DIGITAL ELECTRONICS

(EC-262)

PROJECT TOPIC – DIGITAL CLOCK WITH 7-SEGMENT DISPLAY USING ARDUINO.

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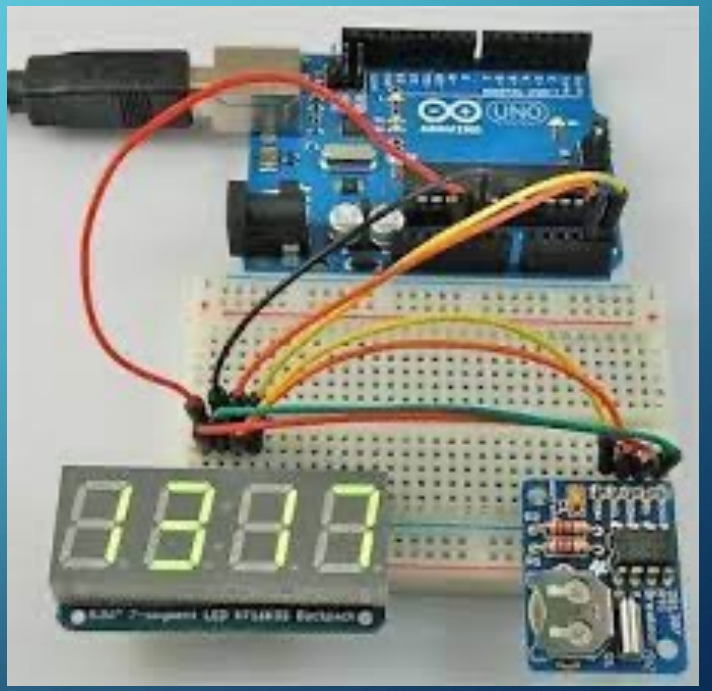
DESCRIPTION OF PROJECT & CONCEPT USED :-

- **MICRO-CONTROLLER** concept of ***Digital Electronics*** is used in this project.
- This clock is formed in a manner that it shows time digitally in hours and minutes. The user can also be able to change the time as per required.
- ***ARDUINO UNO*** is used to make this project which **uses the Programming language** to start the clock and perform actions which are encoded in the code.

MOTIVATION FOR THIS PROJECT :-

Digital Clock is very common and useful device for daily use. So, by using the components of digital electronics we can easily make the clock in a very cheap cost. This shows the use of components to produce a fruitful output. We can fix these clocks in public so that every person can see time for eg: we see digital clocks on metro station platforms etc. This motivated me to make this project.

CONTENTS :-



ABSTRACT

- ✓ **Digital clock** is a most common device which is used by the entire world in their daily life. The ***Aim*** of the project is to design a 24-hour Digital Clock that displays the time digitally, in contrast to an Analog clock, where the time is indicated by the positions of rotating hands.

- ✓ With the help of ***Arduino-UNO***, a digital clock to display time in hours & minutes can be constructed. ***Micro-Controller*** concept of Digital Electronics is used to build this project.

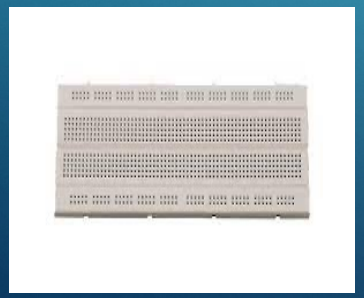
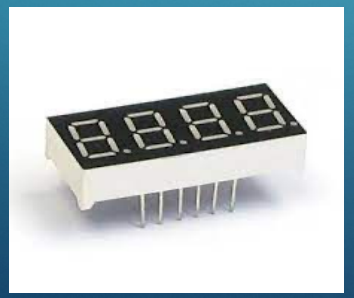
- ✓ ***Seven-segment*** display is a very common and efficient option for displaying a decimal value. This clock works on a ***Programming based*** element.

