**MORSE CODE DECODER**

A course project report submitted in partial fulfilment of the requirement

of

**SMART SYSTEM DESIGN**

by

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**ABSTRACT**

The main motive of this project is to depict the funtion of Morse Code which was effectively used before the innovation of telephones.

Morse code is the most basic emergency communication method. It expresses alphabet and numbers by using the combinations of dots and dashes. Because of its simple structure which only contains dots and dashes, Morse code is expressed in a variety of ways.

The Aim of this project presents the implementation of a cost-effective decoding.Morse Code, either of two systems for representing letters of the alphabet, numerals, and punctuation marks by an arrangement of dots, dashes, and spaces. The codes are transmitted as electrical pulses of varied lengths or analogous mechanical or visual signals, such as flashing lights.

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**CHAPTER 1**

**INTRODUCTION**

**1.1 About The Project.**

Morse Code, either of two systems for representing letters of the alphabet, numerals, and punctuation marks by an arrangement of dots, dashes, and spaces. The codes are transmitted as electrical pulses of varied lengths or analogous mechanical or visual signals, such as flashing lights. One of the systems was invented in the United States by American artist and inventor Samuel F.B. Morse during the 1830s for electrical telegraphy. This version was further improved by American scientist and businessman Alfred Lewis Vail, Morse’s assistant and partner. Soon after its introduction in Europe, it became apparent that the original Morse Code was inadequate for the transmission of much non-English text, since it lacked codes for letters with diacritic marks. To remedy this deficiency, a variant called the International Morse Code was devised by a conference of European nations in 1851. This newer code is also called Continental Morse Code.

**1.2 OBJECTIVES**

 The objective of this project is to implement a low cost , reliable, and scalable decoder of morse code.the purpose of this project is to understand codes easly by decoding device.

**CHAPTER 2**

**PROJECT DESCRIPTION**

**2.1 BLOCK DIAGRAM OF THE PROJECT**

As shown in the blow schematic diagram it mainly consists of an Arduino Nano, Buzzer,light , Push Buttons, 330 Ohm resistor’s , jumper wires,serial monitor and bread board.In figure 2.1 the schematic shows the connection of elements.

Note:

