Alexandria University

Faculty of Engineering

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Hex keypad encoder report

Logic circuits (digital)

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For Dr. Hossam Abdelbaki

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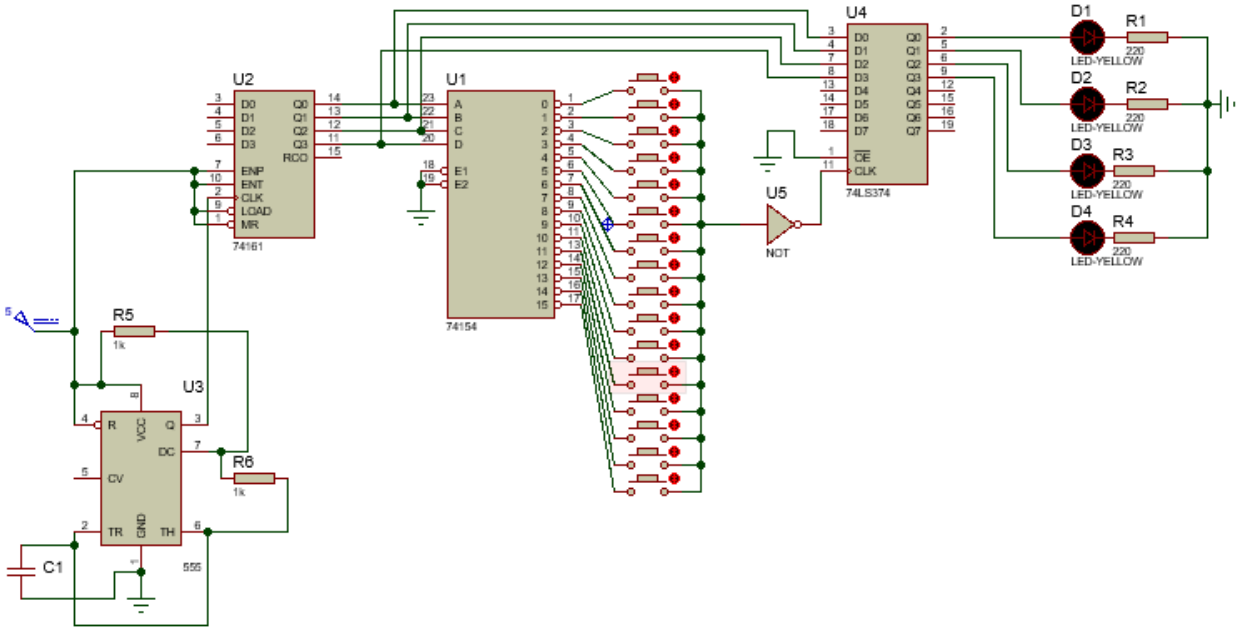
Introduction

The purpose of this project was to design a hex keypad encoder using commonly available digital logic ICs. The hex keypad encoder is a device that takes input from a hex keypad and converts it into binary-coded decimal (BCD) format for further processing.

In this report, we will describe the design, implementation, and testing of the hexa keypad encoder. We will explain the role of each IC in the circuit and provide a detailed schematic diagram of the circuit.

Schematic



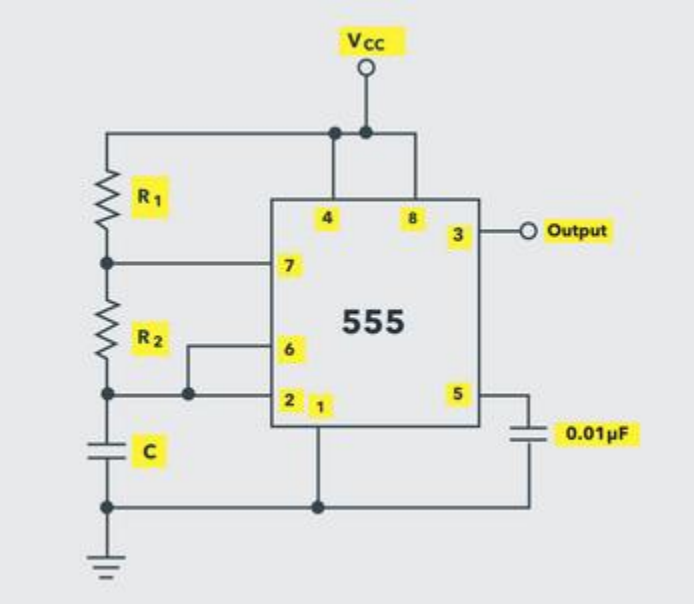
Design

The hex keypad encoder circuit is designed to convert hexadecimal input from 16 push buttons into binary-coded decimal (BCD) format using digital logic ICs. The circuit consists of the following ICs:

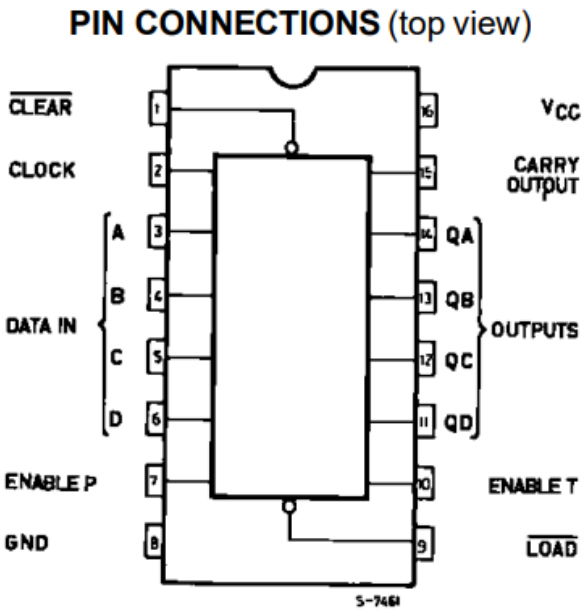
1. 555 timer IC: configured in **astable** mode to generate a continuous train of rectangular pulses of a specified frequency and duty cycle. The frequency and duty cycle of the output waveform can be calculated using the following equations:

Frequency (f):

$$f = 1.44 / ((R1 + 2*R2) * C)$$

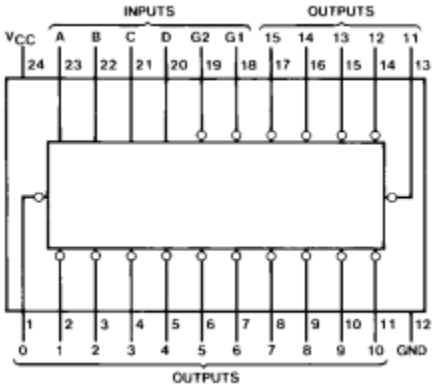


2. 74161 synchronous counter IC: has four parallel load outputs that are connected to the 74374 latch IC to load the BCD output data. The 74161 IC is a 4-bit binary counter that can count up or down, depending on the state of its control inputs. In this circuit, the counter is used to generate a BCD output that is sent to the 74154 demultiplexer IC.



