

Smart Home

ENGR 2000 - Engineering Design III

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Problem Definition

- Home burglary is a common crime that happens more often than many people would think. Statistics reveal that there are almost three burglaries every minute in the U.S. and only 17% of U.S. citizens have security systems in their house.
- One of the most obvious energy wasting habits is leaving the lights on. This waste affects the environment and results in serious problems such as air pollution, water pollution and climate change. Moreover wasting electricity costs money
- The problem of flooding is very common and commonly it is appearing in river floodplains and coastal areas. It is very dangerous as it can result in serious injuries and has a potential to produce electrical arcs when water touches the electrical blocks in homes.

Functions

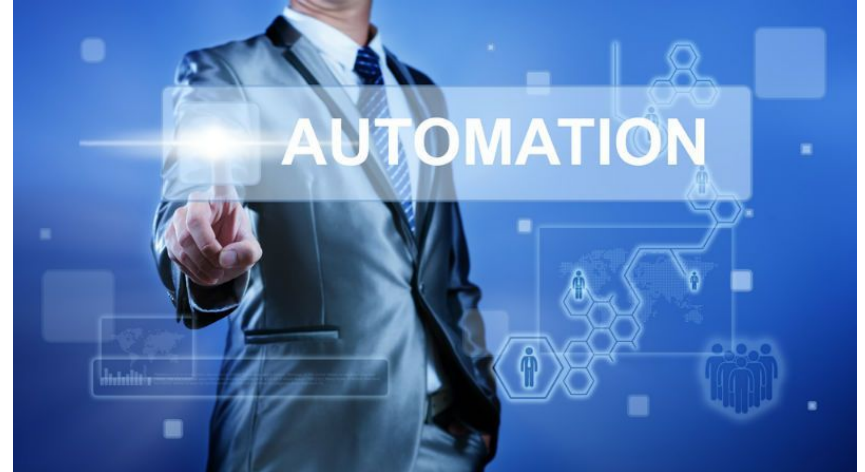
Smart home should be able to:

Performance	8
Safety	8
Simplicity	7
Maintenance	6
Affordability	7

- Detect movement outside and turn outdoor light for users walking into the house at night.
- Read the humidity and temperature level in the home and turn on the ventilation system if humidity is too high.
- Read when the front door is opened and the security system is on to alert the homeowner of an intruder.
- Alert the homeowner of any changes in the system through the bluetooth app and able to take commands via the app.
- Open/close the garage remotely and be time sensitive so personal contents are not at risk.

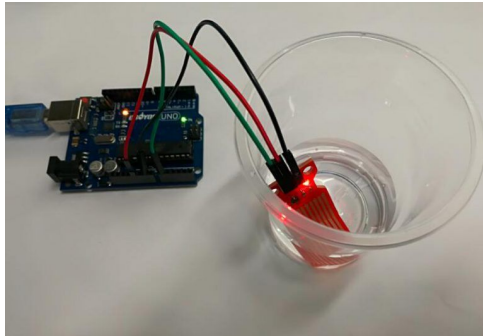
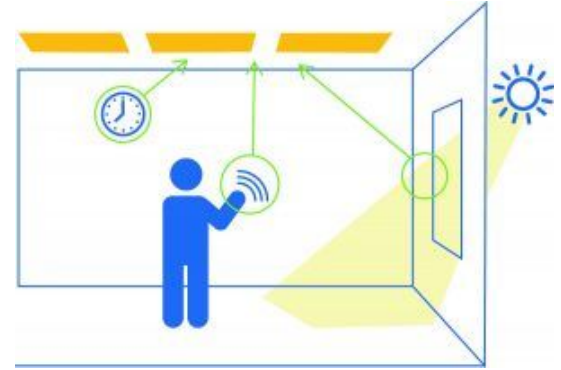
Objectives

- Elimination of human manual effort
- Cost-effective system
- Prevent strangers from breaking inside the home
- Warn household members of flooding and fire.



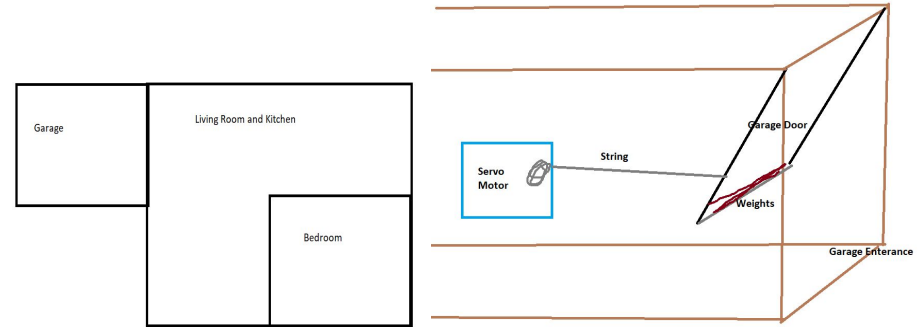
Constraints

- Must cost under \$40
- Required Features:
 - Automatic lighting inside and outside the house
 - Automatic ventilation
 - Security Alarm
 - Smart Garage
 - Automatic power off in an event of a flood inside the house