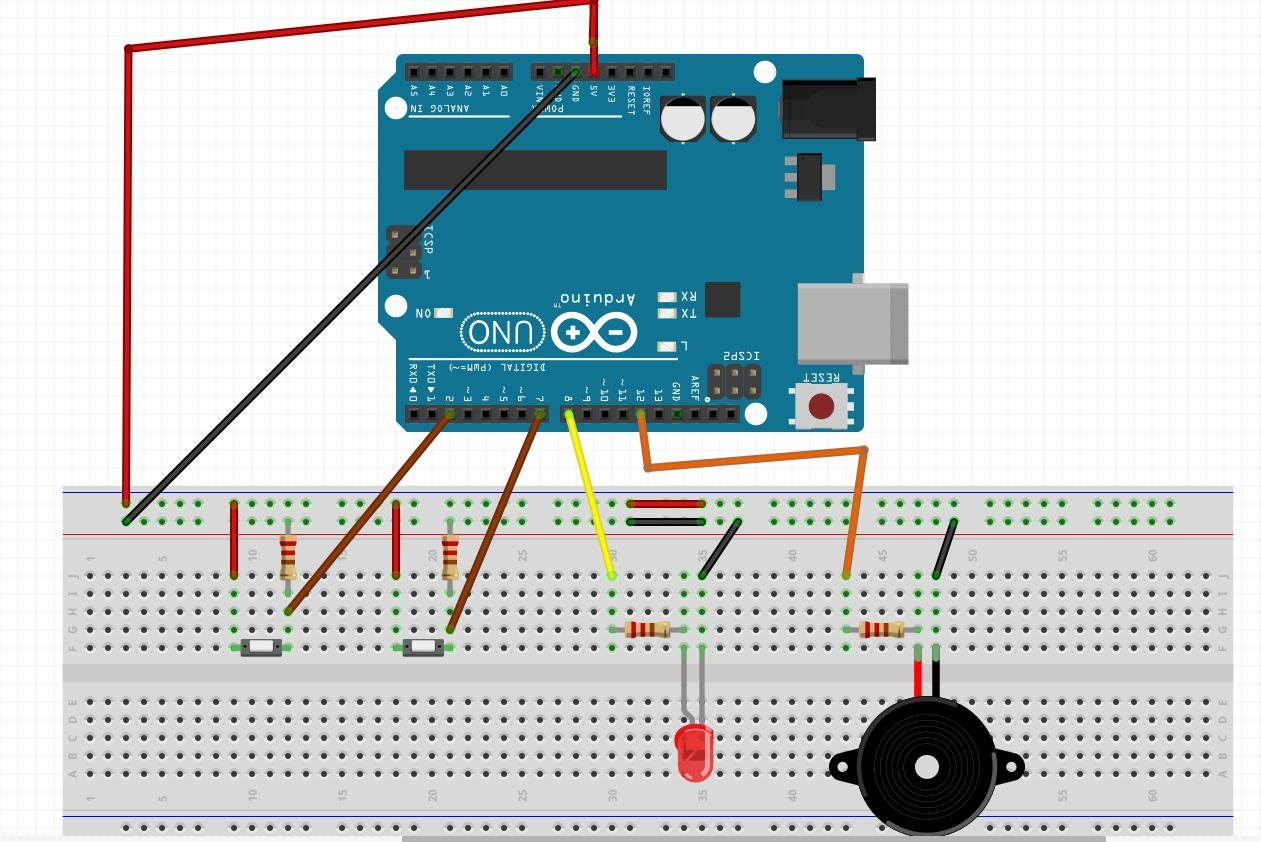


Fig.2.1 Block Diagram of project.

**2.3 HARDWARE DESCRIPTION**

**2.3.1 Arduino Nano**

The classic Nano is the oldest member of the Arduino Nano family boards. It is similar to the Arduino Duemilanove but made for the use of a breadboard and has no dedicated power jack. Successors of the classic Nano are for example the Nano 33 IoT featuring a WiFi module or the Nano 33 BLE Sense featuring Bluetooth® Low Energy and several environment sensors.

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Arduino Nano Features

The features of an Arduino nano mainly include the following.

