NEW HORIZON
COLLEGE OF ENGINEERING
New Horizon Knowledge Park, Ring Road, Marathalli
Autonomous College Permanently Affiliated to VTU, Approved by AICTE & UGC
Accredited by NAAC with 'A' Grade, Accredited by NBA

SERIES GENERATOR USING KEYPAD

A MINI PROJECT REPORT

Submitted by:

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In partial fulfillment for the award of the degree of

Bachelors of Engineering (BE)

In

Electrical & Electronics

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

CERTIFICATE

Certified that the Mini Project work entitled **"SERIES GENERATOR USING KEYPAD"** carried out by **Nischal Dinesh(1NH18EE039), Prajwal(1NH18EE042), Sarthak Das(1NH18EE053)** are bonafide students of New Horizon College of Engineering submitted the report in completion of project at Department of Electrical and Electronics Engineering, New Horizon College of Engineering during the Academic Year 2019-20.

It is certified that all the corrections/suggestions indicated for Internal Assessment have been incorporated in the report deposited in the departmental library. The project report has been approved as it satisfies the academic requirements in respect of Project work prescribed for said Degree.

Project Guide | **HOD-EEE**

Mr. Inbasakaran | **Dr. RamKumar S**

ABSTRACT

The overall goal of this project is to create a series generator using a keypad and Arduino. The different series we have used is Fibonacci series, Prime numbers up to 100, Sum of n numbers & Factorial of a given number.

We as people like to always make calculations easier for us. It's always hard to generate few mathematical sequences and series at an instant, so we have designed a calculator which generates few of the complex series which helps us save time and directly give us the desired output. Just by a click of a single button on the keypad and entering the input value through the keyboard, we are able to generate multiple complex series in a very short span of time. Series have properties of convergence, they are used to study functions, spaces, differential equations and other mathematical structures. This helps in its many application not any in mathematics but also in technical world of today such as cryptography, data structures, networking etc.

We are using Arduino Uno which is a microcontroller and on programming with Arduino C programming, we are getting the desired results on the serial window by giving inputs through keyboard.

ACKNOWLEGMENT

We would like to thank everyone who supported us during this entire period of making of this project. It would not have been possible without the kind support and help of many individuals and professors. We would like to extend our sincere gratitude to every one of them. In performing this mini project, we had to take the help and guideline of some respected persons, who deserve our greatest gratitude. The completion of this project gives us much pleasure and satisfaction. We would like to show our gratitude to **Mr. Inbasakaran, Professor Dept. of Electrical Engineering** for giving us a good guideline and helping for project throughout numerous consultations.

I am grateful to the Chairman of New Horizon Educational Institution, **Dr. Mohan Manghnani** for motivating me to carry out research in the NHCE and for providing me with infrastructural facilities and many other resources needed for my project work.

We would also like to thank **Dr. Ramkumar S, Head of the Dept. of Electrical Engineering** for helping us**.** I am thankful to other professors also for the valuable information provided by them in their respective fields. I am grateful for their cooperation during the period of our mini project. We would also like to expand our deepest gratitude to all those who have directly and indirectly guided us in preparing this report for this mini project.

Many people, especially our own classmates and team members itself, have made valuable comment suggestions on this proposal which gave us an inspiration and hope to improve and complete the mini project. We were very excited in doing this. We thank all the people for their help directly and indirectly to complete our project successfully.

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AIM

To generate different series in mathematics using Arduino UNO, and a simple 4X4 Keypad.

OBJECTIVE

To create a complex series generator using Arduino and simple keypad. The series we are generating are Fibonacci series, Factorial of a given number, Sum of n numbers and Prime numbers from 0-100.

CHAPTER 1

INTRODUCTION

Series generator is a programmable calculator wherein we are able to generate various mathematical series and complex calculations. The present simple calculators we can only perform certain arithmetic functions like addition, subtraction, multiplication and division. In order to generate a mathematical series like Fibonacci series or sum of numbers or a to calculate a complicate solution, it requires a lot of calculations, time and it is difficult and almost impossible to get in a simple calculator, whereas in this series generator we can generate many mathematical series and calculations within a very less time with more accurate and precise results.

Some of the important mathematical series and calculations are:

Fibonacci series:

In mathematics, Fibonacci numbers is a type of series formed when a number is equal to sum of its two preceding numbers.

$F_{n+2} = F_{n+1} + F_n$

This series is generally valid for n>2. This series is very much similar to the golden ratio. According to Binet's formula it expresses the Fibonacci number in terms of golden ratio and n, this formula implies that the ratio of two successive back to back numbers move towards the golden ratio as n increases. In nature it appears in branching of trees, pineapple fruitlets, leave arrangement in stem or honeybees family tree.

n	Fibonacci	n	Fibonacci
0	0	9	34
1	1	10	55
2	1	11	89
3	2	12	144
4	3	13	233
5	5	14	377
6	8	15	610
7	13	16	987
8	21	17	1597

Table 1.1 – Fibonacci Series

Factorial:

In mathematics, a factorial is an integer (+ve), which is a result of products of all consecutive number less than or equal to the integer itself.

Let 'a' be the number, then its factorial a! = ax(a-1)x(a-2)…..(a-(a-1))

It is found in various areas in mathematics including algebra and mathematical analysis. The most common use of factorial is found in permutation and combination. It is only undefined when it comes to negative number. Factorial also turns up in binomial formula and integration also, apart from that when we try to arrange 'r' things in r! ways or a combination of f! from r!.

