

Senior Design

May 14, 16 : Tool Checkout Vending Machine

seniord.ece.iastate.edu/may1416

Team

- Client / Advisor : Leland Harker
- Design Team
 - Computer Engineering
 - Sean McCracken (group leader)
 - Philip Goodman (communications)
 - Kevin Wong
 - Electrical Engineering
 - Mohd Zulkalnain
 - Brian Sewell

Overview

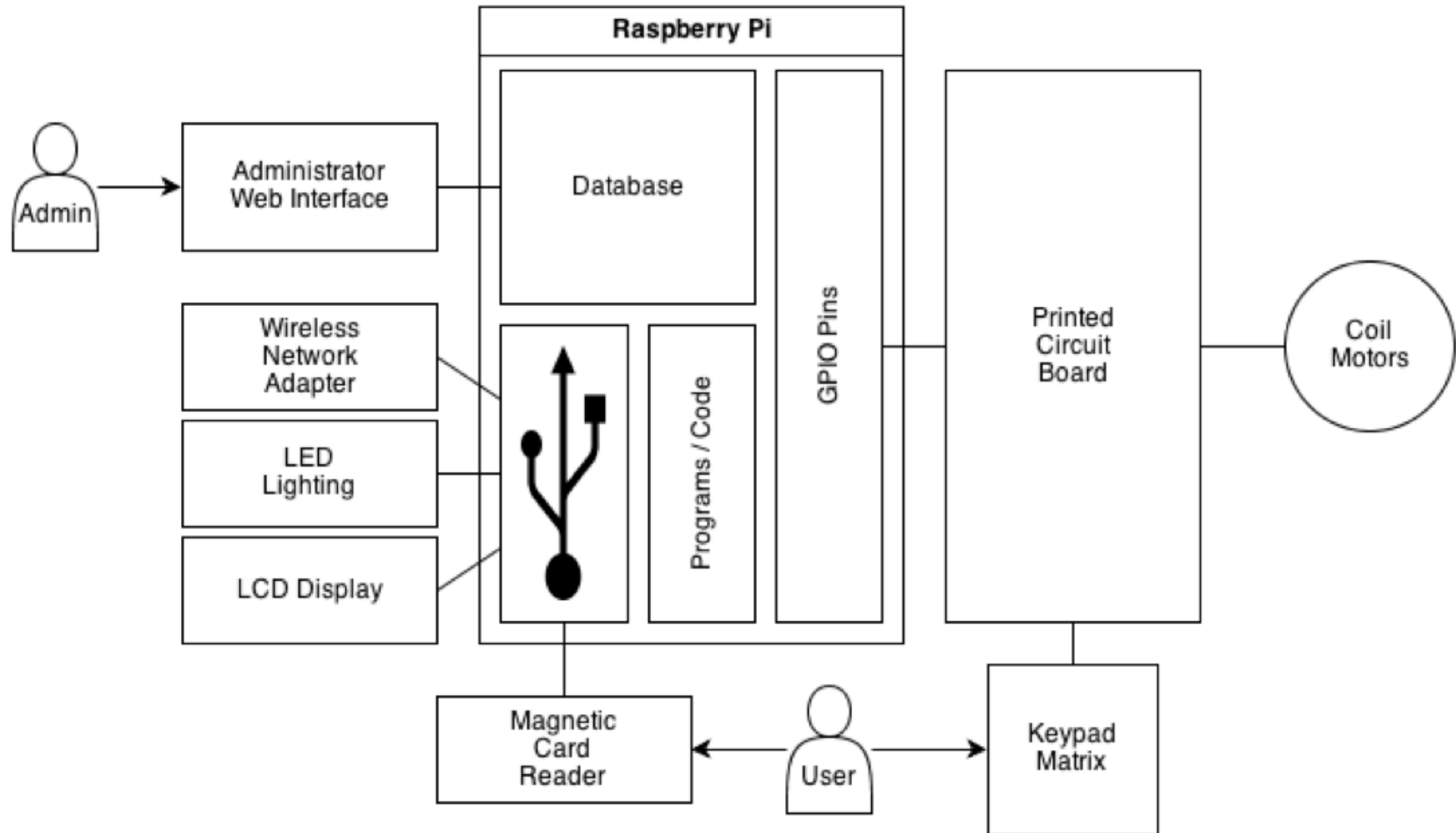


- Similar to a library lending arrangement
- Students swipe ID and select desired product
- Tool record added to authorized student database
- Admin checks in returned tools in CSG electronic shop, modifies student database

Project Plan

- Problem Statement
 - Need of tools and materials outside of standard electronic shop working hours
 - Student work could be hurt by restricted access time frames

Project Plan



Project Plan

- Functional Requirements
 - Vend products to authorized students
 - Authenticate students based on machine database
 - Read student input regarded desired vend item
 - Communicate information on an easy-to-read display
 - Maintain safe operations
 - Give administrator access to student and machine databases

Project Plan

- Non-functional Requirements
 - Clean up machine
 - Paint & adapt machine to ISU theme
 - LED lighting in machine

