B.S. Abdur Rahman Crescent Institute of Science & Technology

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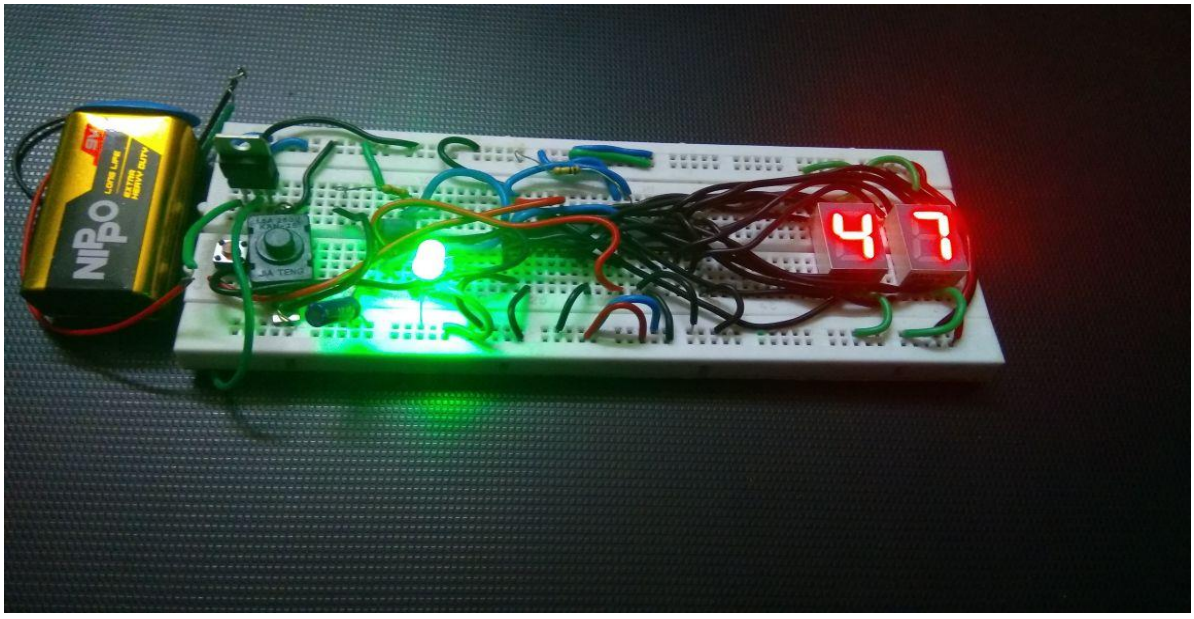
ECB2212 - DIGITAL ELECTRONICS

PROJECT BASED LEARNING

PROJECT REPORT ON

"7 SEGMENT DIGITAL STOP WATCH USING DECODER"



