Detailed Design for

SeLo - Security Locker

Homework 5

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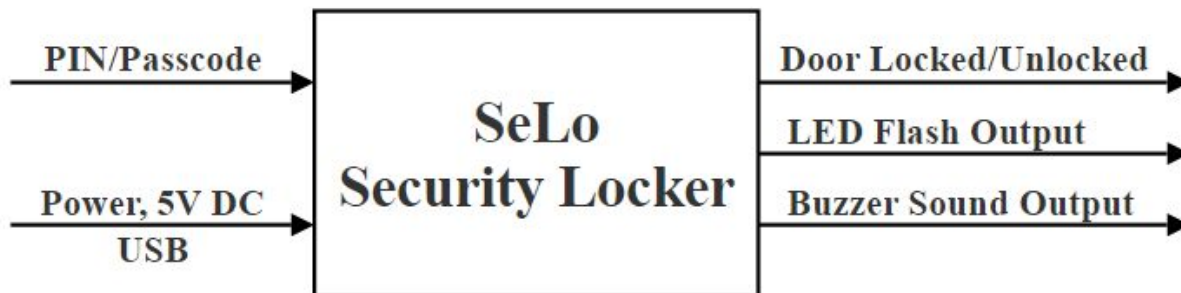**Date of Document Submission: November 14th, 2019**

Table of Content

I. Top Level Block Diagram for SeLo (Level 0):

**Requirements:**

1) Accept a PIN/passcode from user as an input.
2) Is powered with 5V DC transferred over USB.
3) Unlock and lock if the PIN/passcode is correct.
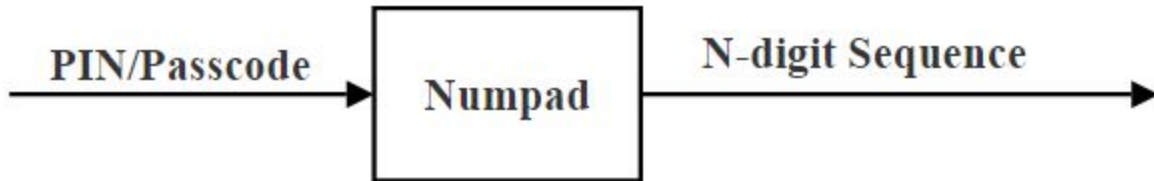4) Output sound and light signals if tampering is detected.

Module	SeLo Security Locker
Inputs	● PIN/passcode: users enter an N-digit PIN/password through a numpad ● Power: 5V DC through USB
Outputs	● Door locked/unlocked: using a servo motor if PIN/password is correct. ● LED: if 3 incorrect trials then send a programmed blinking sequence to the LED to flash. ● Active buzzer: if 3 incorrect trials then send a programmed frequency sequence to the Buzzer to sound. ● LED and Active Buzzer occur simultaneously.
Functionality	Get PIN/passcode from users and enter it on the numpad. If the PIN/passcode is correct within 3 attempts, the servo motor turns to unlock/lock the door. Otherwise, the alarm will activate (LED blinks and active buzzer sounds)