Factorial	Expansion of factorial	Value
1!	1	1
2!	2×1	2
3!	3 ×2× 1	6
4!	4 ×3× 2 ×1	24
5!	5× 4× 3× 2× 1	120
6!	6× 5 ×4 ×3× 2× 1	720
7!	7× 6× 5 ×4× 3× 2 ×1	5,040
8!	8× 7× 6× 5× 4× 3 ×2× 1	40,320
9!	9 ×8× 7× 6× 5× 4 ×3× 2 ×1	362,880
10!	10× 9×8× 7× 6× 5×4× 3× 2× 1	3,628,800

Table 1.2 - Factorial

Sum of numbers:

This is an infinite series of all natural numbers starting from n=1 up to n=infinity.

Let 'x' be the sum of all numbers from 1 to n,

x=1+2+3+4+….n

This is a part of classical divergent series. Apart from mathematics it also has application in various other fields such as the 'bosonic string theory' to calculate all possible energy levels as well as calculating 'Casimir force' for scalar field in one direction.

n	Sum of numbers	Value
1	1	1
2	1+2	3
3	1+2+3	6
4	1+2+3+4	10
5	1+2+3+4+5	15
6	1+2+3+4+5+6	21
7	1+2+3+4+5+6+7	28

8	1+2+3+4+5+6+7+8	36
9	1+2+3+4+5+6+7+8+9	45
10	1+2+3+4+5+6+7+8+9+10	55

Table 1.3 – Sum of n Numbers

Prime numbers:

Prime numbers are all the numbers greater than 1 which can only be divided by 1 and the number itself and no other number. The only factors of the number are also 1 and the umber itself. 2 is the only even number which is a prime number as rest all numbers can be expressed as product of 2 also.

Sequence	Prime Number	Sequence	Prime Number
1	2	**14**	43
2	3	**15**	47
3	5	**16**	53
4	7	**17**	59
5	11	**18**	61
6	13	**19**	67
7	17	**20**	71
8	19	**21**	73
9	23	**22**	79
10	29	**23**	83
11	31	**24**	89
12	37	**25**	97
13	41		

Table 1.4 – Prime Numbers

CHAPTER 2

PROBLEM STATEMENT

The problem which we encounter when we try to find a given series on a day to day basis is that it takes time and have to do multiple calculations. To solve this problem and save us time and give different series instantly, we have created a device which has pre stored few of the series, which when called gives us the required series or output immediately. Calculators are limited to a particular value above which calculations cannot be conducted and by using this device, any number of calculation can be done and performed.

CHAPTER 3

3.1 COMPONENTS REQUIRED

1. Arduino Uno
2. 4X4 Keypad
3. Connecting jumper wires
4. Computer to view serial window
5. Keyboard

3.2 COMPONENTS DESCRIPTION

1. Arduino Uno

Arduino is an open source platform which is used to build various electronic projects. It consists of a circuit board which can be programmable, a kind of microcontroller and software or IDE which runs in the computer, used to write, verify and upload the code to the board. Arduino Uno is one of the various and most common type of microcontrollers based on ATmega28P. For INPUT/OUTPUT it has 14 digital pins out of which 6 pins can be used for PWM (Pulse Width Modulation), 6 analog INPUT pins, a USB connection, a power jack, an ICSP header and a reset button. It has almost everything required to support the microcontroller, we can just connect it to the computer with a USB cable or power it up with an adapter or battery to get started. If hardware is not available there are many online platforms like Tinkercad, Proteus, Eagle etc.

Pin diagram:

