home automation system
vision: 21st century home

Intelligent Environment

- lighting
- audio/video
- home theater
- climate control
- security
- scheduled events

Fully Programmable
project goals

Design
- Flexible
  - generally programmable
- Extensible
  - adding additional features easy
- Modular
  - no need to redesign control when new sensor is added

Function
- control via IR remote
- climate & lighting automation
- schedule-based events
3-layer system architecture

sensors/inputs
- temp
- light level
- clock
- remote control commands

control
- special-purpose processor

actuators
- [Actuator 1]
- [Actuator 2]
- [Actuator 3]

status
Sensor Input Layer: Climate Interpreter

• measures ambient temperature in room and reports it to control unit
• lighting sensor is analogous
Sensor Input Layer: IR Remote Control

- **Data Transmission**

Transmitter

Receiver

- **Phillips RC-5 Encoding**

```
1 1 0 0 0 1 0 0 0 1 1 1 0 0
start  chk  address  command
```
Sensor Input Layer: IR Remote Control

IR Decoder Module Block Diagram
control unit

• *purpose*: apply condition to inputs if condition is true, perform program-specified action by asserting/deasserting actuators

• special-purpose processor runs user-specified program
### instruction format

#### format

<table>
<thead>
<tr>
<th>op</th>
<th>v1</th>
<th>v2</th>
<th>signal</th>
<th>output_value</th>
<th>next_pc</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;</td>
<td>s-0x12</td>
<td>i-68</td>
<td>0x31</td>
<td>0x1</td>
<td>0x0088</td>
</tr>
</tbody>
</table>

#### example

- turn on heat (signal 0x31) when temp (signal 0x12) is less than 68 degrees
truth engine architecture
Actuator Layer

• Outputs
  – Heating Unit
  – Lights
  – Extension: IR Transmission (e.g., TV, Stereo)
Neat Things

- Play with IR
- Build and experiment with a processor
- Implement something we can use in the real world

Questions?