



California State University Bakersfield

Department of Computer and Electrical Engineering and Computer Science

Group 2: Smart House

Abstract

The project that is being presented in this paper, is to have voice-controlled lights. Use your phone, a simple circuit, and an Arduino. Users will be able to communicate with their lights to be able to command the lights to turn off or on, using the microphone on their phone. The simple circuit will consist of an Arduino, an HC-05 Bluetooth chip that will be able to connect to the user's phone, LEDs (representing the lights or anything else that requires power that you wish to control with your voice). The goal of the project is to design a circuit that will allow users a convenient way to control their lights. The project targets many different groups of users all the way from individuals who are unable to walk to the users who enjoy the convenience of not having to get up to click a switch on or off. In both groups, it will make the users' life that much easier and more convenient.

Overview

As our project we decided to create a device that would be able to turn a house into a smart house. We planned on doing this by using an HC-05 Bluetooth chip. We had to write code and wire up the HC-05 chip up to control different devices in a house. To demonstrate those devices, in this project we used two lights and a door that would be able to be controlled via your phone. Using text to speech or just text to control the devices. We created a model house to represent a real house because we did not have the means or access to be able to work on a real house. Of course, if this chip was to go into a real house there would be more requirements and more things to think about. The overall goal of the project was to write the code and be able to get the HC-05 chip up and working.

Contribution

Software-Jakob James, Osvaldo Aranda

Hardware-Stergios Biternas, Juan Zazueta, Gabriel Castro, Maite Gonzalez, Jakob James, Osvaldo Aranda

3D house-Stergios Biternas, Maite Gonzalez

Software Overview

We needed to code the hc-05 chip to be able to control the different devices. We use a program called Arduino. Which is just a terminal that you are able to write code in and then uploaded that code to the Arduino Uno. We used an app BT Terminal(available on the google play store). With this app and the code that we developed we were able to send specific strings to the system and do an action corresponding to the string.

Programs we used.



Pseudo code

We allow strings to be sent to the chip.

Make commands correspond to a specific string

Those commands set specific pins to high and low or turn on/of a servo motor.

Within those commands have actions such as turn on the lights

We test the sting to see if it matches any of the commands that were made.

If the string matches it will execute a command turn specific pin on or off.

Library that were used

```
#include <Servo.h>
```

We add the servo library to the code to be able to declare and the name an instance of the servo library. The library allows Arduino board to control a servo motor.

We are using the C++ standard library.

Code

```
String voice;
int bedroom = 2;
int kitchen = 3;
int door = 8;
void bedroomOn(){
digitalWrite (bedroom, HIGH);
}
void bedroomOff(){
digitalWrite (bedroom, LOW);
}
void kitchenOn(){
digitalWrite (kitchen, HIGH);
}
void kitchenOff(){
digitalWrite (kitchen, LOW);
}
#include <Servo.h>

Servo servo;
int angle = 10;
```

We create a string name voice

We create 3 int Bedroom, kitchen, door and door and their corresponding pin on the board

We create void function that will pass through one of the int made above and turn the pin high to low. This function will work for all the commands. (besides the servo commands).

We include the servo library

We set the starting degree of the servo to 10

Code conti

```
void setup() {
  servo.attach(8);
  servo.write(angle);
  Serial.begin(9600);
  pinMode(door, OUTPUT);
  pinMode(bedroom, OUTPUT);
  pinMode(kitchen, OUTPUT);
}

void doorOn(){
  digitalWrite (door, HIGH);
  {
    // scan from 0 to 90 degrees
    for(angle = 10; angle < 140; angle++)
      {
        servo.write(angle);
        delay(15);
      }
  }
}
```

We go into the video setup

Servo.attach(8) is using the servo library to be able to positioned the servo between 0 and 180

Servo.write(angle) allows use to set the servo to the specific angle

We make sure that the pin is set as an output so when it is high it will output power to power the device.

We have to set up a servo function. Thai one is going to be different then the one from above because we have to set the angle of the servo.

Code Conti

```
void doorOff(){
digitalWrite (door, LOW);
  // now scan back from 90 to 0 degrees
  for(angle = 140; angle > 10; angle--)
  {
    servo.write(angle);
    delay(15);
  }
}

void allon() {
digitalWrite (bedroom, HIGH);
digitalWrite (kitchen, HIGH);
}

void alloff() {
digitalWrite (bedroom, LOW);
digitalWrite (kitchen, LOW);
}
```

Once again the servo off is going to be a little different we need to control the angle of the servo.