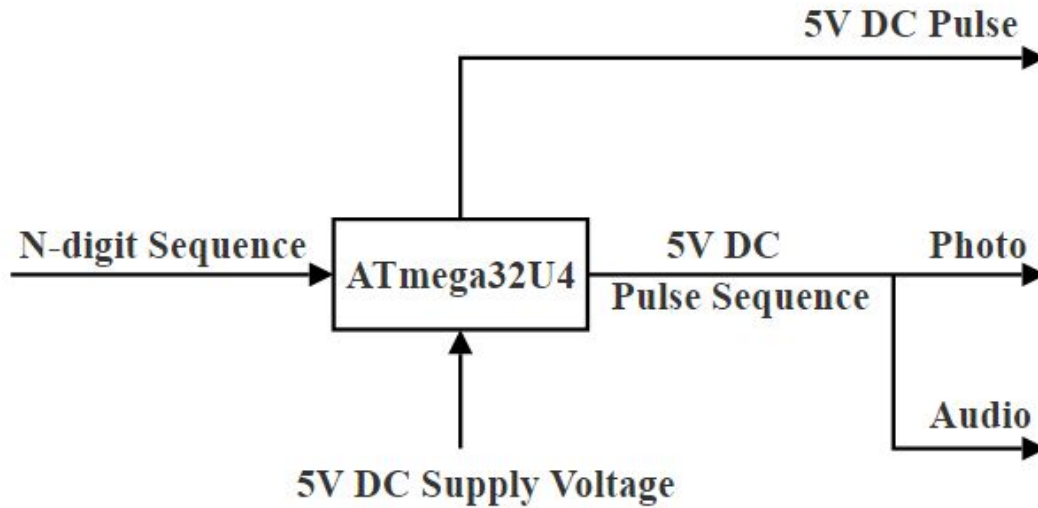## II. Next-level Block Diagram for SeLo (Level 1):
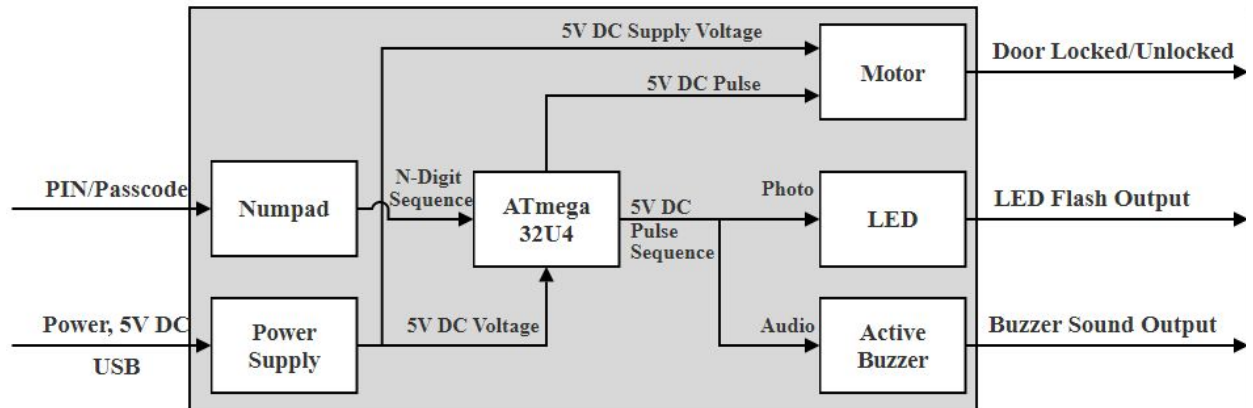
III. Level-0 Block Diagram for Sub-modules:

Numpad

| Module	NUMPAD
Inputs	● PIN/passcode: users input by pressing the keys on the numpad
Outputs	● N-digit sequence: sequence of N number of digits sent to the ATmega32U4 for verification
Functionality	Users push the keys of the numpad to enter the PIN/password for the SeLo Security Box. The digit sequence is then forwarded to the ATmega32U4 processor for verification with the set pincode.

ATmega32U4

Module	ATmega32U4
Inputs	- N-digit sequence: N-digit sequence sent from the numpad 5V DC supply voltage: from USB through the power supply sub-module to power the ATmega32U4 processor.
Outputs	5V DC pulse sequence: the ATmega32U4 processor sends this signal to the LED and the buzzer if trials = 3 & PIN is incorrect. 5V DC pulse: the ATmega32U4 processor sends this signal to the servo motor if trials < 3 & PIN is correct.
Functionality	ATmega32U4 is powered through 5V and taking in N-digit sequence from the numpad. The processor then compares the N-digit sequence with the defined PASSWORD sequence. Also, a counter within the processor is started. The processor will send a 5V pulse to turn the servo motor if the user PIN matches with the defined PASSWORD and the counter is less than 3. Otherwise, the processor will send a 5V DC pulse sequence to flash the LED and sound the buzzer.

