

A REPORT
ON
Automated Pill Dispenser



BY

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PROBLEM STATEMENT

Design an automated pill dispenser at a retirement home that dispenses a minimum of at least 3 pills. User selects the type and number of pills as an input alphanumeric code.

ASSUMPTIONS

- **Design Assumptions:** The logic has been designed keeping in mind the real-life situation in an old age home. The pill dispenser is made for the pills which are daily used by elderly people like vitamins, diabetes medicine, heart medicine etc. The pills required for treatment of special illness is excluded from the machine. Moreover, pills potentially hazardous to a patient it is not prescribed to are not included. In most of the cases an elderly person does not take more than 8 different types of pills in a day and these 8 types of pills accommodate most of the common medicines used by patients (verified by a doctor). More over 1 pill type of pill is not taken more than 7 times in a day is also a reasonable assumption we made. In general, the user of the pill dispenser is expected to know the type and quantity of pills needed by him/her (patient himself/herself) or the patient they are taking the pills for (nurse/doctor).
- **Input Assumptions:** The user expected to input the number and type of pill both before clicking on the dispense button. The button when pushed, first resets the circuit (except the Inventory part) and then transfers the data and starts the clock cycle. The user is expected to input only in the range as specified below:
 - **Quantity of pill:** Within a range of 1 to 7 (both inclusive).
 - **Type of pill:** One of the eight type of pills.
- **Output Assumptions:** The circuit can be used infinite number of times consecutively. There are eight output pins. Each goes to 1 to indicate the dispenser to dispense 1 pill. The number of times an output goes to 1 in an operation is limited to 7 (max number of pills that can be dispensed at a time).
- **Miscellaneous:** The machine is outfitted with an inventory management system. This system indicates the admin (or nurses), using an LED light, for low number of pills (less than 5) of a particular type. So, there are in total 8 LED indicator lights right beside the selection of type of pill that can be used by the user to ensure that the there are enough pills for them to dispense. Upon the lighting of a LED, the admin (or nurse) can open up the machine and add more pills to fill it to the maximum point of 255 pills per type. As soon as this is done the admin pushes a button adjacent to container of that type to let the dispenser know that the pills have been refilled. This shuts off the LED light as soon as the machine operates again.

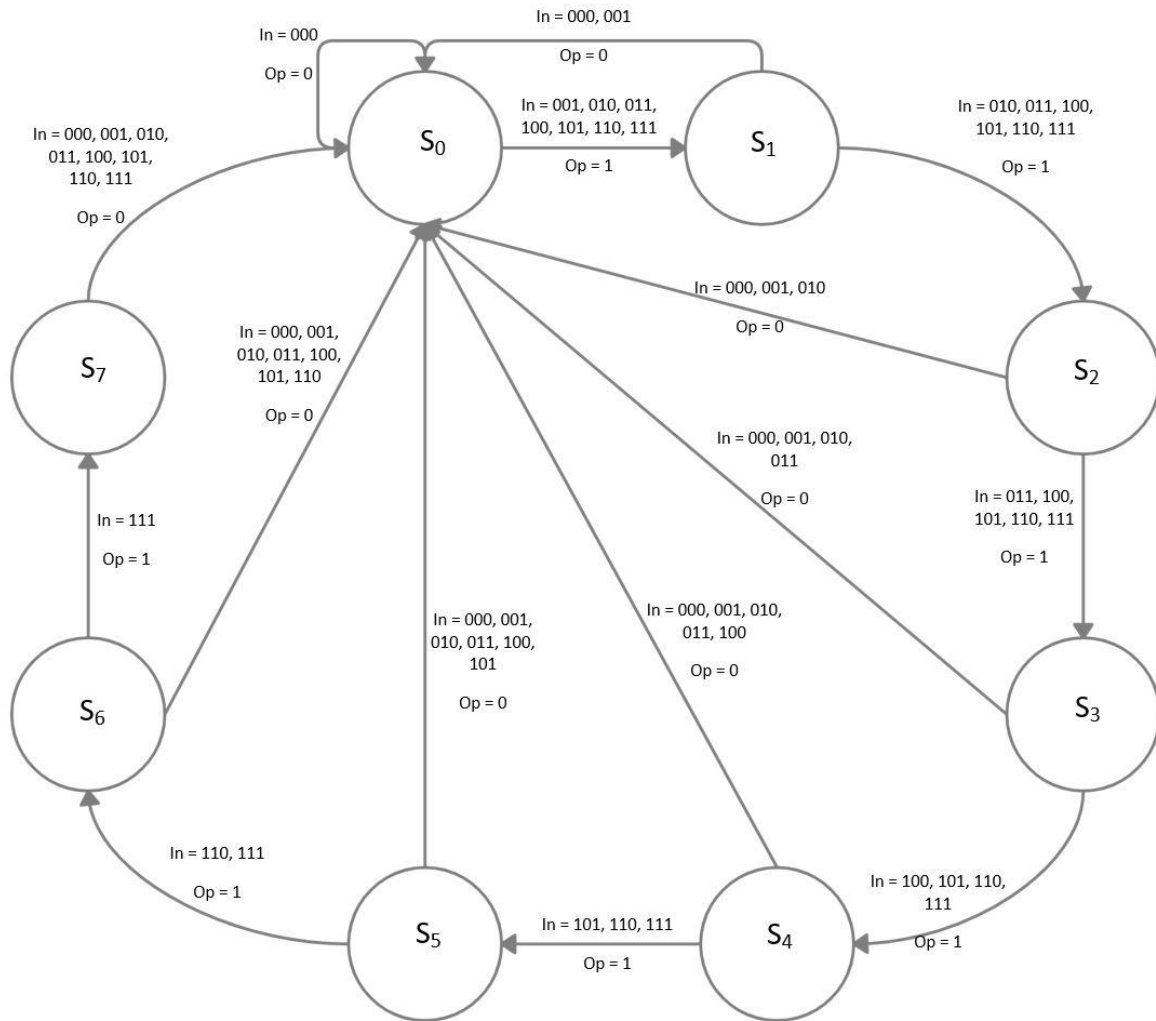
Note: The limitation of 8 types of pills can be eliminated easily by just replicating the logic for higher number of bits input

