IOT SMART HOME SYSTEM

Planning Journal

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Robotics and Mechatronics

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1. Introduction and project overview

This project is to create a IOT smart home system. An IOT smart home is an "application of the Internet of things (IOT) that enables occupants to monitor, control conveniently, and oversee their home activities from any location (2021, Hindawi). As a result, this project will encompass and actively try to implement as many of these required aspects as possible. To integrate this into Arduino the required components of both outputs (LEDs, LCD displays, piezo, webserver) and inputs (buttons/switches, movement sensors, servo, MIC, other components).

The individualized focus for this project is to segregate the project into two sections: the outside and the inside. The outside of the smart home will be an integration of security and input detection through a simplistic security system for the door and the movement of a door. The inside section will be a focus on automation and a simplistic monitoring system. The automation process will be controlled through sensor inputs of movement, voice-activation and an external web server. The monitoring will be physically through an LCD screen and through a web server.

[Internet of Things-Based Intelligent Smart Home Control System (hindawi.com)] (https://www.hindawi.com/journals/scn/2021/9928254/)

- This particular individualised focus was construct after creating a mind map of several different ideas. (See in appendix)

2. Project objective and audience profile

The objective of this assignment is to successfully complete several individualized tasks for both the inside and outside of the home. These tasks are:

Outside:

- Door motion detection: The outside LED will activate if motion is detected.
- Opening of door: The servo that controls the door will only open if both the motion sensor and the force sensor has been activated (Logic: motion + force = door

Inside:

- Initial detection: The LEDs near the door activate immediately after the door has been opened
- Gradual detection: The LEDs gradually turn on as the movement moves further into the room.
- The LCD screen will display all inputs and outputs, therefore transferring it over to the SD card (e.g., door opening, light1 turn on etc.)
- Mic: The mic will only be activated when the room is entered and will perform commands (such as "turn on all lights", "turn off all lights", "play track 1", "plays track 2")

The audience profile for this project is for all age groups who wish to understand and explore the possibilities of integrating IOT devices and sensors inside a house. This project will act as a demonstration for what an energy-efficient, secure and individualized IOT smart home may look like.

3. Project scope

The resources will be a key component for the development and implementation of the project. The components are that readily available are an Arduino, Ethernet Shield, Piezo speaker, LEDs, Ultrasonic sensor, Motion sensor, Force sensor, LCD screen, and a servo motor. The hardware components that are required is a singular microphone module. In terms of design the required elements will be carboard, Lego, hot glue/hot glue gun or Bluetack. string/other components to move the door.

The programming logic of this project will be mainly cantered around conditional statements that meet certain requirements. The use of multi-dimensional arrays and pointers will be used for the gradual light effect. Dynamic memory allocation will be used for the storing of data to an SD card, hence the use of pointer, vectors and malloc will be used. Functions will be used for most of the code. Two user-defined libraries will be created to segregate the outside IOT smart code and the inside IOT smart home code. User defined functions will be used recursively throughout the code. Pin registers may also be used for variables. Other programming logic will be added through future iteration, but this is the bare minimum that is required.

4. Project Assumption and constraints

The assumptions for this project are that the required components will be readily available and will function in the required ways that are documented. The other external assumptions are that that schedule for the process and development will follow to ensure that the project is finished before the deadline. Alongside the fact, that no major events will deter the project like changing the types of IOT connectivity.

The constraint for this project is primarily the limited amount of time before the deadline. Other constraints are the limited access the WIFI module that would further extend this projects complexity.

