MOTUS Control

Smart Room Control System

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Outline

- Overview and motivation: Promotional Video
- Goals
- High level system overview
- Business Case
- Projected/Actual timeline
- Budget
- Separation of tasks and team roles
- Issues encountered
- Conclusion and lessons learned
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- Questions?

Overview and Motivation

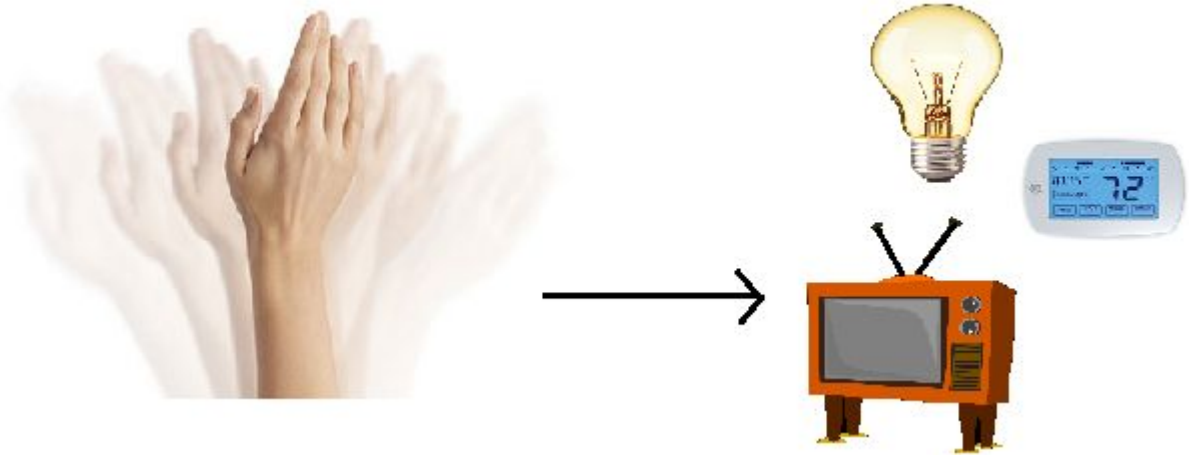
MOTUS CONTROL

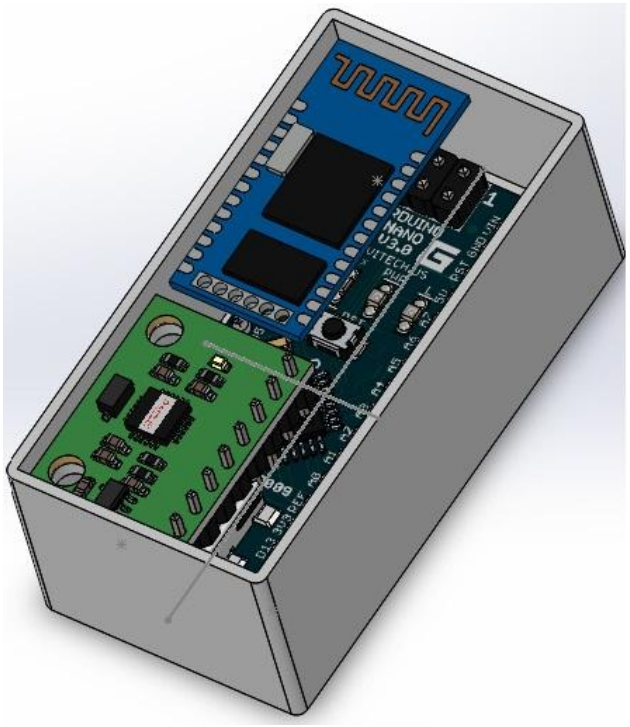
Motivation

- For those who are not fully disabled, there are tasks which although not impossible, are difficult enough to add stress to everyday life
- To alleviate this, we can give them the ability to accomplish these tasks with no more work than a normal person
- Allows them to function with minimal caretaker assistance
- Additional sensors and functionality allow a caretaker to remotely monitor their status