DESIGN METHODOLOGY

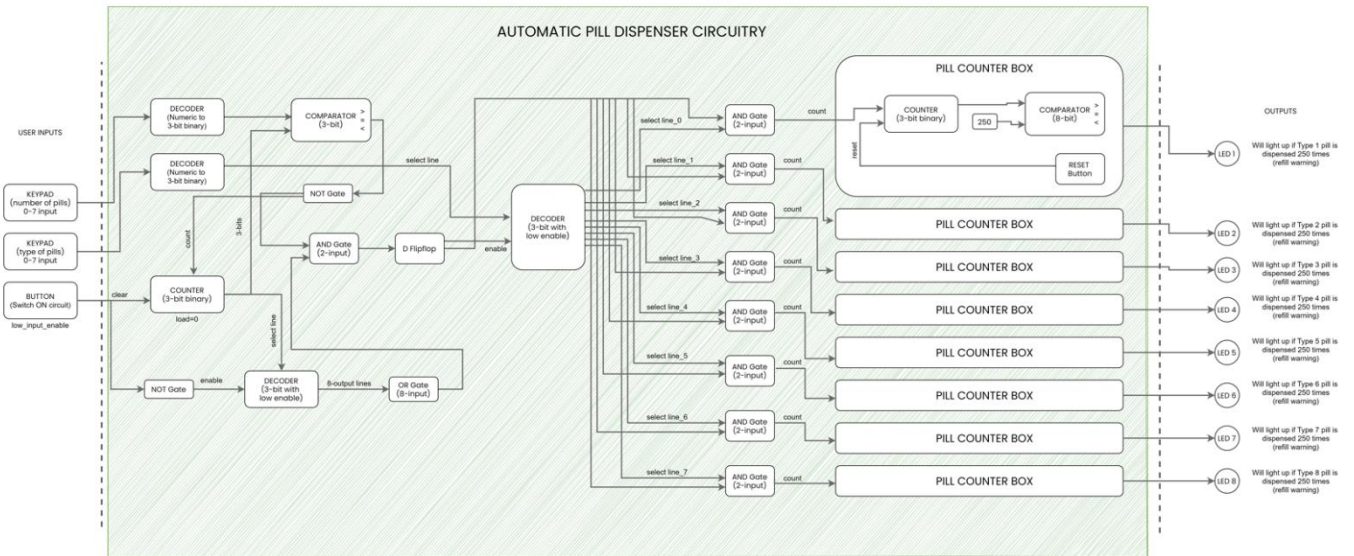
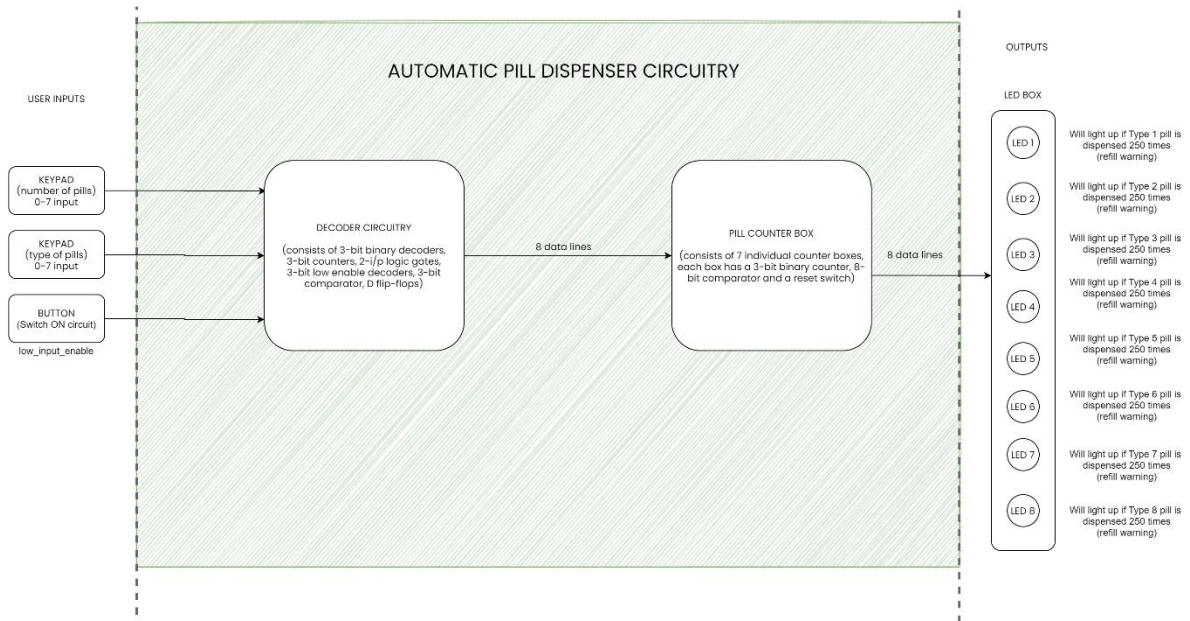
The pill dispenser for this project has been designed as a synchronous sequential circuit.

- The number of pills and the type of pills is accepted as an input from the user.
- This input is validated by checking if the current consumption of this pill is within the per day dosage of that particular type of medicine. Counters keep track of the number of different types pills a patient has consumed in a day. The value of the counter is then compared with the daily limit of that type of medicine using a comparator. If the output of the comparator validates the consumption of number and type of the medicine, a check happens with the inventory counters to ensure that there is a sufficient amount to dispense and the circuit proceeds to the pill dispensing stage. Else it gives an alert signal using a LED output to prevent overdose or the lack of inventory.
- The dispensing of pills is handled by a counter, a comparator and decoders. The counter ensures that only the demanded number of pills is dispensed from the outlet. This is achieved by using a comparator along-side the counter and make sure that count signal to the counter goes low once the desired number of pills are dispensed to make sure that the counter stops counting.
- The decoder works simultaneously with the counter and the comparator. Based on the input from the user on the type of pills, one of the select lines of the decoder goes to high, and that particular type of pill is dispensed. This ensures that only the required type of pill is dispensed in the outlet.
- The final stage of this circuit is the inventory management. A counter is maintained for the inventory level of each type of pill. Every time pill dispensing occurs, the count of the counter of a particular type of medicine is increased accordingly. When the inventory level of a particular medicine goes below a threshold level (5 in our case), an alert is signalled by an LED indicator light to ensure that the pill is refilled duly.

