# Door Lock

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**Revision #2**

**Executive Summary / Concept of Operations:**

This door locking system will lock/unlock the deadbolt of the door when the right code is entered on the keypad. There will be a keypad and screen outside the door which will be connected to a controller located inside of the apartment. When the correct code is entered, the controller will unlock or lock the door according to the status of the lock. If the incorrect code is entered, the user will be asked to try again until the right code is pressed. All different parts of the project may be wired together physically. There will also be a push button inside the apartment to unlock/lock the door from the inside.

**Brief Market Analysis:**

This door lock is for places that need to be secured and only authorized personnel are allowed to enter. This door lock can be on any house, garage, company building, and every other place that needs to be secure, that is already outfitted with a deadbolt. The door lock gives easy access to authorized personnel and protects from unwanted people. What makes this door lock different from the ones that are offered on the market, no new door lock is needed, making this door lock cheaper and easier to install. Most door locks on the market are $200 to $400 and require replacing the existing door lock and handle. This door lock system will be priced at $100 making this system affordable and easy to install.

**Requirements:**

| Marketing Requirements | Engineering Requirements | Justification |
| --- | --- | --- |
| 1,7,8 | The locking device and PCB must both be mounted on the door lock in a secure casing that protects the components from the outside elements. | This feature would save space and around the door as only two modules would be needed. This protective casing would also reduce the risk of unwanted interaction with the components. |
| 7,8 | May connect between keypad and processor wirelessly. | This prevents wires from being visible between the keypad module and the locking module. It would improve the look of the final design on the inside of the door. |
| 2 | The lock must open once the correct code is entered. | Allows access to users that are authorized to enter. |

| 3 | The lock must not open if the code entered on the keypad is incorrect. | Prevents any unwanted personnel to enter without knowing the code. |
|---|---|---|
| 5 | The locking mechanism must be efficient and turn the deadbolt entirely without failure (not too little or too much) | This is very important as it prevents the deadbolt from unlocking halfway or turning too much which would cause damage to the door or the design. |
| 6 | The locking mechanism must not interfere with the existing key functionality. | This feature prevents the locking mechanism from being stuck to a specific position. In case of an emergency or malfunction, the user must be able to use the key to unlock or lock the door manually. |

**Marketing Requirements:**
1. Must be surface mounted.
2. May connect between keypad and processor wirelessly.
3. Must not unlock when incorrect code is entered.
4. Must unlock when correct code is entered.
5. Must have enough torque to turn a standard deadbolt.
6. Must not interfere with key functionality.
7. Must not be invasive of the current deadbolt.
8. Must be easy to install.

**System Architecture:**

This project will be composed of 2 inputs and 2 actuators. It will be controlled by an ATMega328 and will be powered using a 12V power supply. There will be several safety features including switching the power to the Stepper Motor ON and OFF in order to avoid overheating of the driver and ability to open the door with the key in case of malfunction. The following Block Diagram represents the connections and interactions between the main components of the design:
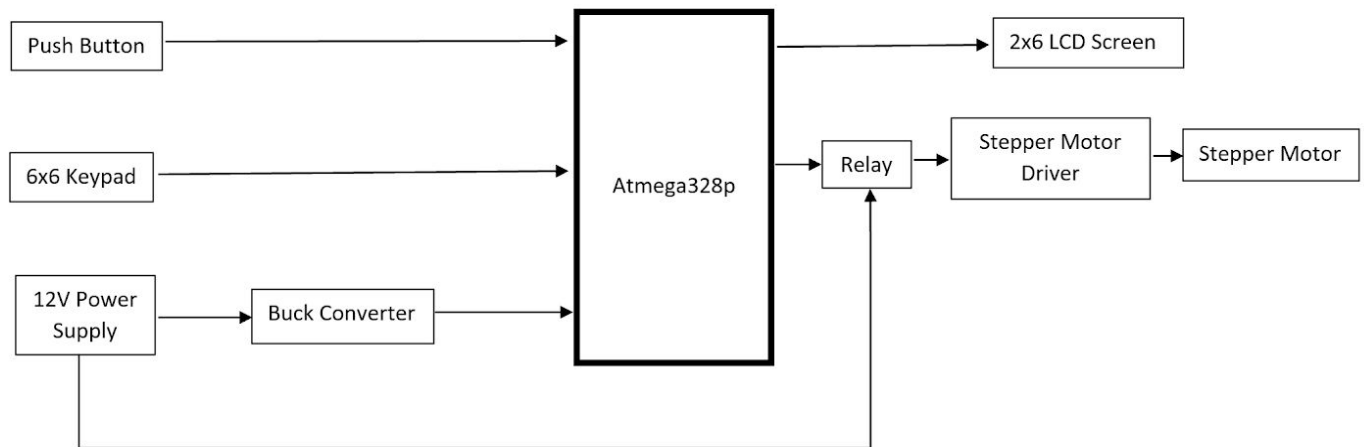
**Figure**: Level 1 Block Diagram

**Design Specification:**
- Processor: AtMega328
- Actuators: Nema 17 Stepper Motor, CFAH1602B-TMI-JT LCD Screen, Relay
- Controller: A4988 Stepper Motor Controller
- Sensors: 1528-1136-ND 6x6 Keypad, 0844632076046 Push Button
- Power Supply: HYK 120200 12VDC, OKR-T/1.5-W12-C Buck Converter
- Development Environment: Arduino IDE

**Engineering Requirements:**

**Functionality:**
> Open door lock with the correct code via keypad to give access to authorized personnel.

**Performance:**
> The device will have enough force/torque to turn a standard deadbolt.
> The device will lock/unlock when the correct password is entered.
> The device will be easy to install, without the need of replacing the existing door lock.

**Economic:**
> Total parts cost will be less than $80

**Energy:**
> The door lock will only be activated once the keypad has been unlocked.

**Environmental:**

**Health & Safety:**

All moving parts and electrical components will be inaccessible to the user.

The locking mechanism will have a manual lock/unlock mechanism in case of failure or emergency.

**Manufacturing:**

PCB board may to be smaller than 4 square inches

**Operational:**

Some of the device components may be connected wirelessly.

**Reliability & Availability:**

The locking mechanism will not harm/break the current deadbolt.