Title:Washroom Automation System

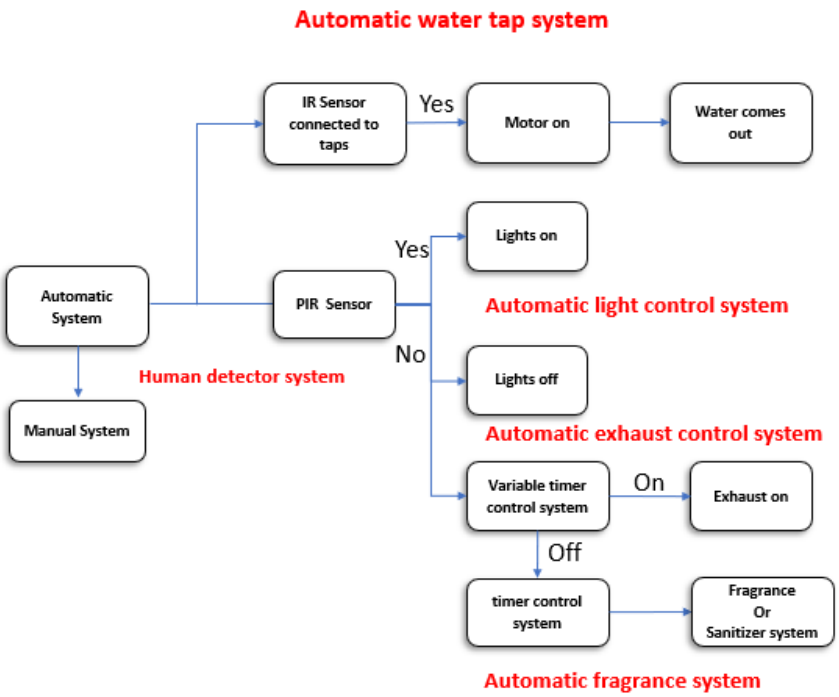
Introduction:

In today's world everyone is craving for a more relaxed, comfortable and a more automatic system to make their life easier. Moreover, Statistics show that a washroom is one of the most hazardous places especially for older people. Older people typically have greater difficulties with mobility and balance, making them more vulnerable to fall and slip injuries in a bathroom and causing serious health issues related to short and long-term well-being. Therefore, we intend to make a washroom automation system which is not only automatic, but it also provides a safe and secure environment for older people. Moreover, it also has the functionality to be manually controlled depending on the user.

Project Scope:

The scope of this project is the formation of an automatic system for washroom that can be deployed easily. With automation, the system will provide efficient usage of energy and will prevent unwanted wastage of energy thus making the system economical. Moreover, it will be convenient to use and helpful for the elderly people and children.

Block Diagram:



Design Steps and Circuit Explanation:

Our project consists of 4 main parts:

1.Automatic Water Tap System.

2.Automatic Light Control System.

3. Time Controlled Exhaust System.

4.Time Controlled Fragrance/Sanitizer Spray.

Procedure:

- Firstly, we started our work with the automatic tap system.
- Then we moved on to Automatic Light Control System Design.
- Then we designed Time controlled exhaust system.
- And lastly, we designed Time controlled Fragrance/Sanitizer Spray.

Automatic Water Tap System.

Design:

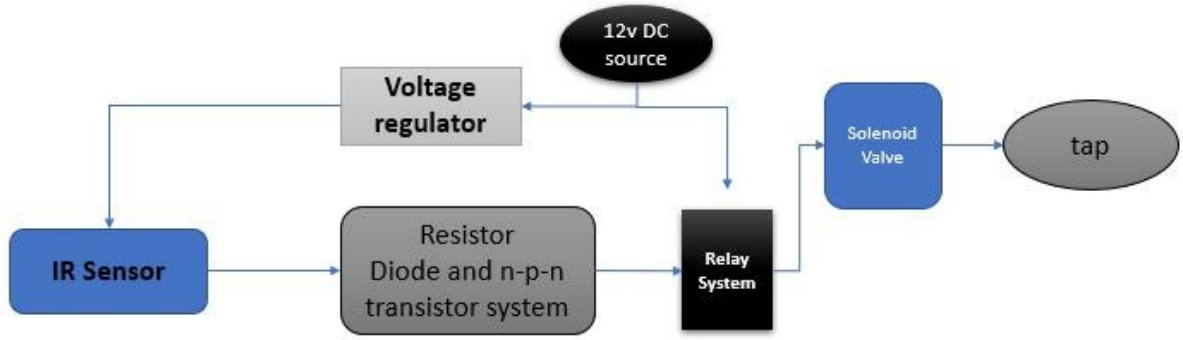
Design includes IR sensor, resistor, relay, solenoid valve, 12-volt source, 1N4002 diode, npn-transistors, voltage regulator.

