Polytechnic University of the Philippines

Parañaque City Campus

Bachelor of Science in Computer Engineering

Introduction to Hardware Description Language CMPE 30121

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Title of the Project

Security Lock System using XOR & NOR Gates

Description of the Project

I.   Introduction

Talking about security, a lock is that the very known invention for the items we would like to be secured. And there are many innovations since the primary metal lock was created including a lock powered by digital integrated circuits. The thought of this experiment is, one switch acts to carry the right code for unlocking the lock, while the opposite switch is a knowledge entry point for the person trying to open the lock.

This experiment could also be built using just one 8-position DIP switch, but the concept is simpler to know if two switch assemblies are used. In real world, of course, the switch assembly with the "key" code assail it must be hidden from the sight of the person opening the lock, which suggests it must be physically located elsewhere from where the info entry switch assembly is.

II. Rationale

Technological breakthroughs and therefore the interplay of variety of fields, including advanced robotics, AI, nanotechnology, neurotech, data analytics, blockchain, cloud technology, biotechnology, Internet of Things (IOT), and 3D printing, have ushered within the Fourth technological revolution. These various fourth industrial technologies are already being adopted by Philippine industries, although in varying degrees of diffusion.

The extent to which all the potential benefits are going to be realized from these technologies depends on the country's ability to beat its capacity to aptly adapt to the worldwide disruptions that are expected to return alongside the Fourth technological revolution (PIDS, 2018). The Philippines and therefore therefor the world will undoubtedly see rapid expansion of opportunities for productivity growth and the emergence of latest business models also as new goods and services within the years to return.

As Computer Engineering students of Polytechnic University of the Philippines Paranaque Campus, we might wish to encourage the readers to immerse themselves on this subject of electronics and automation. Which are interrelated phenomena that have significant impacts on the economies of our country and especially, the technologically inclined market.

III. Features and Limitation

Features

Key Control and Security features

The main function of a lock is to provide security to any building or premises. One key security feature of a lock is the selection of people who have access to its control.

Remote access

This means you can lock and unlock doors and change the passcode even from a considerable distance using a device.

Electronic key feature

Every reliable lock must come with a useful set of keys. One of the problems associated with traditional lock was the need to have and keep track of an extra bunch all the time. In some cases, having too many keys exposes the home if they fall into the wrong hands. With this lock, this problem has been significantly reduced.

Limitation

Because four bits provides a mere sixteen possible combinations, this lock circuit isn't very sophisticated. If it were utilized in a true application like a home security system, the "No go" output would need to be connected to some quite siren or other alarming device in order that the entry of an incorrect code would deter an unauthorized person from attempting another code entry.

Lock Picking

Lock picking is the practice of unlocking a lock by manipulating the pins. Our prototype security lock system is vulnerable to unauthorized persons and may bypass the lock because it only has 24 combinations.

Wireless Connection

Majority of the modern locks today offers Wi-Fi and Bluetooth connectivity that allow you to leave the hindrance of house keys behind and can allow you to lock and unlock using entry code, fingerprint or voice command. It also allows remote control using an app and many other features.

Power Source

Our security lock system relies on a 12V battery that there will eventually come a time when the battery's power will run out and will result to a failure; the lock will be automatically lock and unlock.

Coverage/ Working Area

Because it lacks the features of Wireless connections the user will only allow to use the lock in the range of it unlike the other modern locks that are remotely control and can unlock the door using smarphones by these features.

IV. Significance

a. For the user

The lock system is an easy access and very easy to use instead of a manual lock system as the digital integrated circuits revolutionized electronics industry and paved the way for devices such as mobile phones, computers, CD players, televisions, and many appliances found around the home. In addition, this lock system can be used as a lock for doors or vaults and the spread of the chips helped to bring advanced electronic devices. They will no longer have to go to the door for example and manually manipulate the lock.

b. For the Community

Since the lock is powered by digital integrated circuits, people can now have technologically inclined locks for a very affordable price. This invention also reduces the time and effort of the user. It is more secured because it is digital and can only be access using the device that runs it. Somehow, it can also reduce the number of theft or robberies especially from small food stalls at closed hours because their gate or door locks are navigated using this project.