High Level Overview: Gesture Controller

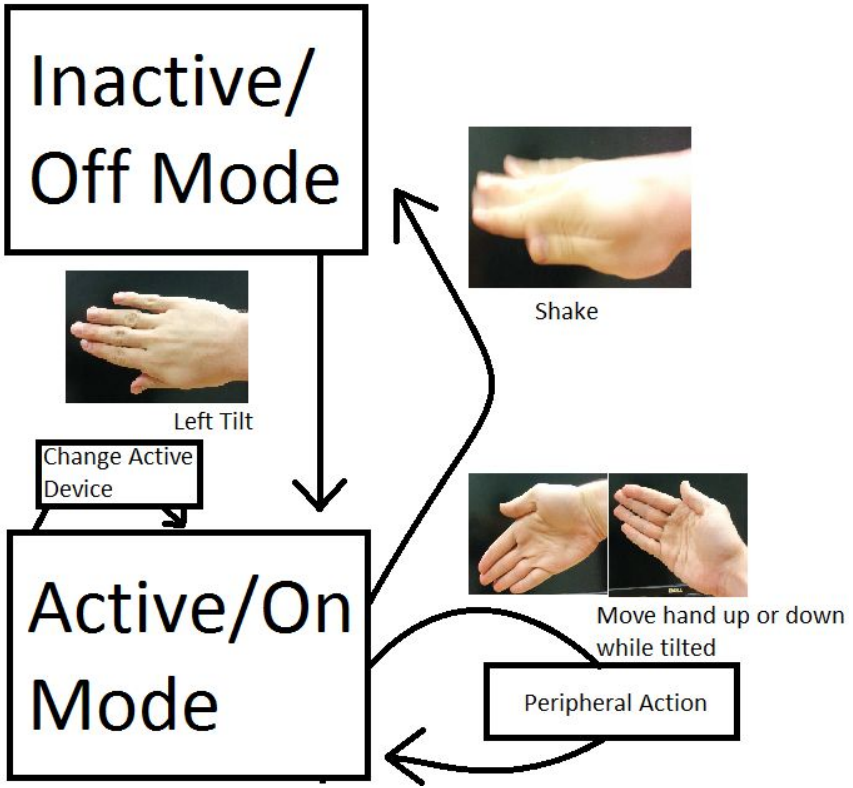
- System has two main parts
- First part is the motion controller via hand gestures
- Simple hand gestures can be used to control multiple peripherals



