ECE 251 L – FALL 2023

DIGITAL SHOOTING GAME

STUDENTS:

Maha Alblwai- Hajer bakoor

S22107905-S21207843

INSTUCTOR:

Dr. Nema Salem

Table of Contents

PROBLEM STATMENT

Many electronic video games are available in the market but for those who may prefer to sample the game themselves, a digital number, shooting game circuit is described here.

The chain of single digit numbers appears on seven segment display, and the player must shoot a number by pressing switch Corresponding to that number before it vanishes. If he shoots the number, he scores 10 points which are displayed on the scoreboard successful shooting is accompanied by beep sound.

OBJECTIVE

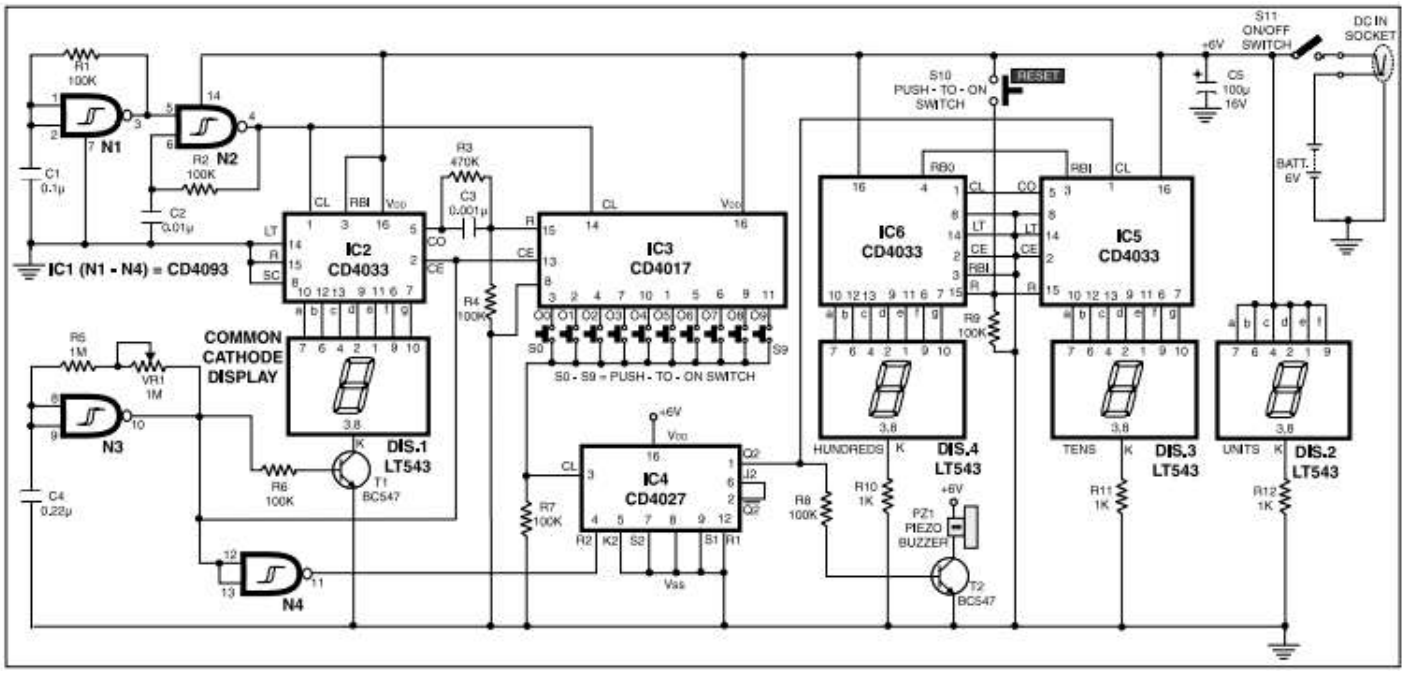
The objective of this project was to design and construct a digital shooting game circuit by integrating electronic components, and user interaction. Throughout the process, we gained valuable skills in electronics, IC types and problem-solving.

Through the integration of various electronic components and careful building, we aimed to create the digital number shooting game with an engaging and interactive gaming experience.

DESIGN CIRCUIT

In this project, the main goal was to build a digital shooting game circuit that create a fun experience and will be able to display the score for the player using 7 segment display.