Project Plan

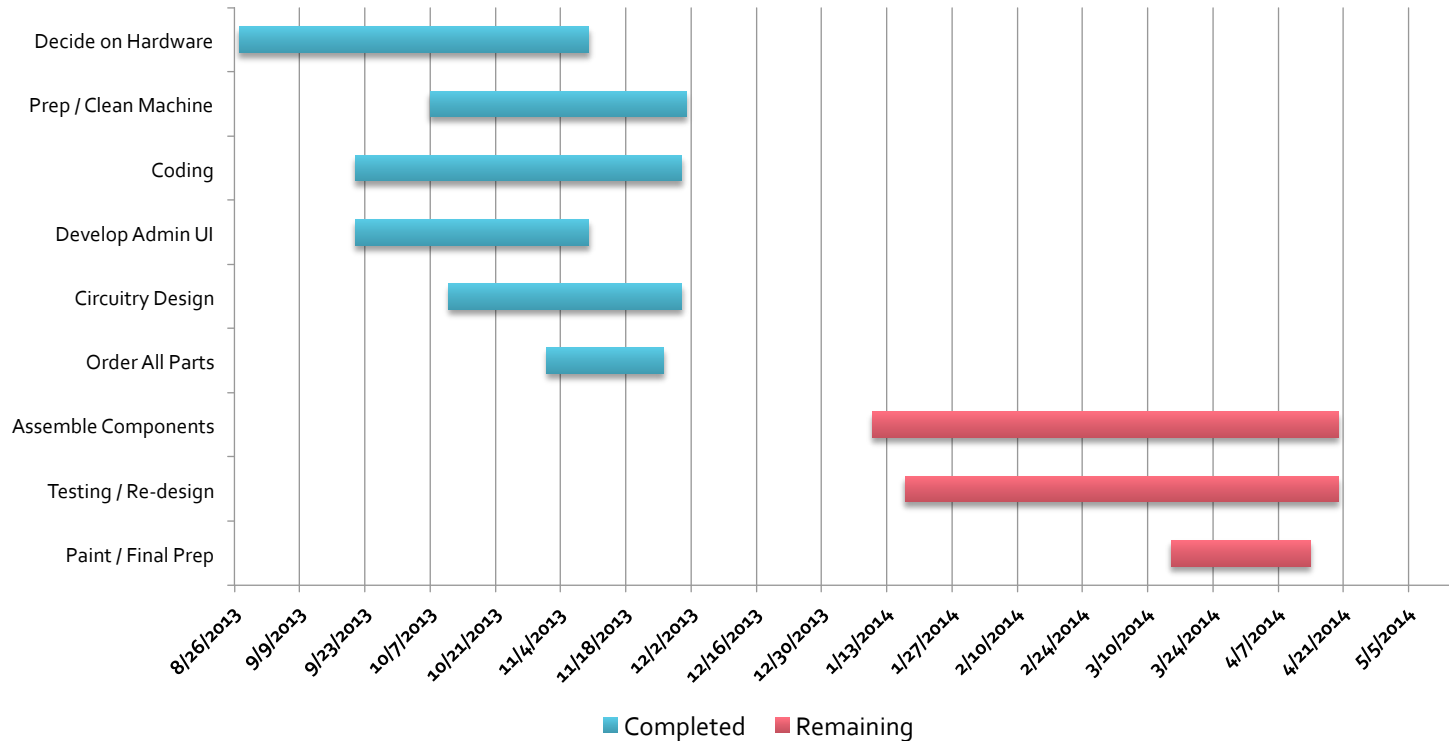
- Market Survey
 - Similar scholarly projects
 - Raspberry Pi peripherals

Project Plan

- Risks
 - Machine Breakdown / Malfunctions
 - Power Issues
 - Database Loss
 - Mechanical Safety
 - Logic Bugs

Project Plan

■ Schedule



System Design – Raspberry Pi

- Apache Server
 - Provides administrator websites
- Database
 - Student Information
 - Tool Inventory
- Python Scripts
- LCD Screens
- Wireless Network Adaptor
- GPIO Pins
 - Motors
 - Matrix Keypad

System Design – Matrix Keypad



- 10-pin matrix
- Connected to GPIO pins on Raspberry Pi
- Functionality
 - Read pressed column
 - Read pressed row
 - Get value from pre-determined 2d array

System Design – Magnetic Reader



- Connects to USB port on Raspberry Pi
- Reads & parses student ID (9-digit) from ISU card
- Used to track users within database

