SEAS Computing Facility
Raspberry Pi Workshop 3:
Internet of Things with Cayenne

October 28, 2017
Overview

- Introduction to Cayenne
- Controlling triggers, outputs and actions without programming
  - Program a push-button ON/OFF input system for LED
  - Connect and program motion sensor with LED
What is Cayenne?

- Cayenne is an app for smartphones and computers that allows you to control the Raspberry Pi through a graphical user interface.
  - Add and remotely control sensors, motors, actuators, GPIO boards, and more
  - Customizable dashboards with drag-and-drop widgets for connection devices
  - Create triggers and threshold alerts for devices, events, and actions
  - Schedule one-time or multi-device events for easy automation
  - Allows remote desktop
Getting Started

● Create an account at https://cayenne.mydevices.com
● Follow the instructions to connect the Raspberry Pi
● After the Raspberry Pi restarts, go to cayenne.mydevices.com
● When you are done, the Dashboard should appear

Terminal commands:
  ○ wget https://cayenne.mydevices.com/dl/rpi_3a6ljvjptb.sh
  ○ sudo bash rpi_3a6ljvjptb.sh -v
Cayenne Dashboard
Circuit Basics

- Ohm’s Law: $V = IR$
  - $V$: Voltage (volts)
  - $I$: Current (amperes)
  - $R$: Resistance (ohms)
- LEDs have a maximum current
- Ohm’s Law (rewritten): $I = V / R$
  - To keep current ($I$) low, resistance ($R$) must be high enough

**Absolute Maximum Rating**

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Absolute Maximum Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward Current</td>
<td>$I_F$</td>
<td>20</td>
<td>mA</td>
</tr>
<tr>
<td>Peak Forward Current</td>
<td>$I_F$</td>
<td>120</td>
<td>mA</td>
</tr>
<tr>
<td>Reverse Voltage</td>
<td>$V_R$</td>
<td>5</td>
<td>V</td>
</tr>
<tr>
<td>Power Dissipation</td>
<td>$P_T$</td>
<td>85</td>
<td>W</td>
</tr>
<tr>
<td>Operation Temperature</td>
<td>$T_{op}$</td>
<td>-35° to 85°</td>
<td>°C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>$T_{stg}$</td>
<td>-40° to 80°</td>
<td>°C</td>
</tr>
<tr>
<td>Lead Soldering Temperature</td>
<td>$T_{s}$</td>
<td>Max. 200° for 3sec Max.</td>
<td></td>
</tr>
</tbody>
</table>

*Note: Conditions: Pulse Width 10μsec, Duty Cycle 1/10
*Tooled Conditions: 4mm from the base of the epoxy bulb

**4-Band Code**

- 4-Band Code: 2%, 5%, 10%
- 5-Band Code: 0.1%, 0.25%, 0.5%, 1%, 5%
- Tolerance: ±1% (F), ±2% (G), ±0.5% (D), ±0.25% (C), ±10% (B)
- Multiplier: $10$, $100$, $1000$

**1st Band & 2nd Band**

- Black: 0
- Brown: 1
- Red: 2
- Orange: 3
- Yellow: 4
- Green: 5
- Blue: 6
- Violet: 7
- Grey: 8
- White: 9
- Gold: 11
- Silver: 12

**3rd Band & Multiplier**

- 3rd Band: 0, 1, 2, 3
- Multiplier: 1, 10, 100, 1000

**5-Band Code**

- 5-Band Code: 237
- Tolerance: ±1%
Breadboard

Diagram from Tweaking4All
Connecting an LED to Cayenne

- Connect the positive (long) side to pin 23
- Connect a resistor between the negative (short) side and ground
Connecting an LED to Cayenne
Adding an LED to Cayenne Dashboard

In the Cayenne dashboard, navigate to the 'Devices & Widgets' section. Expand the 'Actuators' category and select 'Light'. Then, choose an LED option for your device, such as 'Red LED' and select 'Raspberry Pi' and 'Integrated GPIO'. Next, choose the 'Channel' and 'Choose Icon'. Finally, configure the LED settings to your desired brightness and behavior.
Dragging Devices to the Dashboard
PIR Motion Sensor Detector Module

- Time Delay Adjust
  - Clockwise increases delay
- Sensitivity Adjust
  - Clockwise decreases range
- Pins
  - Power: Should be between 5 and 20 V input
  - Ground: Should be connected to ground
  - Output: Will be 3.3 V if activated, 0 if not

Diagram from Henry’s Bench
Creating Triggers with Motion Sensor

[Diagram showing a motion sensor and its settings options.]
Creating Triggers with Motion Sensor & LED
Creating Triggers with Motion Sensor & LED
Adding Notifications

Triggers

**if** Raspberry Pi

- Digital Motion Sensor (MotionSensor, Channel 24)
  - On (1)
  - Off (0)

**then** Raspberry Pi

- Send a notification
- Add custom recipient
  - 
- Add more recipients?

- Select All
- Send Text Message (requires mobile phone number)
- Send Email
Extension Ideas from Last Week

Easy:
- Take video for 10 seconds after motion detected
- Time-lapse photography

Medium:
- Use button to activate or deactivate security system
- Have multiple LEDs represent how long since motion was detected
- Use secret code in terminal to deactivate security system
- Define your own functions in your code

Hard:
- Send email with photo of intruder (consider smtplib)
- Take photo upon receiving specific email