Motor
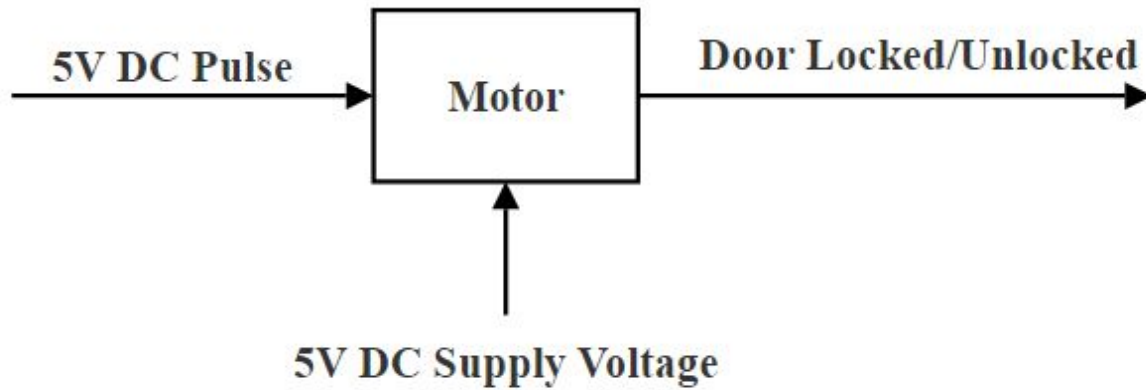
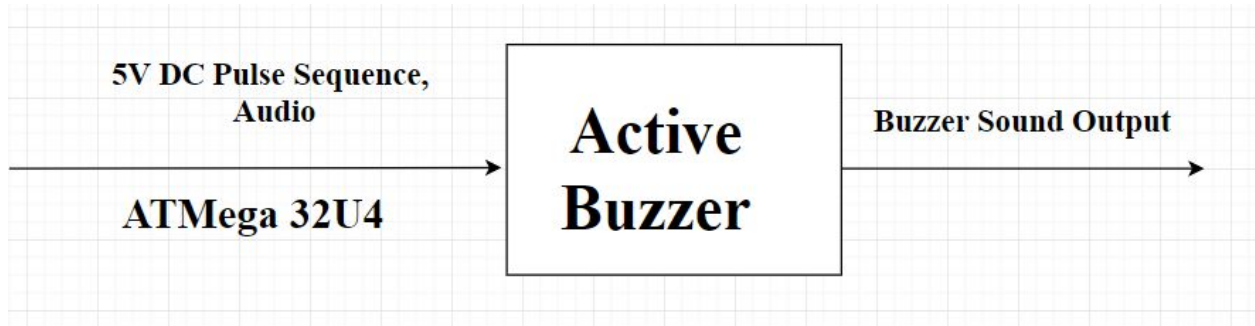| Module	Actuator/Motor
Inputs	● 5V DC pulse: signal sent from the ATmega32U4 if the PIN is correct and the clock count is less than 3. ● 5V DC supply voltage: from USB through the power supply submodule to power the servo motor.
Outputs	● Door locked/unlocked: lock/unlock mechanism is activated by turning a servo motor at preset angles.
Functionality	The servo motor is supplied with 5V DC through USB, and when the 5V DC pulse is sent from the processor, the servo turn clockwise 90º for unlocking and counter-clockwise 90º for locking.