Explanation of circuit:

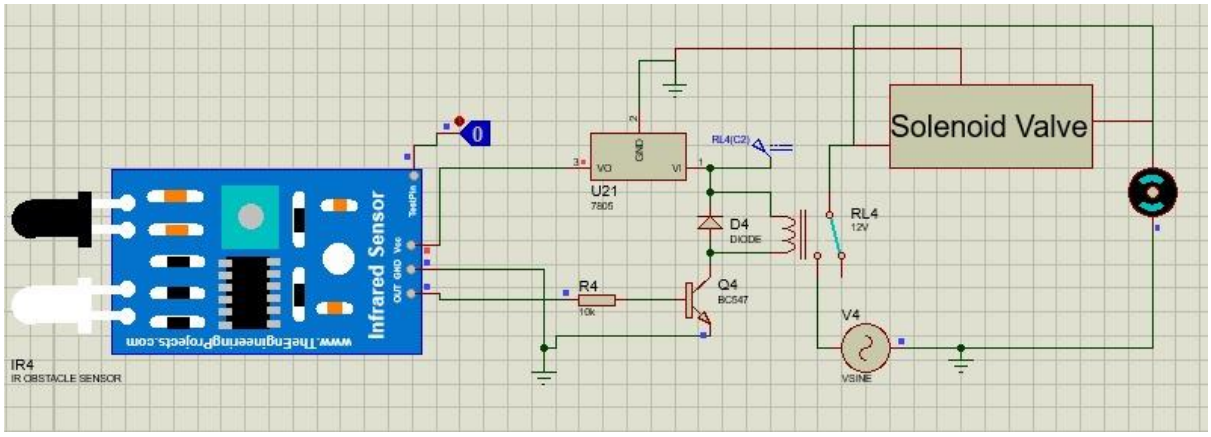
The circuit is employing an IR Obstacle sensor as a detector and the solenoid valve to control the water flow. The circuit is being powered by a 12-volt battery as a power source. There is a solenoid valve connected to the relay COM pin. As soon as the hand comes in front of the sensor, the IR sensor detects them. It does detection work by the principle depending upon the working of the IR encoder and receiver. Once, the hand comes in the range with the sensor the IR light emitted by the emitter falls and strikes back from the hands. This reflected IR radiation is sensed by the IR receiver LED in the sensor. The IR sensor then gives a TTL Output to the transistor Q1’s base to turn it ON.

This makes relay to turn ON. After that, the relay makes the solenoid valve connected to a power source connected to the NO pin that leads to water flow. If hands are removed, the sensor stops the transistor supply making relay to turn off and the solenoid valve stops getting supply too. The water flow then stops as the relay COM pin gets back to NC. This makes solenoid to turn off and water supply is off. A 12-Volt DC power is used for the solenoid valve. This is the working principle of Automatic water tap system.

Block diagram:



Schematic Diagram:



Automatic Light Control System.

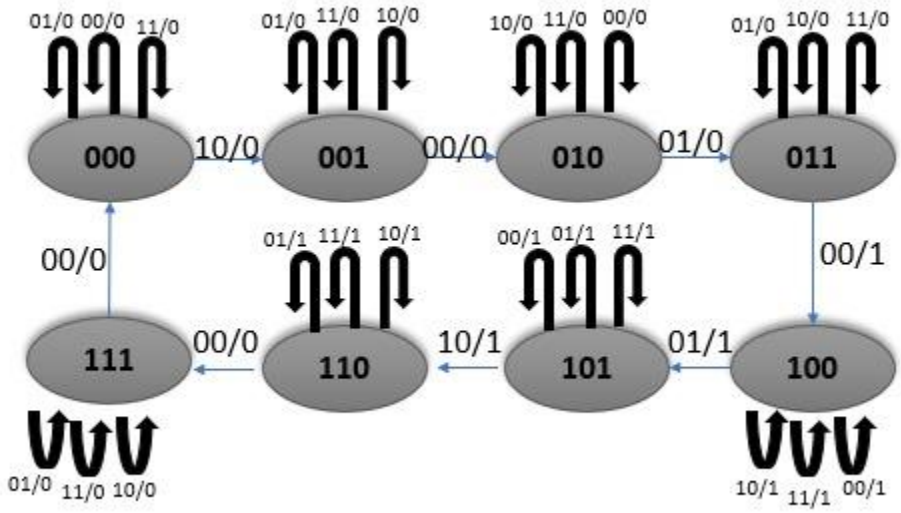
Design:

Design includes IR sensor, And gate, Or gate, D flip flop, resistor, relay, 12-volt source, 1N4002 diode, transistors, voltage regulator, light bulb.