INTRODUCTION

- Digital Clock is very common and useful device for daily use. So, by using the ***components of digital electronics*** we can easily make the clock in a very cheap cost. This shows the use of components to produce a fruitful output. We can fix these clocks in public so that every person can see time for eg: we see digital clocks on metro station platforms etc. This **motivated** me to make this project.
- Because digital clocks can be ***very small and inexpensive*** devices that enhance the popularity of product designs, they are often incorporated into all kinds of devices such as cars, radios, Televisions, Microwave Ovens standard ovens , computers and cell phones.
- ***In this Project we build a Digital Clock which shows time in hours & minutes only. Arduino-UNO is used to program the clock & showing the functioning of the digital clock. There will be Buttons which will help to change time (in hours & minutes) according to our convenience.***
- **INVENTION –** Digital Alarm clock was invented by **D.E. Protzmann.**

MATERIALS REQUIRED

- ***BREADBOARD*** – It is a solderless device which is used to test circuit designs for a temporary time.
- ***4-DIGIT 7-SEGMENT DISPLAY*** – A **4-digit 7-segment LED display** has 12 pins. 8 of the pins are for the 8 LEDs on each of the **7 segment displays**, which includes A-G and DP (decimal point). The other **4** pins represent each of the **4 digits** from D1-D4.
