
NUM-MENU

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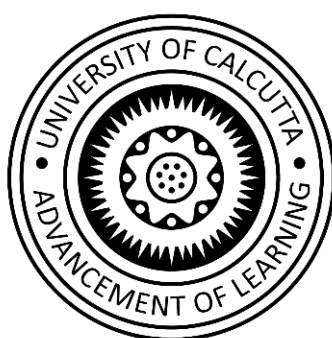
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A Project Submitted in Partial Fulfillment of the Requirements
for the Degree of Bachelors of Science in Physics

Under the Supervision of

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Abstract

This project aims to demonstrate a Menu-Driven program that display various types of numbers as per choice from User on a 16 x 2 LCD display. User chooses from a list of options: Odd, Even, Palindrome, Prime, Perfect Square and Fibonacci numbers. Corresponding the choice, such numbers are displayed on the LCD sequentially till terminated. This Arduino Project can serve as the premise to many other applications, as will be explained in the later pages.

Introduction

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Over the years Arduino has been the brain of thousands of projects, from everyday objects to complex scientific instruments. A program for Arduino Hardware may be written in any programming language with compilers that produce binary machine code for the target processor. The Arduino Integrated Development Environment (IDE) is a cross-platform application (for Windows, macOS, and Linux) that is written in the Java programming language. It originated from the IDE for the languages Processing and Wiring.

- **Pros of Arduino:**

- a. *Inexpensive* : Arduino Boards are relatively inexpensive compared to other microcontroller platforms.
- b. *Cross-platform* : The Arduino Software (IDE) runs on Windows, Macintosh OSX, and Linux operating systems. Most microcontroller systems are limited to Windows.
- c. *Simple, clear programming environment* : The Arduino Software (IDE) is easy-to-use for beginners, yet flexible enough for advanced users to take advantage of as well.
- d. *Open source and extensible software* : The Arduino software is published as open-source tools, available for extension by experienced programmers. The language can be expanded through C++ libraries.

Numbers in Nutshell

A number is a mathematical object used to count, measure, and label. Numbers can be represented in language with number words. More universally, individual numbers can be represented by symbols, called numerals. The most common numeral system is the Hindu–Arabic numeral system, which allows for the representation of any number using a combination of ten fundamental numeric symbols, called digits. In addition to their use in counting and measuring, numerals are often used for labels (as with telephone numbers), for ordering (as with serial numbers), and for codes (as with ISBNs).

- **Some Interesting Numbers:**

- a. *Odd Numbers:*

An odd number is an integer when divided by two, either leaves a remainder or the result is a fraction. Some examples of odd numbers are 1, 3, 5, 7, 9, 11...

- b. *Even Numbers:*

An even number is an integer when divided by two, leaves a remainder or the result is an integer. Some examples of Even Numbers are 2,4,6,8,10,12...

c. *Palindrome Numbers* :

A palindromic number (also known as a numeral palindrome or a numeric palindrome) is a number (such as 16461) that remains the same when its digits are reversed. In other words, it has reflectional symmetry across a vertical axis. Some examples of Palindromic numbers are 0,11,121,1331...

d. *Prime Numbers* :

A prime number (or a prime) is a natural number greater than 1 that is not a product of two smaller natural numbers. Some examples of Prime Numbers are 2,3,5,7,11,13...

e. *Perfect Square* :

a square number or perfect square is an integer that is the square of an integer; in other words, it is the product of some integer with itself. For example, 9 is a square number, since it equals 3^2 and can be written as 3×3 .

f. *Hemachandra Numbers (Fibonacci Numbers)* :

The Fibonacci numbers, commonly denoted F_n , form a sequence, the Fibonacci sequence, in which each number is the sum of the two preceding ones. The Fibonacci numbers were first described in Indian Mathematics. The sequence goes like this : 0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144...