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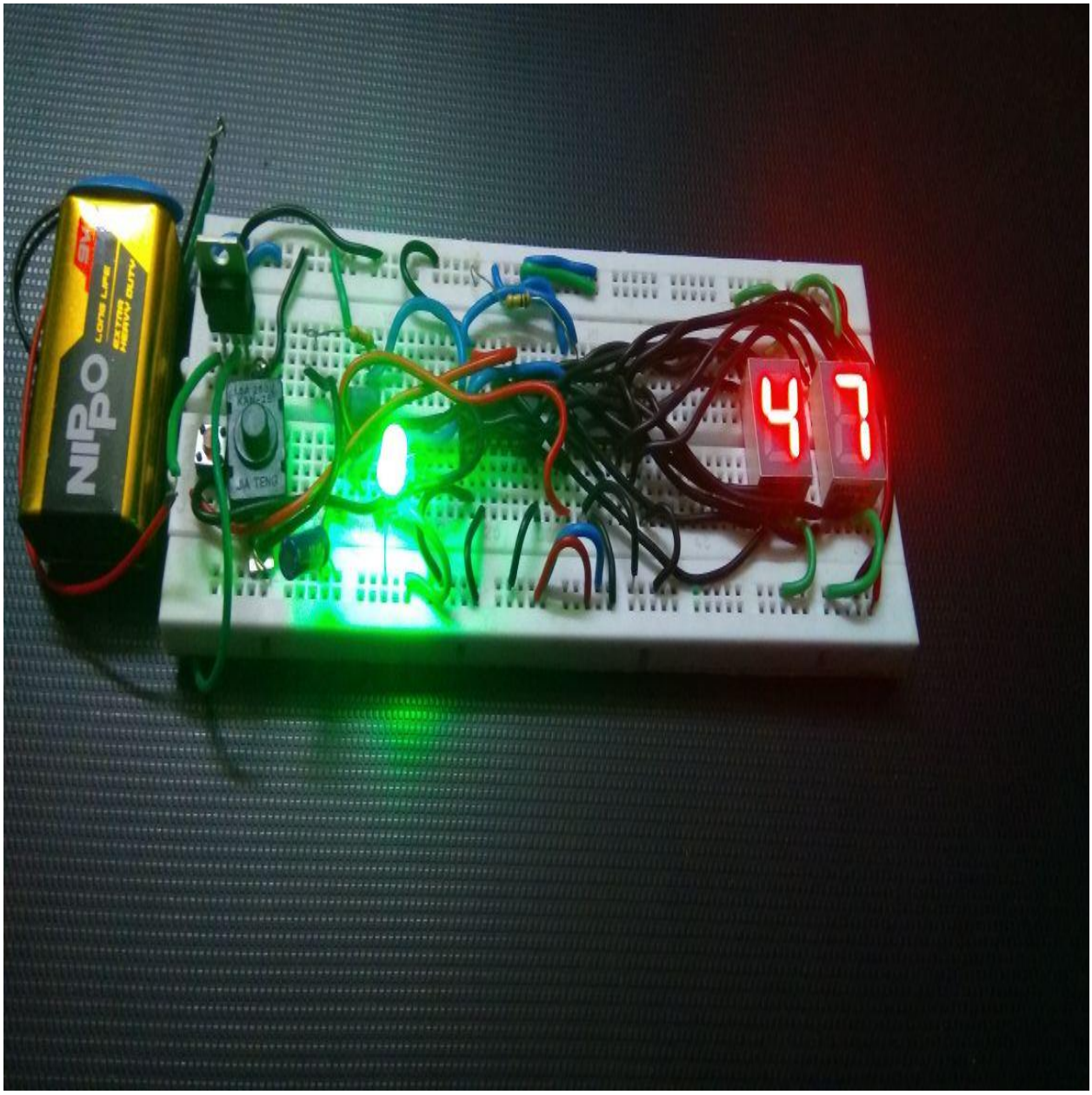
Model:



7 segment Digital stop watch using decoder:

AIM: To make a Digital stop watch circuit that can count from 0 to 99 seconds which can also be used for different applications like photo counter, countdown timer and alarm clock.

Introduction:

Stopwatches find use as time keeping devices in many fields, namely sports. Stopwatches may be analog or digital. Digital stopwatches are much more common the analog version owing to their higher accuracy and ease of use. Here we have tried to realize a digital stopwatch of reasonable accuracy and reliability.

This particular stopwatch can count up to 9 minutes and 59.9 seconds .It is accurate up to one tenth of a second. The circuit is relatively simple and easy to realize .The heart of the circuit is an a stable mv followed by counter and decoder stages. The circuit us explained extensively in the following pages.The circuit operates on 5-v dc supply. It uses a seven segment LED display of common anode type show time.

Working:

This digital stopwatch can count nine minutes and 59.9 seconds. The circuit consists of a 555 Astable multivibrator. It generates 10 pulses in one second. We can enable or disable IC 555 by applying a high or low voltage to pin 4 of 555. This is done by IC 7476. 7476 is a JK flip-flop. Its J and K input are given high level. Therefore this flip-flop toggles at each trailing edge of the clock pulse. Here clock pulses are given by push-to-on switch S1.

IC 7490 counts the pulses of astable multivibrator. It counts upto 9 (1001). When the first counter reaches nine, second counter starts counting, because it gets a trailing edge when first display goes from 9 to 0. so it reaches one second. The third display begins its counting as the second display changes from 9 to 0. Then the display counts 10 seconds.

When the count of the third display reaches 6, both input terminals of NAND gate A of IC 7400 becomes high. So its output becomes low. This output appears as a trailing edge for the fourth display and it starts counting. Then output of the NAND gate gets inverted. C now becomes high. This is applied to RESET pin of 7490. Therefore all

counters except 4 reset to 0. The display shows 1.000. i.e. 1 minute and 0 seconds. IC 7447 is used to convert BCD to 7-segment form.