- ***ARDUINO UNO*** - **It** is a microcontroller board based on the ATmega328P.
- ***JUMPER WIRES*** – These are the wires which are used for connecting the components.
- ***TINY PUSH-BUTTONS (12mm)*** – These buttons are used to change time in the project. One click of button change time to one unit respectively.
- ***1 K-OHM RESISTORS*** – A **resistor** reduces (or resists) the flow of current. ... So, a **1k Ω resistor** has a value of 1,000 **ohms** and the number we will code is 1,000.

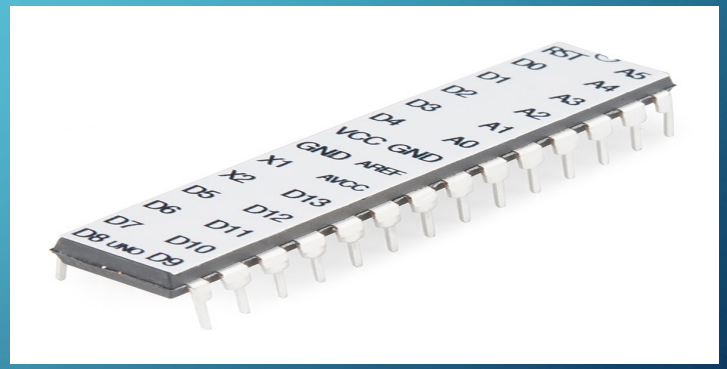



CONCEPT OF ARDUINO (MICRO-CONTROLLER)

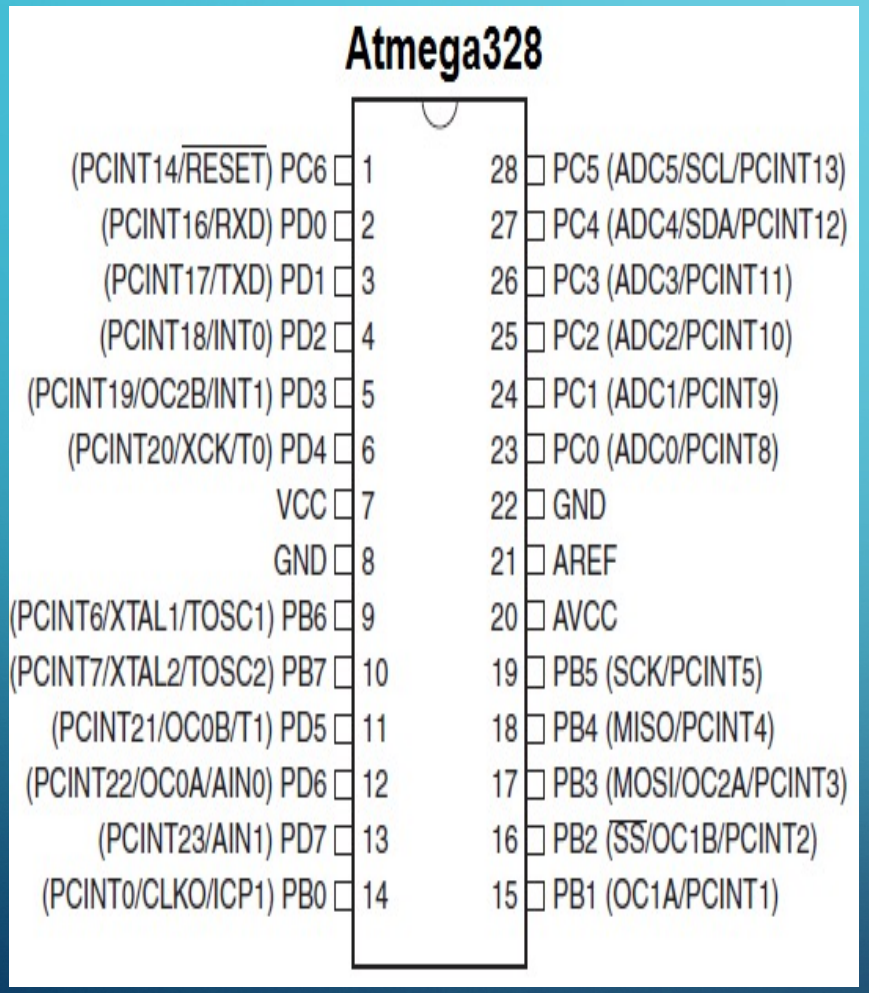
- Arduino is an electronic circuit board which is used to build program-based projects. It is an open source platform to which works upon computer codes & functions upon the code commands. Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware (called a programmer) in order to load new code onto the board , we can simply use a USB cable.
- Additionally, the Arduino IDE uses a simplified version of **C++** , making it easier to learn to program. Finally, Arduino provides a standard form factor that breaks out the functions of the micro-controller into a more accessible package.
- A ***Microcontroller***, the primary chip, which allows us to program the Arduino in order for it to be able to execute commands and make decisions based on various input.
- **Arduino used in our Project** - In this Project, we are using *Arduino-UNO* having ***ATmega328*** Chip.