Approach to Project

Essentially speaking about the code, at the core of the project is a menu driven program devised by Switch Case statements. In particular, a switch statement compares the value of a variable to the values specified in case statements. When a case statement is found whose value matches that of the variable, the code in that case statement is run.

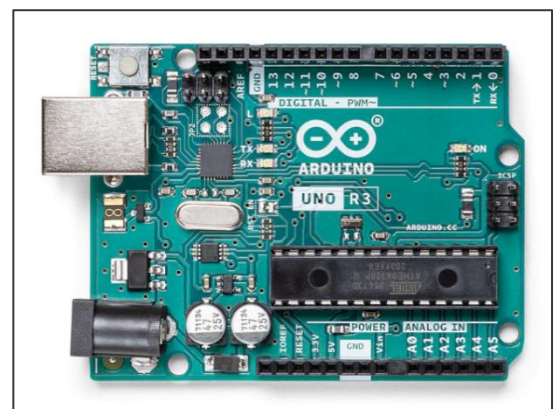
Here, as the User enters his/her choice the case (or option) corresponding to the choice is activated and the sub block under the case is processed. The options range from 1 to 6 for different types of number displaying. After every case there is a Break statement to prevent sequential execution after the matching case till end of switch case is reached. Also, a default case is assigned which returns a "Wrong Input" message once the input choice is anything but 1 to 6.

The Arduino Circuit consists of Arduino UNO board connected to an LCD display to exhibit the various kinds of numbers. On the breadboard are two signal LEDs Red and Green; Red to signify the state of taking User Input from user and the Green to signify the code running to give the output on LCD. The user is supposed to enter his/her choice in the Serial Monitor. The code is such designed so that the system gets reset if any invalid choice is entered.

Methodology

1. Hardware Used :

- I. Arduino UNO Rev 3 [1 pc.]
- II. LCD 16 X 2 [1 pc.]
- III. 1k Ohm Potentiometer [1 pc.]
- IV. LEDs : RED [1 pc] & Green [1 pc]
- V. Resistor : 1 kOhm [2 pc.] & 470 Ohm [1 pc.]
- VI. Breadboard
- VII. Jumper cables [Male-Male & Male-Female both]