LED
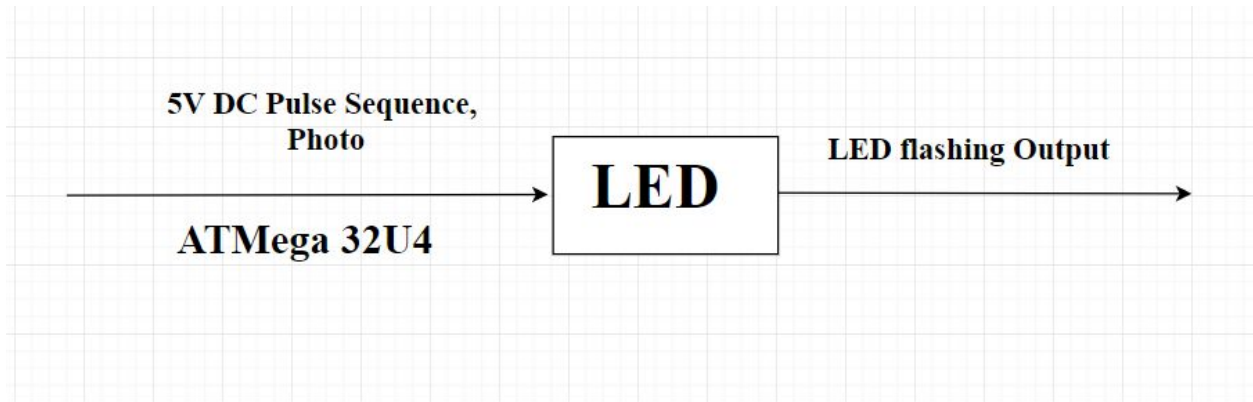
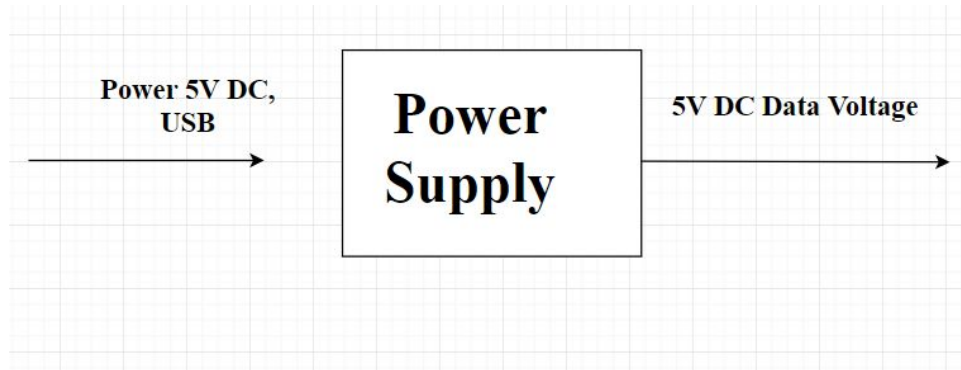| Module	Actuator/Motor
Inputs	• 5V DC pulse sequence: a sequence of HIGH (5V) and LOW (0V) to gives blink sequence for LED.
Outputs	• LED flash output: LED blink/flash through the sequence when detecting theft.
Functionality	The LED receives the 5V pulse sequence from the processor when theft is detected, and flash/blink through the sequence.

Active Buzzer

Module	Actuator/Motor
Inputs	● 5V DC pulse sequence: a sequence of HIGH (5V) and LOW (0V) to gives range of frequency for the buzzer
Outputs	● Buzzer sound output: Buzzer gives audio output based on the audio frequency to make a siren noise.
Functionality	The buzzer receives the 5V pulse sequence from the processor when theft is detected, and sound the alarm with a range of audio frequency.

Power Supply

Module	Actuator/Motor
Inputs	• Power 5V DC, USB: the power supply takes in 5V DC from USB
Outputs	• 5V DC supply power: the power supply generate a stable 5V DC voltage to power the ATmega32U4 and the servo motor.
Functionality	The power supply takes in 5V DC from the USB and pass it to the processor (ATmega32U4) and the servo motor to supply them.