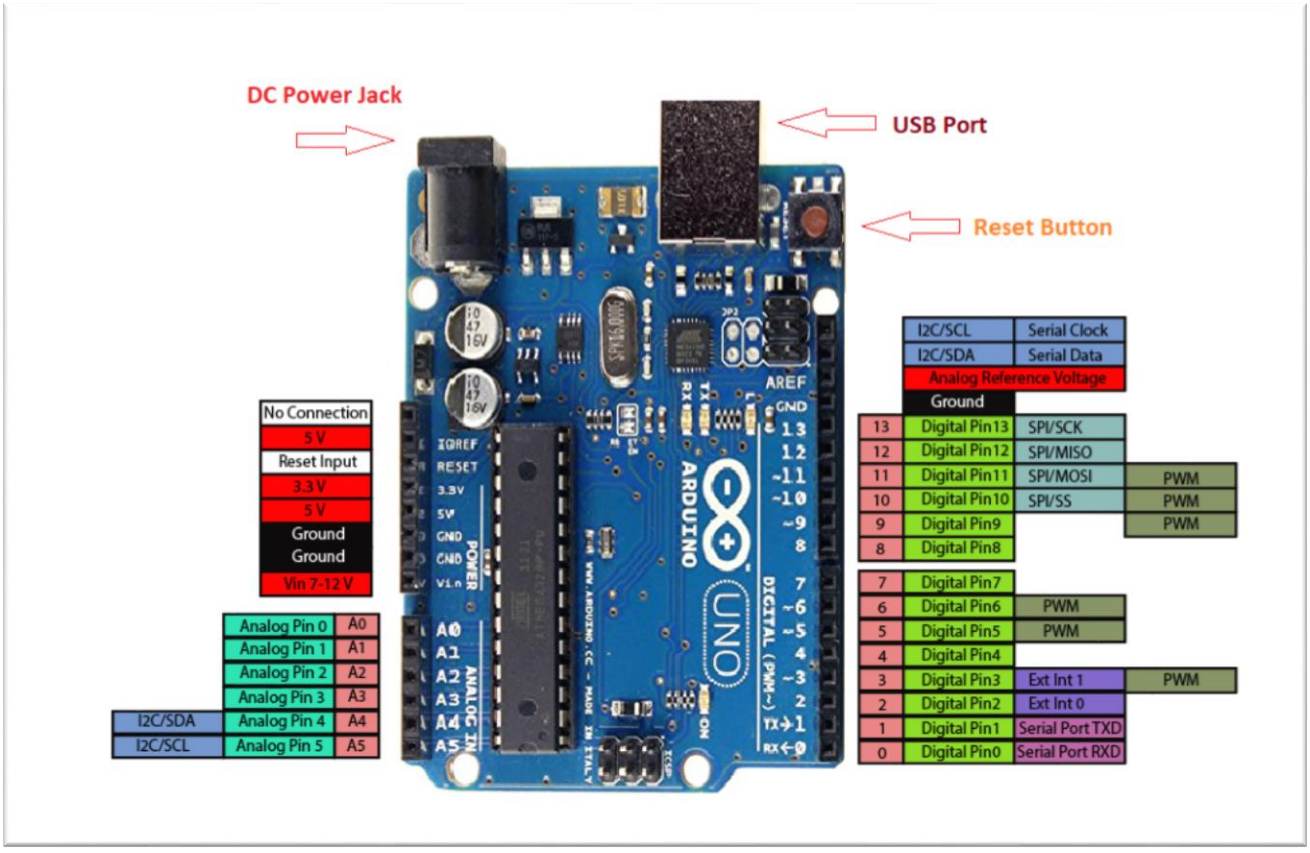

Fig 3.2.1 – Arduino UNO

2. (4x4) Keypad

It is a matrix keypad of 4 rows and 4 columns used for giving input. The main advantage of matrix keypad is that we need not need to interface all GPIO pins. For example, when we want to interface 16 keys to the microcontroller, we need 16 GPIO pins to interface, with this matrix keypad we can interface with just 8 GPIO pins with the microcontroller.

Pin diagram:

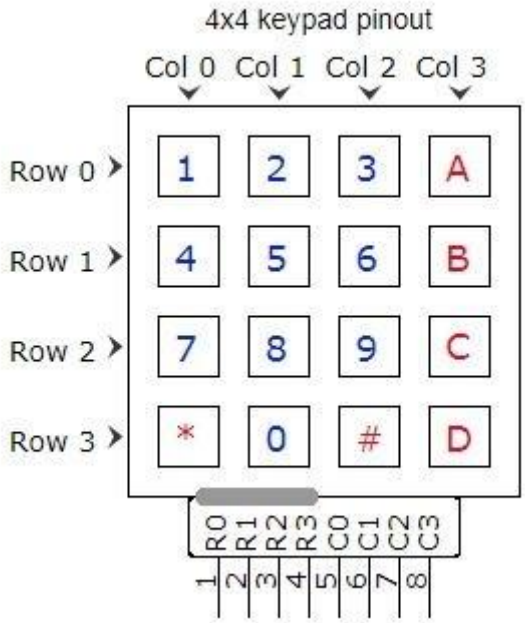

Fig 3.2.2 – Keypad Pin Diagram

Fig 3.2.3 - Keypad

3. Connecting wires:

Connecting wires acts as a medium for electrical current to flow from one point to the other. In the case of computers and PCBs it is embedded into the circuit boards to carry pulses of electricity. Most wires are made up of copper because it is cheap and is highly conductive.

Fig 3.2.4 – Connecting wires

CHAPTER 4

4.1 CONSTRUCTION

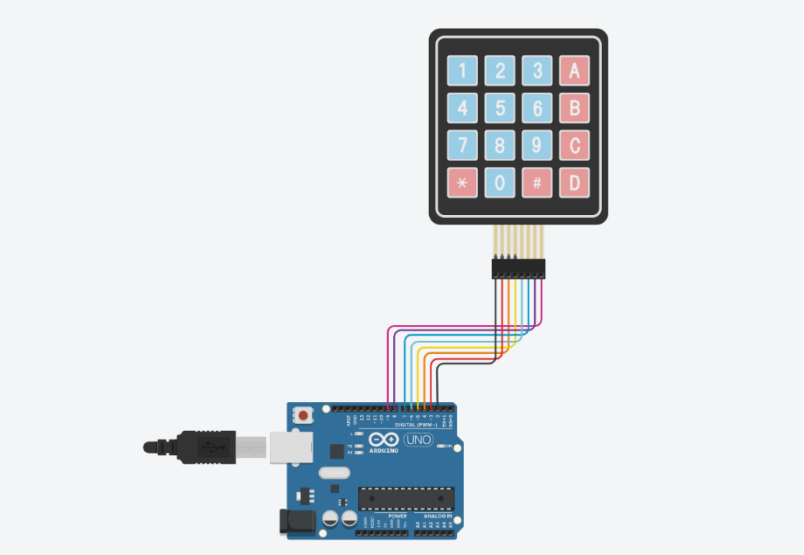

Fig 4.1.1 – Circuit Diagram

Above diagram shows the connection of the Series Generator using Keypad. A simple and easy to use but very reliable and effective circuit diagram of the Arduino connected to the Keypad is shown here. The Arduino UNO is connected to PC, supplying an input voltage of a range between 7-12V. This input voltage is used to power the Arduino and the components connected to it.