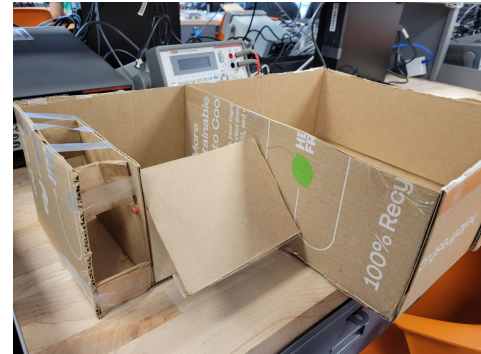


Alternative Designs

- First Solution:
 - Well Organized with Multiple rooms
 - All Wiring under the floor
 - Uses two microcontrollers
 - Used String to pull the garage door
 - Uses Switches on smart app
 - Too Complex to build
 - Expensive
- Second Solution:
 - Simpler Design
 - All Wiring are in the walls
 - Cheaper to build
 - Uses one microcontroller
 - Uses Switches on smart app
 - Less Space for each room
 - Hard to manage/adjust wiring



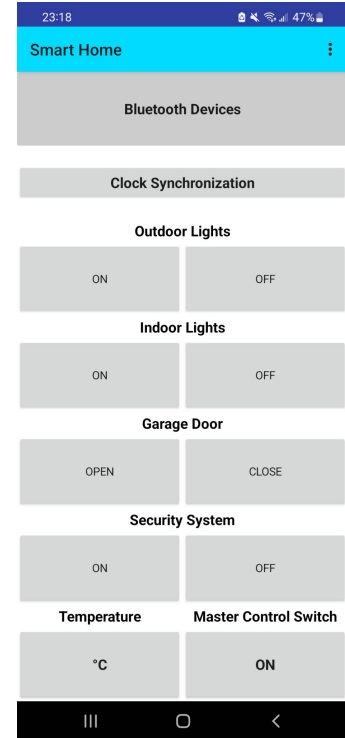
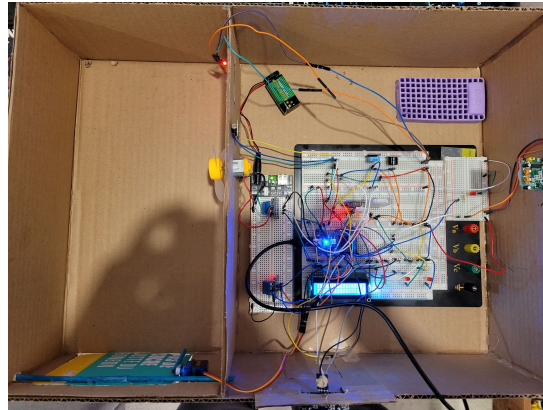
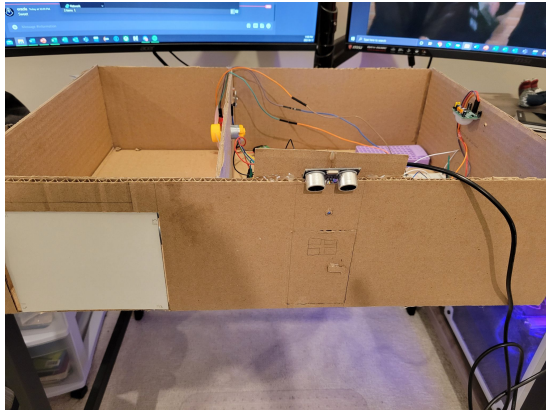
First Solution



Second Solution

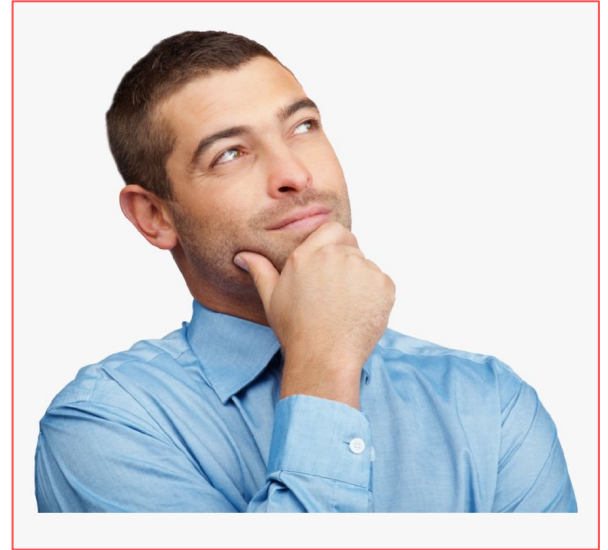
Final Design

- All wiring is throughout the home
- Choose a regular shaped frame for the house
- Uses buttons to turn on and off devices
- Garage Door using a dowel to push and hold the door