Explanation of circuit:

The working principle is basically based on the logic state of two sensors; S1 and S2. When the object is not in range both the sensors are at the waiting situation (state 0). When the object is in the vicinity of sensor S1, the sensor S1 has state 1 but the sensor S2 is in state zero (state 1). Similarly, when the object is in the vicinity of sensor S2, the sensor S1 has state 0 (state 2) but then sensor S2 is in state 1 (state 3). Further, when he enters the bathroom, the sensor S2 turns to zero state and then the lights are on (state 4). And, now both sensors are at zero state, but the light remain on till state 8 occurs. Further, again when object is in the vicinity of sensor S2, the state of S2 becomes 1 (state 5). When close to S1 the state of the sensor 2 becomes 0 (state 6) and 1 for S1 (state 7). As the body leaves the room the sensor again are in waiting situation (state 8) and the lights turn off. This is the basic principle of this Automatic bathroom light system.

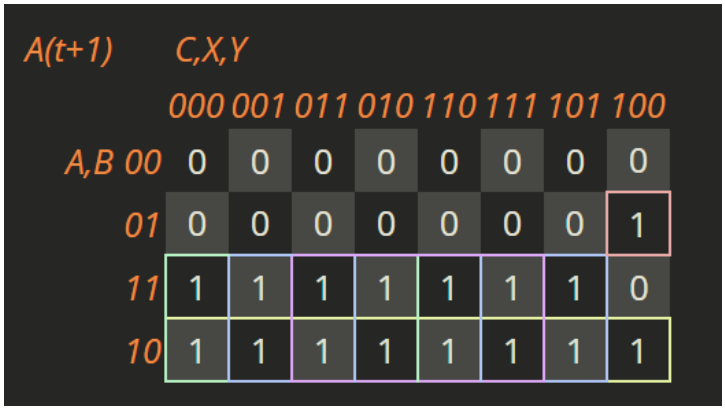
State Diagram:



State Table:

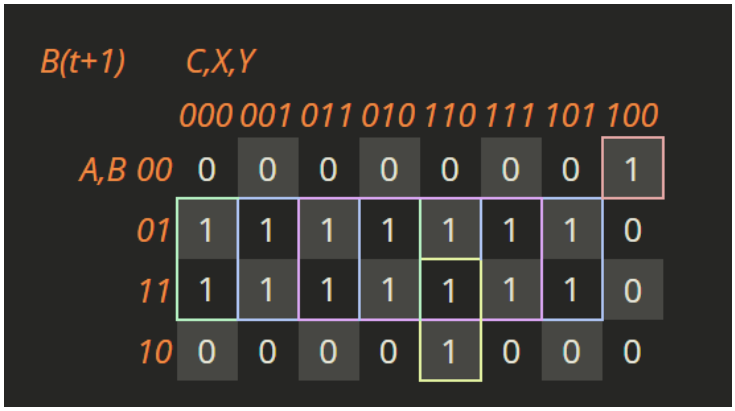
A	B	C	X	Y	A(t+1)	B(t+1)	C(t+1)	Output
0	0	0	0	0	0	0	0	0
0	0	0	0	1	0	0	0	0
0	0	0	1	0	0	0	1	0
0	0	0	1	1	0	0	0	0
0	0	1	0	0	0	1	0	0
0	0	1	0	1	0	0	1	0
0	0	1	1	0	0	0	1	0
0	0	1	1	1	0	0	1	0
0	1	0	0	0	0	1	0	0
0	1	0	0	1	0	1	1	0
0	1	0	1	0	0	1	0	0
0	1	0	1	1	0	1	0	0
0	1	1	0	0	1	0	0	1
0	1	1	0	1	0	1	1	0
0	1	1	1	0	0	1	1	0
0	1	1	1	1	0	1	1	0
1	0	0	0	0	1	0	0	1
1	0	0	0	1	1	0	1	1
1	0	0	1	0	1	0	0	1
1	0	0	1	1	1	0	0	1
1	0	1	0	0	1	0	1	1
1	0	1	0	1	1	0	1	1
1	0	1	1	0	1	1	0	1
1	0	1	1	1	1	0	1	1
1	1	0	0	0	1	1	1	0
1	1	0	0	1	1	1	0	1
1	1	0	1	0	1	1	0	1
1	1	0	1	1	1	1	0	1
1	1	1	0	0	0	0	0	0
1	1	1	0	1	1	1	1	0
1	1	1	1	0	1	1	1	0
1	1	1	1	1	1	1	1	0