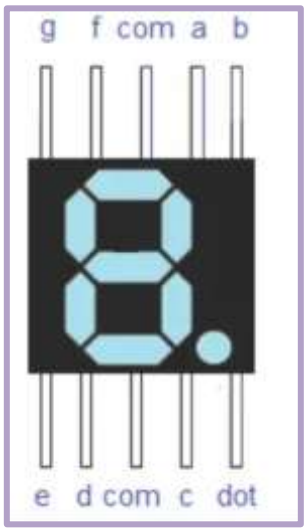
We used many components that will help achieving our goal. After searching online, we found that by using four different type of IC's we will be able to build the circuit. The IC's we used based on our needs were CD 4033, CD4093, IC4017, IC4027. Furthermore, we used other components such as restores, buzzer and many more.



7 SEGMENT DISPLAY

Seven segment display is a device that can display decimal numbers and it is widely used in the electronic industry, in this circuit the Seven Segment Display was one of our main components we used 4 common cathodes in this circuit. Furthermore, it has many important features such as:

- Displays both hex and integer values.
- Supports decimal points built into 7-Segment display.
- Supports both common cathode and common anode displays.
- Configurable for both Active High and Active Low segment and digit drives.



CD 4033 IC

The CD4033 has four main sections: a 4-bit binary counter, a latch, a decoder, and a 7-segment driver. The binary counter section increments its count on each clock pulse input. The latch section holds the current count value until the next clock pulse arrives. The decoder section converts the binary count to the corresponding 7-segment display pattern. Finally, the 7-segment driver section drives the appropriate segments of the display to show the desired number or character.

some of the CD 4033 IC features:

1. High Voltage Types (20V Rating)
2. Decoded 7 Segment Display Outputs and Ripple Blanking
3. Counter and 7 Segment Decoding in One Package
4. Easily Interfaced with 7 Segment Display Types
5. Fully Static Counter Operation DC to 6MHz (typ.) at VDD = 10V

CD 4093 IC

There are four Schmitt-trigger circuits in the CD4093B. With Schmitt-trigger action on both inputs, each circuit operates as a 2-input NAND gate. For signals that are going negative or positive, the gate changes at various times. Hysteresis voltage (VH) is defined as the difference between the positive (VTa) and negative (VTb) voltages. Every output complies with the standard B-series output drive specifications and has equal source and sink currents. In this circuit we used 3 CD 4093 IC.

some of the CD 4093 IC features:

- Number of Gates: The CD4093 contains four NAND gates. Each gate has two inputs and one output.
- Schmitt Trigger Inputs: The inputs of the NAND gates are equipped with Schmitt trigger circuits.
- The Schmitt trigger allows the IC to have hysteresis, meaning it provides a more stable and noise-tolerant input.
- Wide Operating Voltage Range: The CD4093 can operate within a wide range of power supply voltages, typically from 3V to 18V.
- Low Power Consumption: The IC is designed to consume low power, making it suitable for battery-powered applications.

4017 IC

The IC 4017 is a counter IC with 16 pins that is used counting applications, this circuit is a CMOS decade counter cum decoder. Its outputs are decoded, and it has a zero–ten count capability. When our application calls for employing a counter followed by a decoder IC, this saves a significant amount of board space and the time needed to design our circuits. A digital counter and decoder circuit is the IC 4017.

some of the 4017 IC features:

- High speed 16 pin CMOS Decade counter
- Supports 10 decoded outputs.
- Wide supply voltage ranges from 3V to 15V, typically +5V
- TTL compatible.
- Maximum Clock Frequency: 5.5Mhz.
- Available in 16-pin PDIP, GDIP, PDSO packages.

4027 IC

The IC 4027 is commonly used in various digital logic applications, such as counters, frequency dividers, timers, and sequential logic circuits. It can be used to store and manipulate binary information based on clock signals and input conditions.

some of the 4027 IC features:

- Dual Flip-Flops: The IC 4027 contains two independent J-K flip-flops. Each flip-flop has J (data) and K (complement data) inputs, a clock input, a set input, a reset input, and complementary outputs (Q and $\overline{Q}$).
- J-K Flip-Flop Operation: The flip-flops in the IC 4027 are J-K flip-flops, which means they can store and change data based on the clock signal and the state of the J and K inputs. The J and K inputs allow for toggling, setting, or resetting the flip-flop based on the clock edge.
- Set and Reset Inputs: The IC 4027 has set (S) and reset (R) inputs for each flip-flop. The set input sets the Q output to high (logic 1), while the reset input resets the Q output to low (logic 0).