74161

3. 74154 demultiplexer IC: has four output lines, the demultiplexer selects the output line corresponding to the pressed push button. The 74154 IC is a 4-to-16-line demultiplexer that can be used to select one output line from among 16 possible output lines. The selected output line is determined by the binary value of the inputs A, B,C, and D, which are connected to the outputs of the 74161 counter IC.



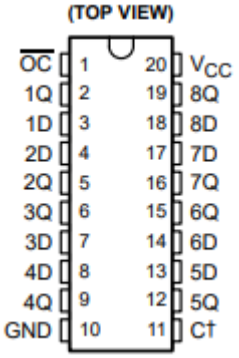
74154

4. 74374 latch IC: The 74374 latch IC is a 16-bit D-type transparent latch that can store digital data for as long as it is powered on. The IC is commonly used in digital circuits for applications such as data storage, data transfer, and address decoding. The 74374 IC consists of 16 D-type flip-flops, each of which can store a single bit of digital data.

The latch is transparent when its Enable input (pin 1) is high, which means that the data on its D (data) input is transferred to its Q (output) when the clock signal on its CLK (clock) input (pin 11) transitions from low to high. When the Enable input is low, the latch holds the data that was present on its Q outputs when the Enable input went low.

The 74374 IC is a positive-edge triggered latch, which means that the data on its D input is latched into its Q output on the rising edge of the clock signal. The inverted output of the 16 push buttons is connected to the CLK input of each flip-flop in the 74374 latch IC, which ensures that the BCD output data is correctly stored in the flip-flops.

it is powered on. The latch is transparent when its Enable input is high, which means that the data on its D input is transferred to its Q output. When the Enable input is low, the latch holds the data that was present on its D input when the Enable input went low.



74374

5. 7404 NOT gate IC: inverts the clock signal to latch the BCD output data into the flip-flops of the 74374 latch IC. The NOT gate ICs are simple logic gates that produce an inverted output of their input signal. In this circuit, the NOT gate IC inverts the clock signal that is generated by the 555 timer IC, so that it can be used to latch the BCDoutput data into the flip-flops of the 74374 latch IC.

Functionality

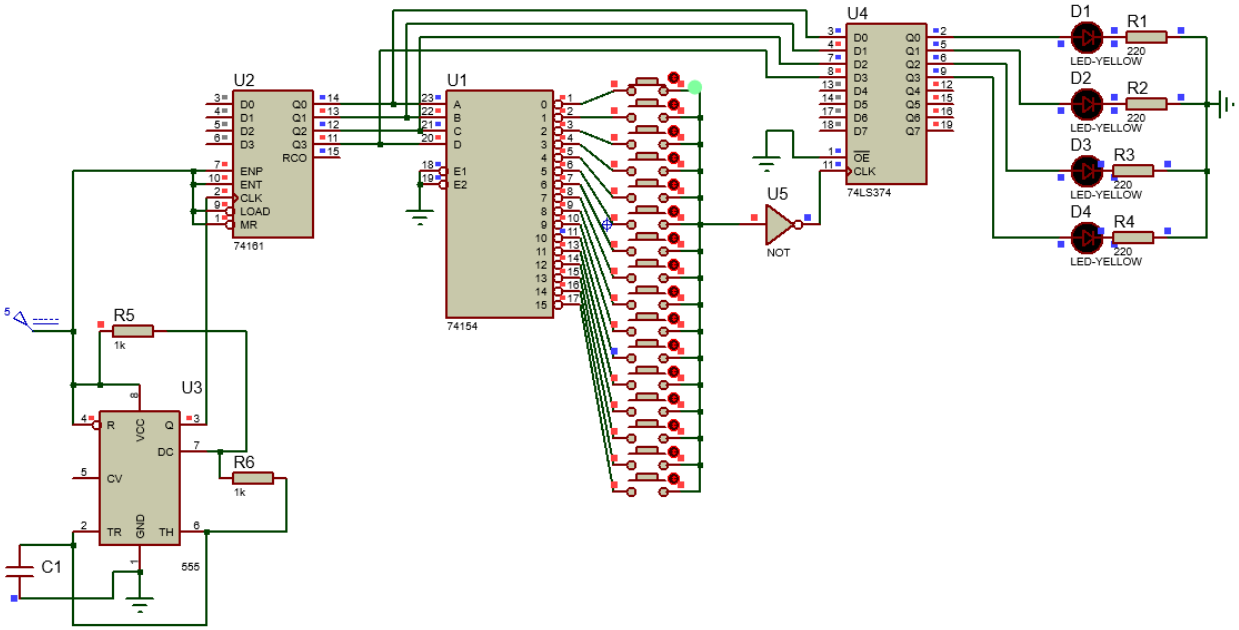
The hex keypad encoder circuit works as follows: When a push button on the hex keypad is pressed, the corresponding output line of the 74154 demultiplexer IC is selected, and the BCD output data is stored in the corresponding flip-flop in the 74374 latch IC. The CLK (clock) input (pin 11) of each flip-flop in the 74374 latch IC is connected to the inverted output of the NOT gate IC, which ensures that the BCD output data is correctly stored in the flip-flops.

The BCD output data is generated by the 74161 synchronous counter IC, which counts up in binary from 0000 to 1111 (decimal 0 to 15) when a push button is pressed. The BCD output is sent to the 74154 demultiplexer IC, which selects the output line that corresponds to the binary value of the BCD output. The selected output line is used to store the BCD output data in the corresponding flip-flop of the 74374 latch IC.