K-Map for A(t+1):



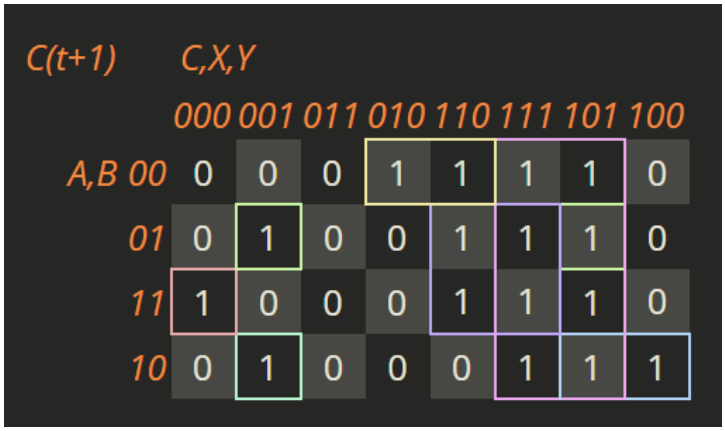
A(t+1)= A'BCX'Y' + AB' + AC' + AY + AX

K-Map for B(t+1):



B(t+1)= A'B'CX'Y' + BC' + BY + BX + ACXY'

K-Map for C(t+1):



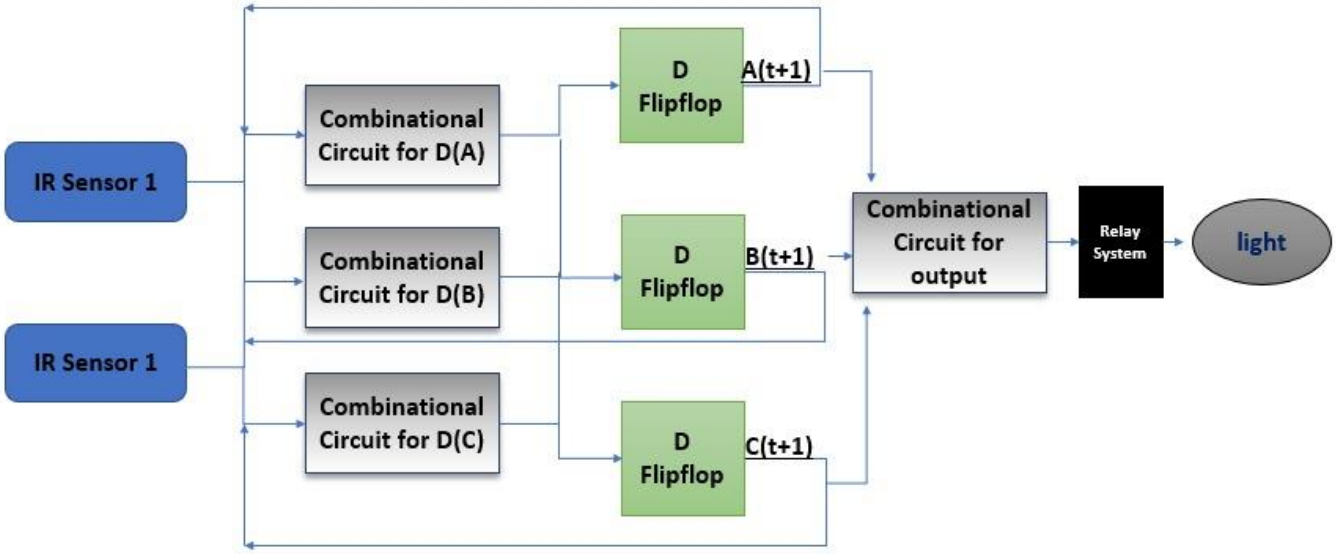
C(t+1)= A'B'XY' + CY + A'BX'Y + AB'X'Y + AB'CX' + ABC'X'Y' + BCX

K-Map for Output:

Output	C,X,Y							
	000	001	011	010	110	111	101	100
A,B 00	0	0	0	0	0	0	0	0
01	0	0	0	0	0	0	0	1
11	0	1	1	1	0	0	0	0
10	1	1	1	1	1	1	1	1

Output= A'BCX'Y' + AB' + AC'Y + AC'X

Block diagram:



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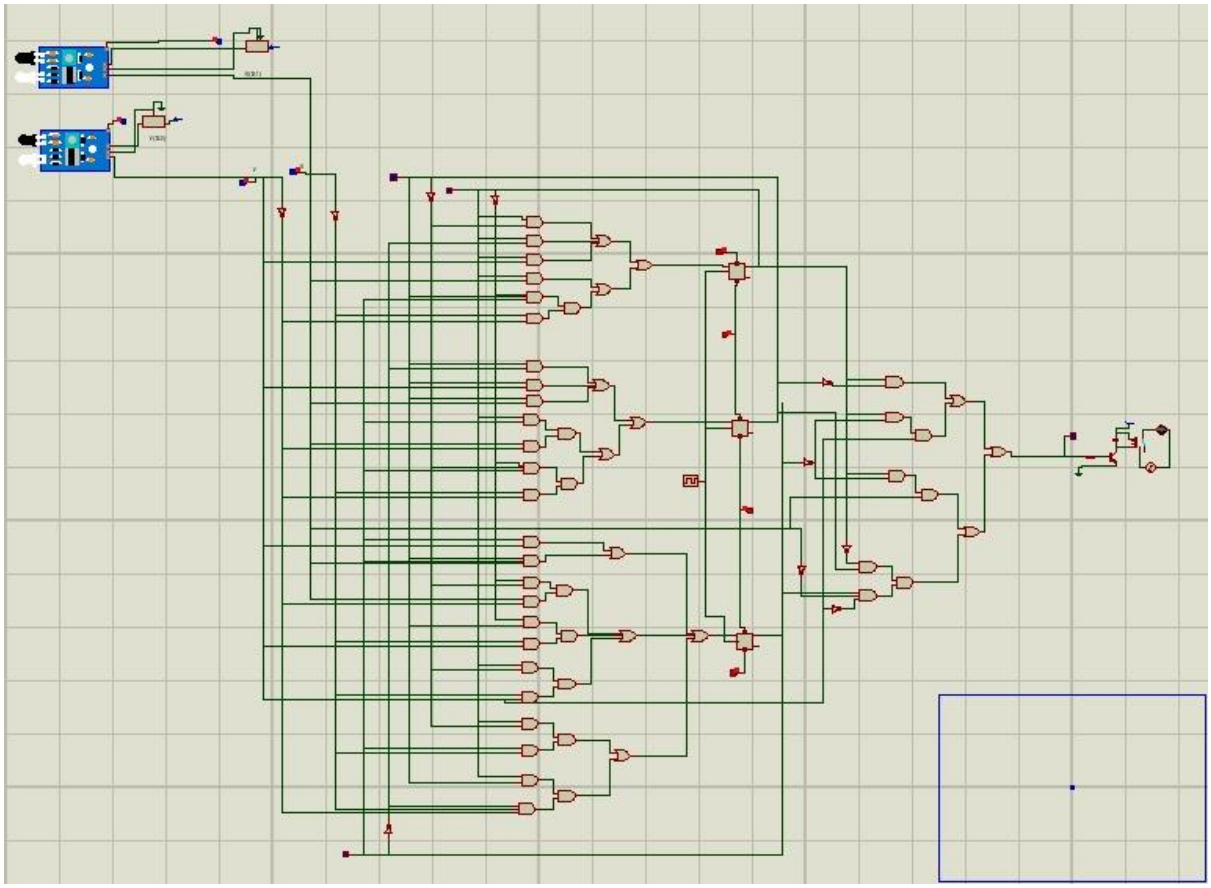
Schematic Diagram:



Time Controlled Exhaust System.

Design:

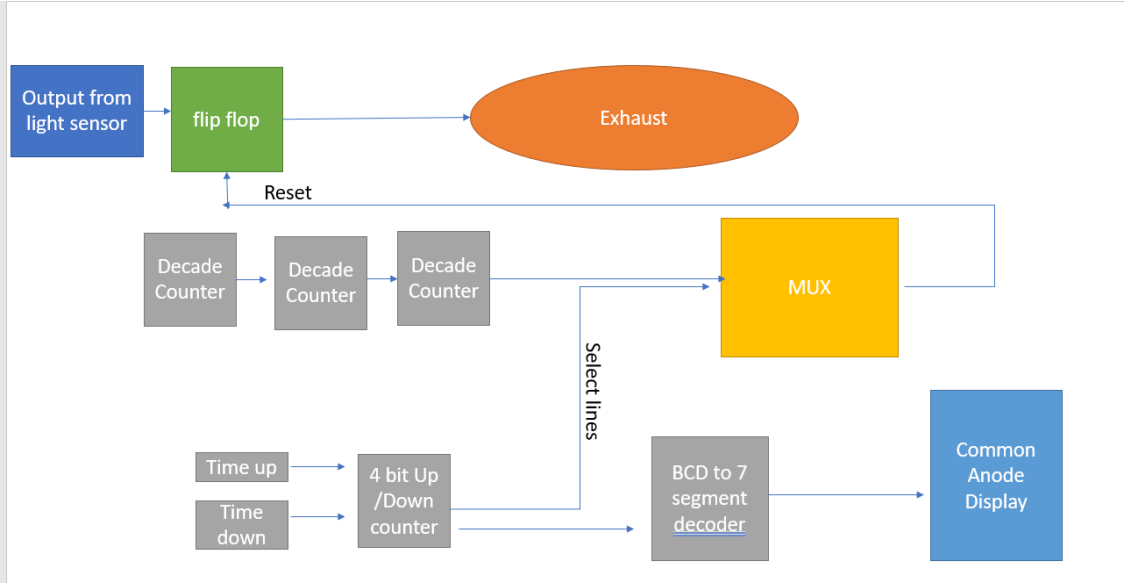
It includes:

And gate, OR gate, Not Gate, Resistors, Counters, Multiplexer, Decoder, J-K flip flop used as a T Flip Flop, 7 Segment Common Anode Display.

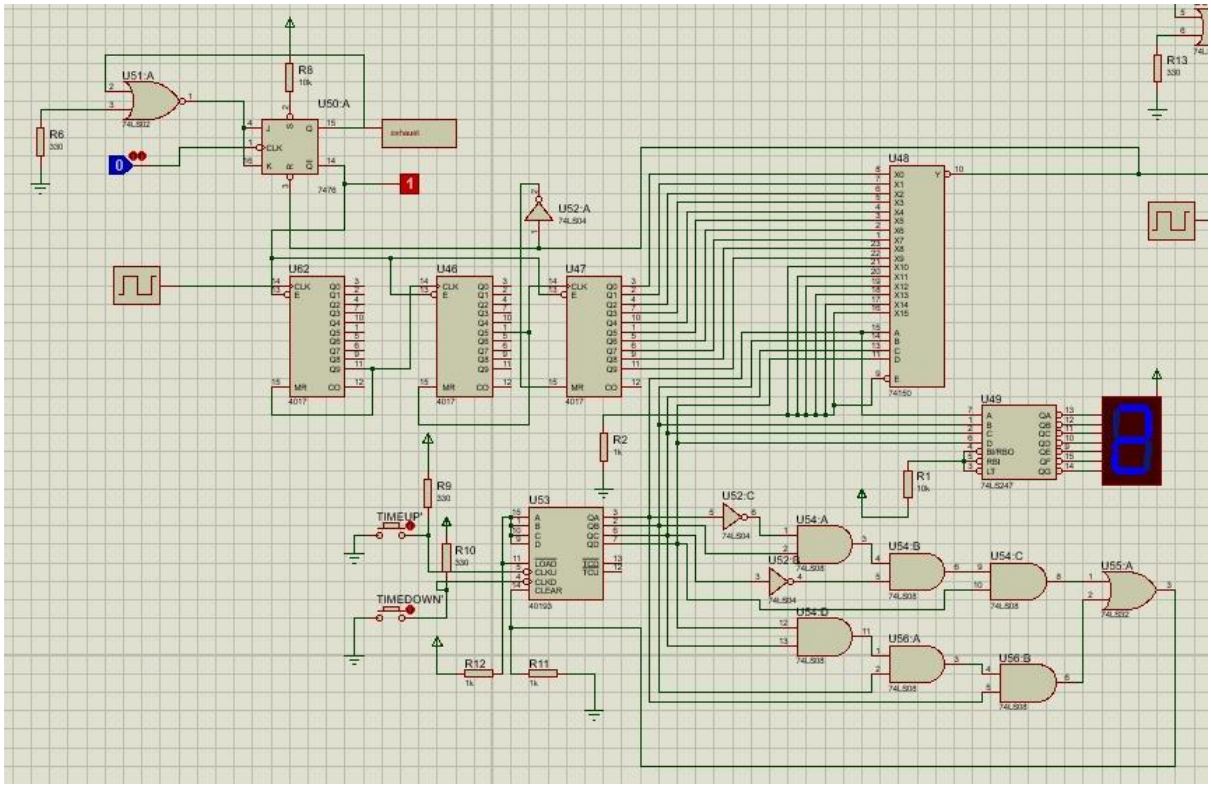
Explanation of circuit:

The power input to the different components in this system has been provided with the help of relay from a voltage source. We have used 3 Decade counters. They are connected in such a way that the 3rd counter counts after a minute. The output of the third counter is connected to a MUX. The select lines of the MUX are connected to the output of a 4 bit UP/Down counter which is also simultaneously connected to a 7-segment common anode display that displays the number of minutes selected by the user another 16-segment display is connected to show M that stands for minutes. The maximum number of minutes are 9 after that the 4 bit Up/Down counter will get reset. The output of the MUX will be connected to the reset pin of the T flip flop. The input of the flip flop is connected to the output of the light sensor. The output of T flip flop remains high unless it is reset.