Jumper wires are used to connect the keypad to the Arduino UNO on the display side form the pin number 2 to pin number 9. In the computer, the code for the generation of series is stored. Now, using the keypad, the inputs – A,B,C,D are set with different functions. Once an input from the keypad is selected, keyboard of the computer is used to enter the values into the serial window to get the desired output.

4.2 WORKING

This project on series generator mainly consists of an Arduino UNO microcontroller, keypad, computer and keyboard. Once the program is loaded onto the Arduino using the computer, the computer acts as an input power supply to run the Arduino and the components connected to it. Once the code is entered into the Arduino, the code can be simulated. On simulating, the serial window must be kept open. Now selecting either of the four inputs A, B, C, D from the keypad gives us the respective desired series.

CASE I

When "A" is selected, the factorial of a given number is calculated. As soon as "A" has been selected using the keypad, the keyboard is used to enter the input value into the serial window, and on pressing enter, the factorial of the input value is given.

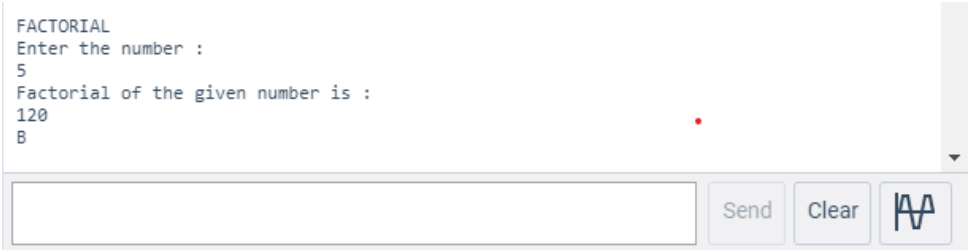

Fig 4.2.1 – Factorial Result

CASE II

When "B" is selected, the Fibonacci series is generated until the given number. As soon as "B" has been selected using the keypad, the keyboard is used to enter the input value into the serial window. This input value is used to give the number of values for Fibonacci series to display. On pressing enter, the Fibonacci series is given until the desired number of times.

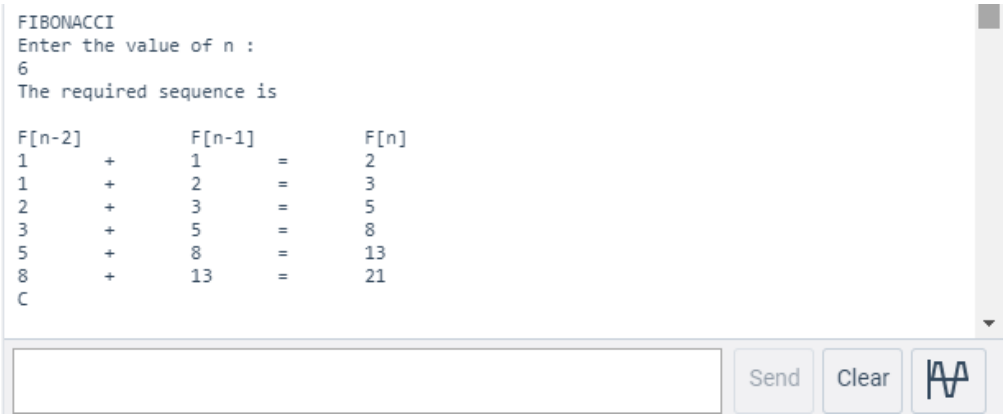

Fig 4.2.2 – Fibonacci Result

CASE III

When “C” is selected, the Sum of n numbers is calculated and displayed. As soon as “C” is selected using the keypad, the value of n must be entered in the serial window using the keyboard. The value of n is the number of times the loop must repeat to and add the numbers up until n and on pressing enter must give the sum of the n numbers as the output.

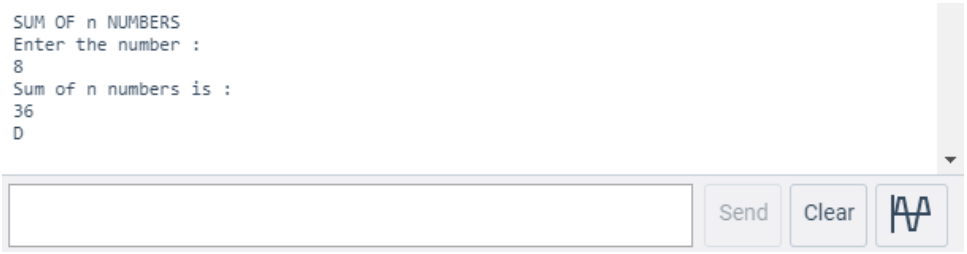

Fig 4.2.3 – Sum of n numbers result

CASE IV

When “D” is selected, prime numbers from 0-100 is displayed. As soon as “D” has been selected using the keypad, the program immediately starts giving the prime numbers from 0 to 100. The output speed had been set with a delay, which results in continuous display of one number after another increasing at a constant speed.

