

**Keyless Door Locking System**  
**Project Design Specification and Requirements Document**  
*Version 1.1*

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## **A. Background**

Keys are small and very easy to lose. They are also a hassle to use in the dark because the key hole cannot be seen and insertion of the key is not easy in such a situation. To top that off if they are not physically present in the same location as the door it is not possible to unlock it.

According to IKEA, if the key were to be eliminated from the equation we could save an average of 6 minutes in the morning, which is the amount of time we spend looking for our keys. We could also solve other problems like allowing our kids into the house even when we are not at home, or giving access to a delivery person so they can place our package inside the house among other things. The possibilities are endless.

## **B. Needs Statement**

Today, to lock or unlock doors either we are using physical keys or cards. The limitations of the current practice is that if a key or card is lost, the door can't be unlocked. According to IKEA, We spend an average of 6 minutes in the morning looking for our keys. We often lose items because of "a breakdown at the interface of attention and memory" says Daniel L. Schacter, a psychology professor at Harvard University. A solution must be found to alleviate some of the burden of looking for lost items in particular keys which cost the average person roughly 36 hours per year.

## **C. Objective**

In order to solve the problems presented by the locking mechanism used in most residences today we propose to create a keyless door locking system which is cheap, durable, and easy to use.

## **D. Requirements**

### **a. Hardware Requirements**

<b>Requirement</b>	<b>Priority</b>	<b>Justification</b>
Use a two layer PCB that is between 9 and 900 cm <sup>2</sup>	Must	External constraint
Have a PCB with no side of the board being less than 2 cm or more than 30 cm.	Must	External constraint
Have Digital or Analogue processor	Must	External constraint
Have the processor on the PCB	Must	External constraint
Have one or more sensors	Must	External constraint
Have one or more actuators	Must	External constraint
Must use components that can be hand soldered or easily soldered in a crude reflow oven.	Must	External constraint
Must have at least 25% surface mount components	Must	External constraint

### **b. Functional Requirements**

<b>Requirement</b>	<b>Priority</b>	<b>Justification</b>
Unlock and lock without the use of a key	Must	The purpose of the project is to eliminate the use of a key to unlock and lock doors
Only permit access to authorized users	Must	If anyone can unlock the door then it wouldn't be safe
Stay locked if power is lost to system	Must	It wouldn't be safe otherwise
Allow entry in case of power outage	Must	No one would buy it otherwise because they would get locked out in a power outage
Provide a log of when the lock was locked or unlocked	Should	To allow the owner to check when someone entered the house
Provide a log of who locked/unlocked the door	should	To allow the owner to check who entered/left the house
Be connected to the internet	May	So it can be integrated with surveillance systems
Notify user if lock has been physically damaged	May	To allow the user to know that the lock has been compromised
Have an LEDs that illuminates when door is opened	May	To visually alert the user that the door is unlocked

**c. Performance Requirements**

<b>Requirement</b>	<b>Priority</b>	<b>Justification</b>
Successfully lock and unlock 99.5% of the time	Must	No one would want to use it otherwise
Can receive multiple lock and unlock requests from authorized users without glitching	Must	In case the user accidentally sends too many requests

**d. Economic and Marketing Requirements**

<b>Requirement</b>	<b>Priority</b>	<b>Justification</b>
Must be less than \$70 per unit	Must	Otherwise it would be too expensive / to increase sales
Should not use non-standard components	Must	They are more expensive to buy and are harder to find in case a repair is needed

**e. Power Requirements**

<b>Requirement</b>	<b>Priority</b>	<b>Justification</b>
Be connected to the power grid	Must	So that the user doesn't have to worry about forgetting to replace the battery and getting locked out
Have a battery in case of a power outage	May	One possible solution for entry when there is a power outage

**f. Maintainability**

<b>Requirement</b>	<b>Priority</b>	<b>Justification</b>
Can be replaced by a novice in 20 minutes	Must	In case the unit becomes defective
Have Code and engineering documentation	Must	External constraint
Allows replacement of worn parts	Should	So the user doesn't have to buy a new unit every time something goes wrong
Can be maintained with readily available tools	Should	Otherwise it would be more costly to the user

**g. Operational Environment**

<b>Requirement</b>	<b>Priority</b>	<b>Justification</b>
Can operate from a temperature of $-40^{\circ}$ to $70^{\circ}$	Must	So that it can work in all weather conditions

#### **h. Usability**

<b>Requirement</b>	<b>Priority</b>	<b>Justification</b>
User can figure out how to use the device in 5 minutes by reading the instructions the first time around	Must	If it is too complicated people won't buy it