5. Issues and risks

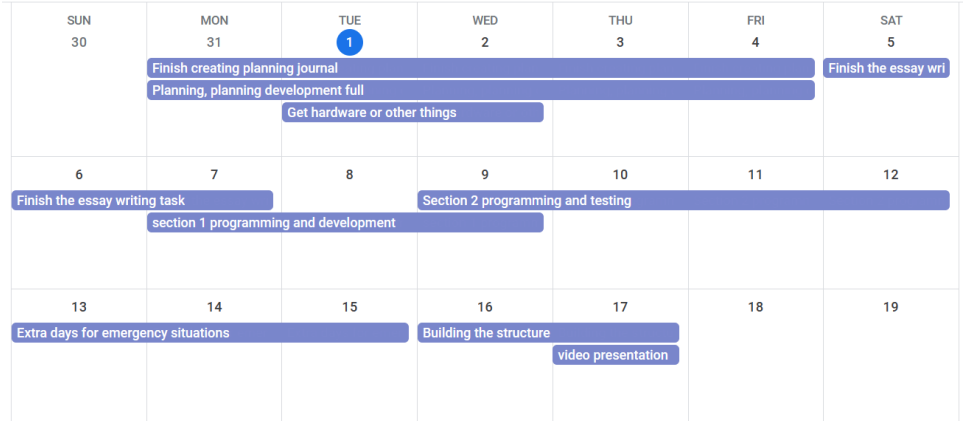
The main risks for this project are the risk of electrocution, cuts, burns, eye strain and muscle strain. The risk of electrocution may be mitigated by following electrical safety hazard such as turning of electrical plugs or discharging different aspects before unplugging them. Cuts and burns may be mitigated by following safety practices' around sharp, hot and dangerous objects. Eye strain from extensive screentime or development

may be mitigated by occasionally changing types of tasks (e.g., programming to practical). Muscle strain from heavy lifting may be mitigated by receiving assistance from others.

The issues that may occur within this project are the loss of data, invalid/incorrect data, and unethical practice's whilst developing the final product. The loss of data from not saving or backing up data can be mitigated through following standard practice's in managing data, this being backing up data through different sources and locations. Incorrect or invalid data can be mitigated through iterative testing. Unethical practices' of not following the time schedule and therefore working in a time-pressured environment can be mitigated by following the time schedule.

6. Project schedule

Plan schedule:



Project timeline span:

Tasks	**Time taken**
Planning journal and planning	31 July to 3 August
Task 3: Paragraph on smart home	4 August to 5 August
Write up of the progress journal overview and requirements for each section	6 August
Section 1: Original Goal	6 August to 7 August
Section 1: New goal	7 August
Section 1: New Goal (Queue and Stack)	8 August to 13 August
Section 2: Light System	14 August

Section: Sound system	15 August
Section 2: Light and Sound system	15 August
Section 2: Sound, Light and LCD system	15 August
Section 2: Webserver and other elements	17 August
Building housing	17 August
Video Presentation	18 August
Finish	18 August

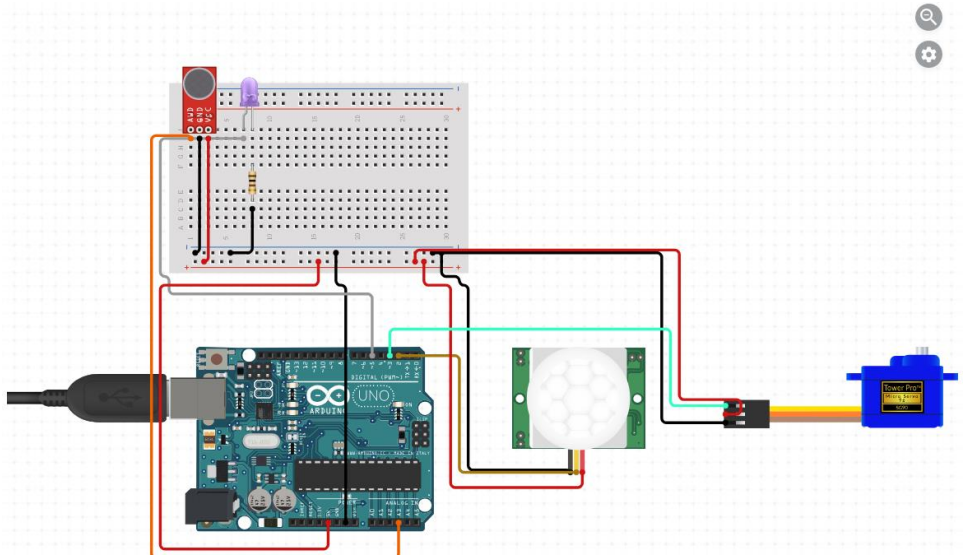
6.1. Phase 1: research, planning, early code development