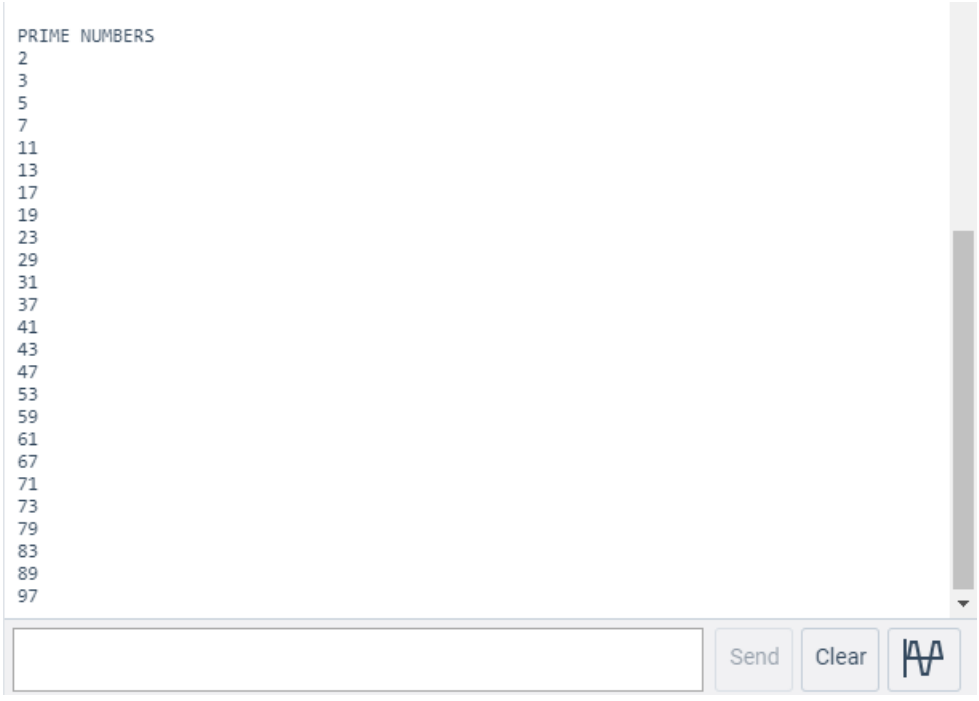

Fig 4.2.4 – Prime numbers Result

4.3 FLOW CHART

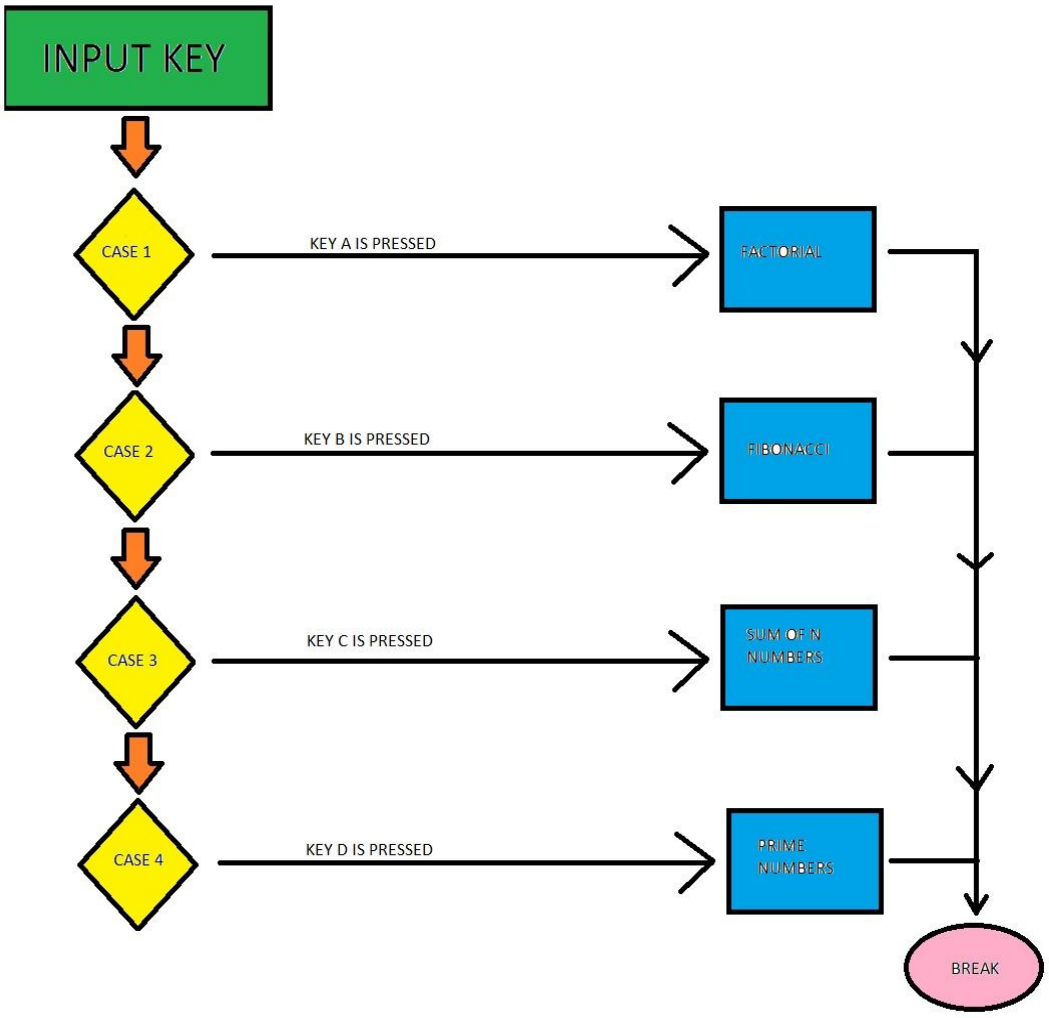

Fig 4.3.1 – Program Flow Chart

4.4 PROGRAM CODE

```
#include <Keypad.h>
int b=0;
const byte ROWWS = 4; //four rows of keypad
const byte COLLS = 4; //three columns of keypad
char keys[ROWWS][COLLS] =
{
 {'1','2','3','A'},
 {'4','5','6','B'},
 {'7','8','9','C'},
 {'*','0','#','D'}
};

const int buttoon = 4;
int switchStates;
int lastButtoonState = HIGH;

unsigned long x = 1;
unsigned long y = 1;
unsigned long z;

byte rowwwPins[ROWWS] = {2, 3, 4, 5}; //connect to the row pinouts of the keypad
byte colllPins[COLLS] = {6,7,8,9};    //connect to the column pinouts of the keypad

Keypad calci = Keypad( makeKeymap(keys), rowwwPins, colllPins, ROWWS, COLLS );

void setup()
{
```

```
 pinMode(buttoon,INPUT);
 Serial.begin(9600);
 delay(2000);
 pinMode(13, OUTPUT);
}

void loop()
{

 int resultss;
 int result;
 switchStates = digitalRead(buttoon);



 char wwe = calci.getKey();
 if (wwe)
 {
  Serial.println(wwe);
 }

 if (wwe=='A')
 {
  Serial.println("\n");
  Serial.println("FACTORIAL");
  Serial.println("Enter the number :");
  while(Serial.available()==0){}
   b=Serial.parseInt();
   Serial.println(b);
   delay(500);
```

```
  resultss = facto(b);
  Serial.println("Factorial  is : ");
  Serial.println(resultss);
  delay(500);
}

if(wwe=='B')
{
 Serial.println("\n");
 Serial.println("FIBONACCI");
 Serial.println("Enter the value of n :");
 while(Serial.available()==0){}
  b=Serial.parseInt();
  Serial.println(b);
  fibonacci();
 if(switchStates == LOW && switchStates != lastButtoonState)
 {
   z = x + y;
   printtheNumbers(x,y,z);
   x = y;