RESISTOR

In this circuit we used many resistors due to it big size.

100 k resistor:

A 100k resistor, with its resistance of 100,000 ohms, is a relatively high-value resistor and is frequently used in applications where higher resistance values are required such in our case. It is often used in analog circuits, audio applications, voltage dividers, and feedback networks, among others.

VR1 1M resistor:

A VR1 1M resistor refers to a variable resistor with a resistance value of 1 megohm (1,000,000 ohms). The "VR1" designation typically indicates that it is the first variable resistor (potentiometer) in a circuit, and the "1M" specifies its resistance value.

Additionally, we used 2 1k resistor and RS 1M resistor.

VOLTAGE

Voltage is the electrical circuit's power source that pushes charged electrons (current) through a conducting loop, enabling them to do work. To make the circuit work we connected 6 voltage batteries to a power supply module. To control the circuit and splay it with the power needed, we used the battery holder, which is a very easy way to splay the circuit with the specific right voltage.

CAPACITOR

Electrical energy is stored and released by an electronic component called a capacitor. It is made up of two conductive plates divided by a dielectric, which is an insulating substance. A capacitor's capacitance, which is expressed in farads (F), controls how much charge it can hold.

A ceramic capacitor is a type of capacitor that uses a ceramic material as its dielectric. It is a common and widely used capacitor in electronic circuits due to its compact size, low cost, and wide range of capacitance values. Ceramic capacitors can have a wide range of capacitance values, from picofarads (pF) to microfarads (µF) or even higher. They are commonly used in decoupling, filtering, timing, coupling, and bypass applications. The choice of a ceramic capacitor depends on the specific requirements of the circuit, including the required capacitance value, voltage rating, and frequency response.

BUZZER

A buzzer is an electronic component that produces sound when an electrical signal is applied to it. It is commonly used in various circuits and projects to provide audio alerts, notifications, or sound effects.

In the case of a buzzer with a voltage range of 3V to 12V, it means that the buzzer can be powered by a direct current (DC) supply ranging from 3 volts to 12 volts. It is essential to ensure that the buzzer is not supplied with a voltage higher than its maximum specified limit (in this case, 12V) to prevent potential damage.

SWITCH

A switch is an electronic component that is used to control the flow of electric current in a circuit. Depending on whether it is controlled manually or mechanically, it functions as a bridge or a gap in the circuit, permitting or preventing the flow of electricity. In the project we used a "4mm switch" typically refers to the mounting size or diameter of the switch. It indicates that the switch is designed to be mounted in a panel or enclosure with a 4mm mounting hole, there are many types of switches what we used was on/off switch.

Moreover, we also used 11 pieces of the push button switch 6x6x5.

TRANSISTOR

Transistors are tiny semiconductors that not only generate and amplify electrical signals but also act as switches or gates for them, controlling the flow of current or voltage. the BC547 is an electronic component. It is a BJT transistor, which is frequently employed to meet the demand for fast switching. Additionally, we managed the circute speed using the BC547 which is one of the many types of transistors.