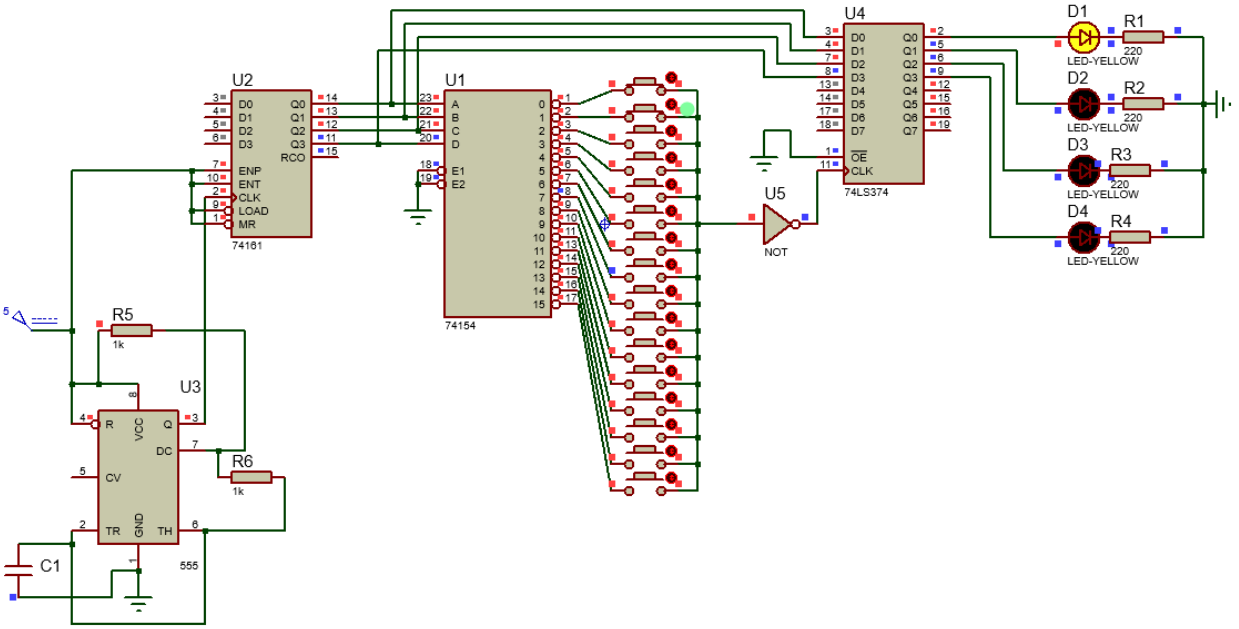
The hex keypad encoder circuit is designed to provide an accurate and reliable way to convert hexadecimal input from 16 push buttons into binary-coded decimal (BCD) format using commonly available digital logic ICs. The circuit has several advantages, including low cost, ease of construction, and flexibility in terms of modifying the circuit for different applications.