The all on/off command are going to be similar to the other ones just add the extra function. So When the function is called upon later on it will run those the function.

Code Conti

```
if (voice.length() > 0) {
  Serial.println(voice);

  if(voice == "bedroom" || voice == "bedroom on"){
    bedroomOn();
  }
  else if(voice == "bedroom off"){
    bedroomOff();
  }
  else if(voice == "kitchen" || voice == "kitchen on"){
    kitchenOn();
  }
  else if( voice == "kitchen off" ){
    kitchenOff();
  }
  else if(voice == "door" || voice == "door on"){
    doorOn();
  }
}
```

Test to make sure there is something in the string, the string is larger than 0.

These are the corresponding commands. They are if else if statement. If the incoming commands matches it will call the function from above. These are not all the command they are all going to be the same.

For example the 1st if statement if the string coming in matches the "bedroom" then it will call bedroom() turning the coresspoing pin high. If not then it will continue to go through the commands.

Problems/Troubleshoot

- Some Issues we had with the code and writing it. Everytime that we wanted to uploaded the code to Arduino Uno would would have to disconnected all the wires.
- We had a dead board
- The app we used did randomly crash and not work properly sometime.

Future plans

We still were not able to find an app that work on app store for iphones. As well as the current app is not the greatest and we want to make something that is more adjusted to our project.

We still wanna added more devices to the system.

Figure out different ways to added the chip into a house

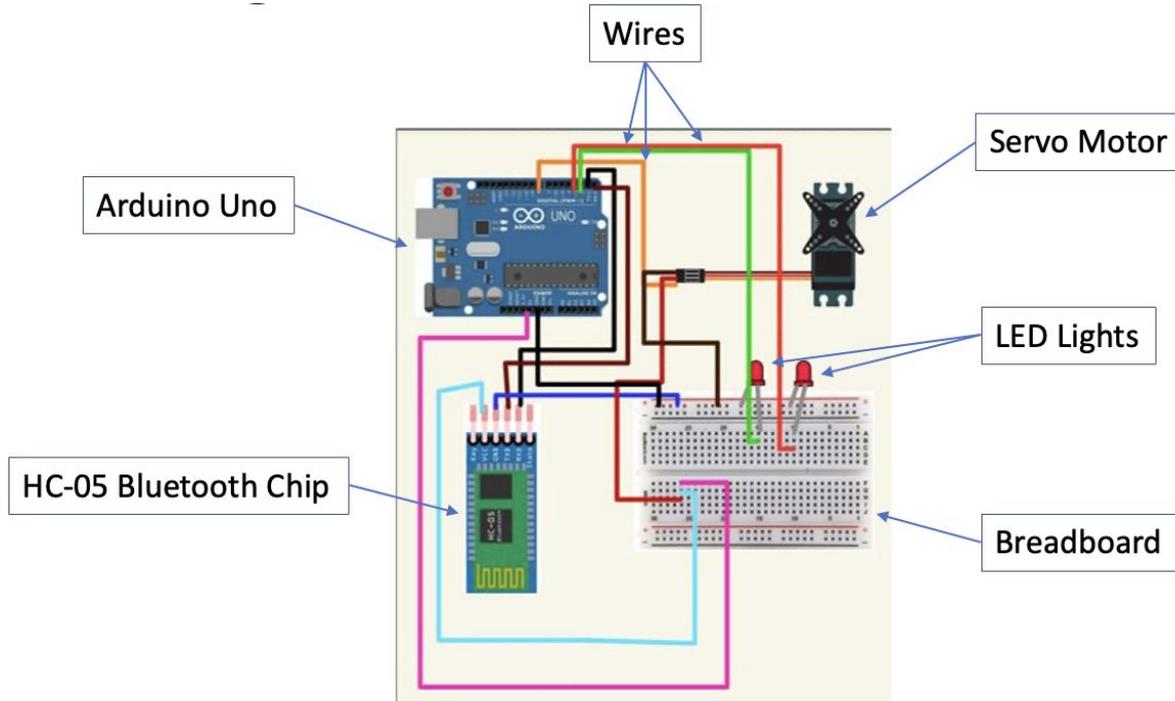
Future app

We want to create an app that is more tailored to our idea and project. We want to do this because we want both android and apple to have access to the app. The current app we are using is not the greatest. We want to make icon on the app so you do not even have to say or type what you want. The user just clicks on a light icon and it will turn off or on the lights. As well we want to create some type of system that allows you to customize your UI like you can on a regular phone. Adding widgets or in our case adding different devices to the UI. This is something that we did not have the time the start as we were still trying to setup the bluetooth chip.