STATE DIAGRAM



TOP LEVEL BLOCK DIAGRAM



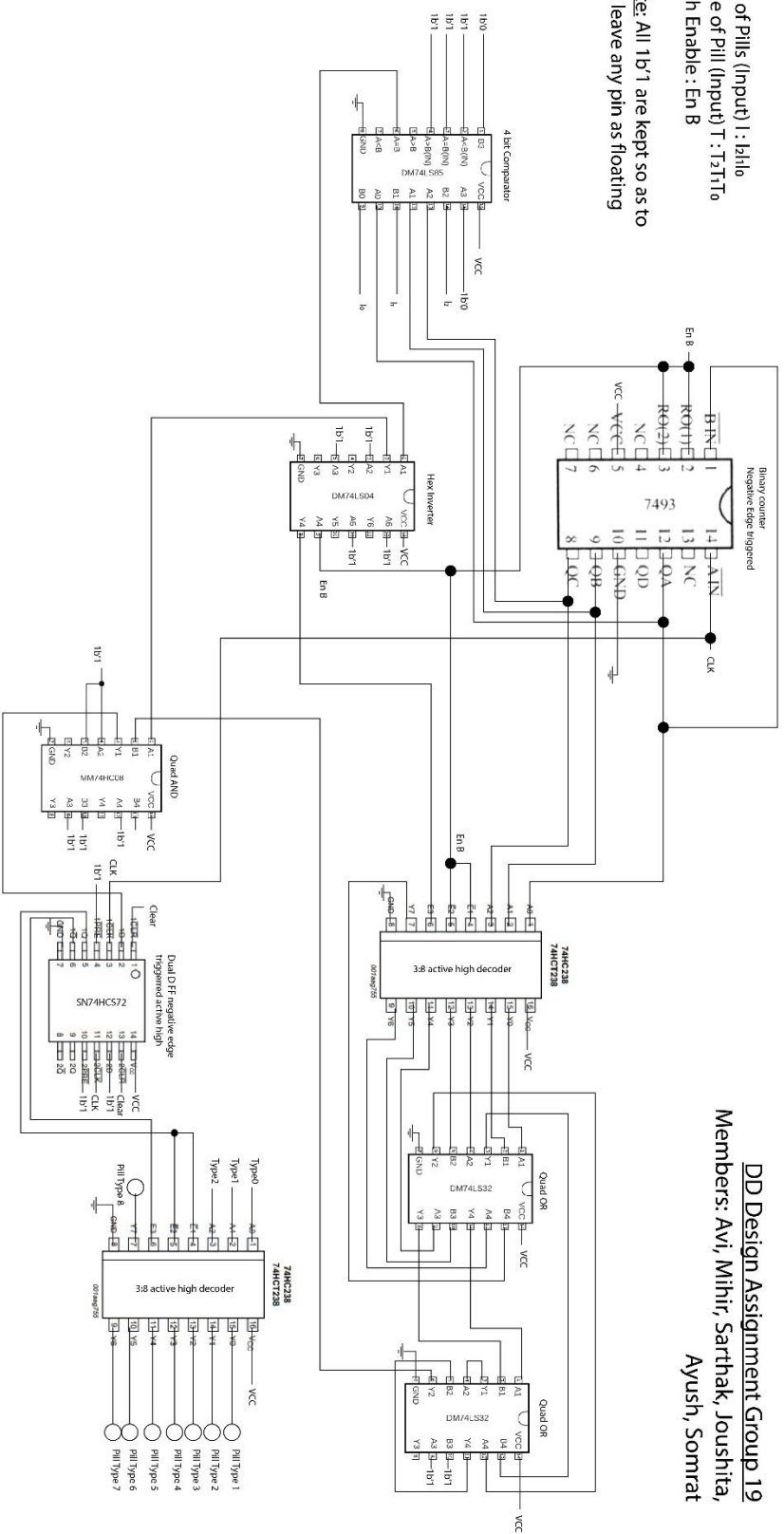
PIN-OUT DIAGRAM

No. of Pills (Input) 1 : 12110

Type of Pill (Input) T: T2T1T0
Push Enable: En B

Push Enable: En B

Note: All 1b'1 are kept so as to not leave any pin as floating



DD Design Assignment Group 19

Members: Avi, Mihir, Sarthak, Joushita,
Ayush, Somrat

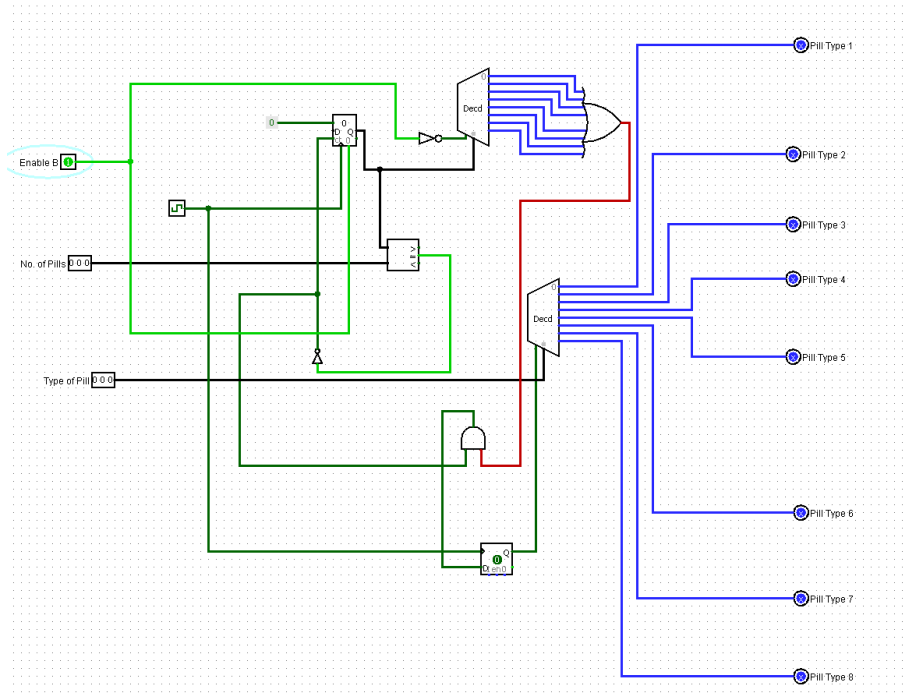
Ayush, Somrat

BILLS OF MATERIALS