Testing

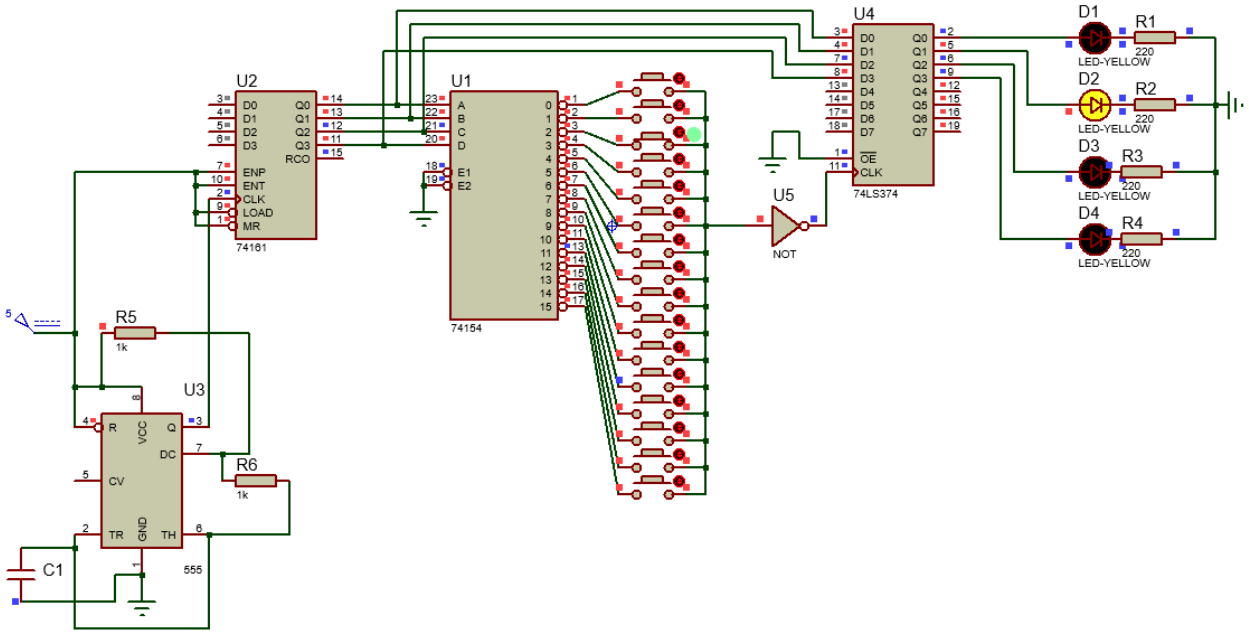
Pressing 0th push button



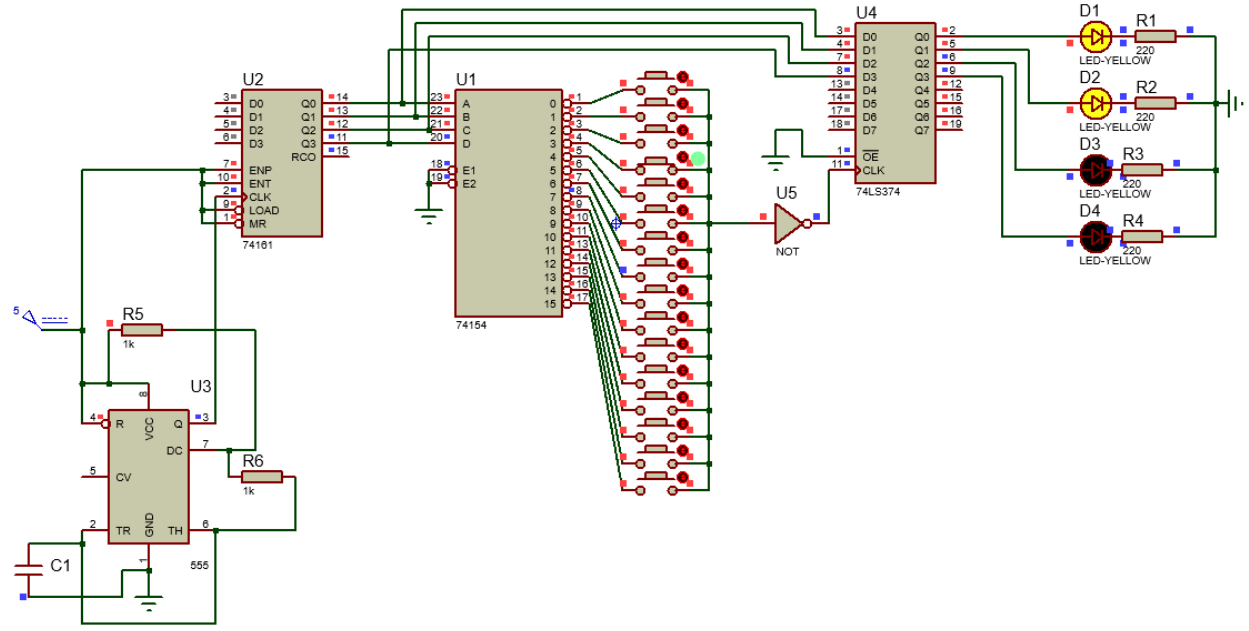
Pressing 1st push button



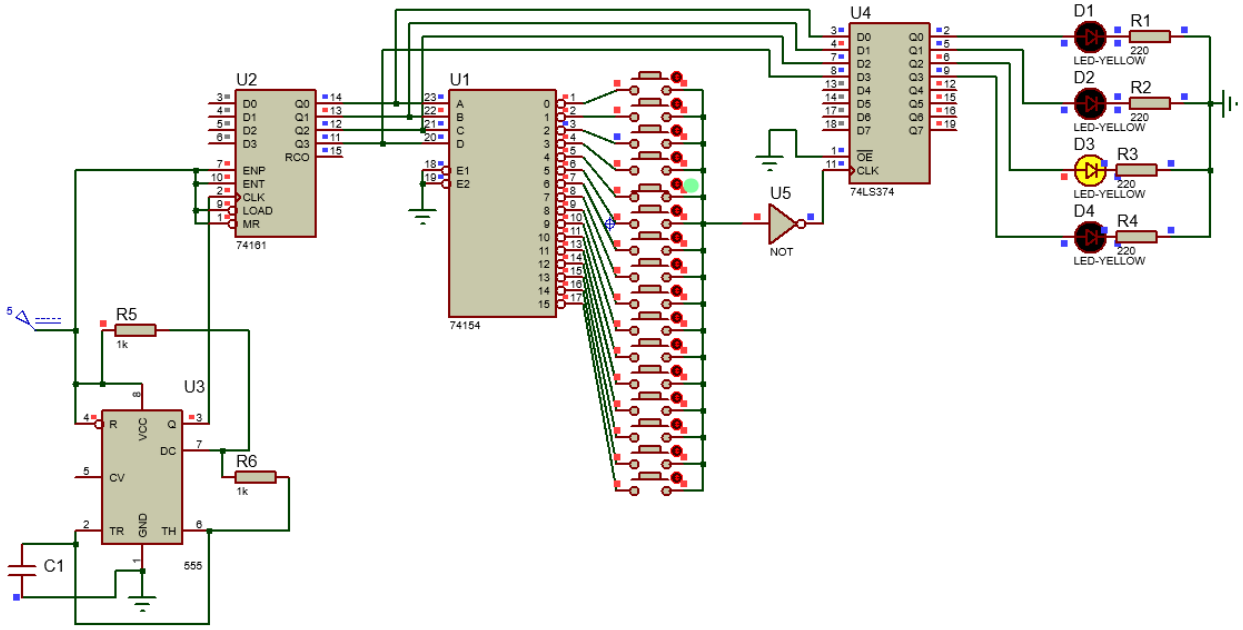