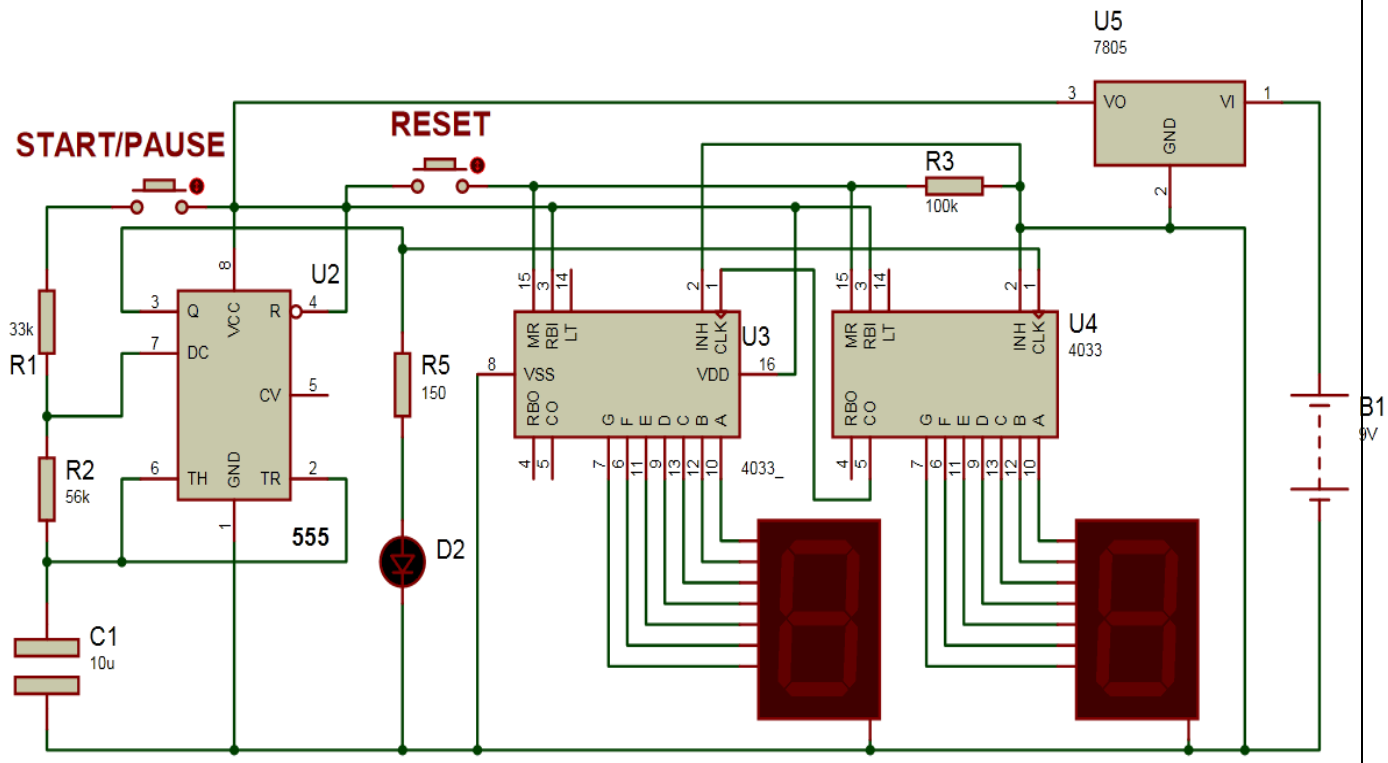
What is a stop watch?

A stopwatch is a handheld timepiece designed to measure the amount of time elapsed from a particular time when it is activated to the time when the piece is deactivated. A large digital version of a stopwatch designed for viewing at a distance, as in a sports stadium, is called a stop clock.