Block diagram of Exhaust system:



Schematic Diagram:



Time Controlled Sanitization/Fragrance Spray.

Design:

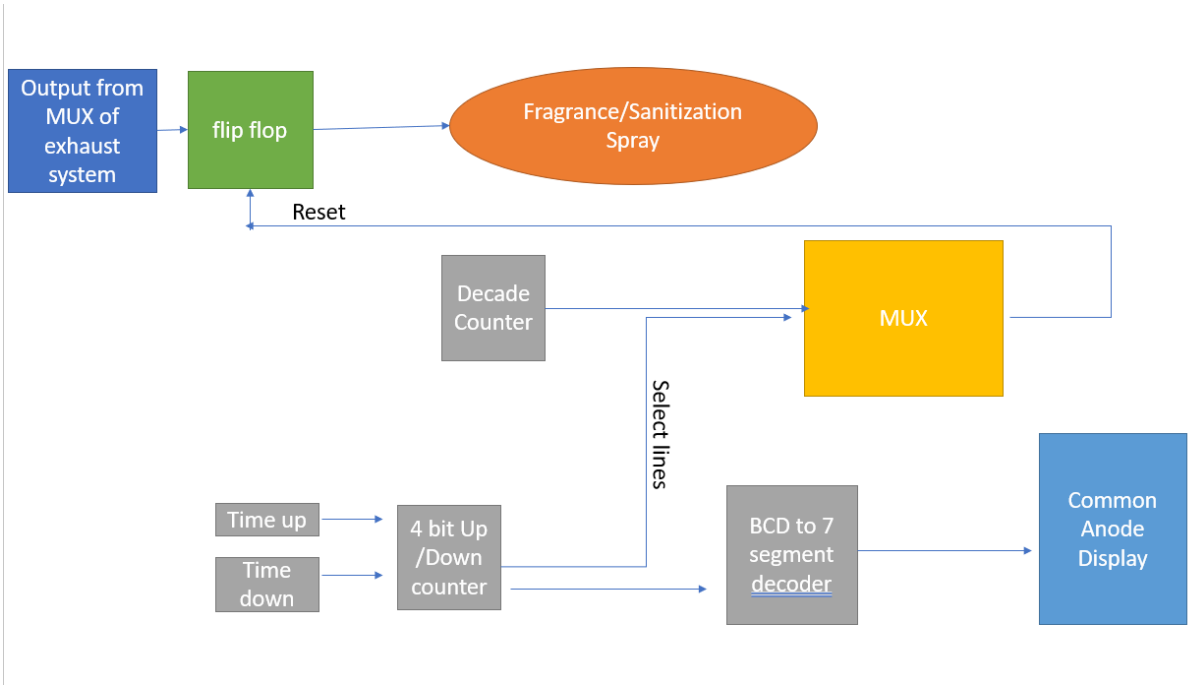
It includes:

And gate, OR gate, Not Gate, Resistors, Counters, Multiplexer, Decoder, J-K flip flop used as a T Flip Flop, 7 Segment Common Anode Display.