Pressing 2nd push button



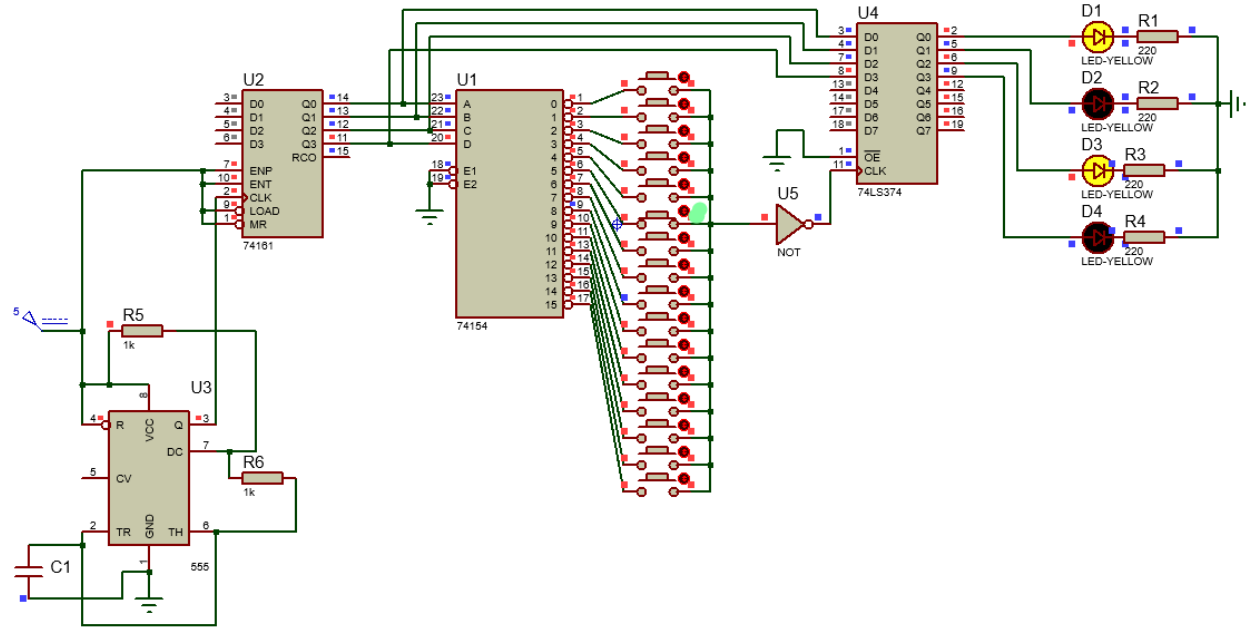
Pressing 3rd push button



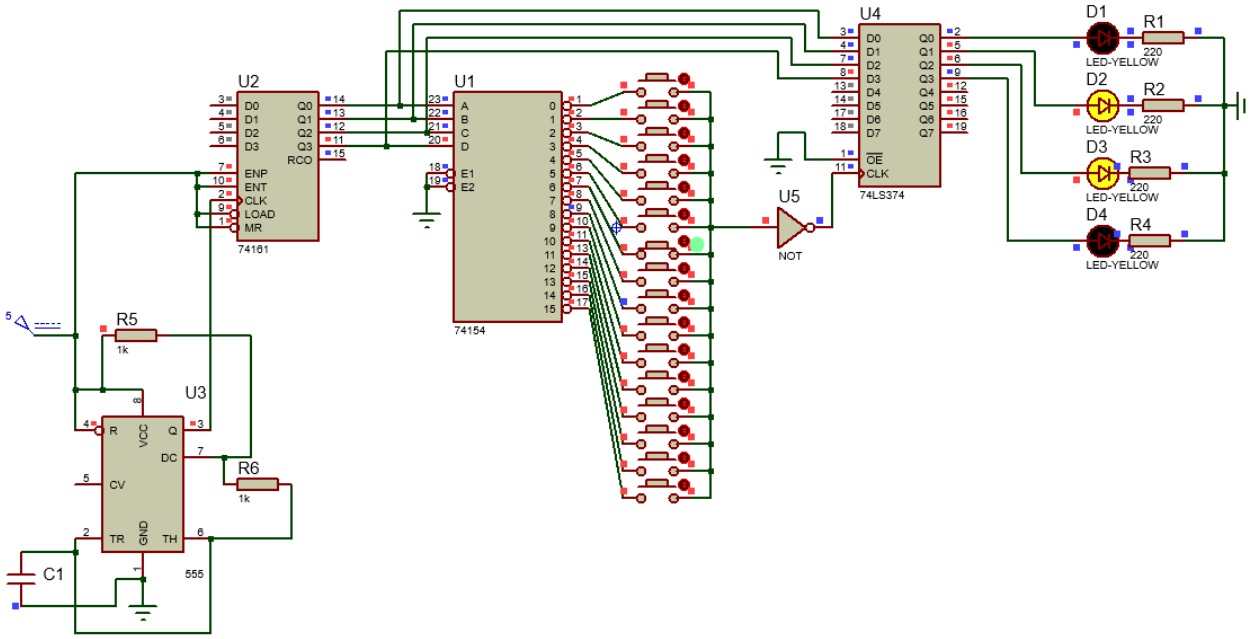
Pressing 4th push button



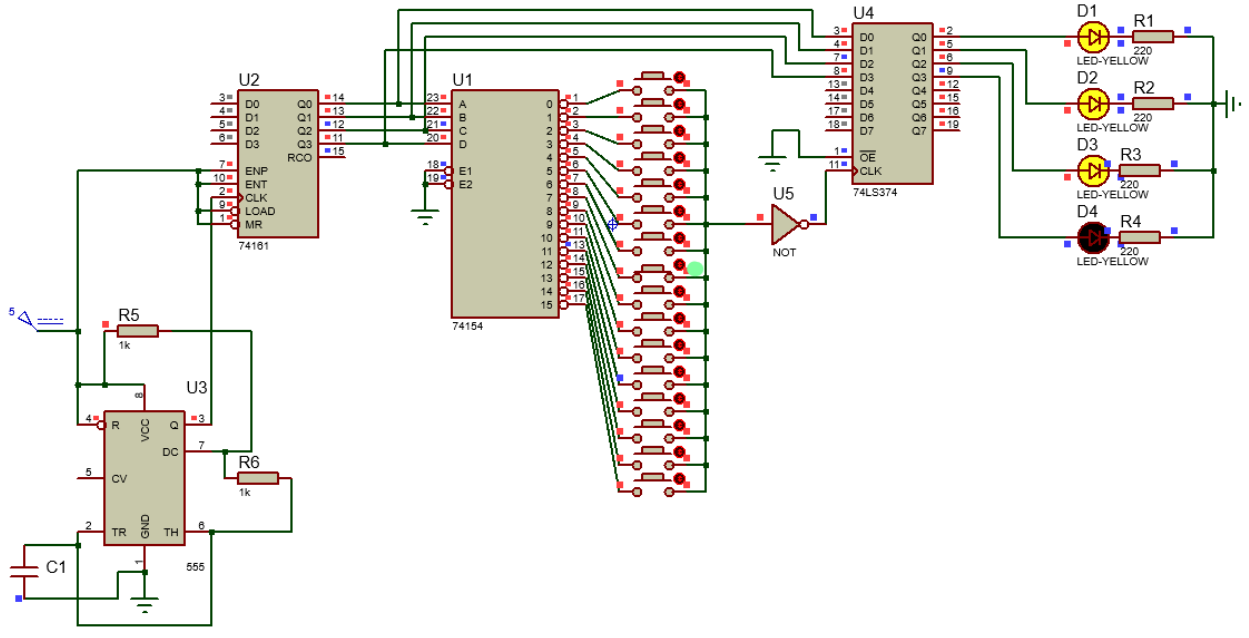
