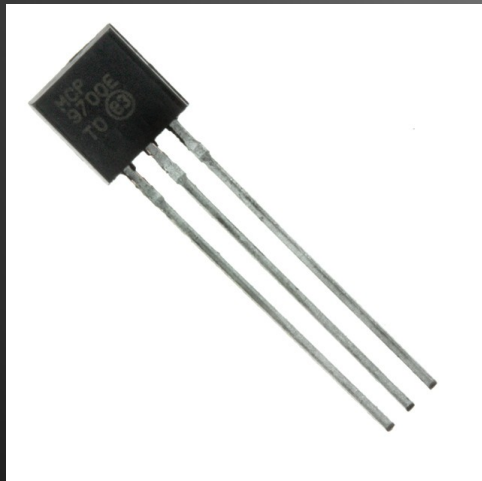
- Embedded Microcontroller [ Atmel AVR platform ]
- Microcontroller firmware [ AVR assembly or C ]
- Ethernet controller hardware [ Microchip ENC28J60 ]
- TCP/UDP/IP stack [ by Guido Socher and tuxgraphics.org ]
- Onboard TCP Server functionality
- Power over Ethernet (PoE) regulator and controller
-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



# Project Equipment

## Digital Thermostat Module:

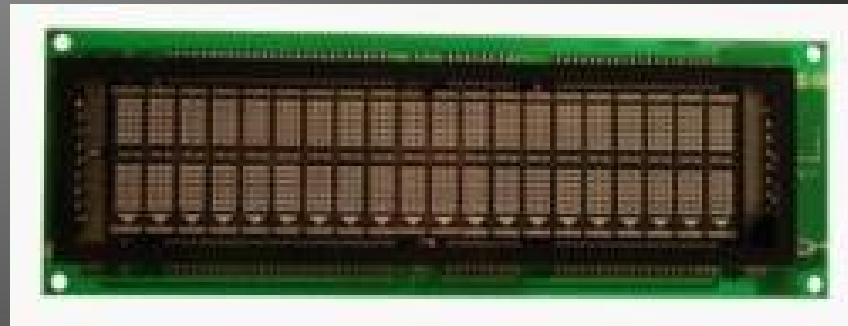
- Backlit, grayscale 128x128 pixel LCD screen
- Six (6) pushbutton switches
- Five (5) LED indicators
- Infrared demodulator/receiver
- Four (4) HVAC-compatible relays
- Temperature Sensor (-40 – 125 °C )
- Humidity Sensor (10 – 95 %RH)



# 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

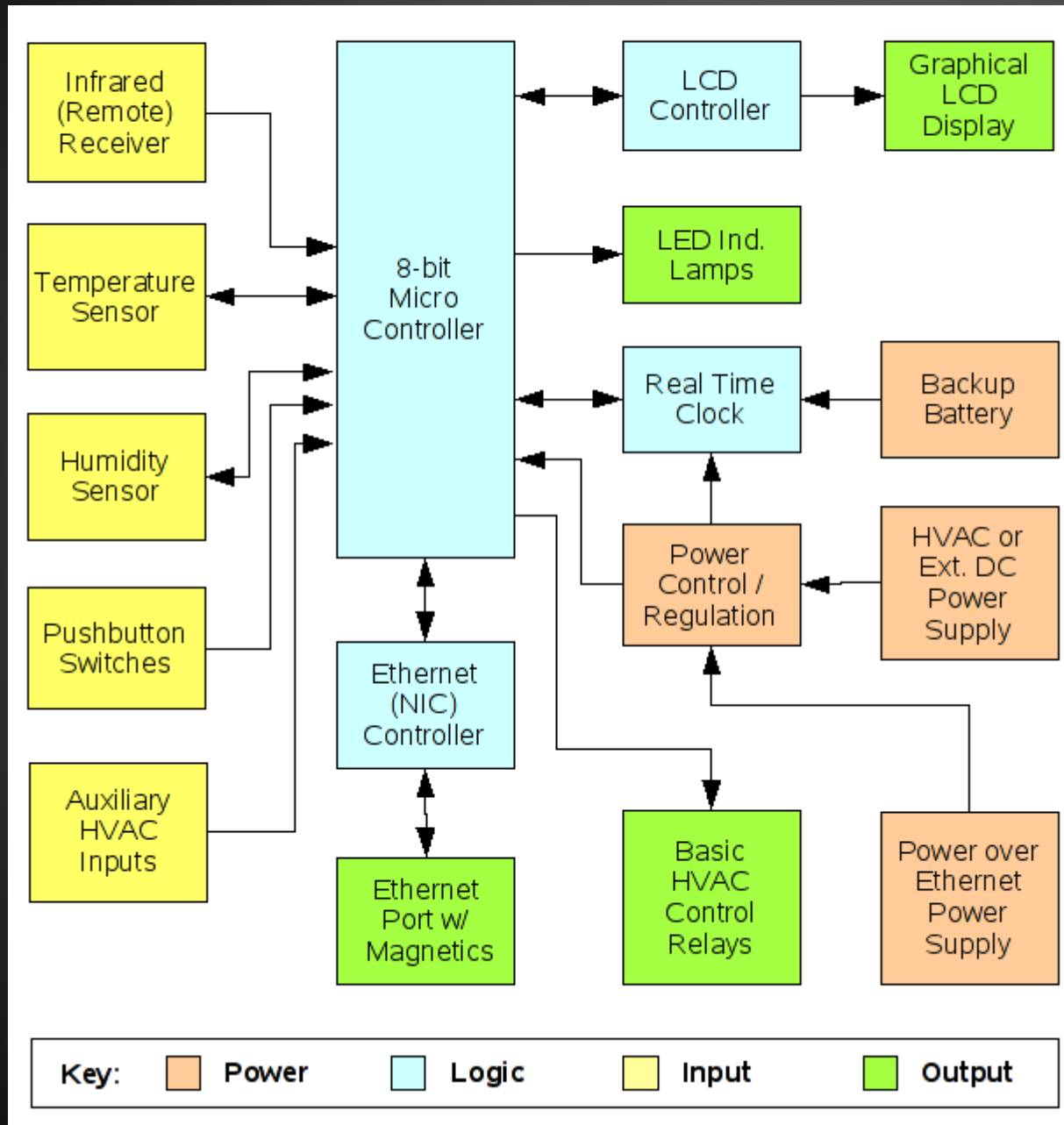
## Electronic Access Module:

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



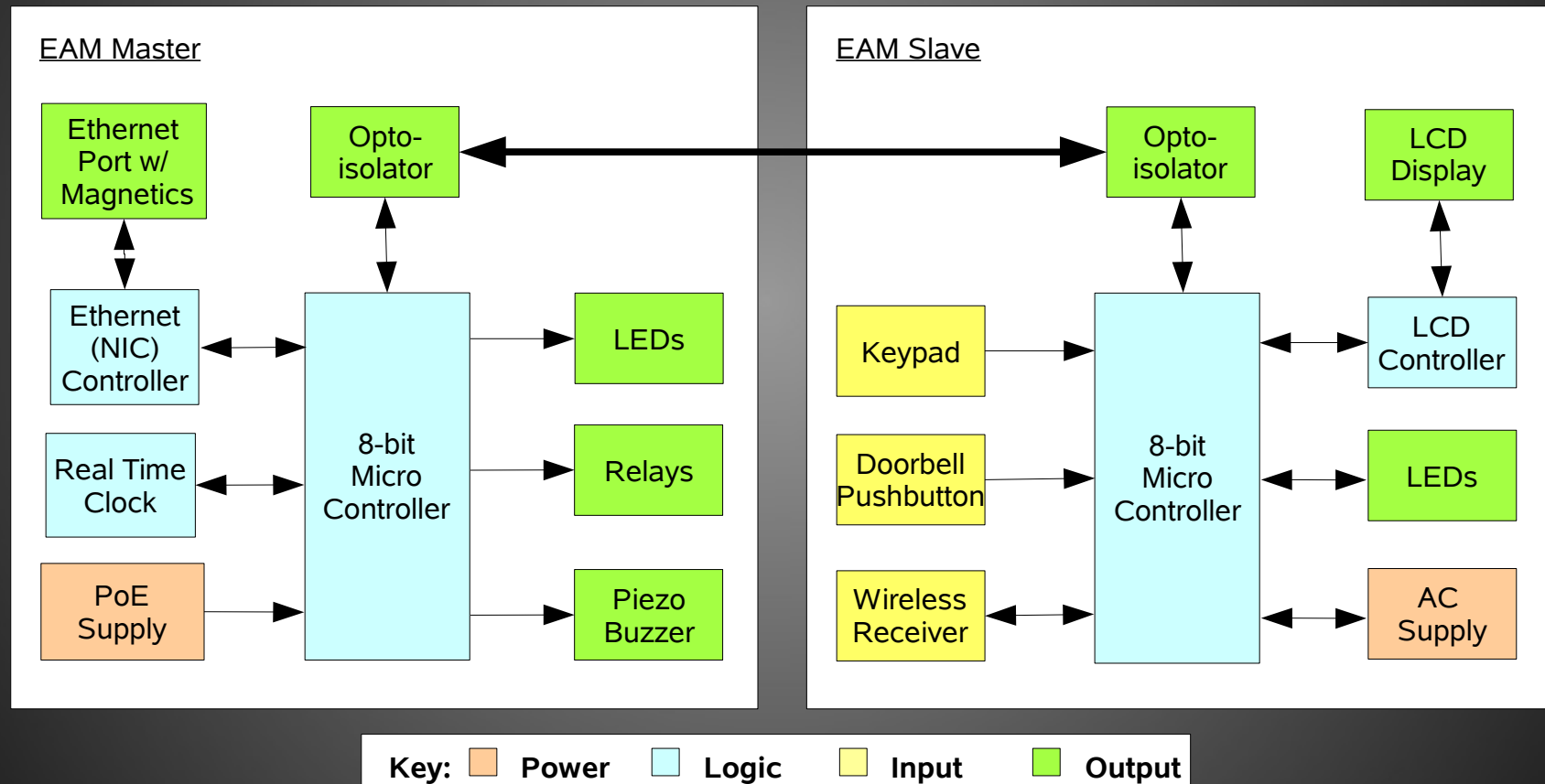
# System Block Diagram

## Digital Thermostat