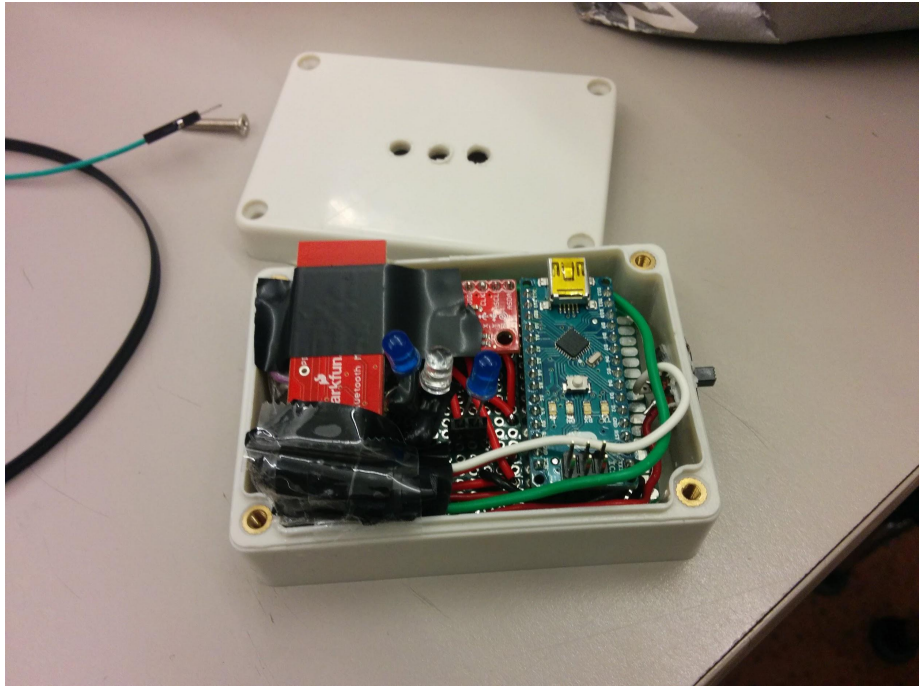


Gesture Controller: Detail

- Our gesture controller uses an accelerometer/gyroscope to sense the movement of the portable device
- The device enters active mode when held to the left for one second, to prevent accidental gestures
- Continuing to hold it to the left cycles between different devices



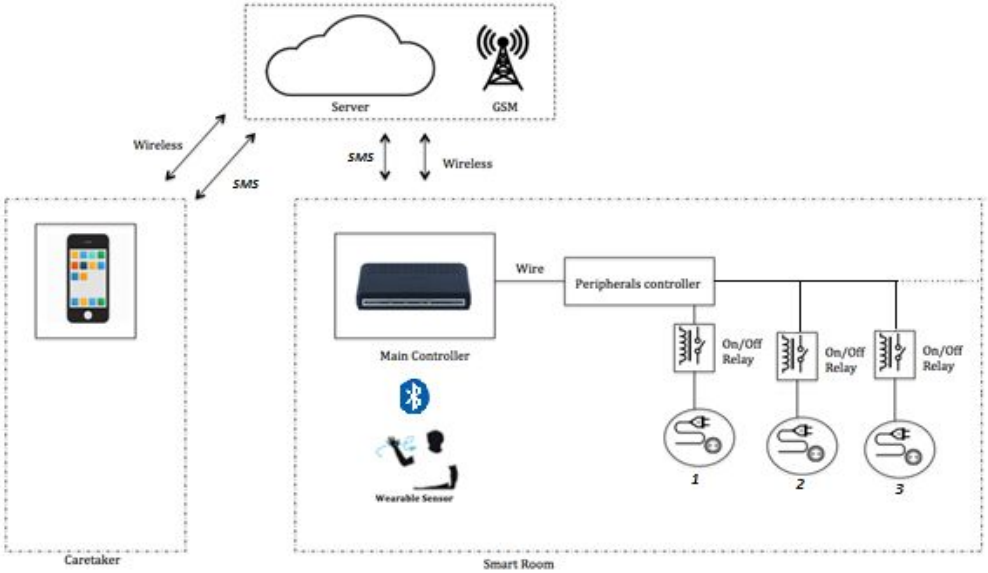
Gesture Controller: Hardware



- For the gesture controller, we used an Arduino Nano, a Bluetooth module, and a MPU (Motion processing unit)
- We also added a few LEDs to provide feedback to the user as to whether the device is active
- It is housed on a prototyping PCB, and is as small as we could get it
- With industrial manufacturing techniques, could be much smaller