Pressing 5th push button



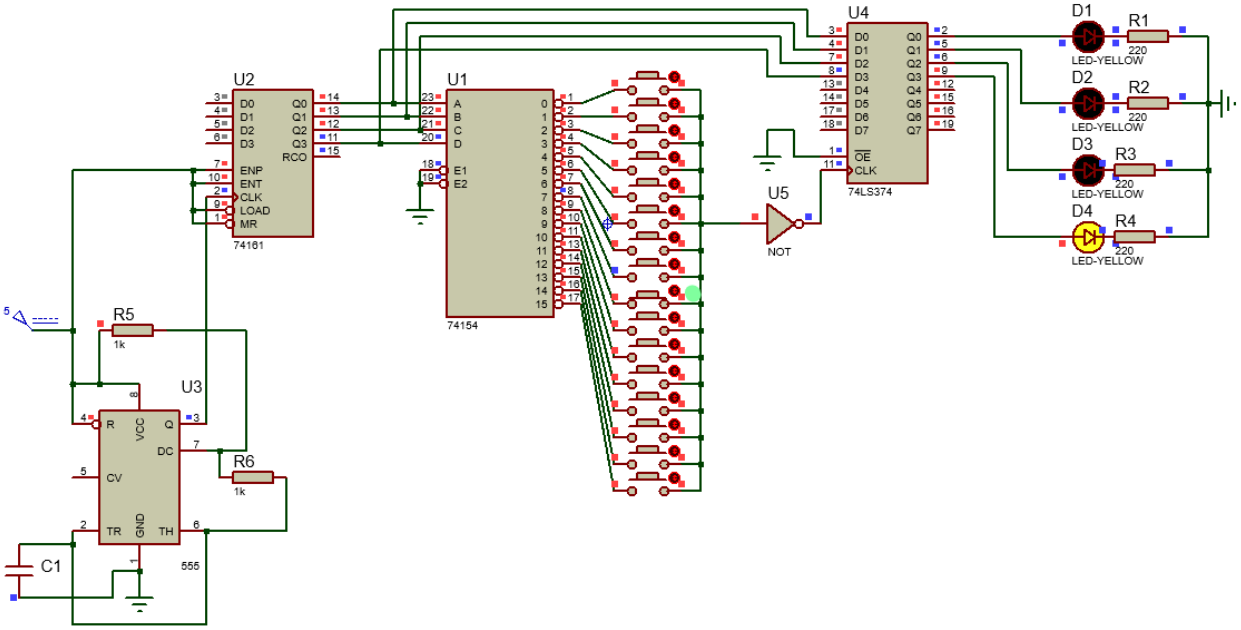
Pressing 6th push button



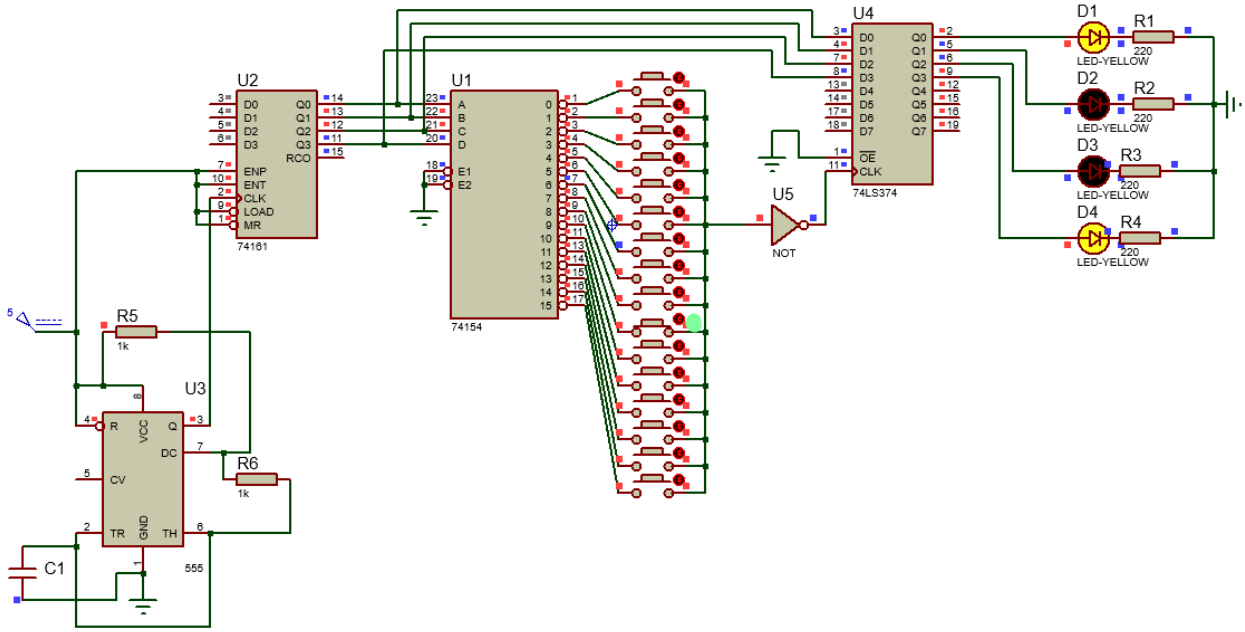
Pressing 7th push button



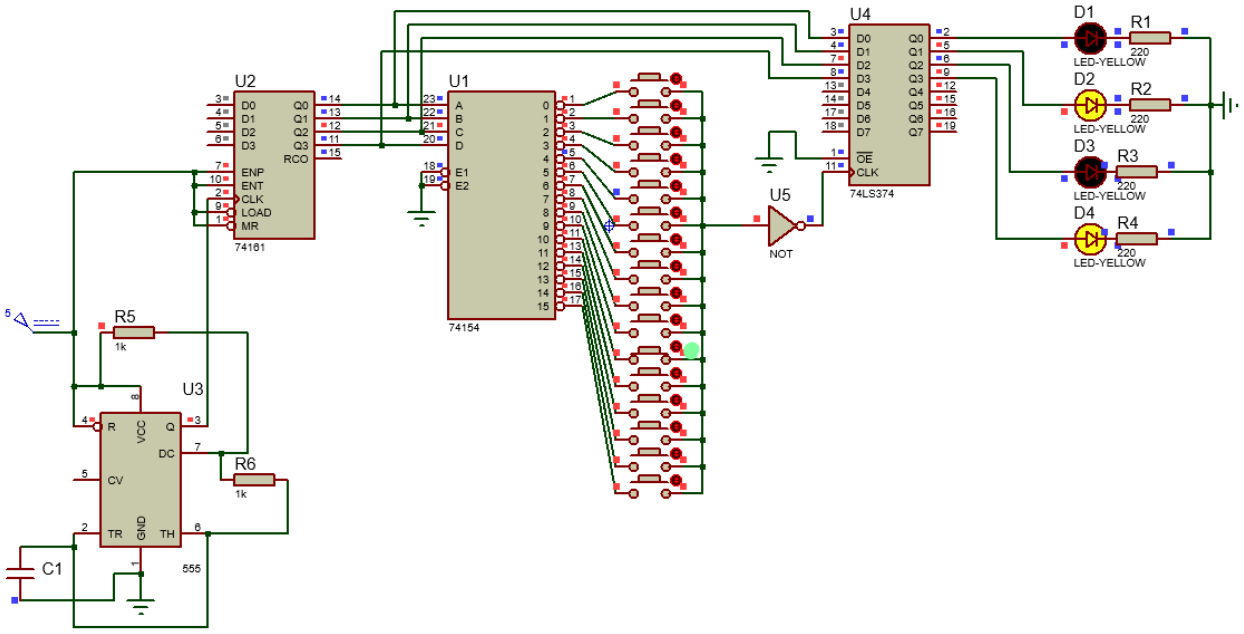