arduino-nano-board

Arduino-nano-board

ATmega328P Microcontroller is from 8-bit AVR family

Operating voltage is 5V

Input voltage (Vin) is 7V to 12V

Input/Output Pins are 22

Analog i/p pins are 6 from A0 to A5

Digital pins are 14

Power consumption is 19 mA

I/O pins DC Current is 40 mA

Flash memory is 32 KB

SRAM is 2 KB

EEPROM is 1 KB

CLK speed is 16 MHz

Weight-7g

Size of the printed circuit board is 18 X 45mm

Supports three communications like SPI, IIC, & USART

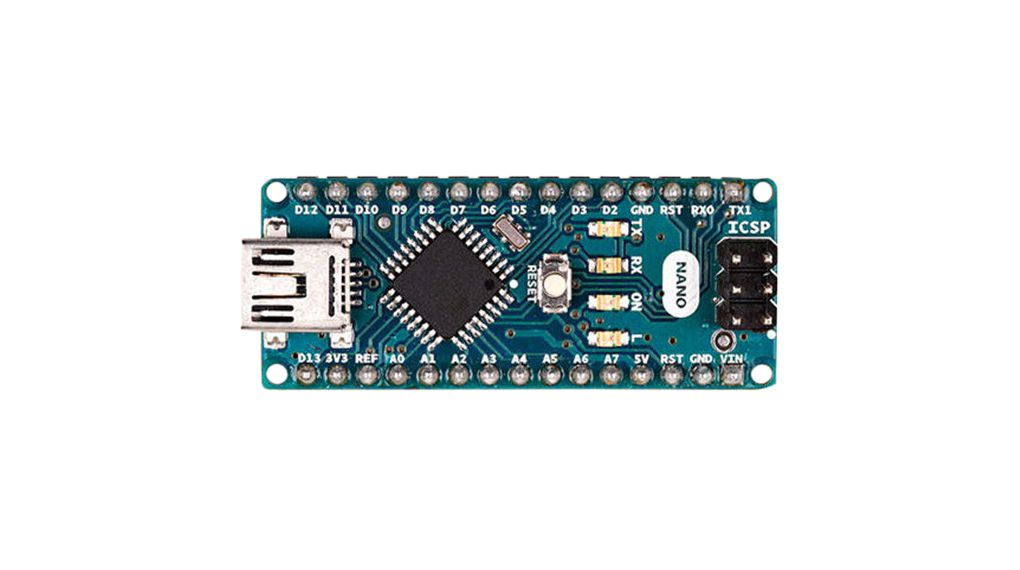


Fig. 2.2 (a)Arduino Uno

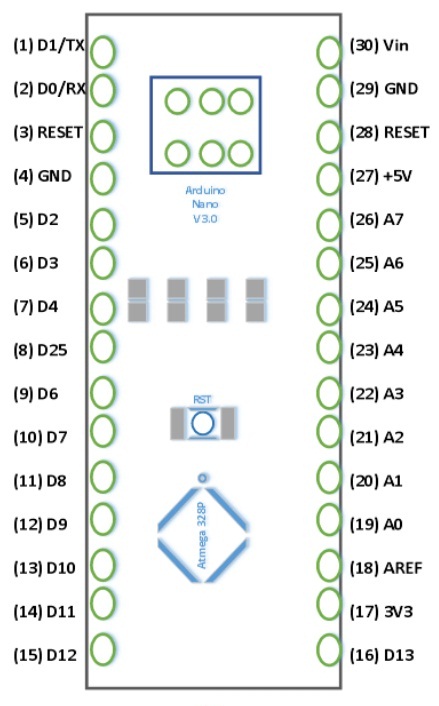


Fig. 2.2(b) Arduino Uno

**Applications:**

1. Samples of electronic systems & products.
2. Automation.
3. Several DIY projects.
4. Control Systems.
5. Embedded Systems.
6. Robotics.
7. Instrumentation.
8. Weighing Machines.
9. Traffic Light Count Down Timer.
10. Parking Lot Counter.
11. Home Automation.
12. Industrial Automation.
13. Medical Instrument.
14. Emergency Light for Railways.

**2.3.2 Buzzer**

A buzzer or beeper is an audio signalling device, which may be

mechanical,electromechanical,or piezoelectric. Typical uses of buzzers and beepers include

alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.



Fig.2.4 Buzzer

**Types of buzzers:**

**1. Electromechanical**

Early devices were based on an electromechanical system identical to an electric bell without the metal gong. Similarly, a relay may be connected to interrupt its own actuating current, causing the contacts to buzz. Often these units were anchored to a wall or ceiling to use it as a sounding board. The word "buzzer" comes from the rasping noise that electromechanical buzzers made.A magnetic field is generated when a voltage is applied causing the magnet to move and the metal disc to vibrate.This generates an audible sound. One of RS Pro's popular electromechanical buzzers is (617-3081).

**2. Mechanical**

The mechanical buzzer uses a magnet to move a reed up and down quickly to emit a lower-pitch buzz! It's quieter than the piezoelectric buzzer but uses more power, so you the terminals will have to be closer to the battery packs. To use them, you'll need to match the wire colors to the wires from the battery pack.

A joy buzzer is an example of a purely mechanical buzzer. They require drivers.

**3. Piezoelectric**

A piezoelectric element may be driven by an oscillating electronic circuit or other audio signal source, driven with a piezoelectric audio amplifier. Sounds commonly used to indicate that a button has been pressed are a click, a ring or a beep.In short,a piezo buzzer works by applying an alternating voltage to the piezoelectric ceramic material. The introduction of such an input signal causes the piezoceramic to vibrate rapidly, resulting in the generation of sound waves.