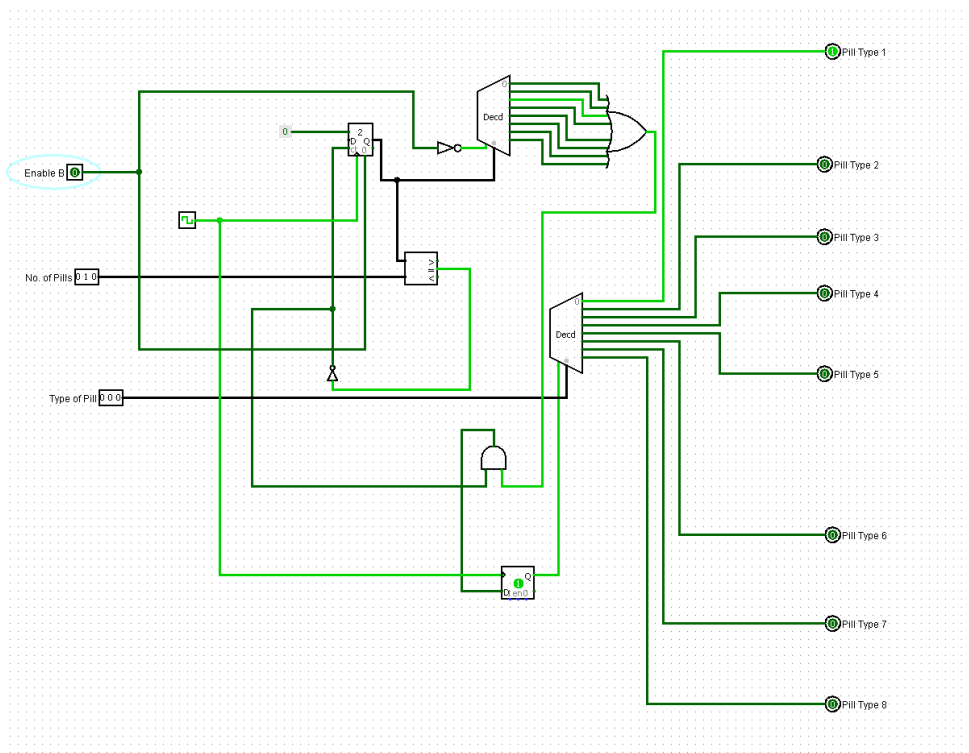
S.NO	COMPONENT	IC	FAMILY	Quantity of ICs used
1	D Flip Flop	SN74HCS72	TTL	1
2	3:8 Decoder	74HCHCT238	TTL	2
3	NOT Gate	DM7404	TTL	1
4	AND Gate	DM7408	TTL	1
5	4-bit Binary Counter	DM7493	TTL	1
6	4-bit binary comparator	DM74LS85	TTL	1
7	OR Gate	SN74LS32	TTL	2

SAMPLE INPUT – OUTPUT

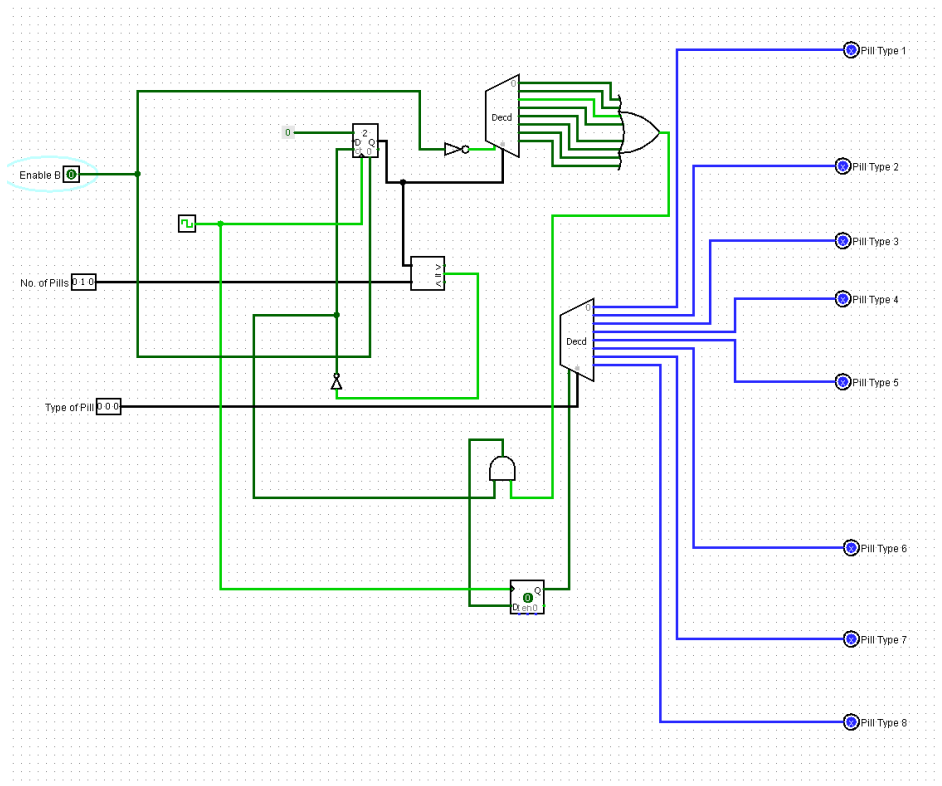
Step 1: Make sure Enable B is high, and then input no. of pills and type of pills



