Programming for the Internet of Things Project

IoT Door Lock System

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January 4, 2021

System Level Design

Design Options:

There are some options in microcontrollers which can be used in this project. These options

Option 1: Arduino with shield:

Components:

- Arduino: Cost $22.95
- Ethernet Shield
- Actuator (Options)
    - Servo motor: Requires Motor Controller
    - Linear Solenoid Actuator: Requires Relay
- Power Adapter: 7 - 12 volts (Recommended)

Option 2: Raspberry pi:

Components:

- Raspberry pi: Cost $25 - $35
- Actuator (Options)
    - Servo motor: Requires Motor Controller (Complex code)
    - Linear Solenoid Actuator: Requires Relay (Relatively simple code)
- Power Adapter: 4.75 - 5.25 volts

Option 3: NodeMCU:

Components:

- Esp8266 NodeMCU: $6
- Actuator (2 Options)
    - Servo motor: Requires Motor Controller
    - Linear Solenoid Actuator: Requires Relay
- Power Adapter for Microcontroller: 4.5 - 10 volts

Option Evaluation:

There are 3 possible design options there are shown here. Among these options, the evaluation can be done by distinguishing

- The Price and Power consumption of microcontroller

- Additional Components
- Code Complexity
- Functionality

There are also two options in actuator which can be distinguished using these factors:

- Code Complexity
- Price
- Reliability
- Additional Components

Option Evaluation (Microcontroller):

Factors	**Option-1 (Arduino)**	**Option-2 (Raspberry pi)**	**Option-3 (NodeMCU)**	**Remarks**
Price	$22.95	$25 - $35	$6	Option-3
Power	7 - 12 volts (Recommended)	4.75 - 5.25 volts	4.5 - 10 volts	Option-3
Functionality	Reliable	Exaggerated	Reliable	Option-1 &3
Additional Components	Shield	Not needed	Not needed	Option-2 &3
Code Complexity	Arduino IDE	Python / C	Arduino IDE	Option - 1&3

So, according to this table, using a **NodeMCU** for the following project will be the best option.

Option Evaluation (Actuator)

Factors	**Option-1 (Servo)**	**Option-2 (Solenoid Actuator)**	**Remarks**
Price	$15	$10	Option-2
Functionality	Extra Procedure Needed	Reliable	Option-2
Additional Components	Motor Controller	Relay Switch	Option-1&2
Code Complexity	High	Low	Option - 2

So, according to this table, using a **Solenoid Actuator** for the following project will be the best option.

Option Choice:

Among the considered options which are evaluated according to some certain criteria, it can be observed that some options are better than others in case of the following project. Using a NodeMCU will allow us to minimize the complexity of microcontroller as it is a IoT specified development board. An esp8266 has built in wifi connectivity. This microcontroller also consumes less power and cost less than other options. The board is perfect for small projects. It can be programmed easily with the help of Arduino IDE using some pre-written libraries and functions.

Another option that we have considered here is the actuator. Using a solenoid actuator allows us to directly create linear actuation which is reliable for simple lock systems. Using a solenoid actuator requires a relay switch which is easy to program and cheap. Description of the design choice is given below with some figures.

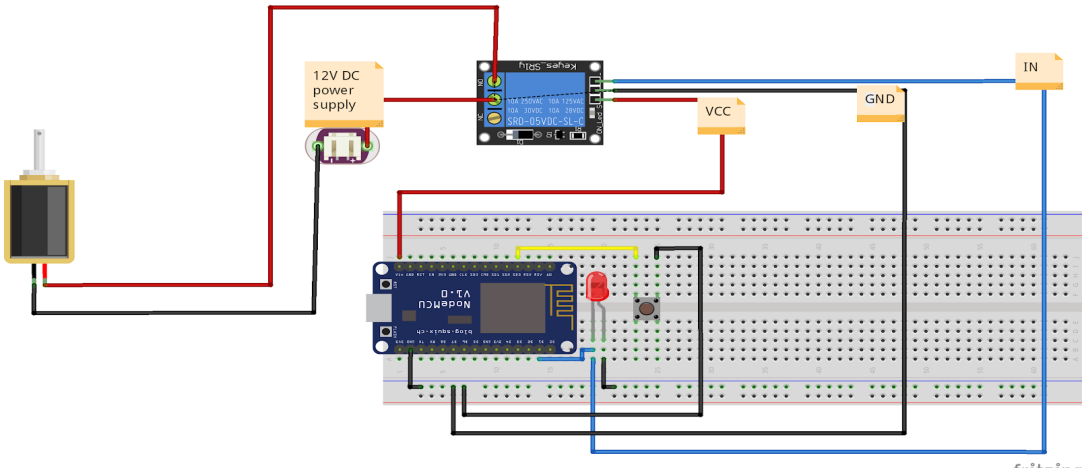

Fig 1.1: Circuit Diagram

Here, two pins (D1 & SD3) of the nodeMCU will be connected with the relay and a push button switch. A led will be also connected to the D1 pin to indicate the condition of the door.The actuator will be powered by a 12V power supplier connected through the relay. The nodeMCU will drive power from a different power supply which is not shown above. A schematic diagram is given below.