Circuit principle:

- **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 A-stable 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. 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.**

Circuit diagram:



Explanation:

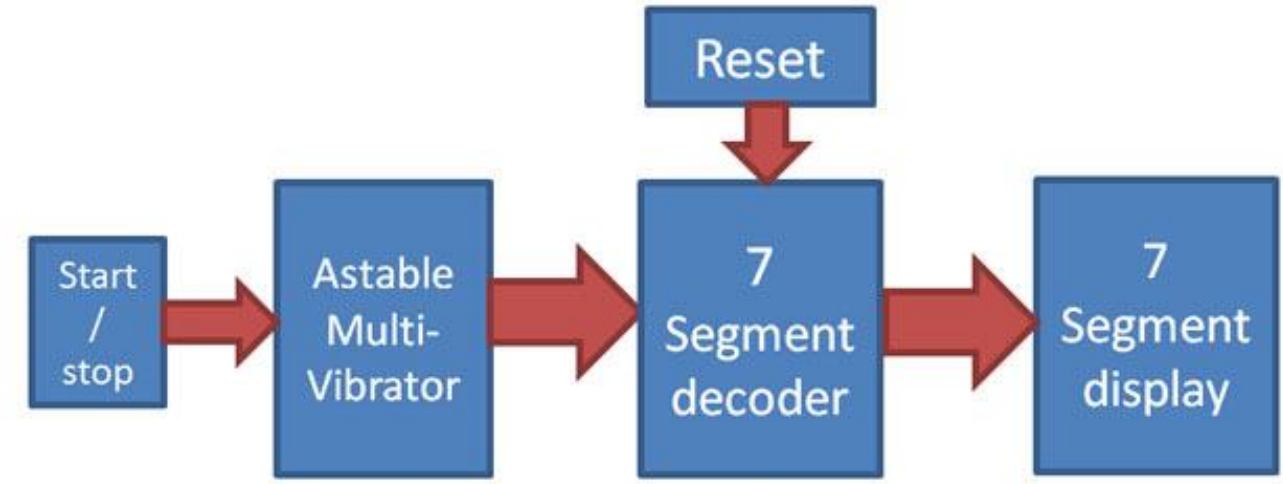
- **In this circuit we have used a 555 timer IC based a-stable multi-vibrator which is for creating 1 second delay. And two common cathode seven segment decoder IC's namely CD4033. The output of a-stable multivibrator is directly applied to seven segment decoder IC's (U4) Clock pin (1) and carry output pin(5) of U4 IC is directly connected to clock pin (1) of second seven segment decoder(U3). And two seven segment are connected with these decoder (U3 and U4). Its connections are shown in stopwatch circuit diagram given below. One push button is used to stop /start the stopwatch and one push button is used to reset the stopwatch. A 5 volt voltage regulator is used for providing 5 volt**

to whole circuit. And a 9 volt battery is used for powering the circuit. Rest of connections are shown in the circuit diagram.

Working:

- In this stop watch circuit we have generated one second delay by using 555 timer based a stable multivibrator. By using some calculation we can easily generates one second delay. In a stable multivibrator there is two resisters and one capacitor is responsible for delay by charging or discharging capacitor through resistors. Calculation formula for generating delay for a stable multivibrator is given below. F=1/T= 1.44/(R1 + 2R2) C1
- In this project we have selected R1 is 33K, R2 is 56K and C1 is 10uF. [Also check: 1 minute timer circuit]
- Ass A-stable multi-vibrator generates one seconds delay, this delay is oscillations or pulse of 0 and 1. So we will use this pulse for triggering the seven segment decoder then seven segment decoder changes the digit number with the one second of time period.
- When we ON the stopwatch (by start/stop button) it start counting from zero and if we turned OFF the same button then counting is stop or pause until again turned ON the same button or press reset button.

There are two seven segments, so this stopwatch circuit can count 00-99 seconds time.



Components used:

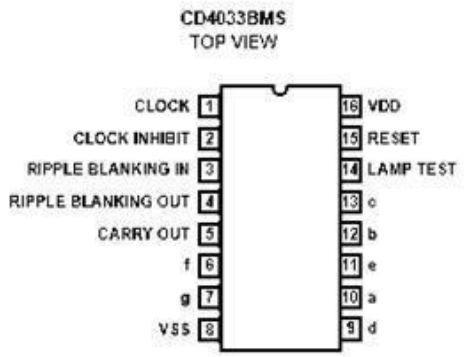
- **IC 4033 - 2**
- **555 timer IC -1**
- **Common Cathode 7 Segment Display -2**
- **150 Ohm -1**
- **100K resistor -1**
- **33K resistor -1**
- **56K resistor -1**
- **10uF capacitor -1**
- **On/off switch -1**
- **Push button -1**
- **Bread board -1**

- **9 Volt Battery -1**
- **Battery Connector -1**
- **LED -1**
- **Voltage Regulator 7805 -1**
- **Connecting wires**