   y = z;
 }
lastButtoonState =switchStates;
}

if(wwe=='C')
{
 Serial.println("\n");
 Serial.println("SUM OF n NUMBERS");
```

```
   Serial.println("Enter the number :");
   while(Serial.available()==0){}
    b=Serial.parseInt();
    Serial.println(b);
    delay(500);
    result = sumof(b);
    Serial.println("Sum is : ");
    Serial.println(result);
    delay(500);
  }

  if(wwe=='D')
  {
   Serial.println("\n");
   Serial.println("PRIME NUMBERS");
   primenumber();
  }
}

int facto(int n) //function for factorial of a number
{
  if (n==1)
  {
   return 1;
  }
  else
  {
   return n * facto(n-1);
  }
```

```
}

void printtheNumbers(int a, int b, int c) //function for printing numbers
{
 Serial.print(a);
 Serial.print("\t");
 Serial.print("+");
 Serial.print("\t");
 Serial.print(b);
 Serial.print("\t");
 Serial.print("=");
 Serial.print("\t");
 Serial.println(c);
}

void fibonacci()  //function for fibonacci series
{
 Serial.println("The required sequence is");
 Serial.println(" ");
 Serial.print("F[n-2]");
 Serial.print("\t");
 Serial.print("\t");
 Serial.print("F[n-1]");
 Serial.print("\t");
 Serial.print("\t");
 Serial.print("F[n]");
 Serial.println();
 for (int i=0; i<b; i++)
 {
```

```
   delay(250);
   z = x + y;
   printtheNumbers(x,y,z);
   x = y;
   y = z;

 }
 x = 1;
 y = 1;}
int sumof(int n)
{
  int add = 0;
  for(int i=1; i<=n; i++)
  {
    add += i;
  }
  return add;
}

void primenumber() //function for prime numbers
{
  int i=2,j,k;
  while(i<=100)
  {
    k=1;
    for(j=2;j<i;j++)
    {
      if( i%j == 0)
      {
```

```
          k=0;
        }
      }
      if(k)
      {
       Serial.println(i);
       delay(600);
      }
      i++;
    }
}
```