Pressing 8th push button



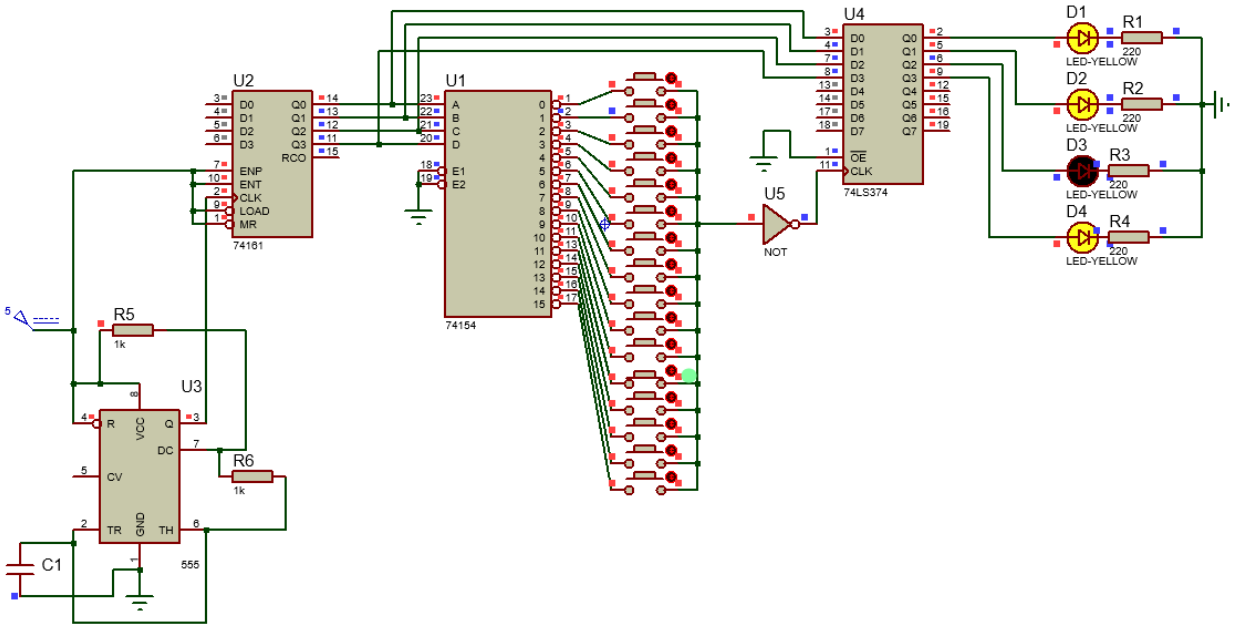
Pressing 9th push button



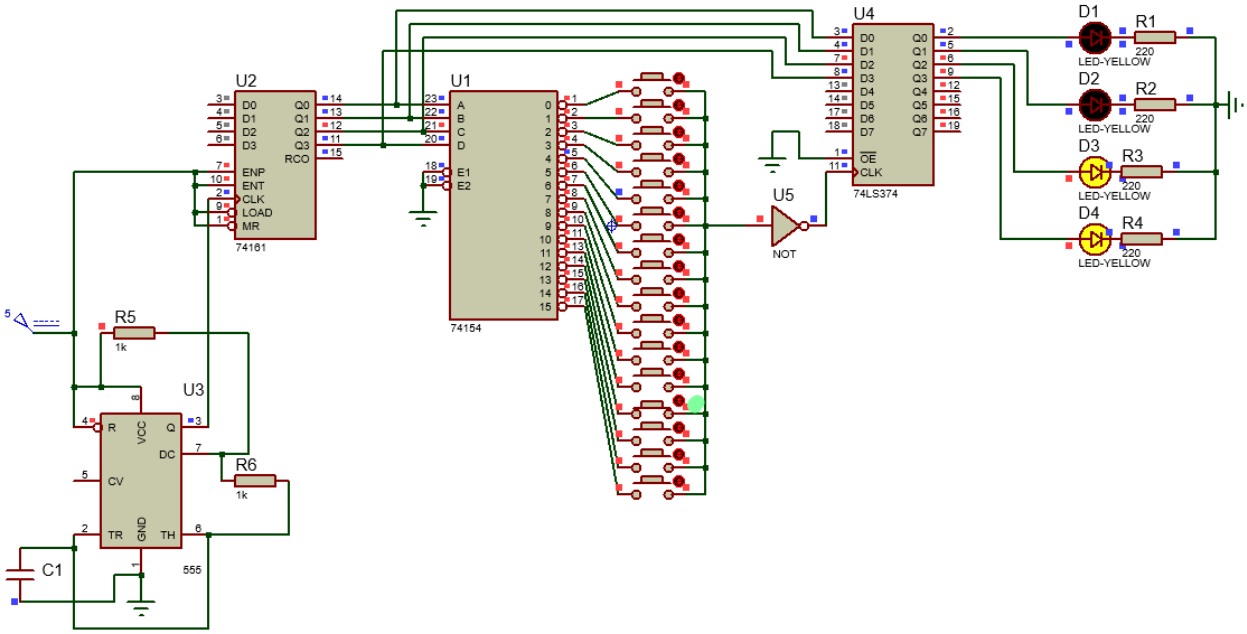
Pressing 10th push button



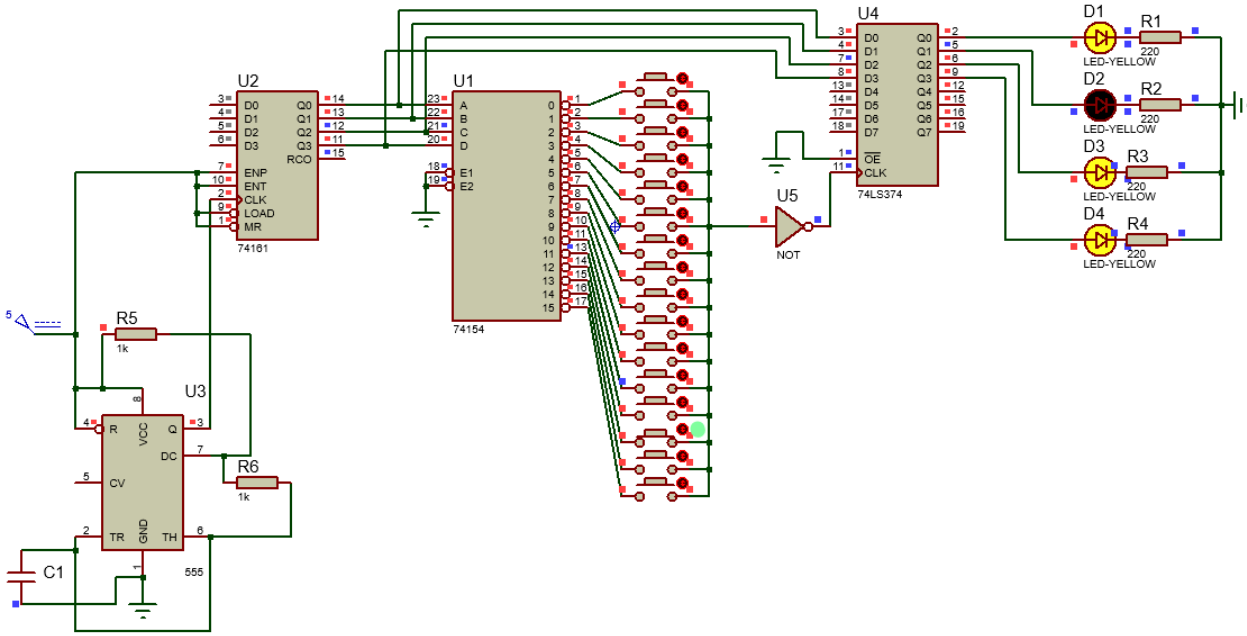