System Design – LCD

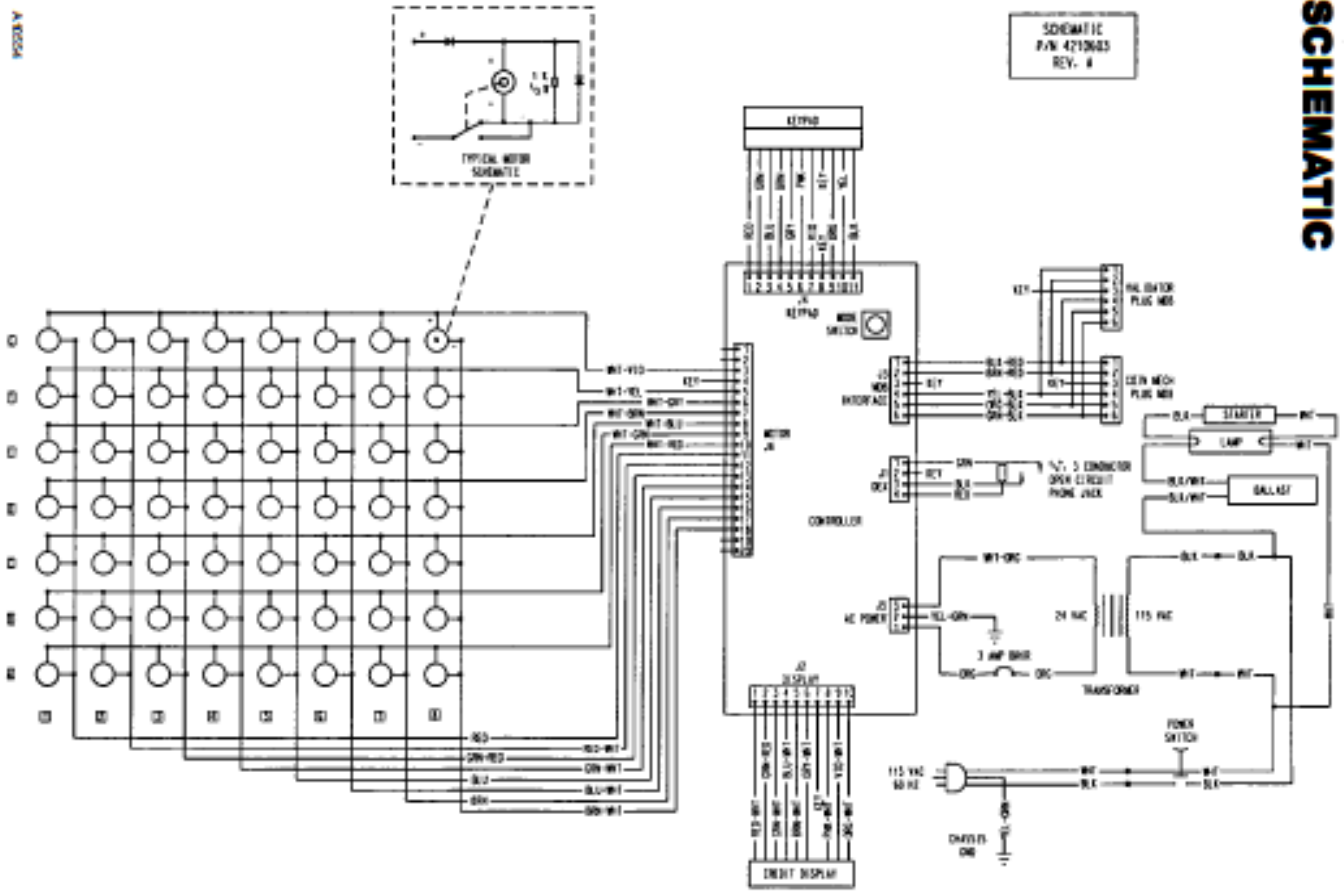


- Connects to RCA video output on Raspberry Pi
- Displays relevant information to user
- Shows appropriate web page based on last user input (determined by scripts on Raspberry Pi)

System Design – Motors / Drivers

- Goal : Drive motor
- Possible solution:-
 - MOSFET
 - Drivers
- Solution:-
 - Drivers : Lesser pins
 - High Side : UDN 2978 (Allegro)
 - Low Side : TLE 6225 (Infeneon)