V. Components and its Costs

4001 quad NOR gate - ₱30 per piece

4070 quad XOR gate - ₱25-35 per piece

Two, eight-position DIP switches - ₱60 per piece

Two light-emitting diodes - ₱50 per piece

Four 1N914 "switching" diodes - ₱15 per piece

Ten 10k Ω resistors - ₱5 per piece

Two 470 Ω resistors - ₱23 per piece

Pushbutton switch - ₱50 per piece
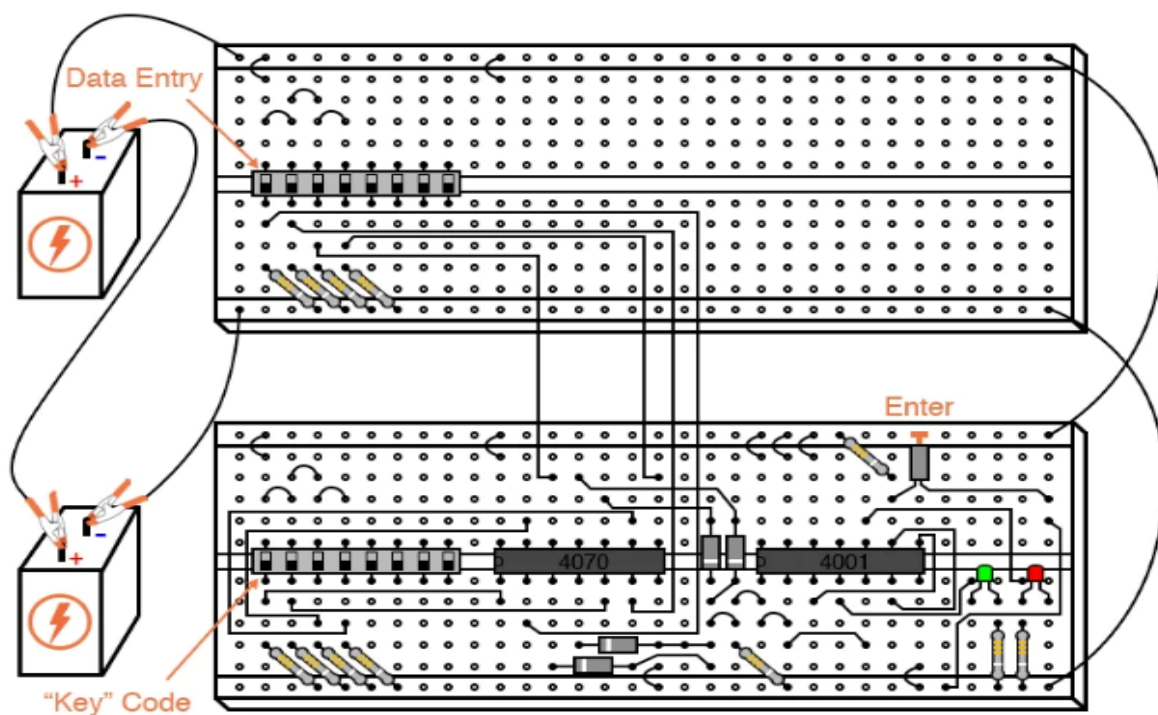
Two 6-volt batteries - ₱200 per piece