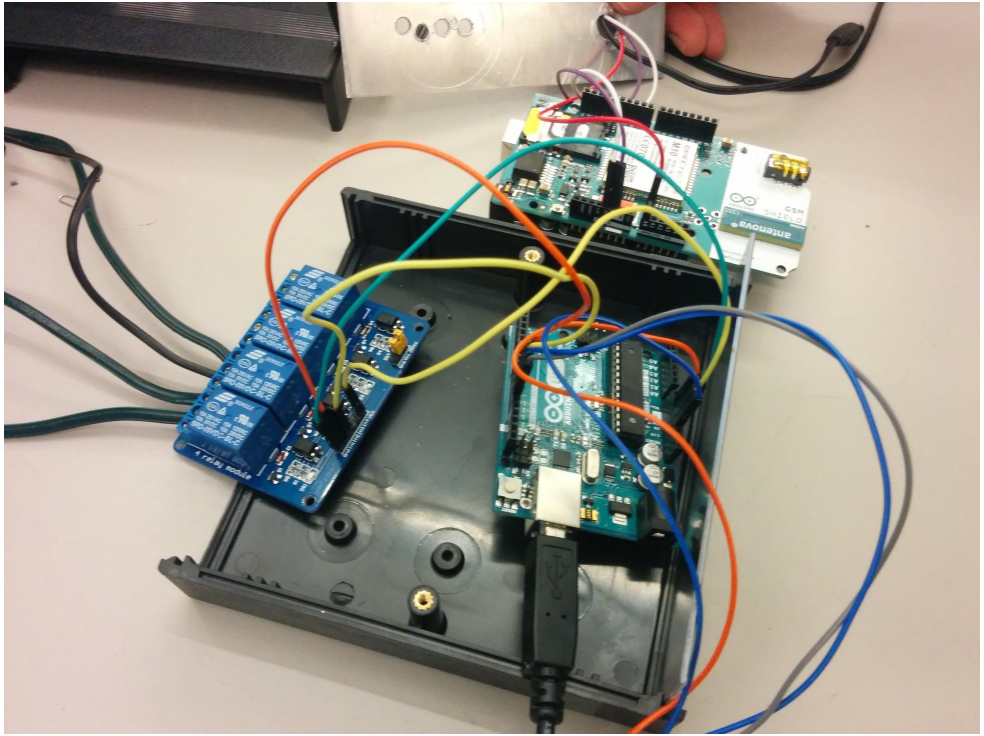
High Level Overview: Main Controller

- Second part of system is made up of a sensor hub
- The hub can measure multiple properties of the room including temperature, humidity, and light
- Has bluetooth, wifi, and SMS capabilities for relaying information
- Provides the physical connection for the motion-controlled peripherals

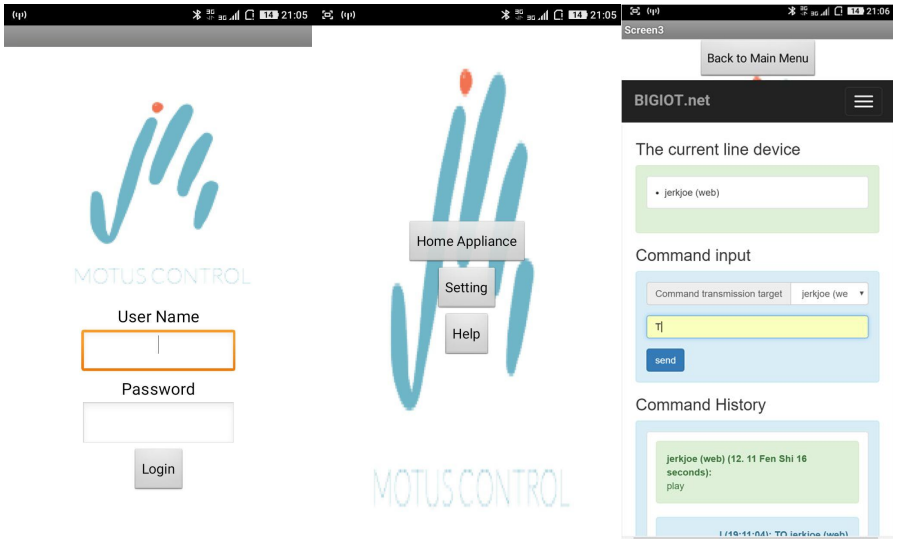


Main Controller: Hardware

- The Main controller uses an Arduino UNO board, a power relay, a Bluetooth module, a Wifi module, and a GSM shield (provides SMS capability)
- It is housed in a simple black box, which can be easily connected to lights and appliances in the home