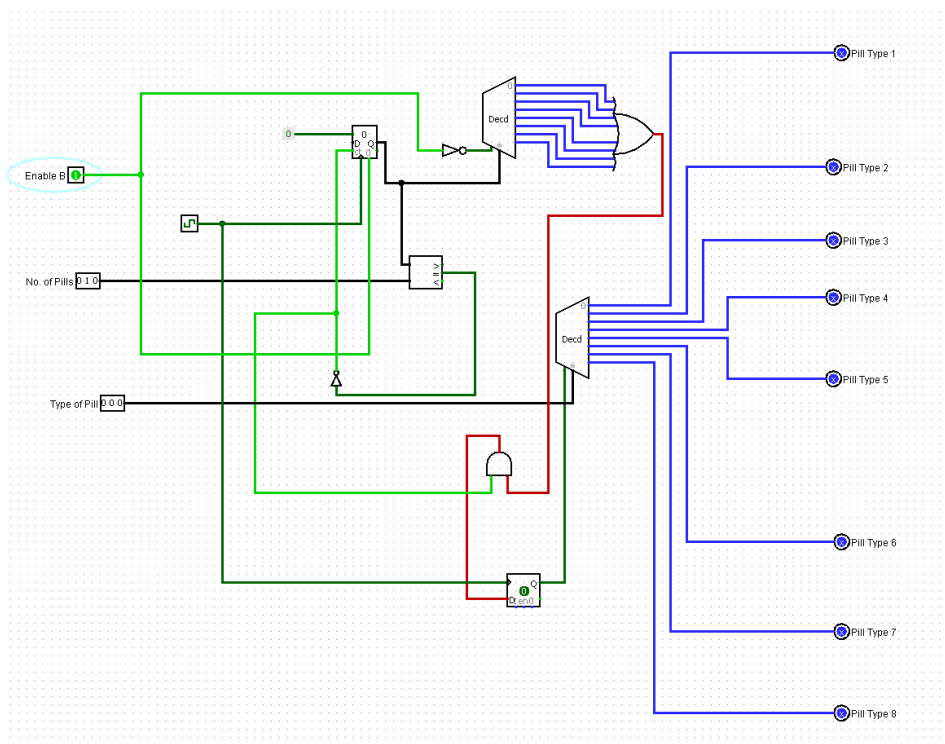
Step 2: Make Enable B low. You will see that the counter will start counting the no. of pills and the output is given as 1 for as many time units as the no. of pills for the corresponding type of pill.



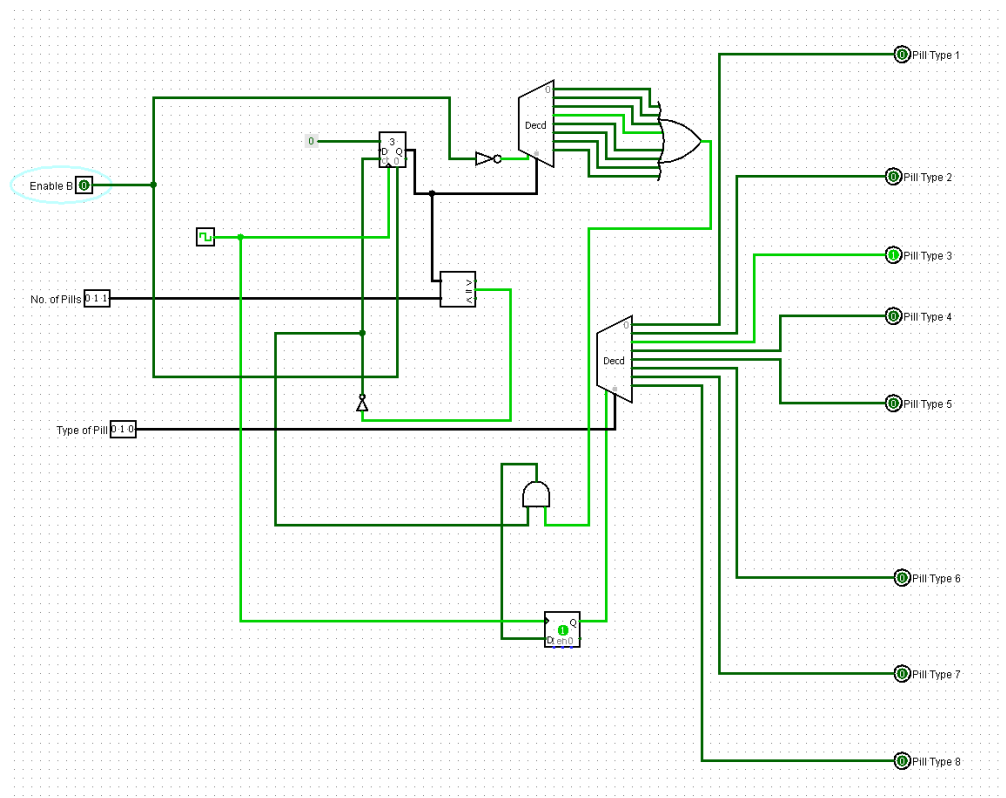
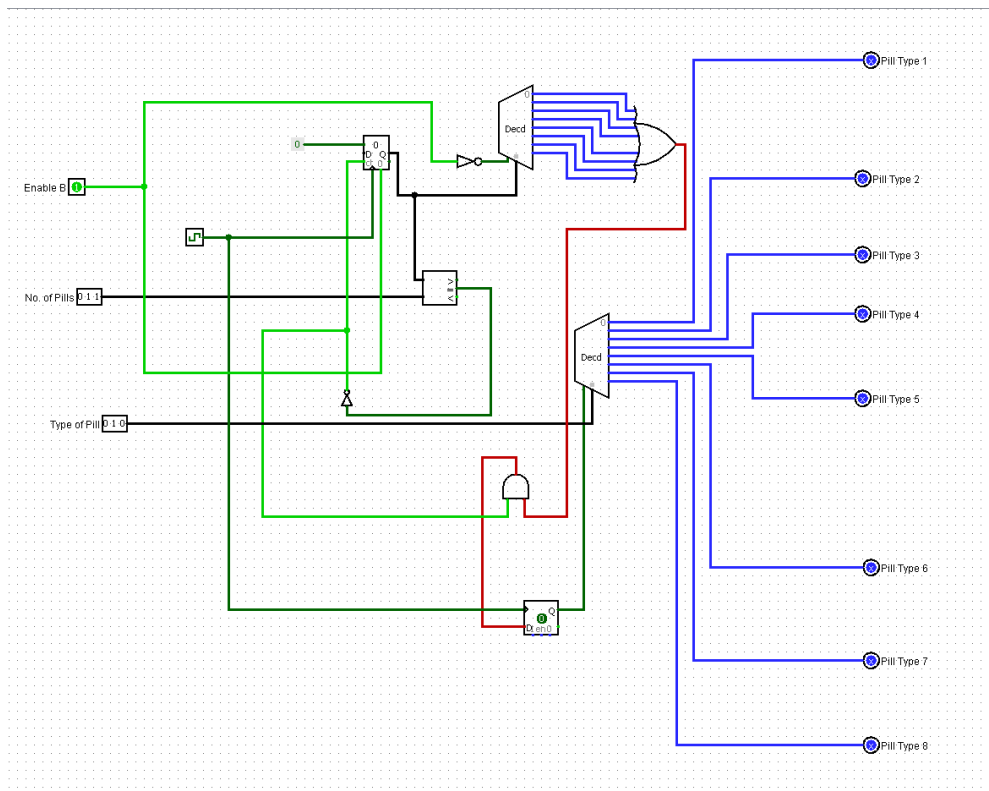
Step 3: Once the required no. of pills are dispensed, the output will go back to zero. Now just make enable B high again.