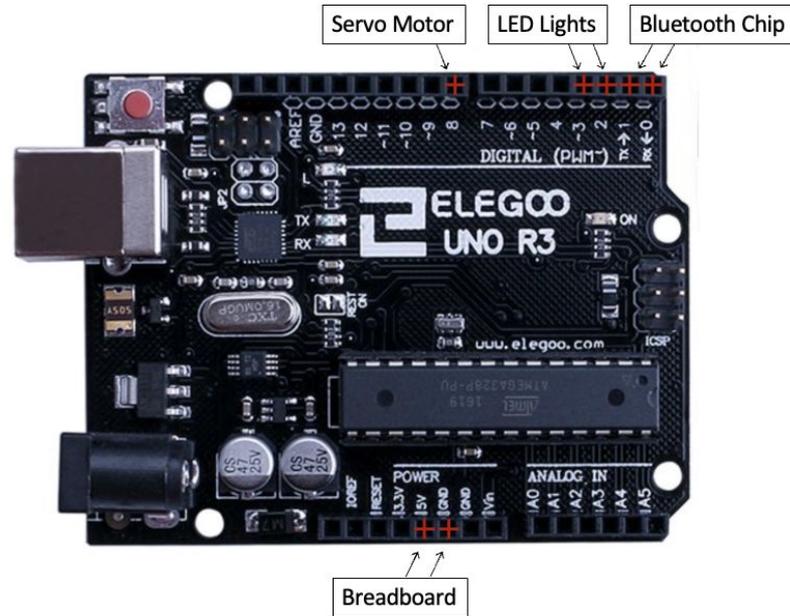
List of Items Used

- Arduino uno kit
 - Arduino uno
 - Breadboard
 - Wires
 - Led lights
 - 9v battery
 - Servo motor
- HC-05 Bluetooth chip
- Smart phone (android)

Circuit Design



Arduino Uno



HC-05 Bluetooth Chip



LED Lights



5 Colors x 30PCS

- Connected through the breadboard

Toggle on and off from commands sent to the Arduino

Servo Motor SG90



- Included in the Arduino uno kit
- Connects straight to Arduino
- Allows precise control of position, velocity, or acceleration
- Used to control open and close the door

Other Add-ons

DC Motor and L293D bridge



Temperature Sensor



Problems

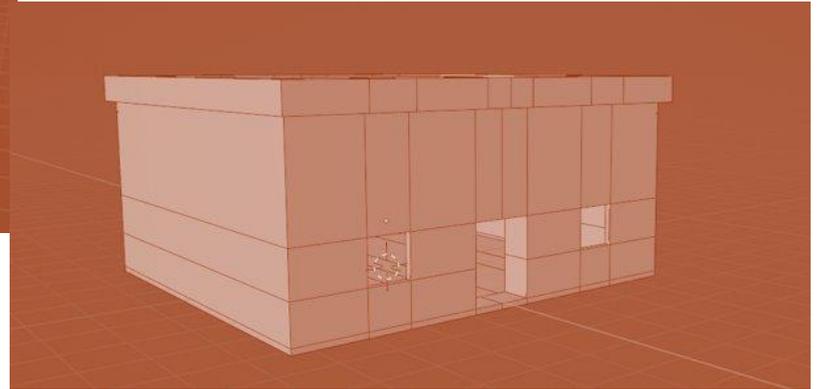
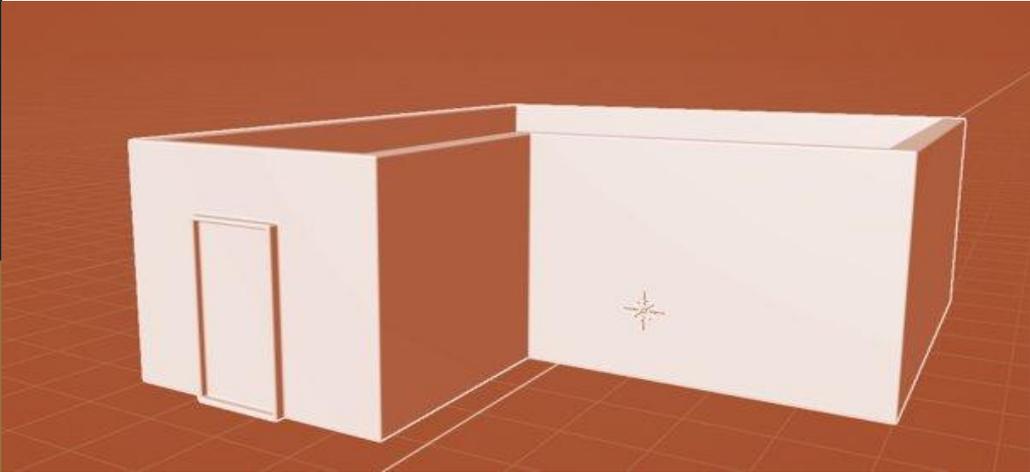
- Getting the door to work with the Servo Motor
- Seeing how to place the arduino and breadboard in the house
- Wires getting anything disconnected