ABOUT ATmega328 CHIP

- The **ATmega328** is a single-chip Micro-Controller created by Atmel in the megaAVR family. It has a Modified Harvard Architecture (8-Bit RISC) processor core.
- ATmega328 is commonly used in many projects and ***autonomous systems*** where a simple, low-powered, low-cost micro-controller is needed. Perhaps the most common implementation of this chip is on the popular Arduino development platform, namely the ***Arduino UNO*** models.
- When converting design from an Arduino Uno to a raw ATmega328 chip it is helpful to be able to relate the pinouts on the ATmega328 to the connections on an Arduino Uno.



PIN DIAGRAM & SPECIFICATIONS

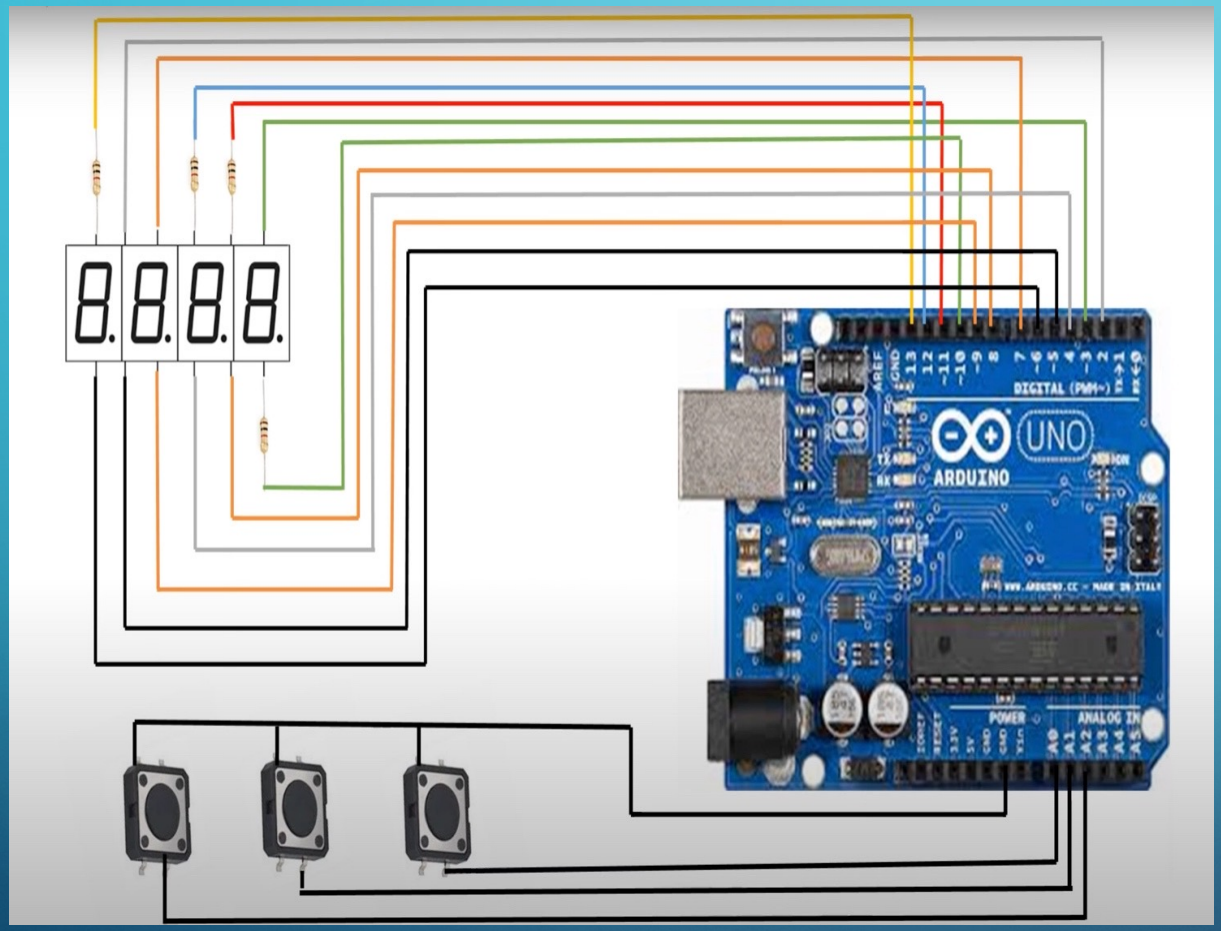


(PIN DIAGRAM)

Parameter	Value
CPU type	8-bit AVR
Performance	20 MIPS at 20 MHz[2]
Flash memory	32 KB
SRAM	2 KB
EEPROM	1 KB
Pin count	28 or 32 pin:
Maximum operating frequency	20 MHz
Number of touch channels	16
Hardware QTouch Acquisition	No
Maximum I/O pins	23
External interrupts	2
USB Interface	No
USB Speed	–

(SPECIFICATIONS)

CIRCUIT DIAGRAM



- These 3 button switches are used to change hour or minute i.e. to change time. While changing the time ***we have to hold one button*** to change time by 2 other buttons, one button is for hour & other is for minute.

- ***NOTE*** : The ***circuit connections*** will be understood in the programming code itself.

PROCEDURE FOR MAKING PROJECT

- We should always connect Resistors with the Display (7-Segment display).
- When connecting to Arduino, we will connect :-
    1. DISPLAY 1 TO PIN 10.
    2. DISPLAY 2 TO PIN 11.
    3. DISPLAY 3 TO PIN 12.
    4. DISPLAY 4 TO PIN 13.
- Further connections we get to know in the Program code.
- When the connection is complete, we ***upload*** the program code in the Arduino. Then the functioning of the clock starts and we can set time according to our convenience.
- We have to ***hold one button*** to use other buttons to change time of hours and minutes.
- In Program code, we use a function **hourformat12()** which will make our watch to run in 12 hour format.
- The **Time library** by default follows the 24 hour format.
- Finally, the **Project model is complete** and further I will show you the results.