**Applications:**

While technological advancements have caused buzzers to be impractical and undesirable, there are still instances in which buzzers and similar circuits may be used.

**Present day applications include:**

1. Novelty uses
2. Judging panels
3. Educational purposes
4. Annunciator panels
5. Electronic metronomes
6. Game show lock-out device
7. Microwave ovens and other household appliances
8. Sporting events such as basketball games

**2.4 SOFTWARE DESCRIPTION**

The software used here is ARDUINO SOFTWARE:

The Arduino Integrated Development Environment - or Arduino Software (IDE)-contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them.

**Writing Sketches:**

Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension ino. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom righthand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

**NB:**

Versions of the Arduino Software (IDE) prior to 2.0.3 saved sketches with the extension pde. It is possible to open these files with version 1.0, you will be prompted to save the sketch with the ino extension on save.



**Verify**

Checks your code for errors compiling it.



**Upload**

Compiles your code and uploads it to the configured board. See uploading below for details.

**Note:** If you are using an external programmer with your board, you can hold down the "shift" key on your computer when using this icon. The text will change to

"Upload using Programmer"

https://www.twitterflightschool.com/assets/activity_icons/png/activity-file-089c7084604bf5e4c2b362b6041d2f92c3aca695856a00f7977283599d7bcb1c.png

**New**

Creates a new sketch.



**Open**

Presents a menu of all the sketches in your sketchbook. Clicking one will open it within the current window overwriting its content.

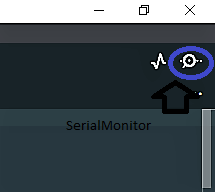
**Note:** due to a bug in Java, this menu doesn't scroll; if you need to open a sketch

late in the list, use the File | Sketchbook menu instead.



**Save**

Saves your sketch.

****

**Serial Monitor**

Opens the serial monitor.

Additional commands are found within the five menus: File, Edit, Sketch, Tools,and help.

**Programming on arduino nano**

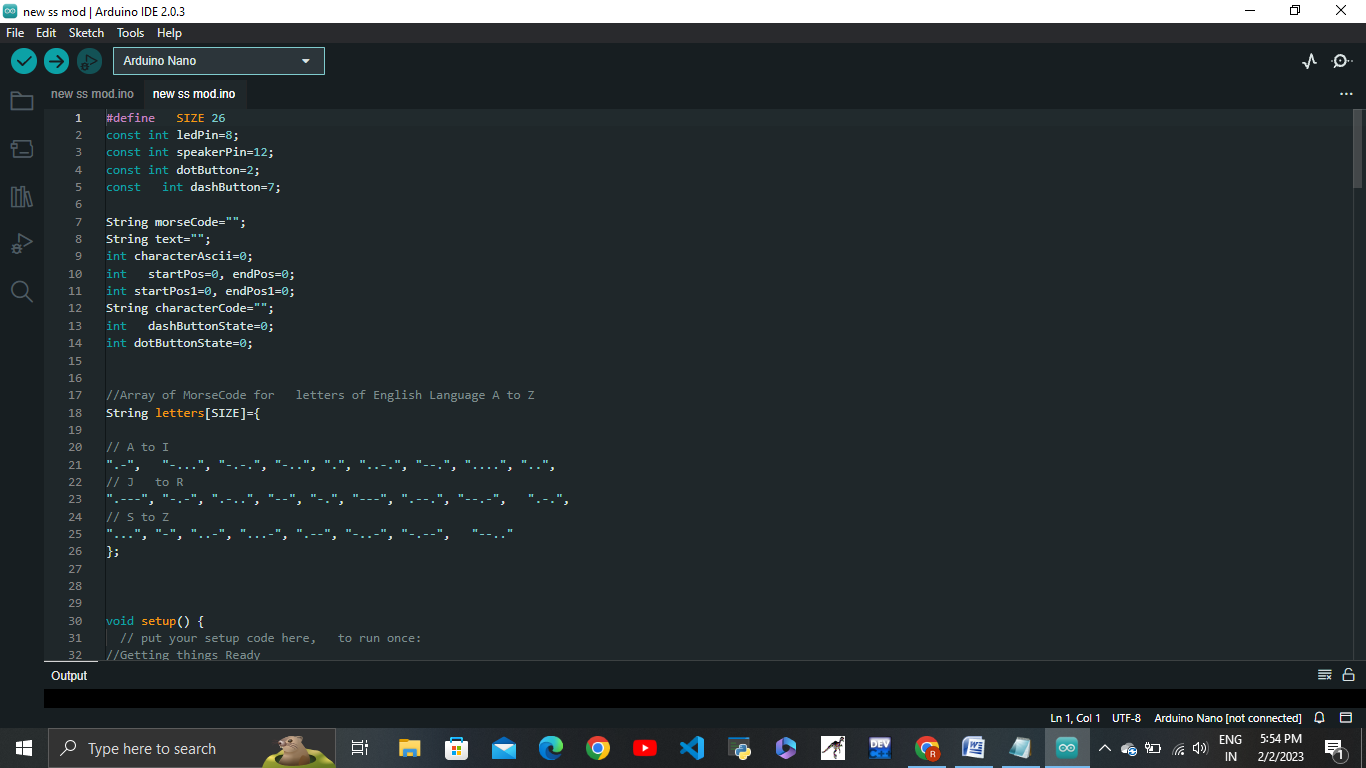
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Fig.2.6 Software IDE

