American International University- Bangladesh (AIUB)
Faculty of Engineering (FE)
Department of Electrical and Electronic Engineering (EEE)

Course Name:	Digital Logic and Circuits Lab	**Course Code:**	EEE 3102
Semester:	Spring 2022-2023	**Section:**	A
Faculty Name:	TAMIM HOSSAIN		

Project Title:	**Digital Stop Watch Using 555 Timer**
Project Group #:	04

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Assessment Materials and Marks Allocation:

COs	Assessment Materials	POIs	Marks
CO2	Course Project Report ***(Analyze a combinational/sequential logic circuit through appropriate survey of research literature to provide valid conclusion acknowledging the limitations.)***	**P.d.2.C4**	**20**

COs	Excellent to Proficient [18-20]	Good [15-17]	Acceptable [10-14]	Unacceptable [1-9]	No Response [0]	Secured Marks
CO2 P.d.2.C4	The outcome of the project demonstrates a course project using logic ICs, transistors, switches, display devices, etc. that can solve a complex engineering problem in the electrical and electronic engineering discipline through appropriate research.	The outcome of the project somewhat demonstrates a course project using logic ICs, transistors, switches, display devices, etc., and also somewhat solves a complex engineering problem in the electrical and electronic engineering discipline through some research.	The outcome of the project demonstrates a course project using logic ICs, transistors, switches, display devices, etc. but cannot solve a complex engineering problem properly in the electrical and electronic engineering discipline through appropriate research.	The outcome of the project does not demonstrate a course project using logic ICs, transistors, switches, display devices, etc. also could not solve a complex engineering problem in the electrical and electronic engineering discipline through appropriate research.	No Response at all	
Comments					**Total Marks (20)**	

Digital Stopwatch Using 555 Timer

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***Abstract*- This article describes the principle, design and operation of a digital stopwatch circuit. A digital stopwatch can be a circuit displaying the actual time in minutes, hours and seconds or a circuit displaying the number of clock pulses. Here we design the second type wherein the circuit displays count from 0 to 59, representing a 60 second time interval. This circuit is based on the principle of 2 stage counter operation, based on synchronous cascading. The idea is to display clock pulses count from 0 to 59, representing a 60 second time interval. This is done by using a 555 Timer IC connected in astable mode to produce the clock pulses of 1 second interval each. While the first counter counts from 0 to 9, the second counter starts its counting operation every time the count value of first counter reaches 9. A time-based oscillator containing a 555 timer Integrated Circuit (IC) in an astable mode with a frequency of 1Hz provides the clock pulses for the seconds display and two counter ICs to carry out the counting operation. The counter ICs connected in cascading format and each counter output is connected to BCD to 7 segment decoder used to drive the 7 segment displays.**

Keywords: Digital Stop Watch, Integrated Circuit (IC), frequency, display.

I. Introduction

The Digital Stopwatch is an electronic timepiece for tracking time. This **digital stopwatch circuit** can be worked as a clock in this counter will advance after every one second. When provide power supply it start its counting from zero and you can stop the timing with the help of switch. Timer can be adjusted by rotating preset clockwise or anticlockwise. It can be used in playing games. Helpful while cooking, studying, medical field etc.[1]

555 Timer:555 Timer is a digital monolithic integrated circuit (IC) which may be used as a clock generator. The 555 timer consists of two comparators, a flip-flop, a discharge transistor, and a voltage divider network. It can be operated in three different modes: monostable, astable, and bistable. In the monostable mode, the 555 timer acts as a one-shot timer, generating a single pulse of a specific duration when triggered. In the astable mode, it acts as an oscillator, generating a continuous stream of pulses at a specific frequency. In the bistable mode, it acts as a flip-flop, holding the output in one of two stable states until triggered to switch to the other state.[2]