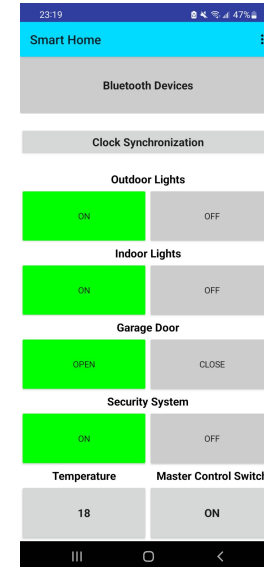
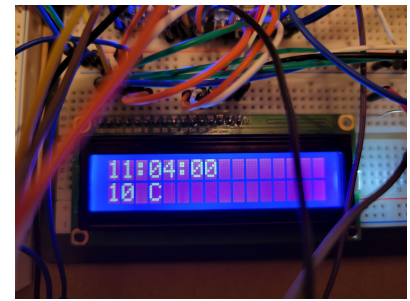
Reasons Why We Picked the Final Design

- Much cheaper to build
- Simple to build
 - No complex system/building
- Only uses one microcontroller
- Easier to use buttons than switches on the app
 - Allows users to tell which buttons are on/off
- Easier to manage/adjust wiring and components



Features

- Color Buttons to tell which device is on/off
- Clock synchronize button to sync the clock to the system and set the time for the whole home
- Master Control Switch to turn back on all devices connected to the app after a flood
- Temperature Button to change the temperature of room
 - Between 15 Degrees to 30 Degrees Celsius
- LCD display that shows the Time and Temperature
- Water Level Sensor to detect any water levels in home
- Photoresistor that turns on outdoor lights if it's nighttime
- Two wires connected at the door
 - When connection is broken, security alarm will activate
- Sensors inside and outside to turn on lights
 - Ultrasonic and PIR Sensor
- Humidity Sensor to turn on the fan.
 - Fan will turn on if the humidity is high



Components

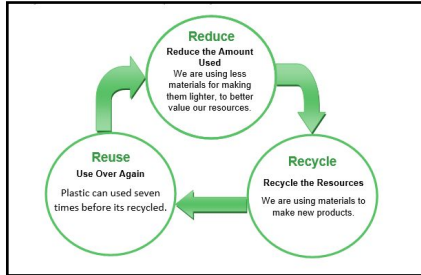
- MBed Microcontroller to
- Smart app to control certain devices
- Ultrasonic to turn outside lights on
- PIR to turn inside lights on
- Servo motor to open garage door
- Water level sensor to detect floods
- Fan to reduce humidity in the house
- Power Supply module to give constant power for devices
- LCD displays Time and Temperature
- Real-time clock to store the time from the app
- Buzzer to alert in break-in
- LED for lights inside and outside
- Bluetooth Module to connect the app with the microcontroller
- Photoresistor detect light levels outside the house
- Humidity & Temperature Sensor to detect humidity and temperature



Environmental, Social, Economic and Safety Considerations

Environmental:

- Used Cardboard to construct the house
 - Easy to reuse, reduce and recycle
- Did not use any harmful components that can affect users



Social:

- Making sure that the system is not intrusive
- Does not collect unnecessary information from users
- Only collects the time from the users phone and not personal data.



Environmental, Social, Economic and Safety Considerations

Economic:

- Used cheap/inexpensive material
- Easy to afford and install in houses
 - Cost Effective
 - Used a small amount of sensors/devices
 - Only one microcontroller



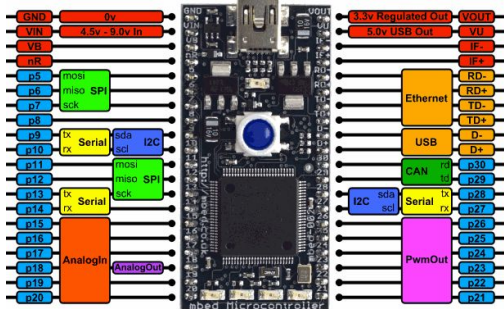
Safety:

- No sharp edges throughout the house
- No exposed wiring and components that can harm any users inside the house
- Structurally Supported



Limitations

- Limited on number of components due to:
 - Limited space on microcontroller
 - Amount of sensors
 - Amount of motors
- Limited on using only one microcontroller
 - To keep the design cost effective
- Framing of our house prototype is made out of cardboard



Conclusion

- Went through many considerable designs for our smart home
 - Many things can happen due to a lack of system
 - Break-ins
 - Floods
 - System failures
 - With the use of smart home, it prevents all these things from happening
-

Future Work

- Add more room for components
- Add passcode to turn of security alarm
- More LCD displays to show the day of the week and weather.



Thank You For
Your Attention!!



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