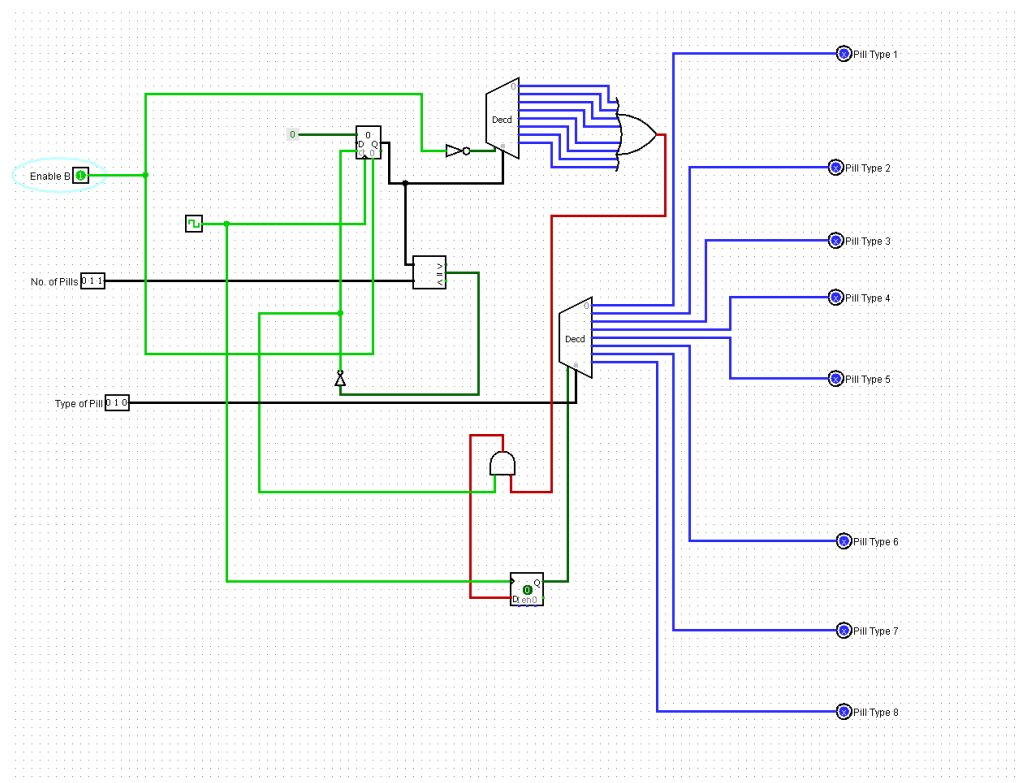
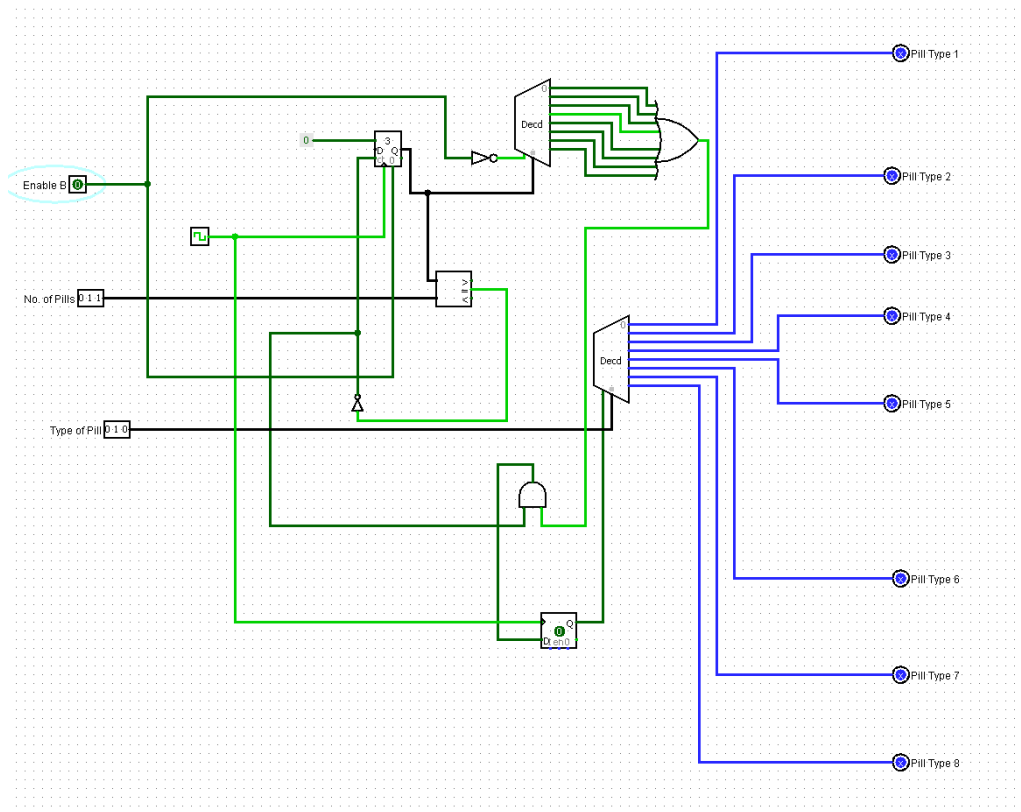


Step 4: The counter is reset and the next person can dispense pills by repeating steps 1 to 3.