Integration

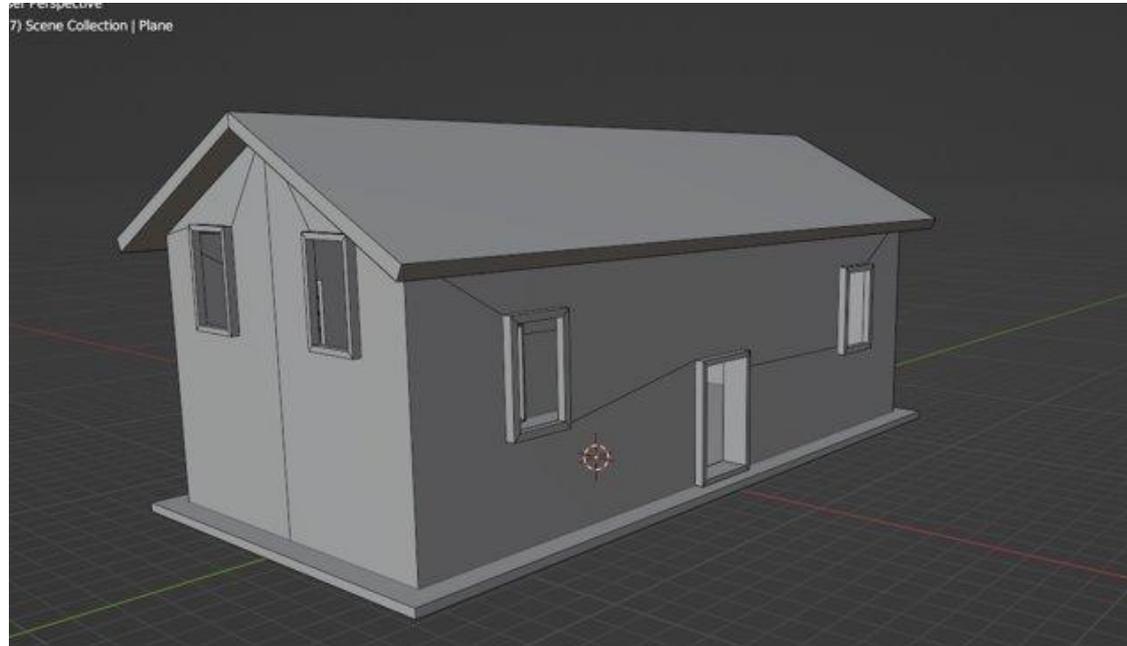
- We designed a 3D model of a house that we would 3D print as a demonstration of our applications utility.
- It was modeled in Blender 3D, and printed at the Fab Lab
- It contains door frames with a separate door model that can be opened by our app
- It also contains windows for us to see the the lights that we can turn on and off



Design



Design



Experiment

- For the experiment, we connected our app to the motors inside of the house that controlled the door swing.
- The application also turns off the LEDs inside of the house, which are meant to represent the lights of a real house.



Future Plans

We have also thought about more things to implement into the house. We thought about the idea of creating a smart plug. Which would plug into the outlet in the home. Using the Bluetooth chip would allow you to control the current running in the plug. Thus being able to control the device plugged into the smart plug.

Conclusion

In the end we learned alot from this class. What we learned from this class:

- How to work together as a team to accomplish a goal.
- How to time manage to be able to get the project done but the deadline.
- how to troubleshoot the problems that we had.
- learned how to do research for the our idea.
- We learned how to give a presentation on our idea.

References

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2. Sriwati, S et al. "Control of Electronic Devices Using Smartphone-Based Voice Identification." IOP Conference Series. Materials Science and Engineering. Vol. 662. IOP Publishing, 2019. 22004–. Web.
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4. M. Asadullah and K. Ullah, "Smart home automation system using Bluetooth technology," 2017 International Conference on Innovations in Electrical Engineering and Computational Technologies (ICIEECT), 2017, pp. 1-6, doi: 10.1109/ICIEECT.2017.7916544

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