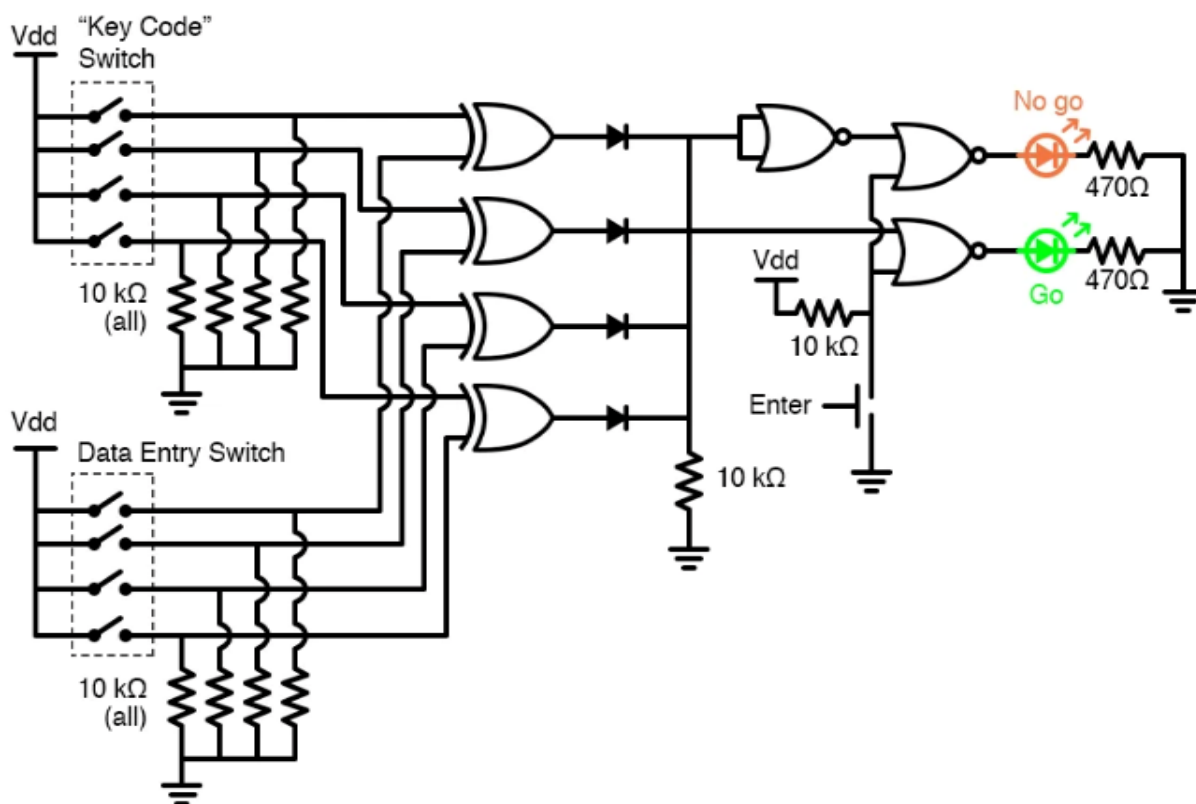*These prices are based on Shopee and just an estimation*