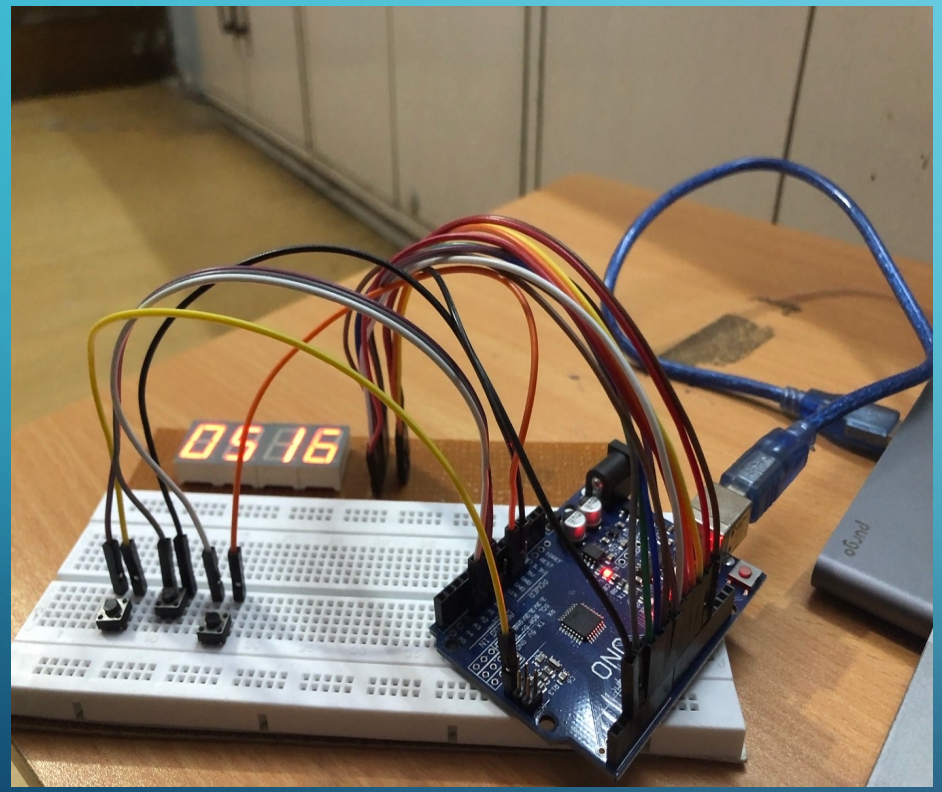
PROGRAM CODE

https://drive.google.com/file/d/1WGpJeSSC-98fUhNuaeoV-DpDDUnFFKvB/view?usp=sharing

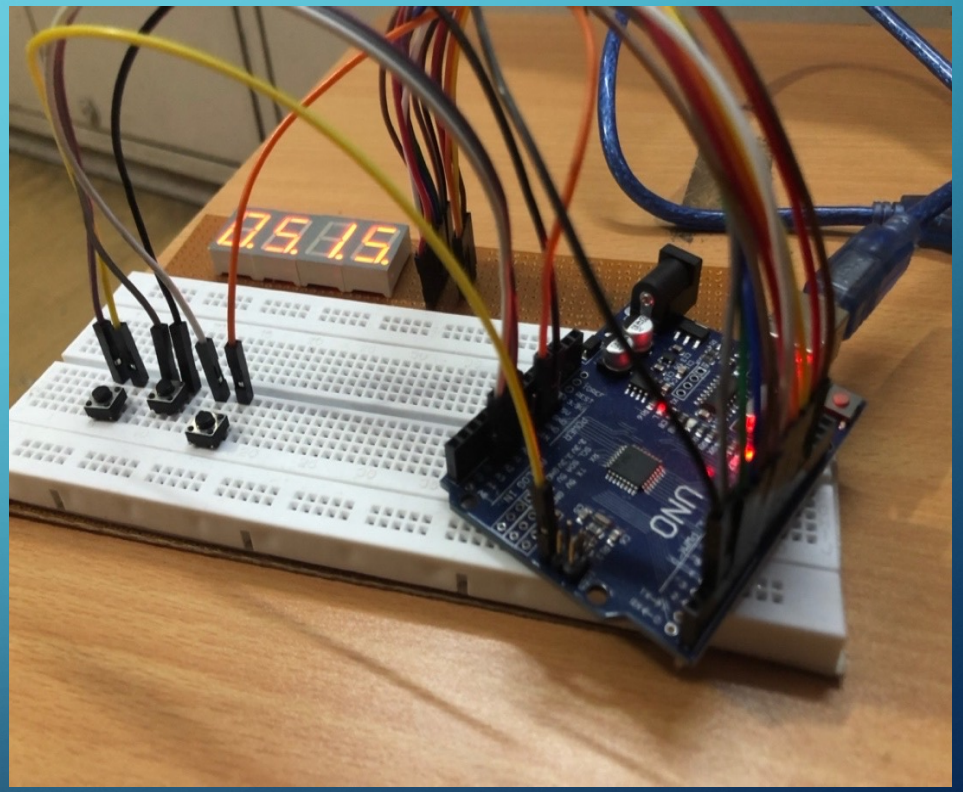
NOTE : In this ***Link***, Program Code of ***Arduino upon which the Project works***, i.e. Digital clock works is present.