Module:

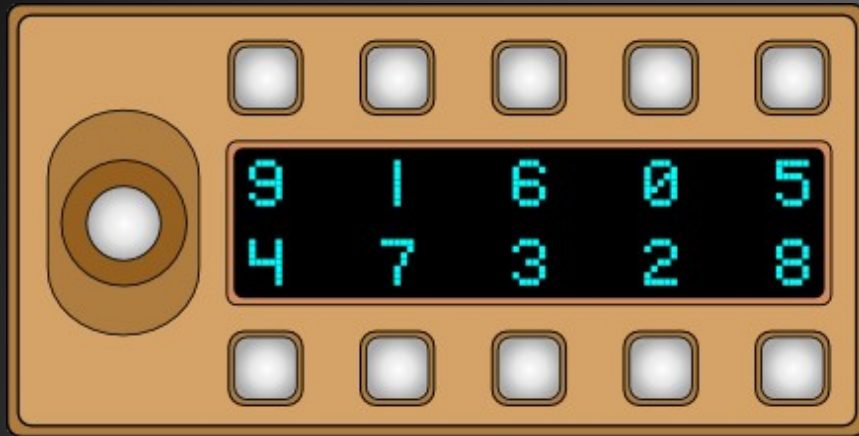


# System Block Diagram

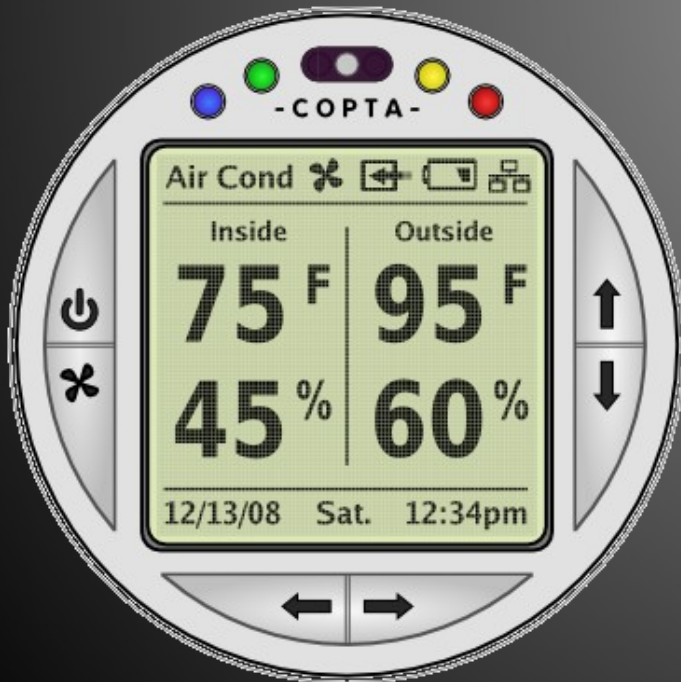
## Electronic Access Module:



# Completed Work

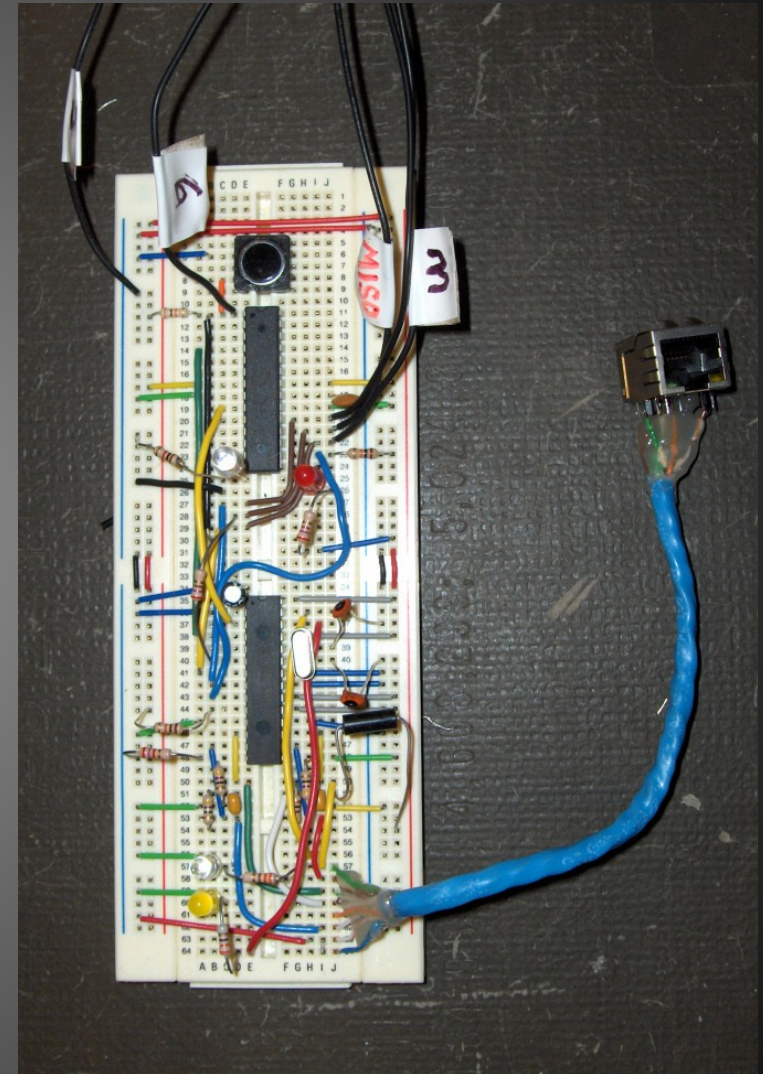


Electronic Access  
Module Design  
Concept



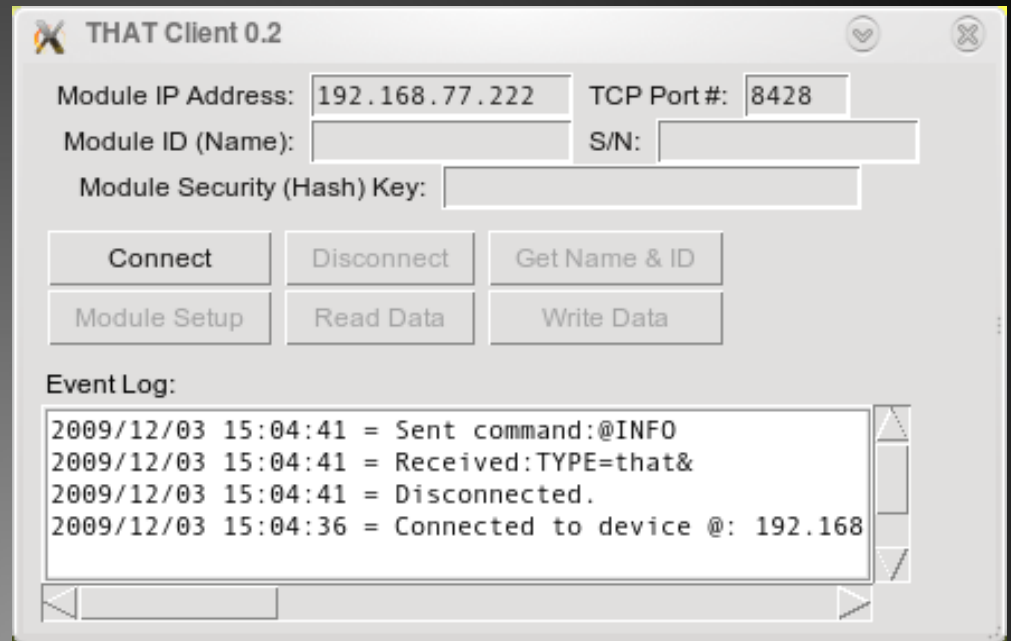
Digital  
Thermostat Module  
Design Concept

# “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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