Reference

https://www.allaboutcircuits.com/textbook/experiments/chpt-7/simple-combinationlock/?fbclid=IwAR0Wg95NcKlVu9rXcGvK5rFQ2N1joZuoP9V34iffnKByhOLXUBTQ9-z_TCo
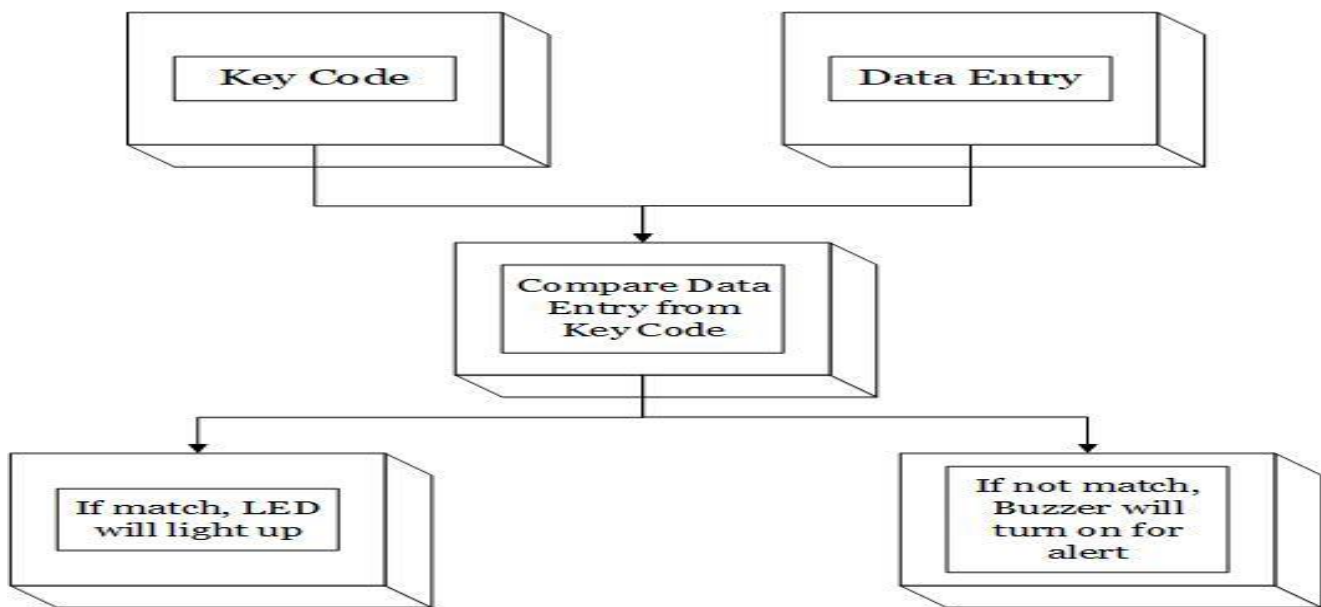
VI. Circuit Diagram
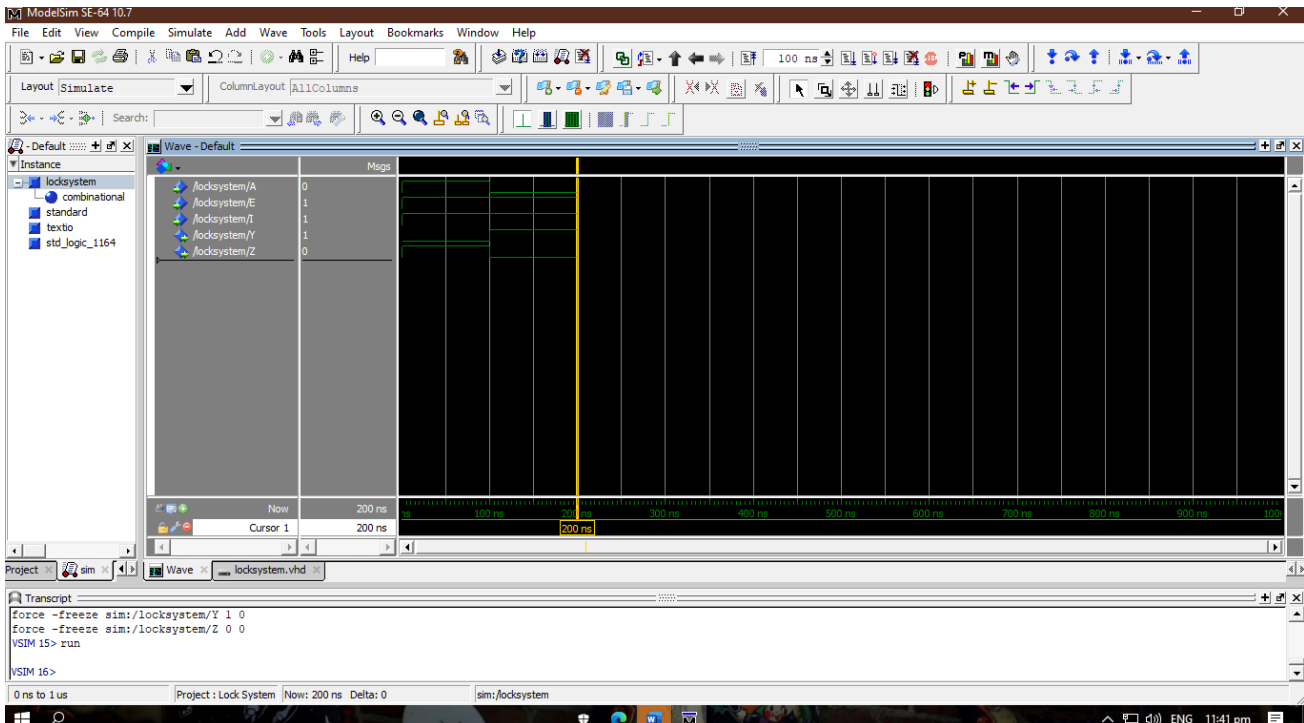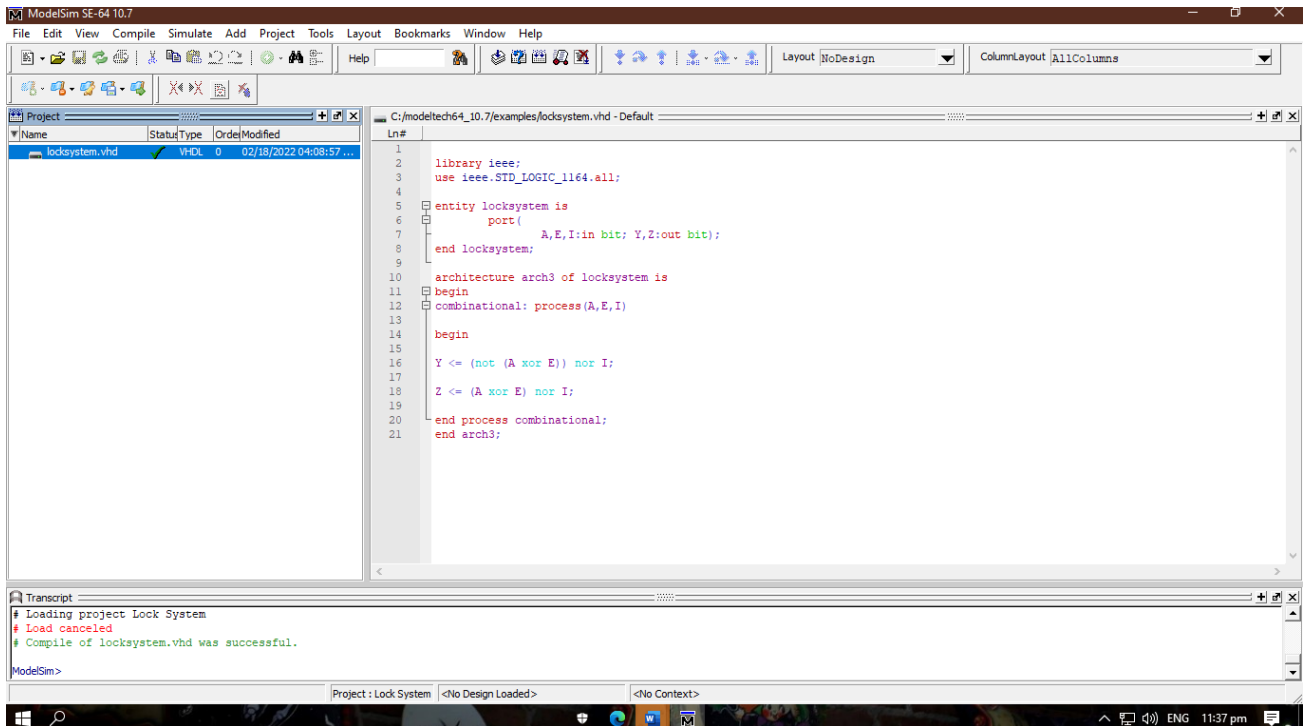