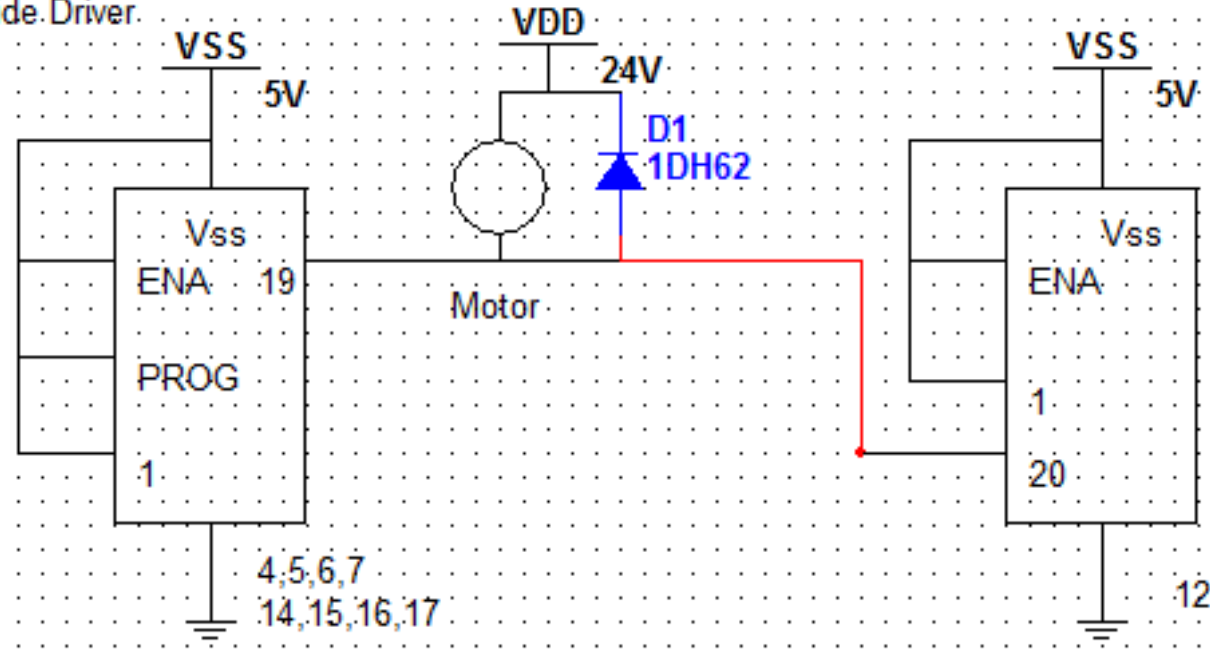
System Design – Motors / Drivers



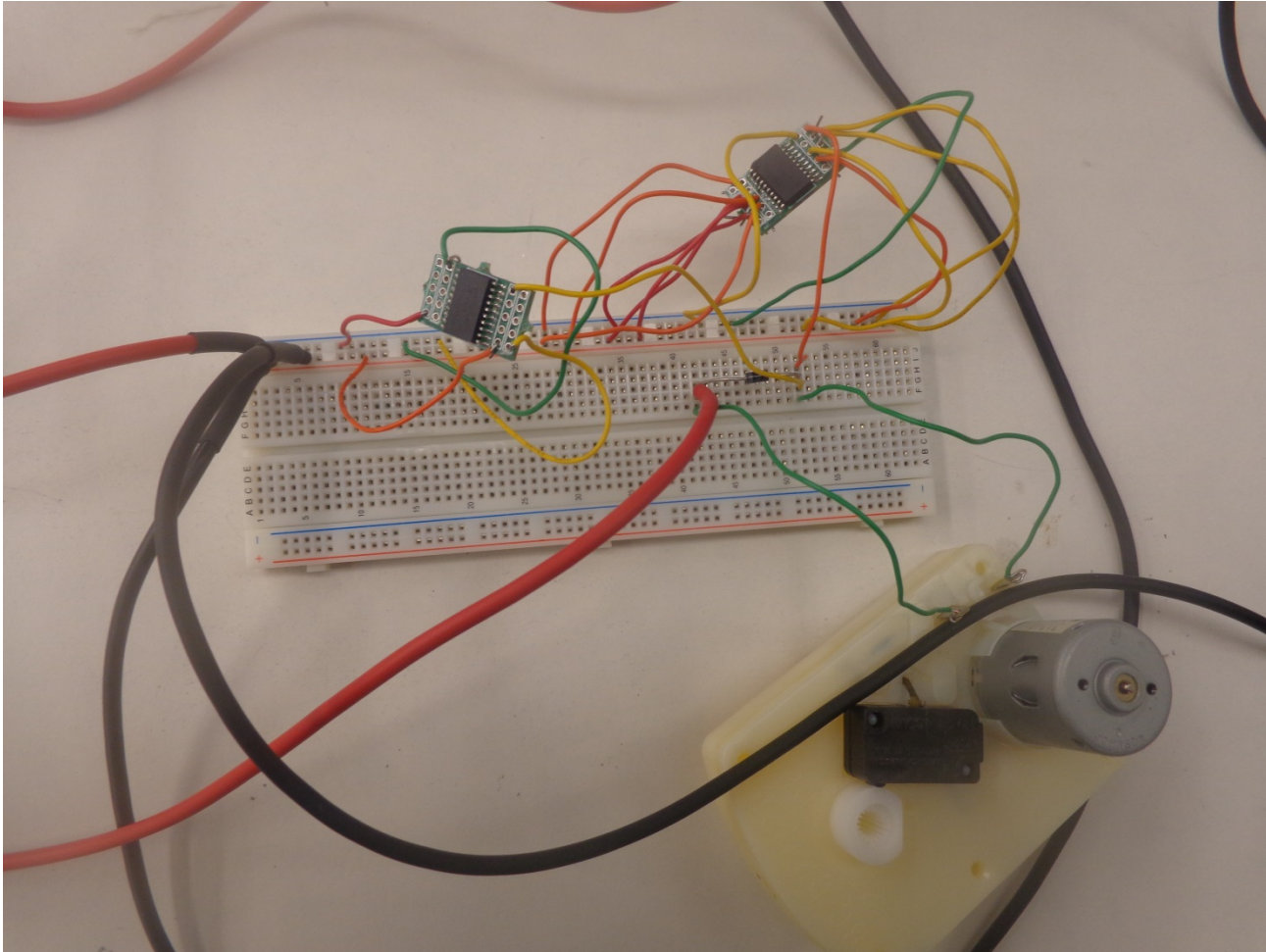
System Design – Motors / Drivers

TLE 6225
Low Side Driver

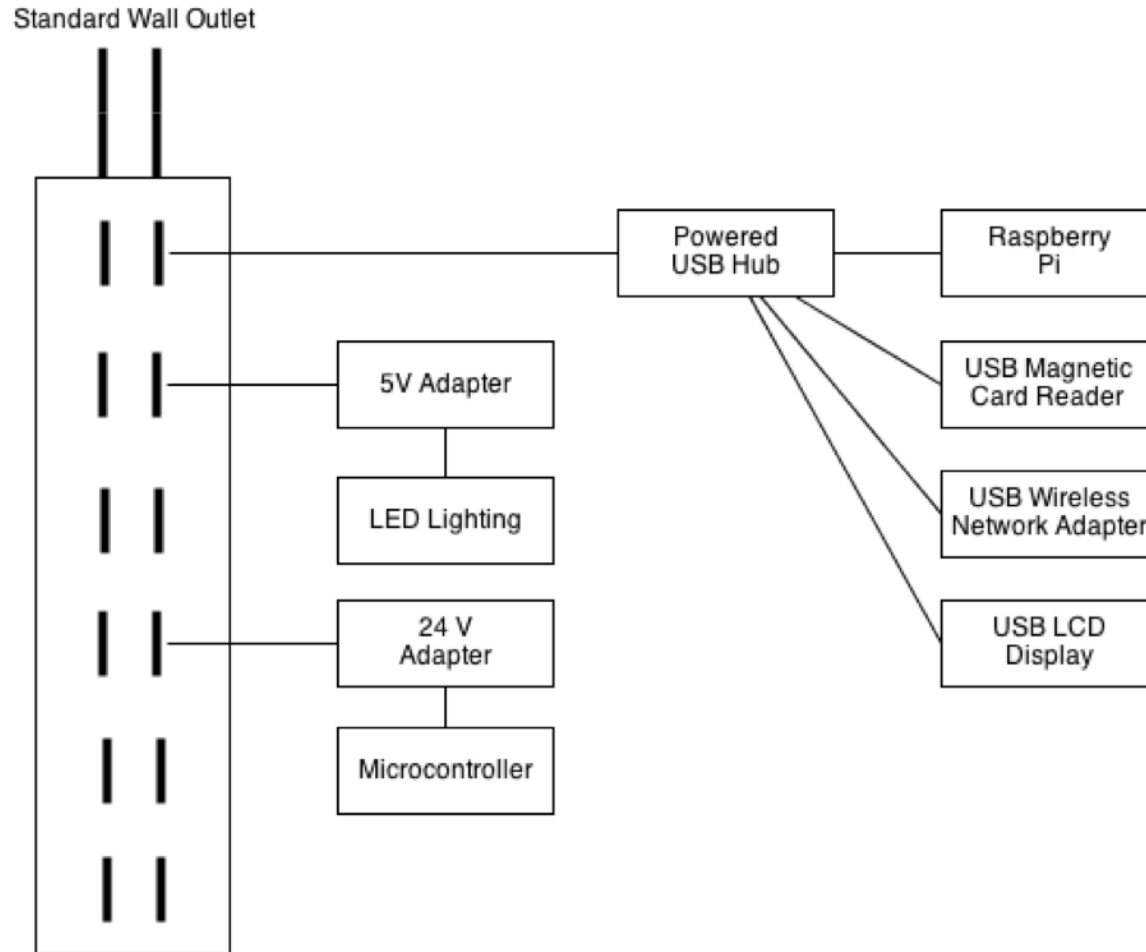
UDN 2987
High Side Driver



System Design – Motors / Drivers



System Design – Power



System Design – Administrator

CprE Tool Vending - Database

Machine

Add Student ID:

Remove Student ID:

Search By ID:

User: 533931398

Tool	Date Taken	3
screws	11/04/2013	<input type="button" value="Check In"/>
screwdriver	11/04/2013	<input type="button" value="Check In"/>
breadboard	12/09/2013	<input type="button" value="Check In"/>
		<input type="button" value="Check In"/>
		<input type="button" value="Check In"/>

System Design - Administrator

CprE Tool Vending - Machine

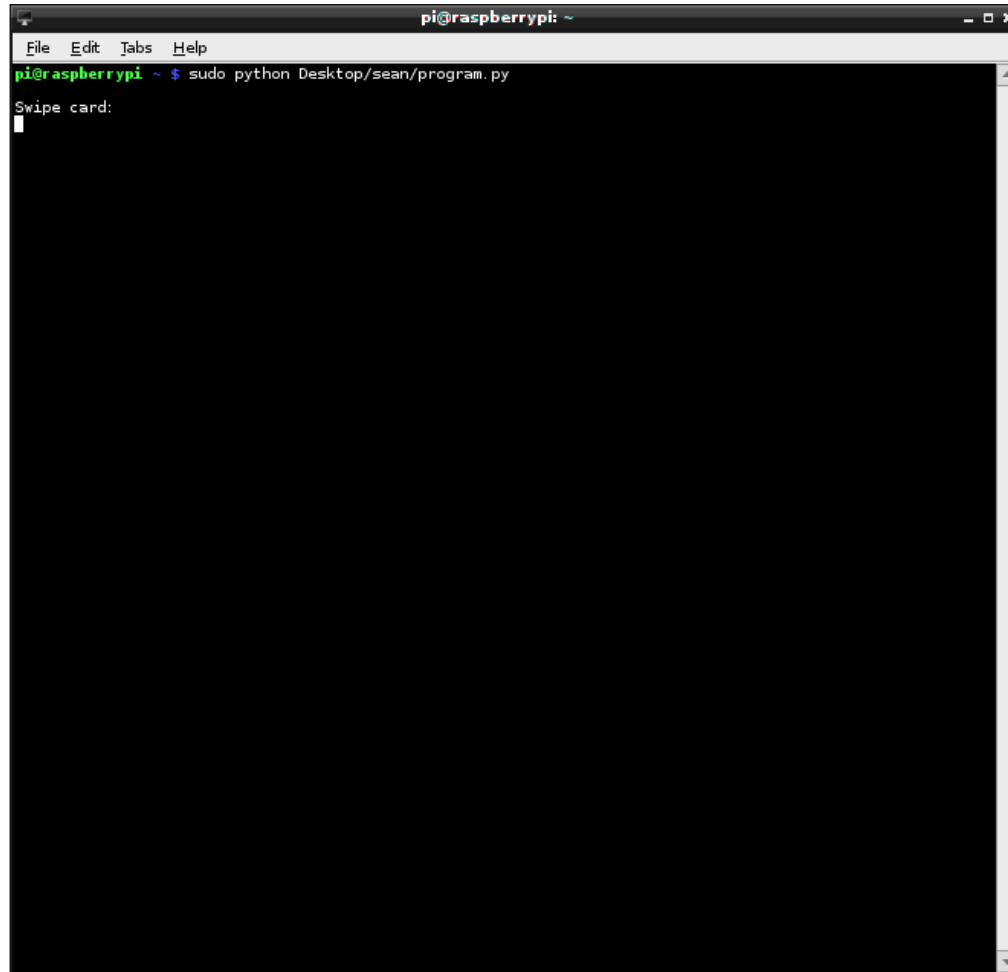
Database

Position: [A] [1] Product: Inventory:

Position: [A] [1] Inventory:

Position	Product	Full	Left
A1	screwdriver	5	4
A2	breadboard	5	0
A3	pliers	5	5
A4	wire cutters	5	5
B1	screws	10	9
B2	resistors	10	0
B3	diodes	10	9
B4	capacitors	10	9