4.5 HARDWARE PICTURE

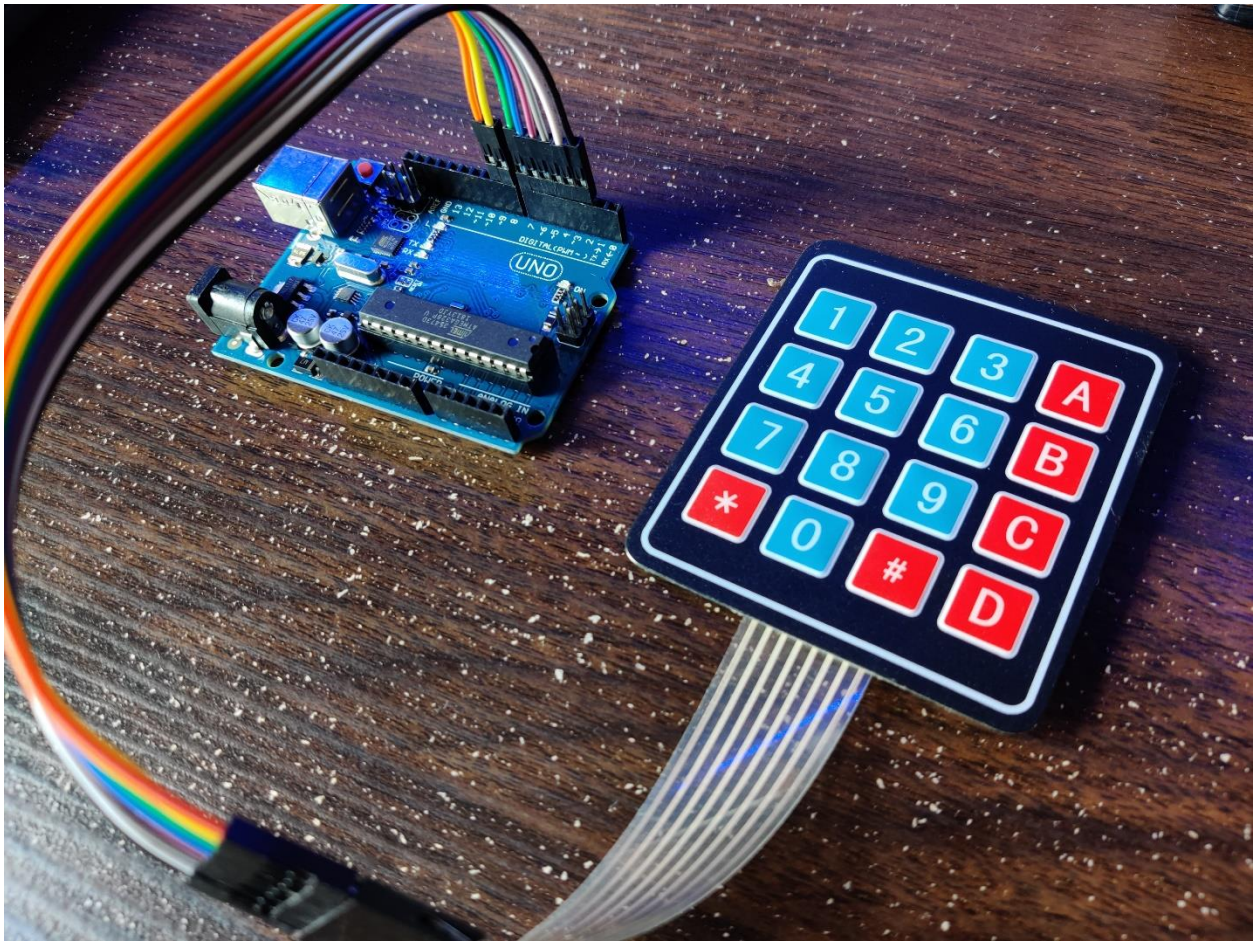

Fig 4.5.1 – Project Model

CHAPTER 5

RESULT

Series is an ordered list of any numbers which follow a particular pattern. The expected series is generated on selection by the user giving precise values at very less time. The series we have used which is factorial, Fibonacci series, Sum of n numbers and Prime numbers have many applications in today's world which helps us save time and the effort of calculating. Also depending upon the value we can even generate infinite range series for prime numbers or sum of numbers within very less without any errors. Thus giving us a complex series generator using basic components of a calculator.

CHAPTER 6

APPLICATIONS

There are a variety of areas where our project can be extensively used:

- Prime numbers are extensively used in cryptography and networking. The main reason is that we when try to break this numbers it can only be broken into 1 and the number itself. Rivest-Shamir-Adleman (RSA) encryption uses prime numbers in order to encrypt and decrypt data. The encryption algorithm can generate the result very fast but to do the reverse calculation is highly complicated and computed.
- Diffie-Hellman key exchange is another type of cryptography where prime numbers are used along with modulo operations to transmit the data in private encryption using certain algorithm.
- We can also use this in integer sequence generator wherein we can just generate any random series based on its algorithm.
- Fibonacci series is extensively used in data structures and algorithms, architecture and design etc.
- Factorial is extensively used in permutation and combination not only for mathematical applications but also in generating a set of ideas or plans in certain ways etc.
- Sum of numbers can be used

REFERENCES

The following data for the project has been gathered from a number of sources. A list of few of the sources are

World Wide Web:

- "What Is An Arduino? - Electronics For You" https://www.electronicsforu.com/arduinobasics-schematics
- "Series -- from Wolfram MathWorld" https://mathworld.wolfram.com/Series.html, by EW Weisstein - 2004
- "Arduino 4x4 Keypad Interfacing With Arduino Uno | Arduino" https://www.electronicwings.com/arduino/4x4-keypad-interfacing-with-arduino-uno, 21 May 2010

Book:

- Exploring Arduino: Tools and Techniques for Engineering Wizardry: by Jeremy Blum
- Arduino Essentials: Book by Francis Perea
- Numbers, Sequences and Series: Book by Keith Hirst

Journal article:

- Ankit Dalal, Ankur Atri "An Introduction to Sequence and Series", Vol 1, No 10 (2014)
- Daniel Arficho "Introduction to Geo*Arithmetic Series", Volume 4 , Issue 5