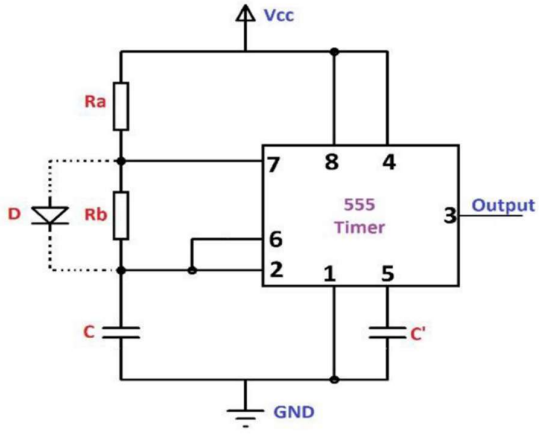

Fig 01: 555 timer IC circuit

IC 4026: The IC 4026 is a decade counter and seven-segment decoder driver IC (integrated circuit) that is commonly used in digital display circuits. It can count up to 10 in decimal or 1010 in binary and can decode the count into a 7-

segment display output. The IC 4026 is designed to drive a common anode 7-segment display, and it can also drive other types of displays with external components. The IC 4026 has several pins that are used for input and output functions. These include a clock input (CLK), a reset input (RST), and a carry output (CO). When the clock input receives a pulse, the IC 4026 counts up by one, and the current count is displayed on the 7-segment display. The carry output can be used to cascade multiple IC 4026s to count to higher numbers.[3]

Fig 02: IC 4026

II. Literature Review

A digital stopwatch using the 555 timer is a popular electronic project in the field of electronics and engineering. This project involves the use of a 555 timer IC in monostable mode, along with a few other components, to create a circuit that can function as a digital stopwatch.

There are various literature and research papers available on this topic that provide detailed information on the working of the circuit, the components used, and the design considerations. A brief review of some of these papers is presented below:

"Design and Implementation of a Digital Stopwatch using 555 Timer IC" by C. U. Nwoye and J. U. Ugwu. This paper presents a detailed description of the design and implementation of a digital stopwatch using the 555 timer IC. The authors explain the working of the circuit, the components used, and the calculations involved in determining the timing parameters. They also provide simulation results and experimental data to validate the performance of the circuit.

"Design and Construction of a Digital Stopwatch" by A. O. Adegbenro et al. This paper presents a comprehensive design and construction guide for a digital stopwatch using the 555 timer IC. The authors provide a detailed circuit diagram, along with a step-by-step procedure for assembling the components. They also discuss the testing and troubleshooting procedures, and provide recommendations for improving the accuracy and precision of the stopwatch.

"Digital Stopwatch Using 555 Timer" by A. Singh and R. Singh. This paper presents a brief overview of the working of a digital stopwatch using the 555 timer IC. The authors provide a simple circuit diagram and a description of the components used. They also discuss the advantages and disadvantages of the circuit, and provide recommendations for optimizing its performance.

Overall, the literature available on the topic of digital stopwatches using the 555 timer provides a wealth of information and guidance for engineers and electronics enthusiasts who wish to design and build their own digital stopwatch. The research papers and design guides presented above offer valuable insights into the working of the circuit, the components used, and the design considerations, and can serve as a starting point for further experimentation and exploration.[6][7][8][9]

III. Methodology and Modeling

Digital Stopwatch Circuit Design:

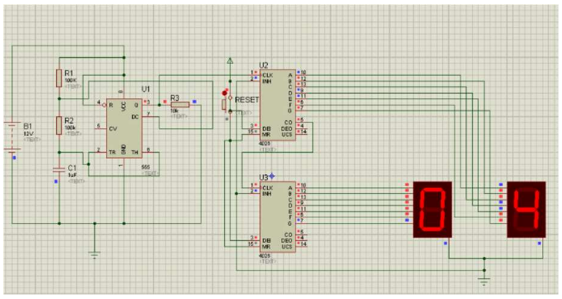

Fig 03: Digital Stopwatch Circuit Diagram

Working of digital stop watch using 555 timer: Designing the 555 Timer's astable multivibrator configuration is the first step in the design process. In this case, 1 second is needed as a time frame. We may determine the values of C using the frequency of the output signal, $f = 1.44/(R_1 + R_2)C$ and assuming that R_1 and R_2 have values of about 10KΩ and a 1µF electrolyte capacitor is presented here. Connecting the two counters IC 4026 in a synchronous cascade configuration is the second step in the design process. This is accomplished by creating parallel clock input signals by connecting the clock pins of the counter ICs to the output of the 555 Timer. One IC's carry out pin and another IC's carry in pin are coupled. Our goal is to start the second counter when the first counter hits the count value of 9, and we do this by creating a straightforward combinational logic circuit. Here, we need the clock pulses up to a count of 60 to be shown. The final part involves designing the display circuits. The inputs of the BCD to 7 Segment Decoder are connected to the outputs of each counter IC to accomplish this. The 7 Segment display is coupled to the outputs of each Decoder ICs 4026.

The circuit operation begins once the normally open switch is changed to closed position. The Timer 555 produces high and low signals at frequent intervals, resulting in oscillating signal whose frequency is based on the values of two resistors and the charging capacitor. In other words, the timer 555 IC produces the clock pulses of required time period.[4]

Ass Astable multi-vibrator creates a delay of one second, which is made up of oscillations or pulses between 0 and 1. In order to modify the digit number within a second of time, the seven segment decoder will be triggered by this pulse.

When we turn on the stopwatch (by pressing the start/stop button), it starts counting from zero. If we turn off the same button, however, counting stops or is put on hold until we push the reset button or turn the button back on. Since there are two seven-segment segments, this stopwatch circuit can count time from 00 to 99 seconds.[5]

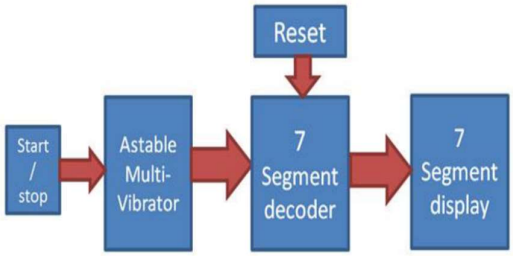

Fig 04: 7 segment working mode

BCD to Seven Segment decoder:

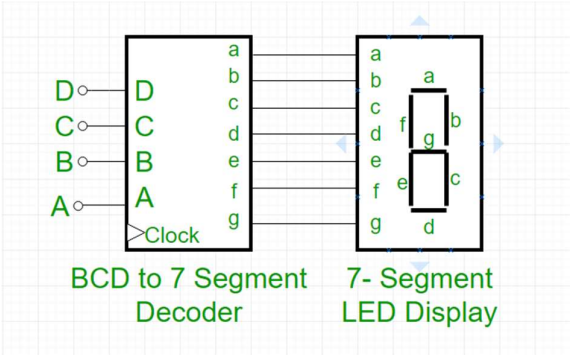

Fig 05: BCD to Seven Segment decoder

Table 01: BCD to Seven Segment decoder truth table

	Input				Output							
No.	A	B	C	D	a	b	c	d	e	f	g	Display
0	0	0	0	0	1	1	1	1	1	1	0	**0**
1	0	0	0	1	0	1	1	0	0	0	0	**1**
2	0	0	1	0	1	1	0	1	1	0	1	**2**
3	0	0	1	1	1	1	1	1	0	0	1	**3**
4	0	1	0	0	0	1	1	0	0	1	1	**4**
5	0	1	0	1	1	0	1	1	0	1	1	**5**
6	0	1	1	0	1	0	1	1	1	1	1	**6**
7	0	1	1	1	1	1	1	0	0	0	0	**7**
8	1	0	0	0	1	1	1	1	1	1	1	**8**
9	1	0	0	1	1	1	1	1	0	1	1	**9**