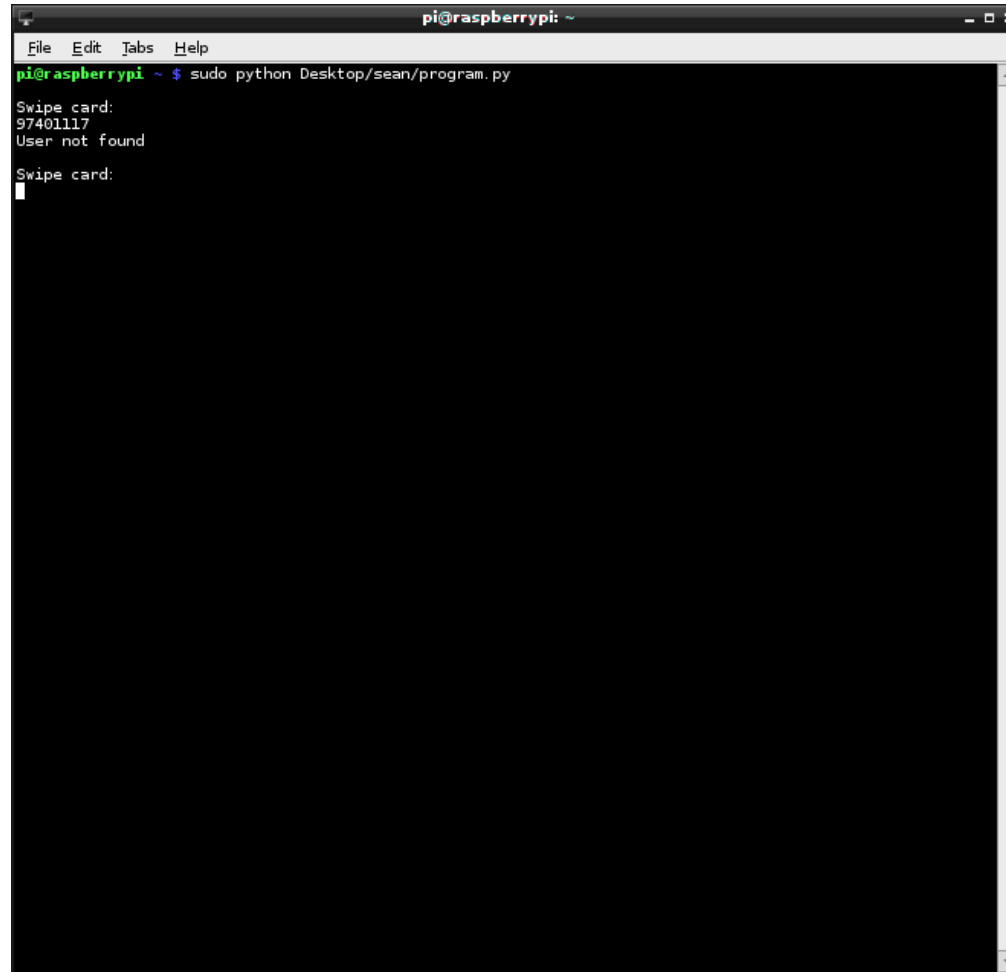
Machine Scripting - Start



```
pi@raspberrypi: ~  
File Edit Tabs Help  
pi@raspberrypi ~ $ sudo python Desktop/sean/program.py  
Swipe card:  
█
```

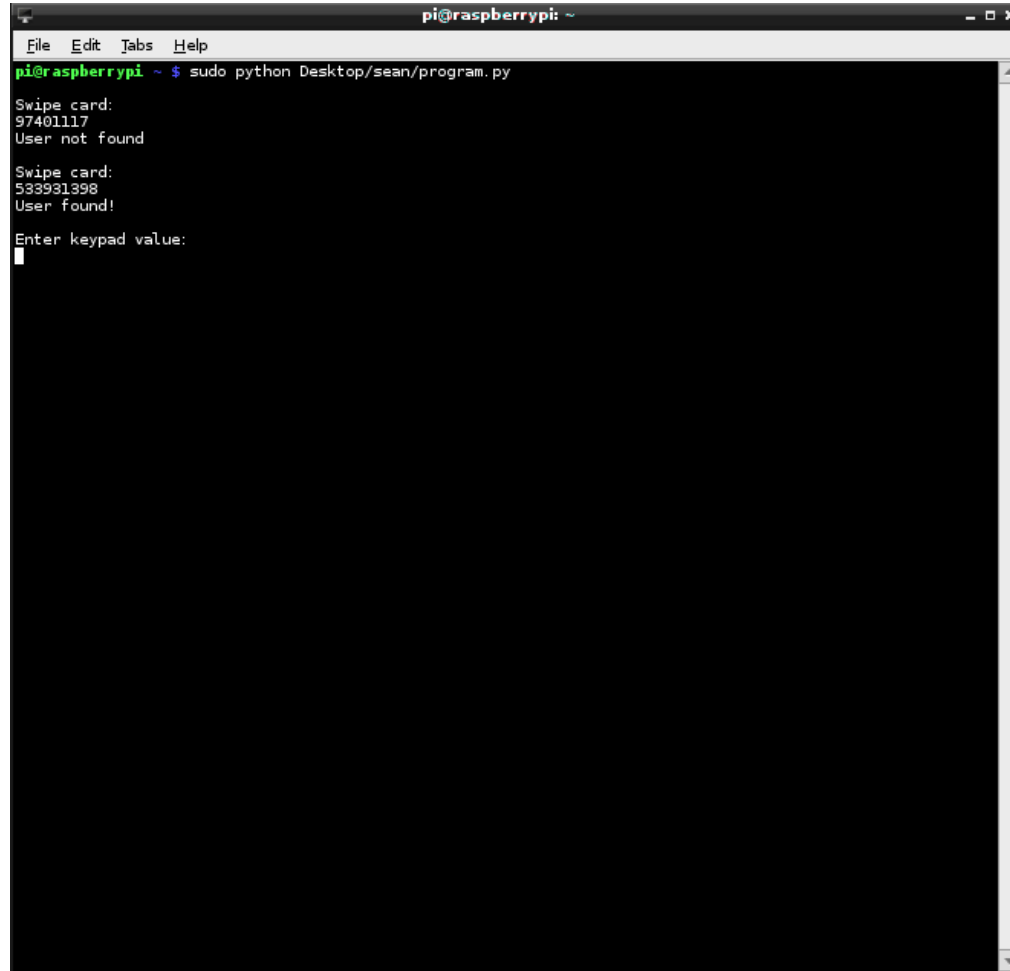
A terminal window titled "pi@raspberrypi: ~" with a menu bar containing "File", "Edit", "Tabs", and "Help". The terminal shows a command prompt where the user has entered "sudo python Desktop/sean/program.py". The output of the script is "Swipe card:" followed by a small black square character (█) on the next line. The terminal background is black, and the text is white.