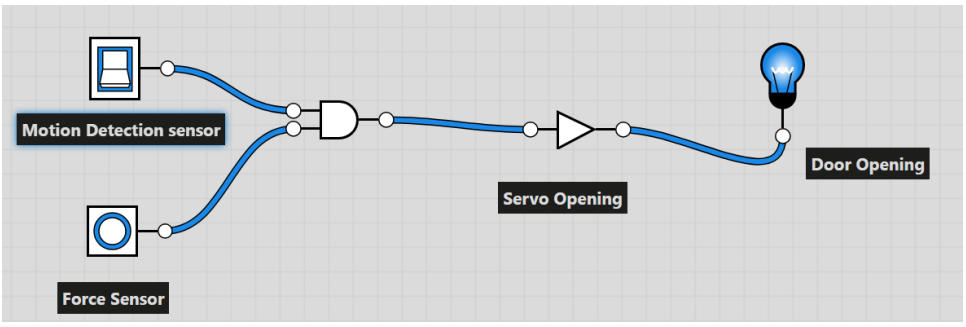
Full Outline of Design

- Aim: The main design will be segregated into two components. This being the outside of the smart home that will be the implementation of a security system resulting in the opening of the front door. The second section is the inside of the smart home where it will include a physical and webserver monitoring and control system, detection monitoring through outputs and sound integration.
- These major points are explained above in the project objective.

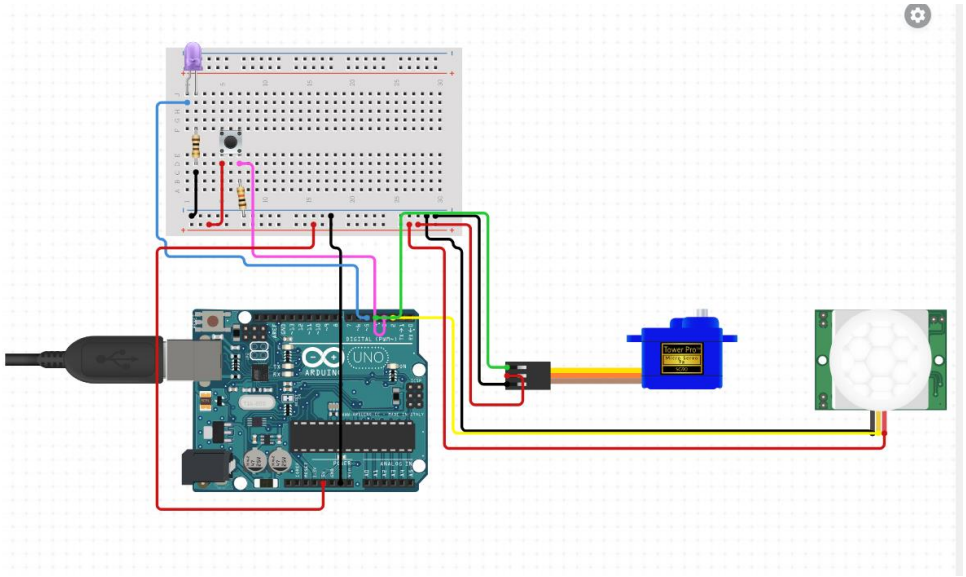
The circuitry and logic diagram for the first section can be seen below:

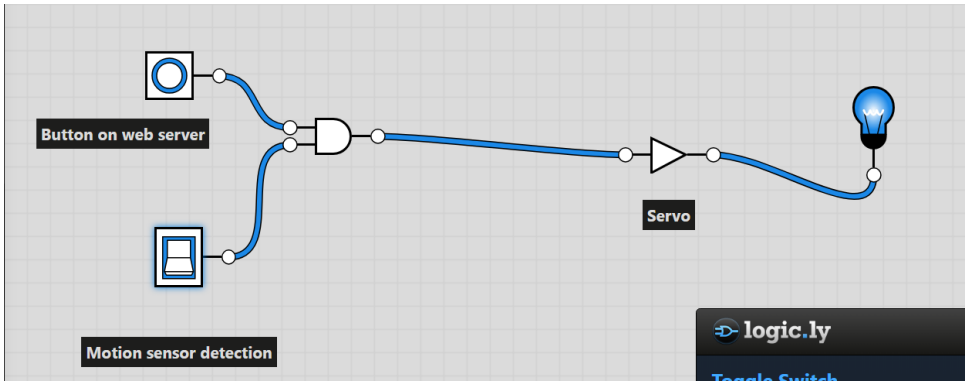
- This is for the first iteration of the design



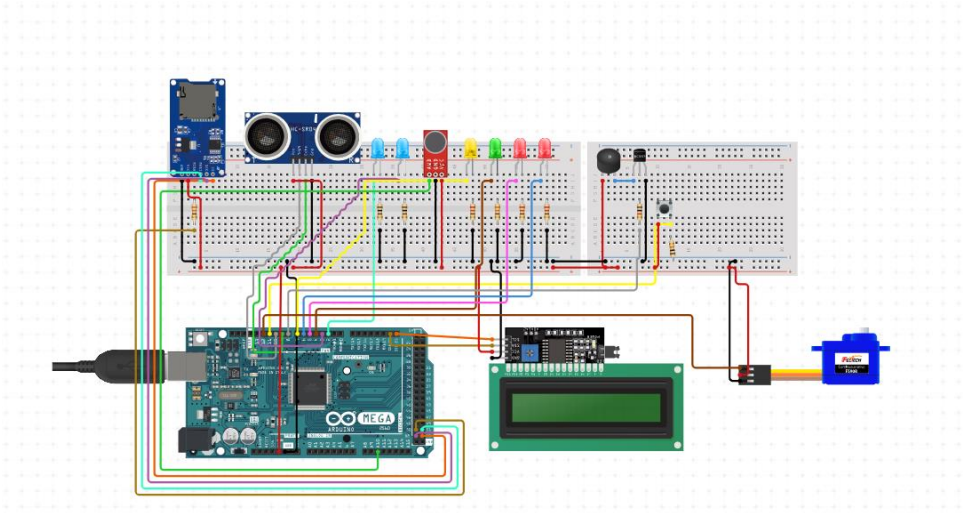


- This is for the second iteration of the design using the web server





The circuitry and logic diagram for the second part of the section can be seen below:



6.2. Optimisation of code and major fixes extensions

The development of this code could be further improved through the use of more libraries for the ether net, Leds and other aspects. It could also be improved through the development of more unique data structures or concepts which have not been learnt more.

The building of the housing could also be improved by making it more unique and placing the structure in a more stronger housing structure that doesn't reveal a lot of cabling.

6.3. Testing and minor fixes

Through the Testing and Development stage of this project, many iterative tests were conducted to ensure the program worked. Whilst there were many major issues that

we're mitigated, the major lessons concepts which will be taken away from this assignment are that:

- When creating stacks and queues it is best to create different function for initialising/printing different data structures (both structures were combined into one function with different variable called but failed)
- When combining numerous aspects together it is best to test each function, code segment individually before putting all the code in and having to work backwards because it failed
- When creating and ethernet webserver, it's best to use client and use a string variable instead of not.
- When creating a library, it's best to remove the (.ino) file when placing the folder into the library as this causes errors

Summary

Overall, through the development of this project, I learn a lot about range of different aspects. In particurly, a new understanding of queues and stack, creating a library as well as the diverse uses of the webserver. I think if I were to improve this system, I would try to get the data logging and monitoring through and sd card working as currently the code is limited in scope in regard to this.