ModulSim

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Overview

Phones and computers have become ingrained into everyday life with their ability to give access to a wide range of services with a single press of a button. This includes providing quality of life improvements with smart home systems to maximize every aspect of our comfort. The modular smart home system is similar but allows homeowners to have this comfort without expensive and intrusive renovations to apartments or older homes. This will also expand on the capabilities of an existing smart home system by integrating independently to add utilities that are not included in a prebuilt model.

Goal

The goal of this project is to create ModulSim, a smart home system that can be installed into any living space to add specific services to homeowners. This is a low-cost solution that gives access to amenities provided by a smart home to a wide range of users that are not willing or can spend thousands on renovating their living space. This includes those living in apartments, mobile homes, rental housing or simply an older model of housing without an existing smart home panel.
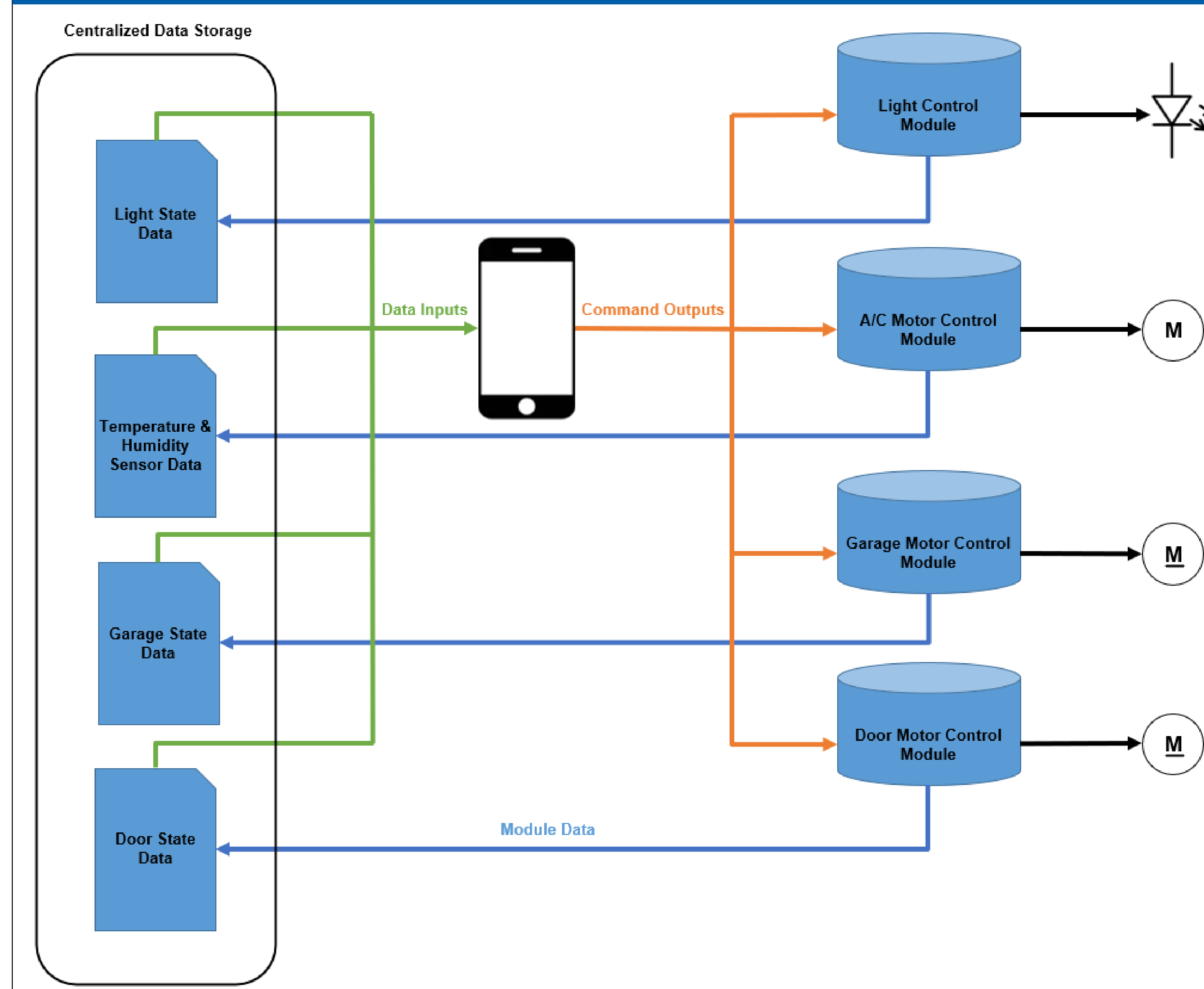
Arduino

ModulSim is composed of separate modules each with an individual Arduino circuit board to oversee the different functions available. Depending on the module, each board has a circuit made with compatible electrical parts. These include IC chips, low-voltage DC and servo motors, temperature/humidity sensors, and HC-05 Bluetooth relays. These separate modules can relay all their information and be controlled via bluetooth through the phone app. The phone app is supported by MIT App Inventor's open-source software.

ModulSim Home Simulation

A small model home was created to emulate a house and test ModulSim. This allowed simulation of different modules in a controlled environment. Each room had LED bulbs to simulate lighting. Rectangular sheets on hinges were attached to act as a door and a garage door. The area for the attic has a small motor-controlled fan to act as an A/C unit. These are controlled with the multiple Arduino-based circuits for each individual module. These are connected to the app via Bluetooth where a user can relay commands to these boards from their phones.

Data Flow Chart

Features

The current version of ModulSim has the following modules:

- Light Control
  -Gives an on or off status for each room light and the ability to control them.
- Door Control
  - Gives an open or close status for each door and the ability to control them.
- Garage Door Control
  - Gives an open or close status for each garage door(s) and the ability to control them.
- A/C Control
  - Gives temperature and humidity data. Allows users to control an A/C unit to change the temperature.
- ModulSim App
  - Primary GUI to visualize sensor data and control each individual modules in the current smart home system.

Future Plans

Future ModulSim versions can be expected to have these modules:

- Modules for window blinds
- Modules for operating door locks
- Modules for monitoring house cameras

Future ModulSim software will also be improved upon with:

- Personal profiles to set multiple modules to specific settings
- Connection with third party software and utilities
- Neural network to learn individual preferences such as temperature and humidity
- Turn on/off AC circuit with the relay

Acknowledgements

Arduino Reference Library
- Open-source C++ libraries used for programming the Arduino controllers inside each module.

MIT App Inventor
- Software used to create the phone app that controls each Arduino via Bluetooth