Pressing 11th push button



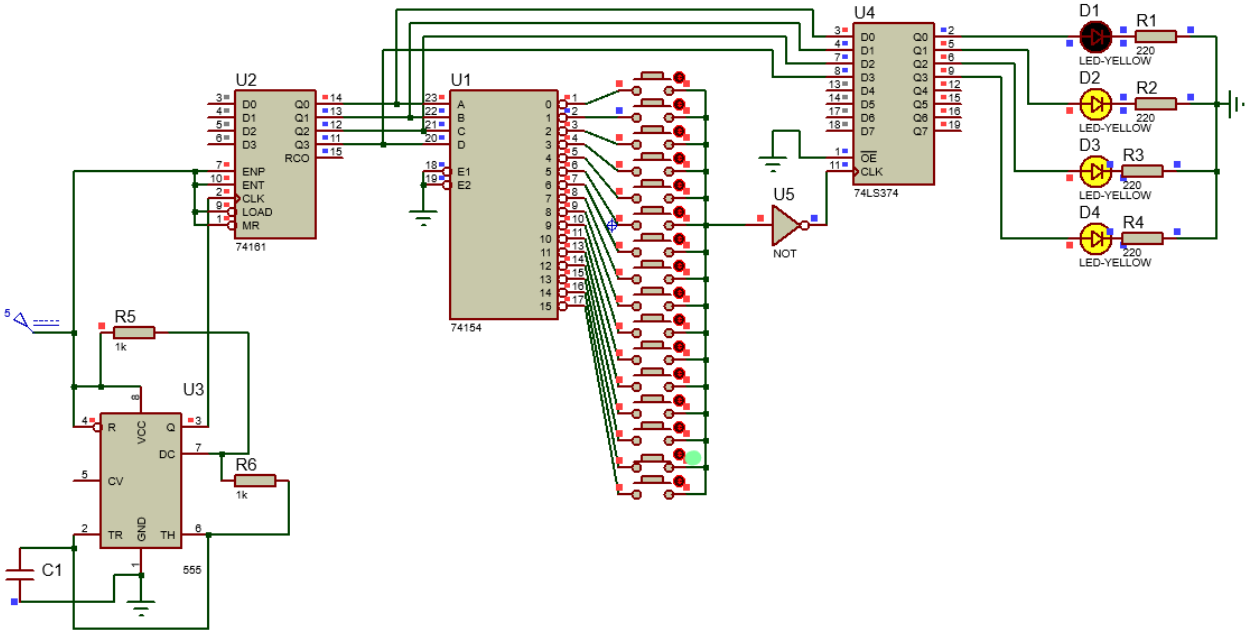
Pressing 12th push button



Pressing 13th push button



Pressing 14th push button



Pressing 15th push button