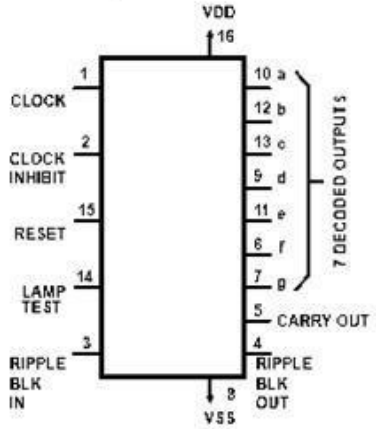
IC CD 4033:

- **CD4033 is a Johnson counter IC commonly used in digital display. It has a 5 stage Johnson decade counter with decoder which convert the Johnson code to a 7 segment decoded output. Means it will convert the input into numeric display which can be seen on 7 segment display or with the help of LED's.**
- **Advantage of this IC is it can be operated at high voltage of 20V. But is highly sensitive, can detect emf present in the atmosphere and is sensitive to static charge also. When you touch your finger at its input terminal its counter get started therefore care should be taken while using it. It can be used in various application like in 7 segment decimal display circuit, in clocks, timer etc. To understand its working first have a look on its pin diagram.**

Pinout



Functional Diagram



WORKING OF INDIVIDUAL PINS:

- **1. Pin 1 known as Clock in - It receives clock signals, and at every positive clock counter advances one by one. You can provide clock with the switch, 555 timer or with the help of logic gates.**
- **2. Pin 2 known as Clock inhibit - CD4033 counter advances one by one by receiving positive pulse at this time clock inhibit pin should be grounded. If it is connected to supply than counter advancement will be inhibited means there will be no meaning of clock pulse. 3. Pin 3 and pin 4 known as Ripple blanking in and Ripple blanking - It is used to display only one zero blanking the other zero. For this IC have ripple blanking in and ripple blanking out. For example you want to display 345 and you are using five 7 segment display then it will display 00345 if blanking input and out is off. But if it is on than you will receive 345. It improves the readability of the circuit.**
- **4. Pin 5 known as carry out - It is used to complete one cycle for every 10 clock input cycle and it also used to cascade more IC's.**
- **5. Pin 6, pin7 and Pin9 to pin 13 - These are 7 decoded output from a to g used to illuminates the corresponding segment of 7 segment display to display the digit from 0 to 9.**
- **6. Pin 14 known as Lamp test - t is used to check that all segments of 7 segment is working properly or not. For testing momentarily make the pin low.**
- **7. Pin 15 known as Reset - It is used to reset the counter. When it receives high it clears the counter and counting again starts from zero. One important thing reset pin should again made low to start the counter once again.**

- **8. Pin 8 known as ground pin and Pin 16 known as Vdd it should be connected to power supply.**
- **1. Interfacing CD4033 with LED's**
- **Below circuit can be used to detect the electromagnetic radiation or emfpresent around it. The radiation may from TV, computer etc.**
- **Working of circuit is simple whenever it detects radiation it receive clock at pin put 1 and its counter starts and LED's connected at output stars glowing. And the cycle repeats till the reset pin receives high at its input.**
- **2. Interfacing CD4033 with 7 segment display**
- **The circuit describes below count numbers from 0 to 9 and display the same on 7 segment display.**
- **Whenever you press the switch, clock input receives the signals and its counter advances one by one. And it will count up to 9 and again start counting from 0 on each successive pressing of switch.**

- **Digital Stopwatch Applications:**
- **This circuit can be used as an indicator at quiz competitions.**

Digital Stopwatch Limitations:

- **The circuit does not display the actual time, but rather the count of clock pulses.**
- **The use of digital counter ICs produces a time delay in the whole operation, because of the propagation delay.**
- **This is a theoretical circuit and may require changes.**

IC 555:

Pin		I/O	DESCRIPTION
NO.	NAME		
1	GND	O	Ground Reference Voltage
2	Trigger	I	Responsible for transition of SR flip-flop
3	Output	O	Output driven waveform
4	Reset	I	A negative pulse on reset will disable or reset the timer
5	Control Voltage	I	Controls the width of the output pulse by controlling the threshold and trigger levels
6	Threshold	I	Compares the voltage applied at the terminal with a reference voltage of 2/3
7	Discharge	I	Connected to open collector of a transistor which discharges a capacitor between intervals.
8	V_{CC} Supply	I	Supply voltage