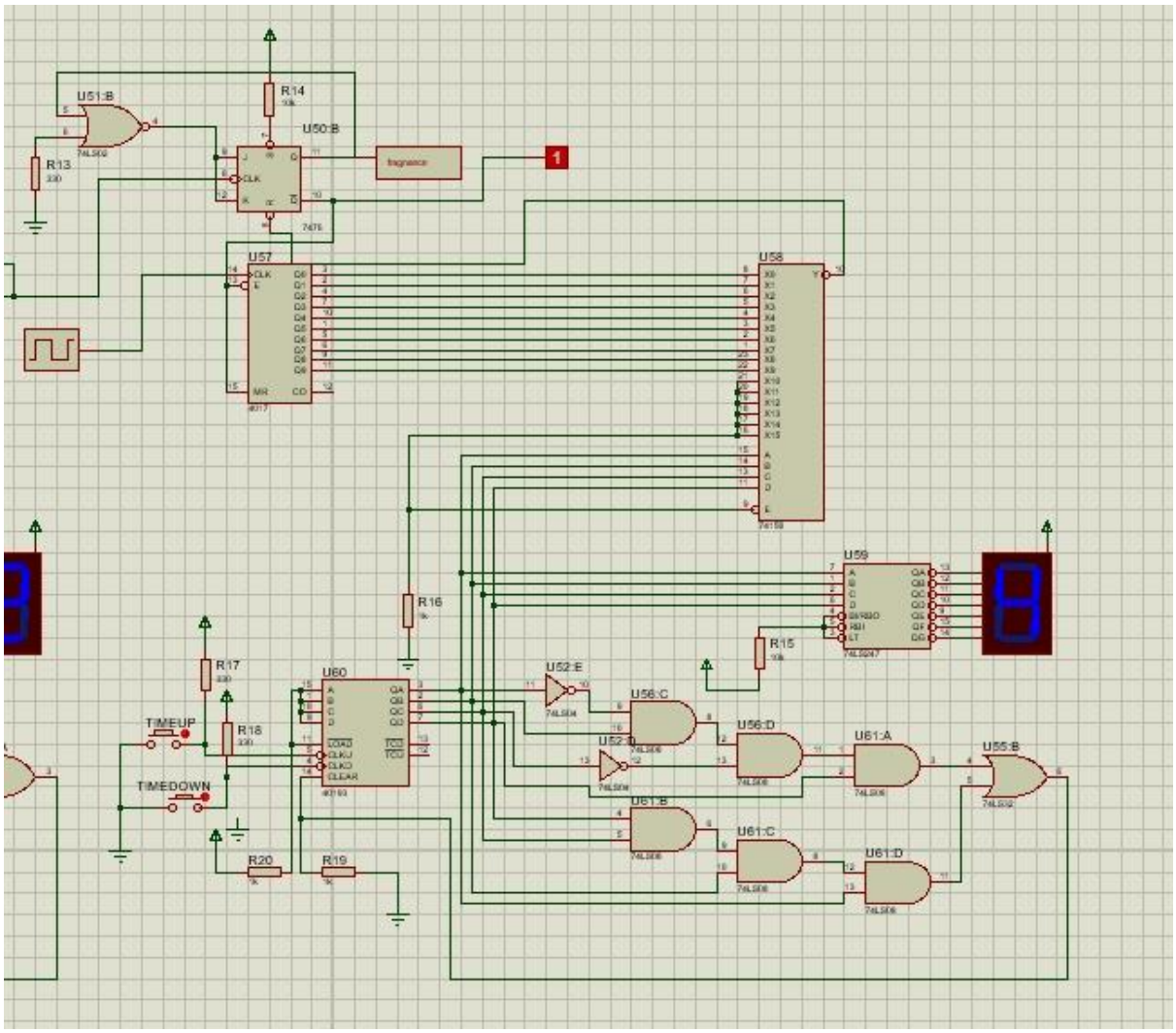
Explanation of circuit:

The power input to the different components in this system has been provided with the help of relay from a voltage source. We have used 1 Decade counter. They are connected in such a way that the counter counts after a second. The output of the third counter is connected to a MUX. The select lines of the MUX are connected to the output of a 4 bit UP/Down counter which is also simultaneously connected to a 7-segment common anode display that displays the number of seconds selected by the user another 7-segment display is connected to show S that stands for seconds. The maximum number of seconds are 9 after that the 4 bit Up/Down counter will get reset. The output of the MUX will be connected to the reset pin of the T flip flop. The clock of the flip flop is connected to the MUX of the exhaust system. The output of T flip flop remains high unless it is reset.

Block diagram of Sanitization/Fragrance system:



Schematic Diagram:



Problems, Results and Achievements:

Problems Faced:

- One of the very first problem we faced was designing the number of states in the state diagram of automatic light control system.
- We created a timer that could increase the number of minutes/seconds but faced problem in decreasing the number of minutes/seconds.

Results Achieved:

We successfully created an automated design that not only makes life easier for the user but is also cost effective. The user can be fully relaxed and comfortable going into the washroom not worrying about using different switches if he wants.

Our project has the functionality of automatic tap system. It also provides user with automated light system. Moreover, it also provides user with time-controlled exhaust system and sanitization/fragrance spray.

Moreover, our project also has the functionality to be manual if the user wants he can have the control himself.

Recommended Future Work:

The things that could have been added were:

- A temperature-controlled water tap/shower system.
- An automatic toilet flush.