RESULTS & OUTPUTS OF REAL-MODEL

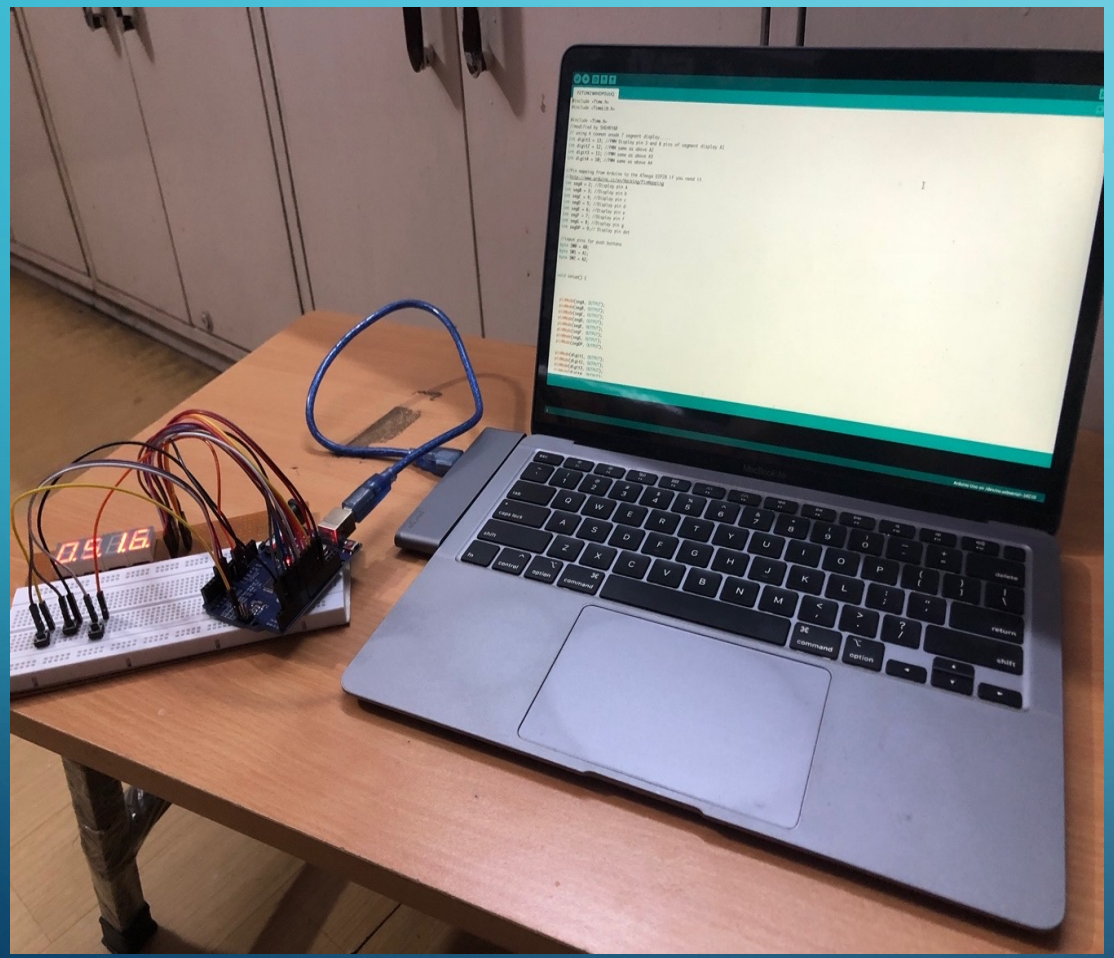
1. CIRCUIT DESIGN.