High Level Overview: Companion Application

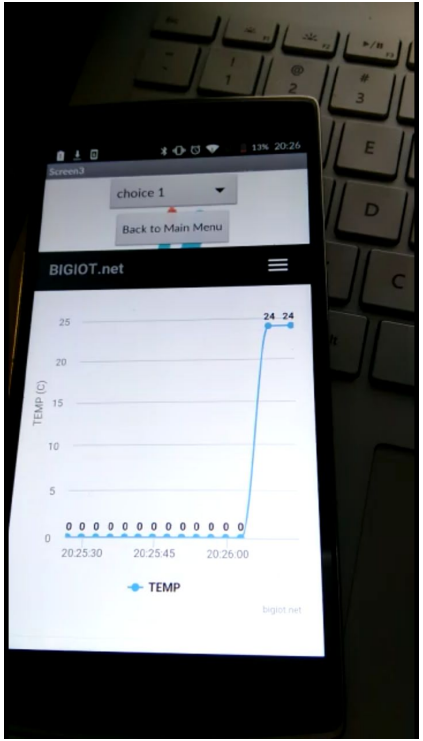


- Provides a medium from which to read the sensor data
- Keeps track of past data and provides graphs
- Can also use to control the same peripherals as the hand gesture system

Companion Application: Graphing

-Our application has the ability to show the graph of our sensor readings over time

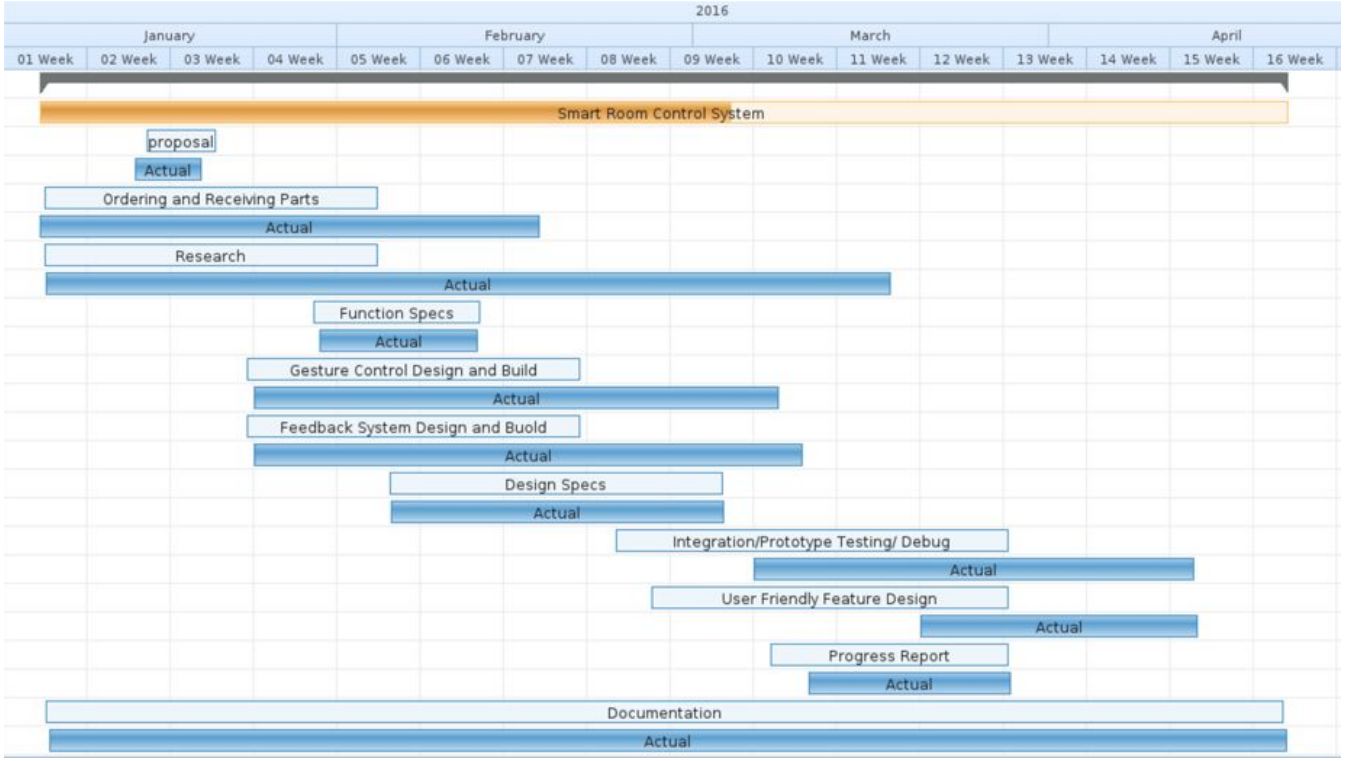
-This helps the caretaker to make sure that everything is functioning correctly