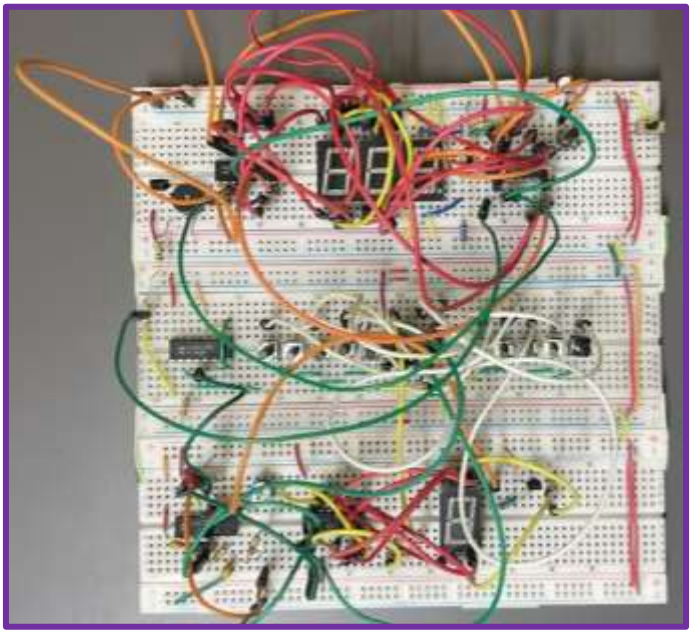
TESTING THE CIRCUIT

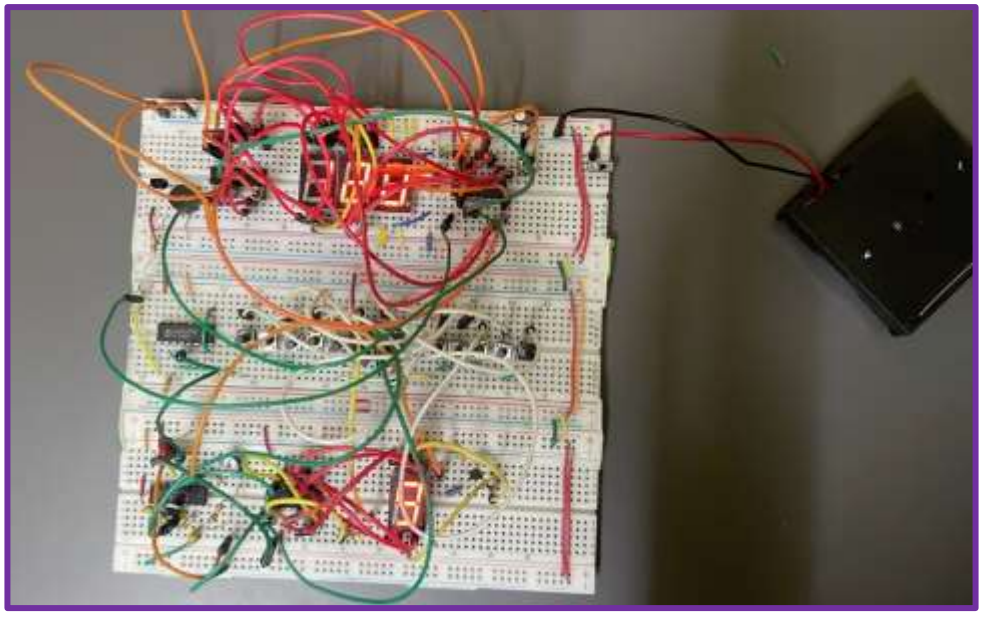
Throughout the testing process, record any observations, discrepancies, or issues encountered. Debug and troubleshoot any errors by reviewing the circuit connections, component values, and datasheets for all the components that we used. By thoroughly testing the digital shooting game circuit we had a chance to immediately fix any issue we faced.

But unfortunately, due to pore of reference we had a problem that we could not fix which is that the 7segment display that display the number for the player to press the switch and gain points is very fast that the plyer would not really be able to see the number.

To solve this problem, we search a lot about the IC that is connected to the 7-segment display and even we changed the resistors to a higher oum resistors, but we could not be able to find the solution. Furthermore, our last solution was to ask help from engineer they advised us to change the resistors to even higher oum resistors and that's leads to a small change in the time of the number displaying, but it was sadly not enough.

RESULTS





CONCLUSION

We encountered various obstacles throughout the project, Overall, this project has been a transformative academic experience, enabling us to apply theoretical knowledge to practical scenarios. It has equipped us with invaluable skills in circuit design, component integration, programming, problem-solving, and research. This project helped us develop our knowledge about how to construct complex systems while nurturing a passion for electronics and game development.

REFERENCE

a. https://www.circuitstoday.com/7-segment-display-driver
b. https://www.circuits-diy.com/cd4033-decade-counter-datasheet
c. https://www.electroschematics.com/ic-4093-datasheet
d. https://www.futurlec.com/4000Series/CD4017.shtml
e. https://www.renesas.com/us/en/document/dst/cd4027bms-datasheet
f. https://www.digchip.com/datasheets/parts/datasheet/891/VR1.php
g. https://www.farnell.com/datasheets/1807347.pdf
h. https://shorturl.at/aeB15
i. https://shorturl.at/joqBE
j. https://www.farnell.com/datasheets/2171929.pdf
k. Electronics projects vol.21