Arduino UNO R3



Jumper Cables

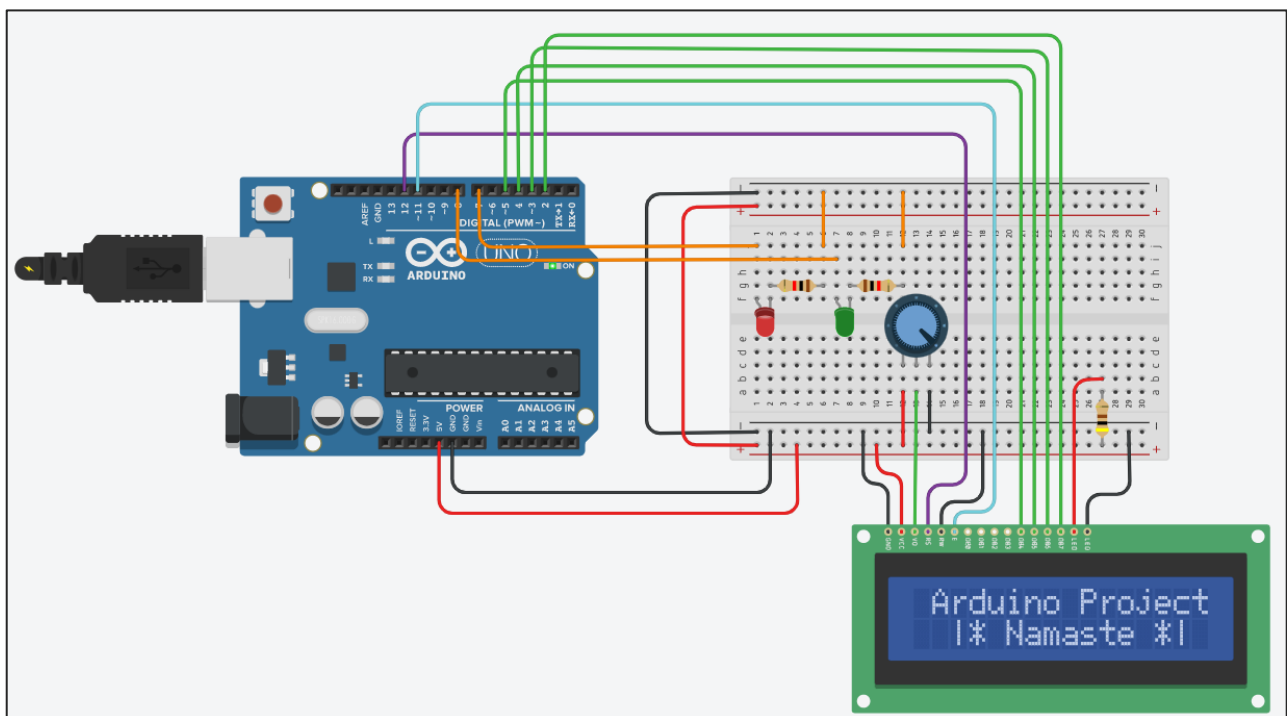


LEDs

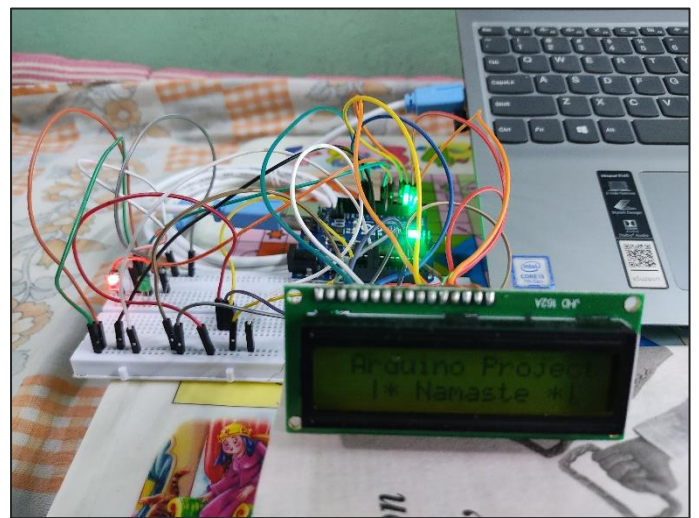
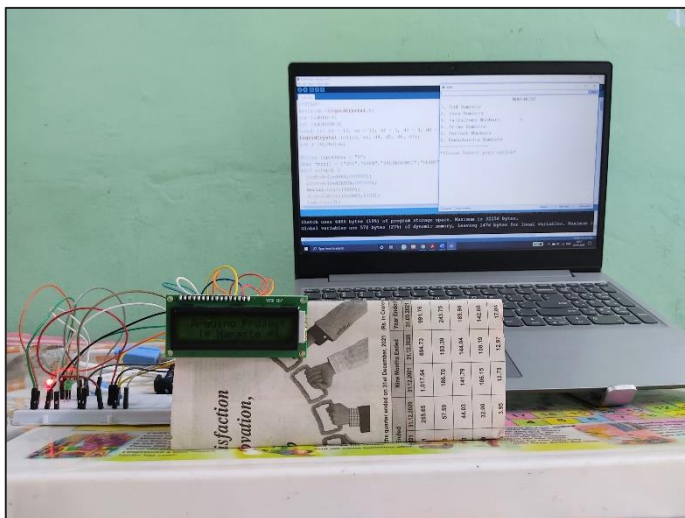