Series Generator Using Keypad

ORIGINALITY REPORT

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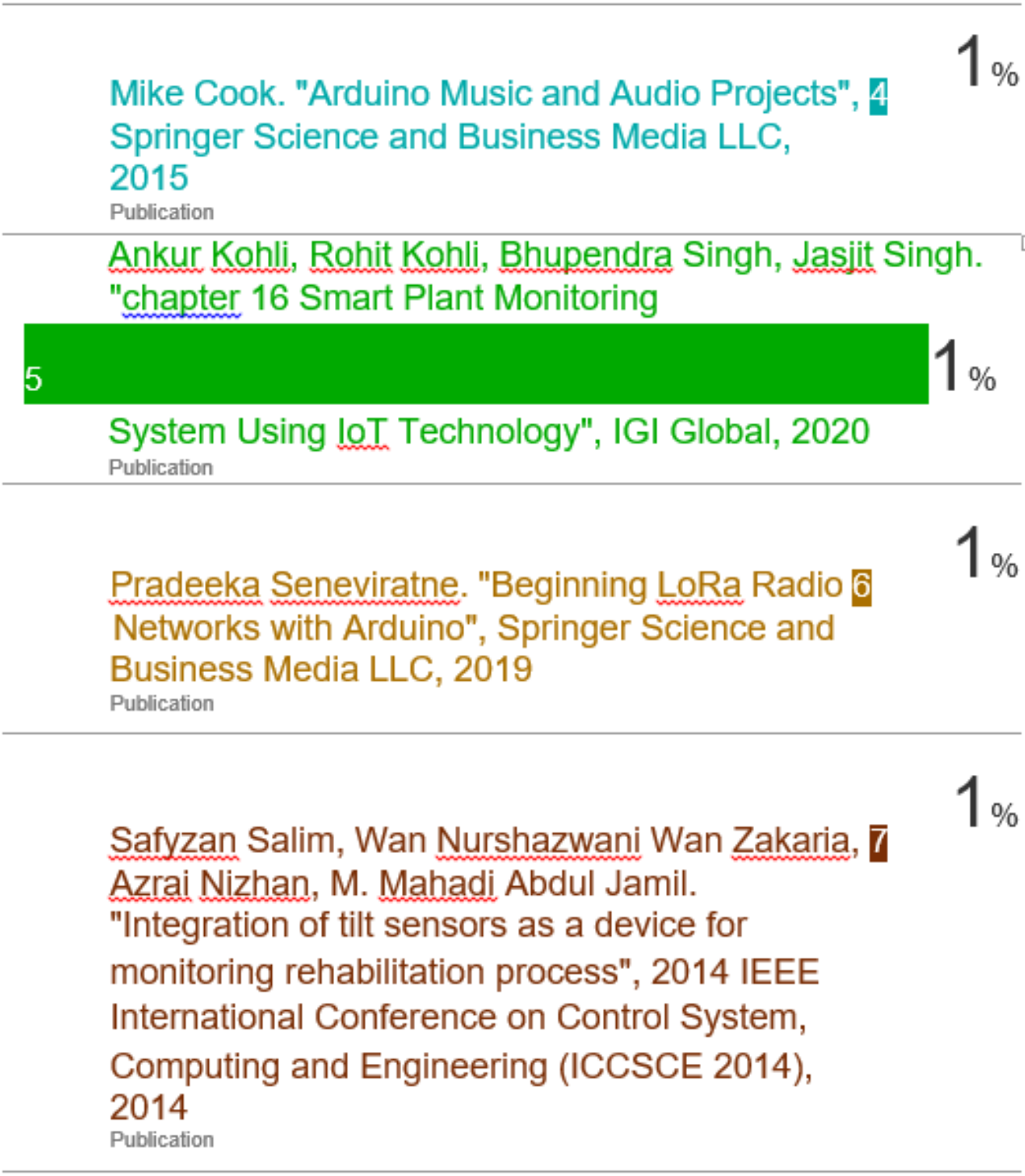
PRIMARY SOURCES

1	Anif Jamaluddin, Fengky Adie Perdana, Agus Supriyanto, Agus Purwanto, Inayati, M. Nizam. "Development of Wireless Battery Monitoring for electric vehicle", 2014 International Conference on Electrical Engineering and Computer Science (ICEECS), 2014 Publication	1%
2	Neil Cameron. "Arduino Applied", Springer Science and Business Media LLC, 2019 Publication	1%
3	Agus Kurniawan. "Arduino Programming with .NET and Sketch", Springer Science and Business Media LLC, 2017 Publication	1%


Mike Cook. "Arduino Music and Audio Projects", Springer Science and Business Media LLC, 2015
Publication
1%
4
Ankur Kohli, Rohit Kohli, Bhupendra Singh, Jasjit Singh. "chapter 16 Smart Plant Monitoring
5
1%
System Using IoT Technology", IGI Global, 2020
Publication
Pradeeka Seneviratne. "Beginning LoRa Radio
6
Networks with Arduino", Springer Science and Business Media LLC, 2019
Publication
1%
Safyzan Salim, Wan Nurshazwani Wan Zakaria,
7
Azrai Nizhan, M. Mahadi Abdul Jamil. "Integration of tilt sensors as a device for monitoring rehabilitation process", 2014 IEEE International Conference on Control System, Computing and Engineering (ICCSCE 2014), 2014
Publication
1%

8 Tianhong Pan, Yi Zhu. "Designing Embedded Systems with Arduino", Springer Science and Business Media LLC, 2018 <1%
Publication

9 Rajesh Kumar Pal. "Authenticated Encryption Schemes on Java Card", 2019 22nd Euromicro Conference on Digital System Design (DSD), 2019 <1%
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10 "Intelligent Systems Design and Applications", Springer Science and Business Media LLC, 2020 <1%
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