Step 5: Repeat process with new number of pills





Output summary

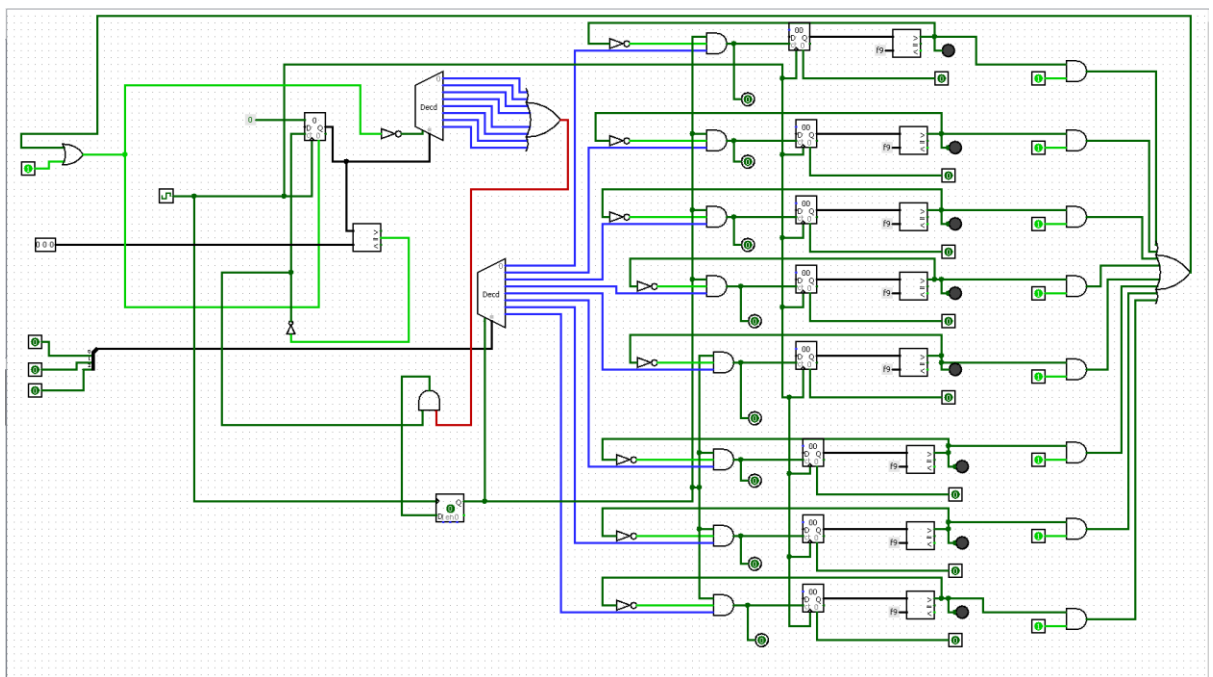
[illegible]

ADDITIONAL FUNCTIONALITIES

1) Keeping track of inventory:

The inventory alert is one of the special features in our design. It is an important feature to prevent the situation where the patient is not able to have his usual dosage of medicines due to unavailability of the medicine. The pill dispenser is designed to signal an alert signal to when the inventory of a particular type of medicine goes below a threshold level, so that the caretakers/nurses can make sure to immediately fill it.

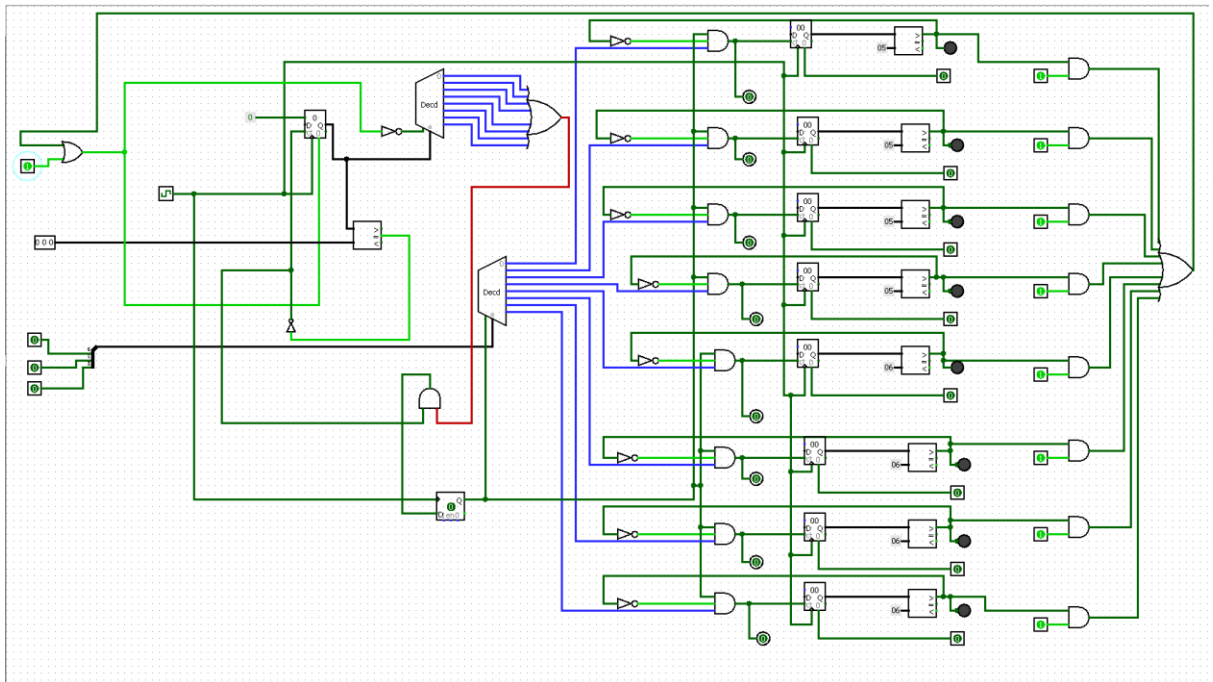
The following circuit diagram achieves this:



2) Preventing over dosage – Imposing daily limit

Another important feature of the pill dispenser is its ability to prevent over dosage. Users can't consume more than a prescribed limit of a particular type of medicine per day. Caretakers/nurses can set the maximum limit of the number of each type of pill that can be consumed by a particular patient in a day. If the user tries to consume more than the prescribed limit, an alert signal is given and the pill is not dispensed in the outlet.