Machine Scripting – Invalid User



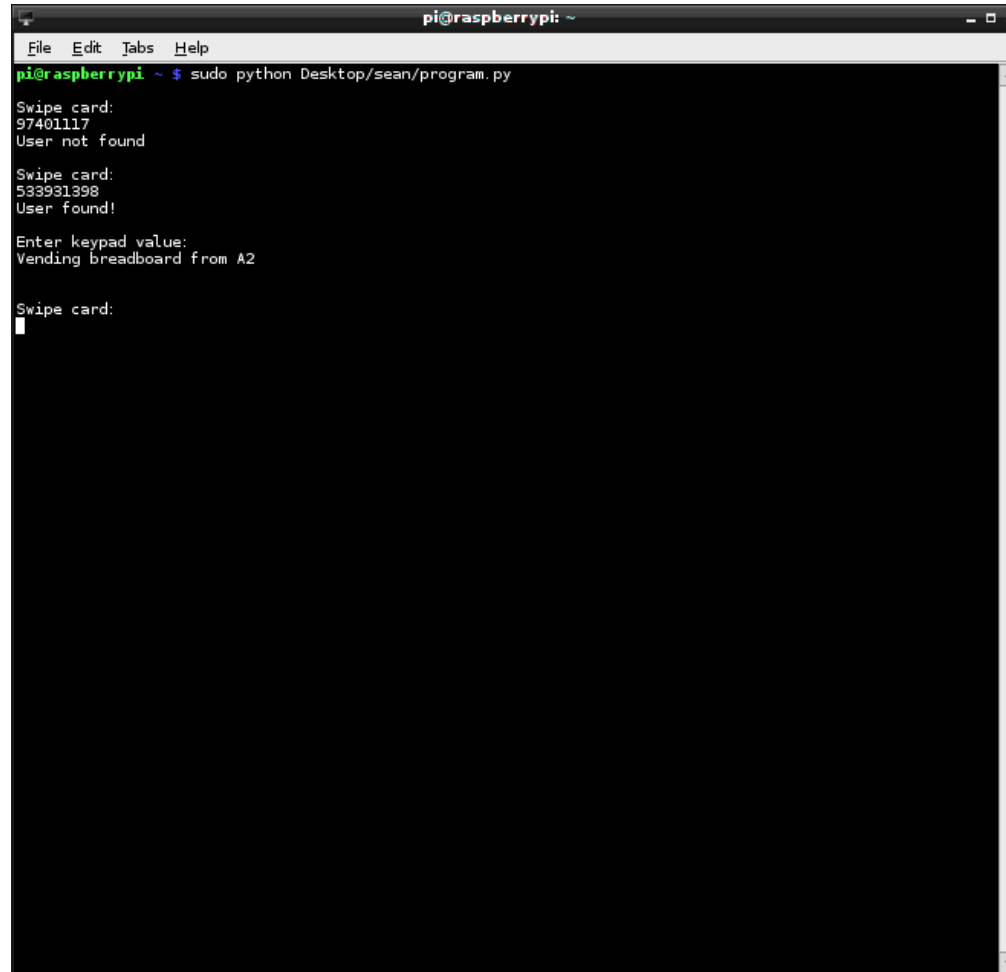
```
pi@raspberrypi: ~  
File Edit Tabs Help  
pi@raspberrypi ~ $ sudo python Desktop/sean/program.py  
Swipe card:  
97401117  
User not found  
Swipe card:  
█
```

Machine Scripting – Valid User



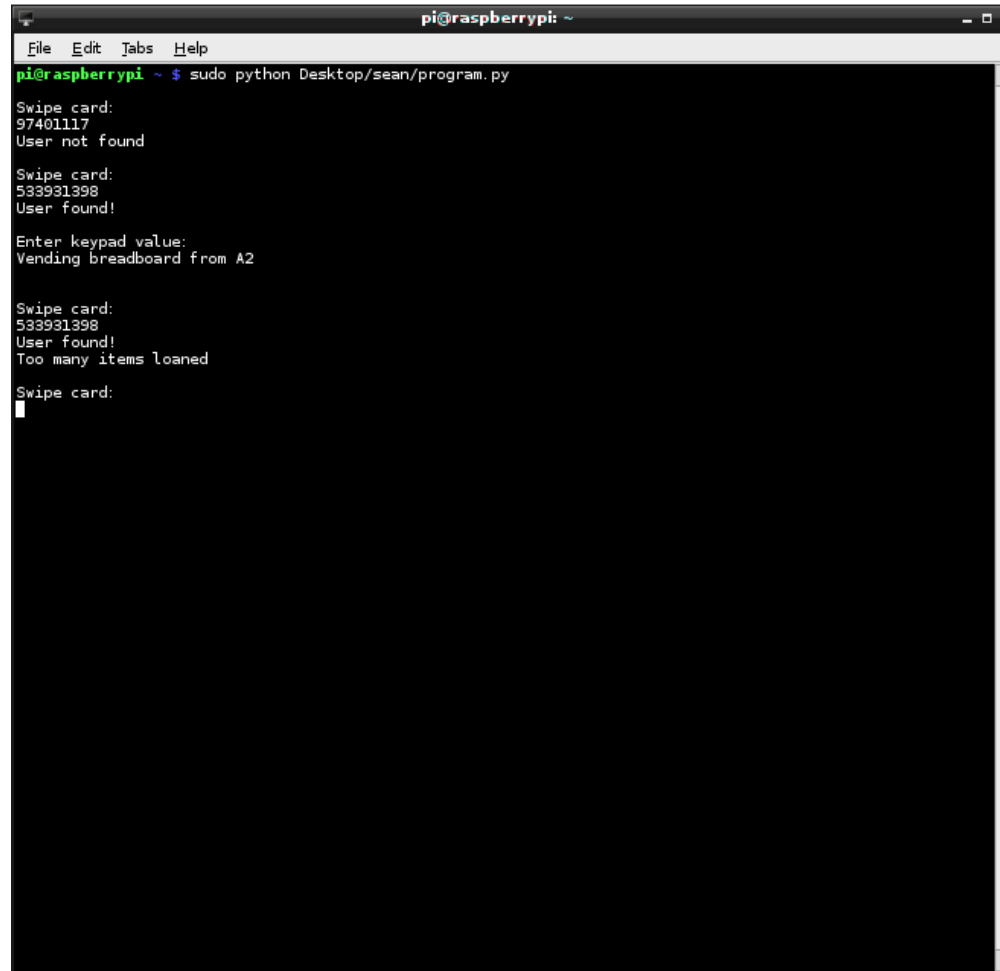
```
pi@raspberrypi: ~  
File Edit Tabs Help  
pi@raspberrypi ~ $ sudo python Desktop/sean/program.py  
Swipe card:  
97401117  
User not found  
  
Swipe card:  
533981398  
User found!  
Enter keypad value:  
█
```