IV. Result and Discussion

Experimental result

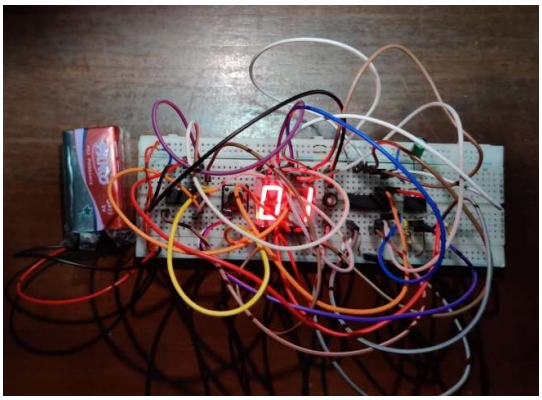

Fig 06: Digital Stopwatch Circuit at timer 01s

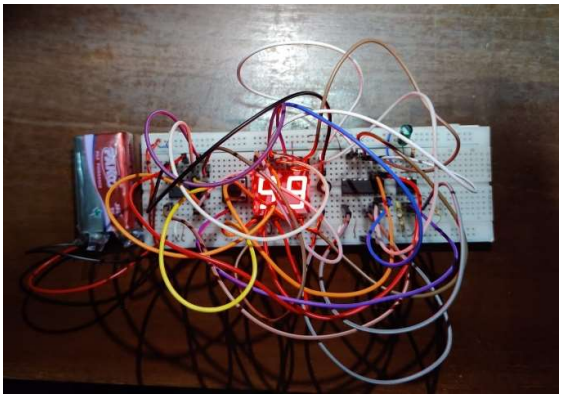

Fig 07: Digital Stopwatch Circuit at timer 99s

Simulation result

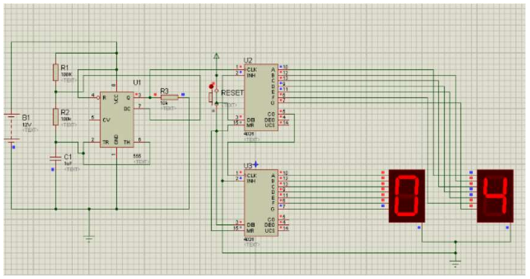

Fig 06: Digital Stopwatch Circuit at timer 04s

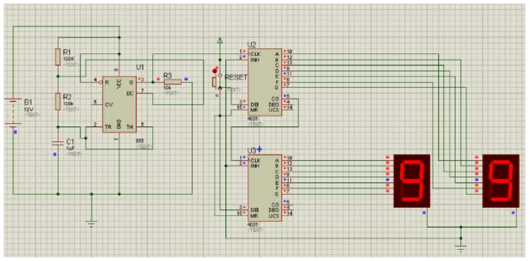

Fig 06: Digital Stopwatch Circuit at timer 99s

We have done it in practical and simulation part with success. We did not face any problem in the practical part also all equipment worked fine. In simulation part we did it in Proteus 7 professional and we have successfully completed it.

Cost analysis

Equipment	Price
555 timer IC	10tk
IC 4026 (2pc)	100tk
9V Battery	100 tk
2 digit 7 segment display	30 tk
Resistor (2pc)	5tk
Capacitor (2pc)	5tk
Push button (2pc)	10tk

V. Conclusion and Future Endeavors

Based on the project report on digital stopwatch using 555 timer, it can be concluded that the project is an efficient and cost-effective way to create a basic stopwatch. The 555 timer IC is widely

available and can be easily configured to produce precise timing signals.

The project successfully demonstrated how to use a 555 timer to create a stopwatch circuit that can count up to 99 seconds with an accuracy of +/- 0.01 seconds. The circuit uses a seven-segment display to show the elapsed time, which makes it easy to read and operate. timing systems for a variety of applications.

However, there are still a few areas where improvements can be made. For instance, the circuit can be modified to include additional features like lap timing, split timing, and countdown functionality. Additionally, the accuracy of the stopwatch can be improved by using a more precise timing crystal.

In the future, the project can be expanded to include other types of timing circuits, like microcontrollers or FPGA-based designs, to create more complex stopwatch designs. Moreover, the project can be integrated with other timing systems, like clock synchronization systems, to provide a more comprehensive and accurate timekeeping solution.

Overall, the digital stopwatch project using 555 timer is a great starting point for future projects that aim to create more advanced.

VI. Reference:

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