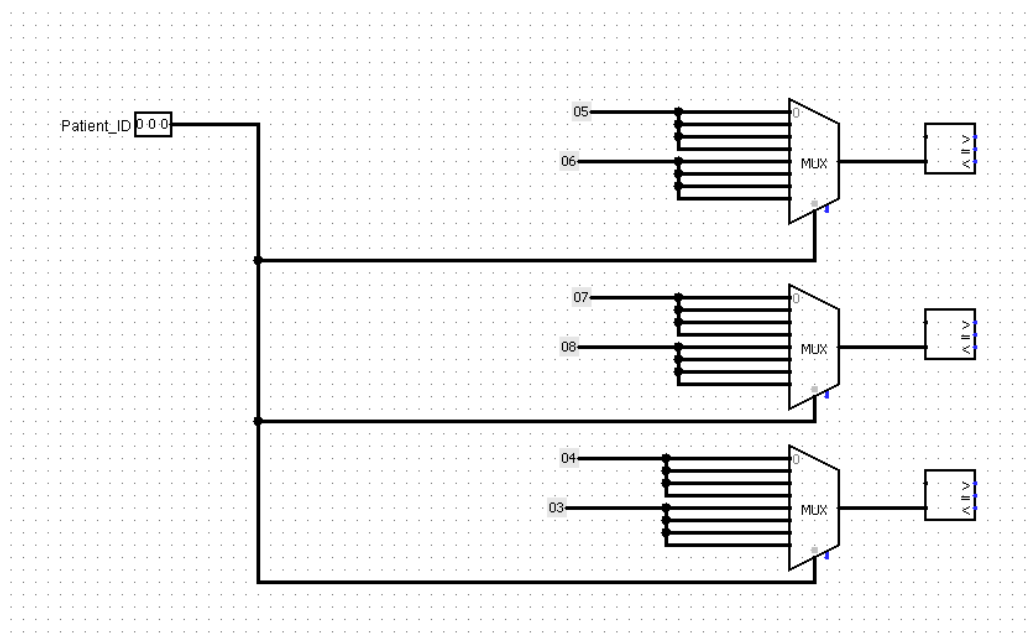
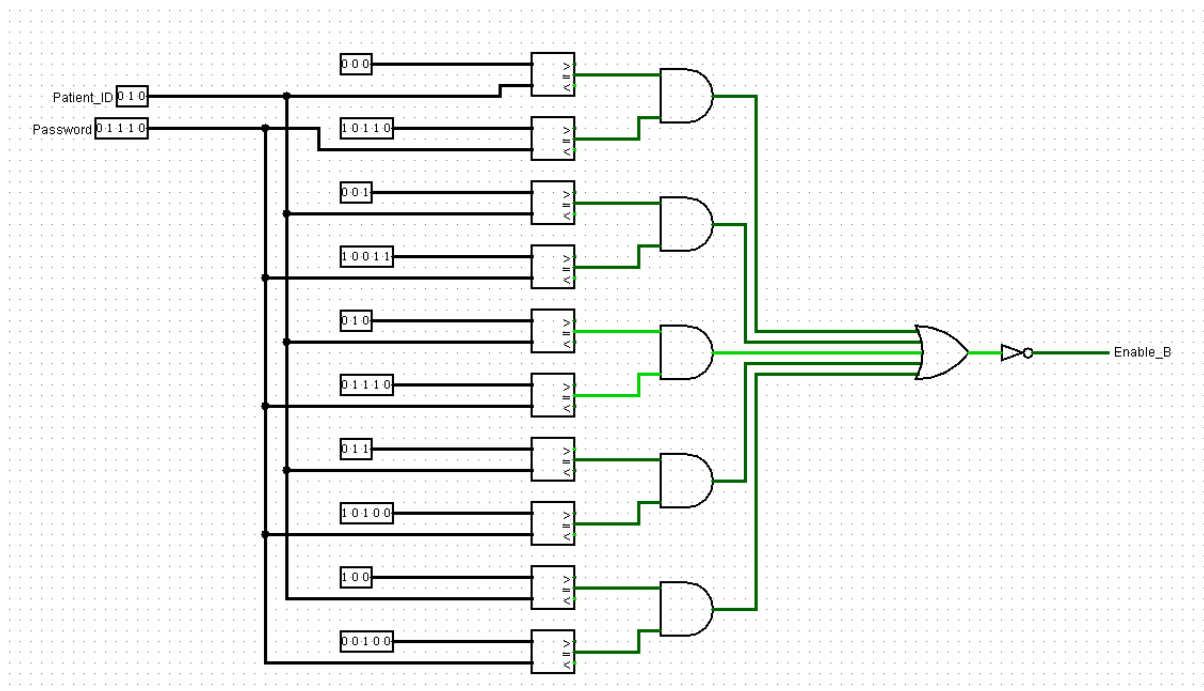
The following circuit diagram achieves this:



3) Fingerprint scanners (and passwords)

Even though this pill dispenser is used as a common pill dispenser for all the patients in the old age home, it has been personalized to meet the different medicinal requirements of each individual. This is achieved using a finger print protection, where the daily limit of the type of pills can be set and monitored from person to person based on their finger prints. Another advantage of having such a protection is to ensure that non-users do not have any unnecessary access to the pills in the dispenser.

The following circuit diagram achieves this:



Appendix

The data sheets of the various components used have been attached as a separate folder in the zip folder.