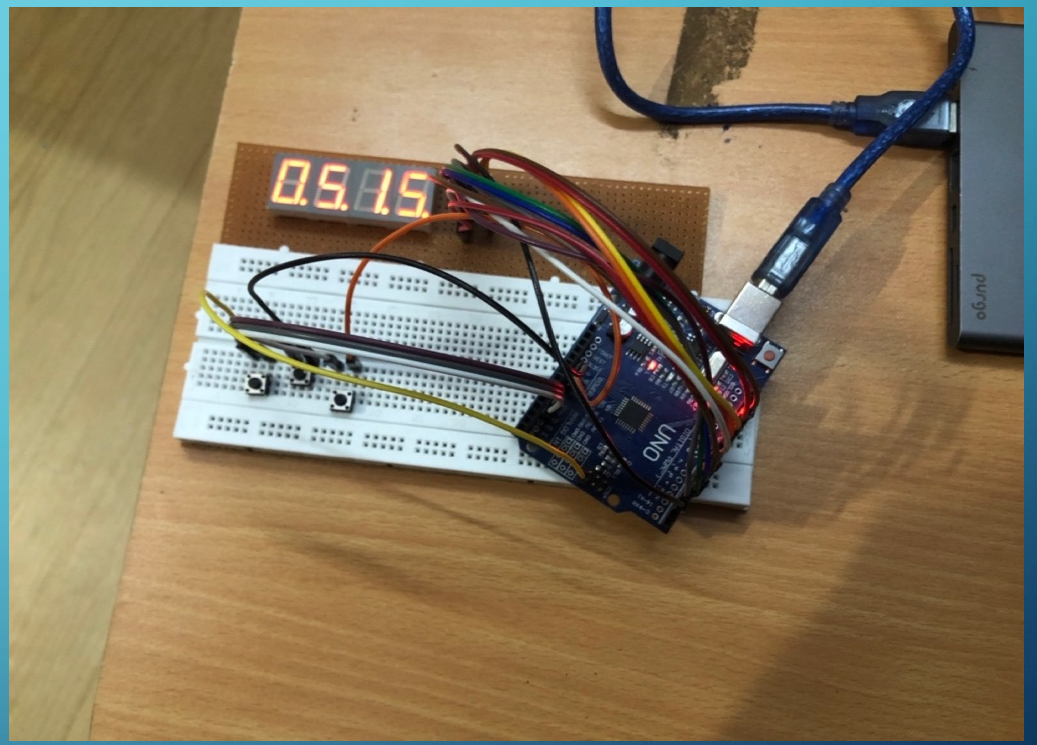
2. BUTTONS TO CHANGE TIME.



3. PROGRAM CODE BY WHICH CLOCK IS WORKING.



4. TOP VIEW.



NOTE **:** As we can see in clock there was ***5:15 & after one minute it automatically turns*** to 5:16.

VIDEO DEMO

FULL DEMO WITH PRESENTATION (WITH AUDIO) :-

https://drive.google.com/file/d/1ap1lWgPqCJBNqntRyrZSSZ0pJfudxBQf/view?usp=sharing

CIRCUIT OVERVIEW :-

https://drive.google.com/file/d/1AeN_yWMKwvH5tSht2MNejtYNCUggtv6C/view?usp=sharing

PRO'S & CON'S OF ARDUINO BASED DIGI-CLOCK

PRO'S **:-**

- ✓ Micro-Controllers are small in size So, we can design Digital Clock of compatible size which can be ***portable***.
- ✓ Nowadays , micro-controllers are ***cheaper*** in price with embedded LCD segment Display.
- ✓ Arduino based Digital Clock has less complex connections & work smoothly &can be made in a very short time.

CON'S **:-**

- ✓ Digital clocks uses ***batteries which goes dead*** very fast, i.e. more power consumption.
- ✓ LCD segment displays are customised by manufacturers So, these ***displays are not cheaper*** in price.
- ✓ These clocks need high maintenance as these are electronic devices.

FUTURE SCOPE

1) This Project was done successfully but some features I was thinking should also be there. I will definitely try to implement this feature in my Project. The feature I would add in the future is a ***Snooze Alarm***.

2) This could be done by generating a high or low edge over a certain amount of clock cycles and then using **edge detection** to trigger an **interrupt** for the alarm. The width of this pulse could be generated using a formula that would get increasingly shorter until it is perpetually on, and the user would have to turn the alarm off.

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