Machine Scripting - Vending



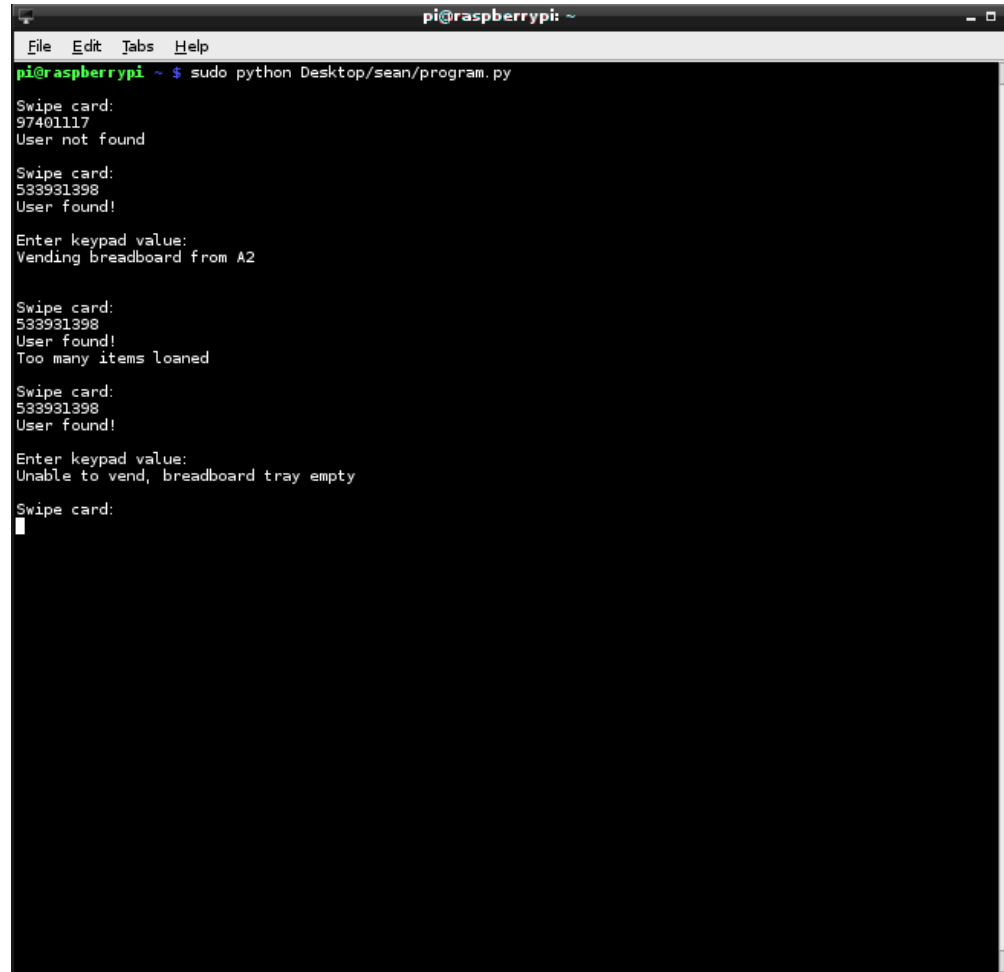
```
pi@raspberrypi: ~  
File Edit Tabs Help  
pi@raspberrypi ~ $ sudo python Desktop/sean/program.py  
  
Swipe card:  
97401117  
User not found  
  
Swipe card:  
533931398  
User found!  
  
Enter keypad value:  
Vending breadboard from A2  
  
Swipe card:  
█
```

Machine Scripting – Full User



```
pi@raspberrypi: ~  
File Edit Tabs Help  
pi@raspberrypi ~ $ sudo python Desktop/sean/program.py  
  
Swipe card:  
97401117  
User not found  
  
Swipe card:  
533931398  
User found!  
  
Enter keypad value:  
Vending breadboard from A2  
  
Swipe card:  
533931398  
User found!  
Too many items loaned  
  
Swipe card:  
█
```

Machine Scripting - Empty



```
pi@raspberrypi: ~  
File Edit Tabs Help  
pi@raspberrypi ~ $ sudo python Desktop/sean/program.py  
Swipe card:  
97401117  
User not found  
  
Swipe card:  
533931398  
User found!  
  
Enter keypad value:  
Vending breadboard from A2  
  
Swipe card:  
533931398  
User found!  
Too many items loaned  
  
Swipe card:  
533931398  
User found!  
  
Enter keypad value:  
Unable to vend, breadboard tray empty  
  
Swipe card:  
█
```

Conclusion

- Plan For Next Semester
 - Finalize circuitry
 - Assembly of machine components
 - Testing / Redesign
 - Paint / Prep Machine