16 X 2 LCD display

2. Circuit Diagram



3. Setup



4. Arduino Code

```
//START
#include <LiquidCrystal.h>
int ledRED=7;
int ledGREEN=8;
const int rs = 12, en = 11, d4 = 5, d5 = 4, d6 = 3, d7 = 2;
LiquidCrystal lcd(rs, en, d4, d5, d6, d7);
int i=0,choice;
String inputData = "0";
char *msg[] = {"ODD", "EVEN", "PALINDROMIC", "PRIME", "PERFECT
SQUARE", "FIBONACCI"};

void setup() {
  pinMode(ledRED,OUTPUT);
  pinMode(ledGREEN,OUTPUT);
  Serial.begin(9600);
  digitalWrite(ledRED,HIGH);
  lcd.clear();
  lcd.begin(16, 2);
  lcd.setCursor(1,0);
  lcd.print("Arduino Project");
  lcd.setCursor(2,1);
  lcd.print("|* Namaste *|");
  delay(1500);

  Serial.println("\t\t\t\t\t NUM-MENU\n1. Odd Numbers \n2. Even Numbers
\n3. Palindrome Numbers \n4. Prime Numbers \n5. Perfect Square \n6.
Hemachandra Numbers \n-----\n*Please Select your
option*");
  while(Serial.available()==0)
  {

  }
  choice = Serial.parseInt();
  Serial.print("Your Choice : ");
  Serial.println(choice);
  lcd.clear();
  lcd.setCursor(0,0);
  lcd.print(choice);
  lcd.print(">");
  lcd.setCursor(2,0);
  lcd.print(msg[choice-1]);
  lcd.print(" no.");
  digitalWrite(ledRED,LOW);
  delay(500);

}

void(* resetFunc) (void) = 0; // declare reset function at address 0
void loop() {

  // Reset System
```

```
    inputData = Serial.readString();

    if (inputData == "0"){
        Serial.println("Reset System.");
        delay(500);
        resetFunc(); //call reset
    }
    // else print number
else{
    digitalWrite(ledGREEN,HIGH);
    lcd.setCursor(0,1);
    lcd.print(">>");
    switch(choice) {
        case 1 :
            i++;
            lcd.print(i++);
            break;

        case 2 :
            lcd.print(i);
            i+=2;
            break;

        case 3:
            palindrome();
            i++;
            break;

        case 4:
            prime();
            i++;
            break;

        case 5:
            perfsq();
            i++;
            break;

        case 6:
            fibonacci();
            i++;
            break;

        default:
            lcd.print("X*X*X*X*X*X*<<");
            delay(5000);
            digitalWrite(ledGREEN,LOW);
            resetFunc(); //call reset
    }
}
}

//Palindrome
int palindrome() {
    int num1= i;
    int rem=0;
```

```
int sum = 0;

while(num1>0)
{
    rem=num1%10;
    sum=sum*10+rem;
    num1=num1/10;
}
if(sum==i)
{
    lcd.print(i);
    return 0;
}
}

//Prime Numbers
int prime() {
    int k=0,j;
    for(j=1;j<=i;j++)
    {
        if(i%j==0)
            k++;
    }
    if(k==2)
    {
        lcd.print(i);
        return 0;
    }
}

//Perfect Square
int perfsq() {
    lcd.print(i*i);
    return 0;
}

int t1=0,t2=1,nt;
//Fibonacci Series
int fibonacci() {
    lcd.print(nt);
    t1 = t2;
    t2=nt;
    nt=t1+t2;
    return 0;
}
```


Conclusion

Thus, we saw a lucid visualization of the magic of numbers by the implementation of basic mathematical and computational vigour. With few amendments this same project can be turned into a Multiplication Table teller, calculator and many more. This project is an amalgamation of various real-life applications like Displays in Shops, Automated Machines (ATMs, ticketing Kiosk) [Menu Driven Program] and LED signal controlling [traffic lights]. Finally, I can say, after accomplishing the project I am motivated to try solving daily life problems using the miraculous device Arduino.

Acknowledgement

I consider myself fortunate to have got the opportunity to do this project. I am grateful to The University of Calcutta for giving me such a wonderful opportunity of doing this project.

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