VII. Schematic Diagram

VIII. Block Diagram

```
┌──────────────┐              ┌──────────────┐
│   Key Code   │              │  Data Entry  │
└──────────────┘              └──────────────┘
              │                      │
              └──────────┬───────────┘
                         ▼
                ┌──────────────────┐
                │  Compare Data    │
                │  Entry from      │
                │  Key Code        │
                └──────────────────┘
            ┌────────────┴────────────┐
            ▼                         ▼
  ┌──────────────────┐     ┌──────────────────┐
  │ If match, LED    │     │ If not match,    │
  │ will light up    │     │ Buzzer will      │
  │                  │     │ turn on for      │
  │                  │     │ alert            │
  └──────────────────┘     └──────────────────┘
```

IX. VHDL Simulation

X. Results

The circuit illustrates the utilization of XOR (Exclusive-OR) gates as bit comparators. Four of those XOR gates compare the respective bits of two 4-bit binary numbers, each number "entered" into the circuit via a group of switches. If the 2 switches match, bit for bit, the green "Go" LED will illuminate when the "Enter" pushbutton switch is pressed. If the 2 switches don't exactly match, the red "No go" LED will illuminate when the "Enter" pushbutton is pressed. We don't describe the way to work this circuit into a true security system or lock mechanism, but only the way to make it recognize a pre-entered code. The "key" code that has got to be matched at the info entry switch array should be hidden from view, of course. If this were a part of a true security system, the info entry switch assembly would be located outside the door and therefore the key code switch assembly behind the door with the remainder of the circuitry.

Reference:

https://www.slideshare.net/FatimaQayyum1/security-system-using-xor-nor
https://www.youtube.com/watch?v=piLq711BDBM
https://www.allaboutcircuits.com/textbook/experiments/chpt-7/simple-combination-lock/