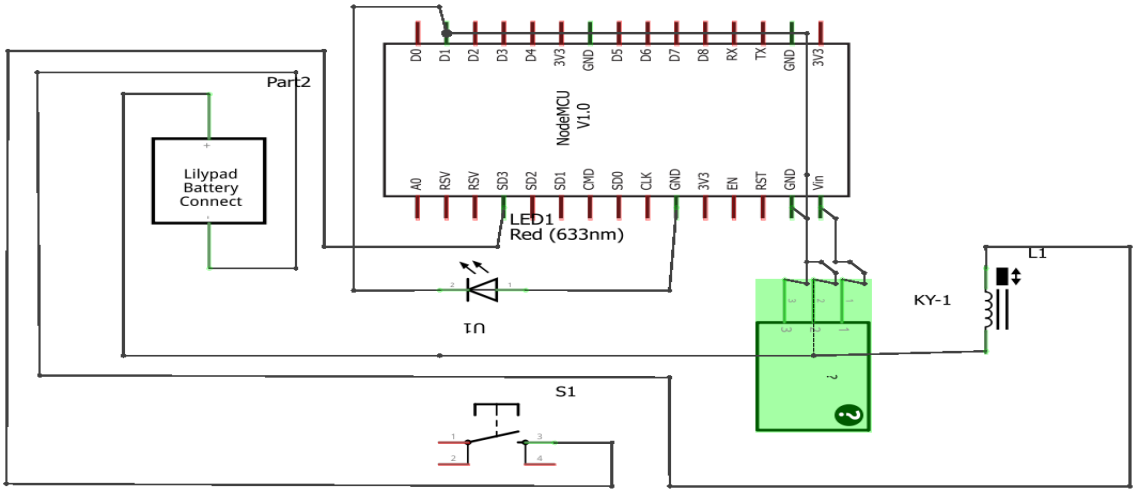

Fig 2.1: Schematic Diagram

Original Photos:

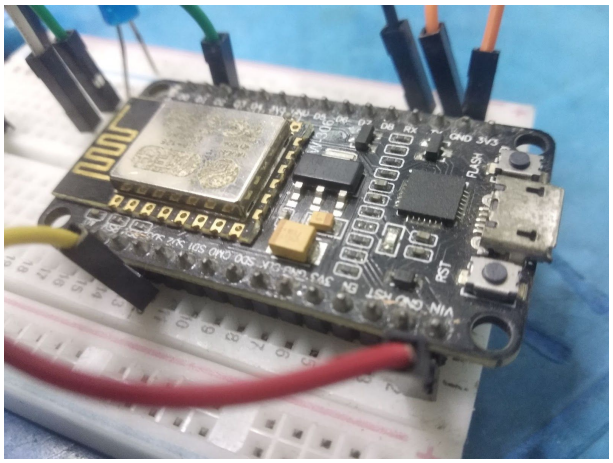

Fig 3.1: NodeMCU V1

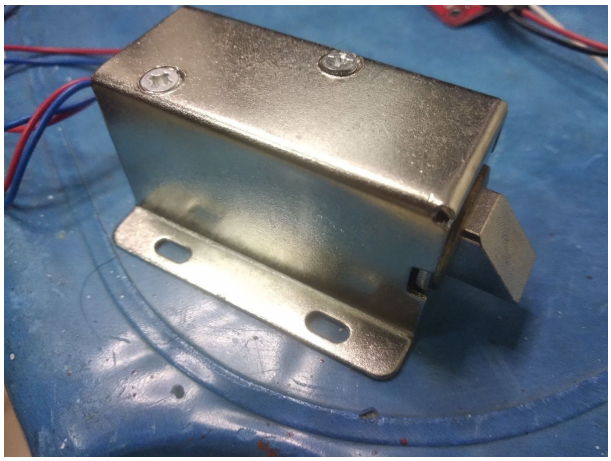

Fig 3.2: Solenoid Actuator