Business Case

Features	MOTUSCONTROL	INSTEON Solution [1]
Light Control	✓	✓
Wall Switches	✓	
Thermostat	✓	✓
SMS	✓	
Control using phone Application	✓	✓
Control using hand gestures	✓	
Cost	$401.75	$480

Project Timeline



Budget

Equipment	Estimated Cost
Arduino Uno Board * 2	CAD $33
Arduino Nano Board	CAD $45
Arduino Bluetooth Mate Silver * 2	CAD $ 46 * 2
Triple Axis Accelerator & Gyro Breakout	CAD $40
Wifi Module Huzzah	CAD $14.25
Arduino GSM Shield	CAD $105
Battery Holder, 9V * 2	CAD $ 6.90 * 2
9V Battery	CAD $9.5 * 2
LED Spot Light	CAD $12 * 2
Flame Sensor	CAD $1.2
Digital Humidity & Temperature Sensor	CAD $13
Enclosure, Instrument Case * 2	CAD $11.50
Total Cost	**CAD $401.75**

Team Roles and Specialties

Adrian Fettes

- Motion control coding
- Solidworks design
- General assembly
- Sensor setup and coding

Moha Alharbi

- Motion control coding
- Relay setup
- General assembly
- Sensor setup and coding

Saad Alkhalifah

- Main controller coding (Relay)
- SMS functionality
- Bluetooth connection
- System integration
- Testing
- General assembly

Yuhui Jin

- Wifi module setup and coding
- Companion application
- Sensor coding
- Testing

Ryadh Almuaili

- Main controller coding (Relay)
- Bluetooth connection
- Subsystem integration
- Testing

Main Problems Encountered

- Web application/server usage
  - None of us had ever created servers or web applications
  - It was difficult to decide on requirements with little knowledge
- Arduino Sensor and Module Setup
  - Some broken libraries for sensors
  - Wifi module was unstable
  - Unable to use wifi module with SFU wifi, need to use unstable phone hotspots
- Battery setup
  - 9V battery too large, need to use smaller cells, but no case
  - Improvised connection to smaller cells unstable at times, losing power
- Hand Module Casing
  - Wanted to create and 3D print case using Solidworks
  - Decided against due to lack of experience, bought a box which was slightly too small
  - Had to alter circuit board size to fit in box

Future Improvements

-- Build a web server on our own.We currently use a third party web server with predefined functions.

-- Used 3D print technology to get the case for different modules.

-- Use rechargeable battery for hand gesture control module.

Conclusion

- The bulk of the work was deciding exactly how to do the assembly as well as the code

- With our current experience, we could probably recreate the project in less than a week

- Wireless communications can be unreliable with low power systems

Acknowledgements

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Questions