In order for the Arduino-Nano board to be able to interact with the application used in this project certain program (code) needs to be uploaded to the Arduino-Nano. Arduino Company provides user friendly software which allows writing any code for any function wanted to be performed by the Arduino-Nano and upload it to the board.Refer to appendix A for the full source code of the Arduino-Nano board.

**CHAPTER 3**

**CIRCUIT DIAGRAM AND DESCRIPTION**

**3.1 Working**

When you done making circuit on breadboard and uploaded Sketch. Click Serial Monitor and you will see it like below image fig:3.1(serial monitor)

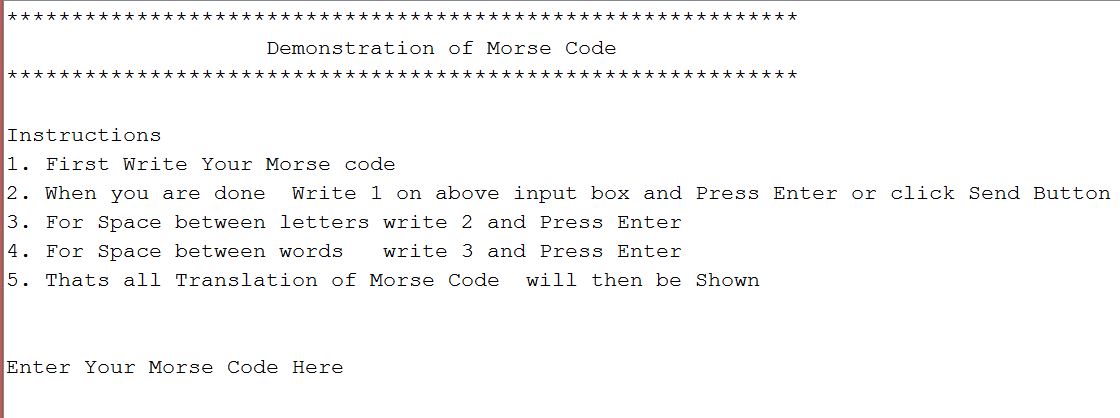


fig:3.1

Now by with the help of International Morse Code table you can write the code.For space between letters write ‘2’ and press enter.For space between words write ‘3’ and press enter.When you are done writing code press ‘1’ and enter.

That’s all translation of morse code is show in serial monitor.

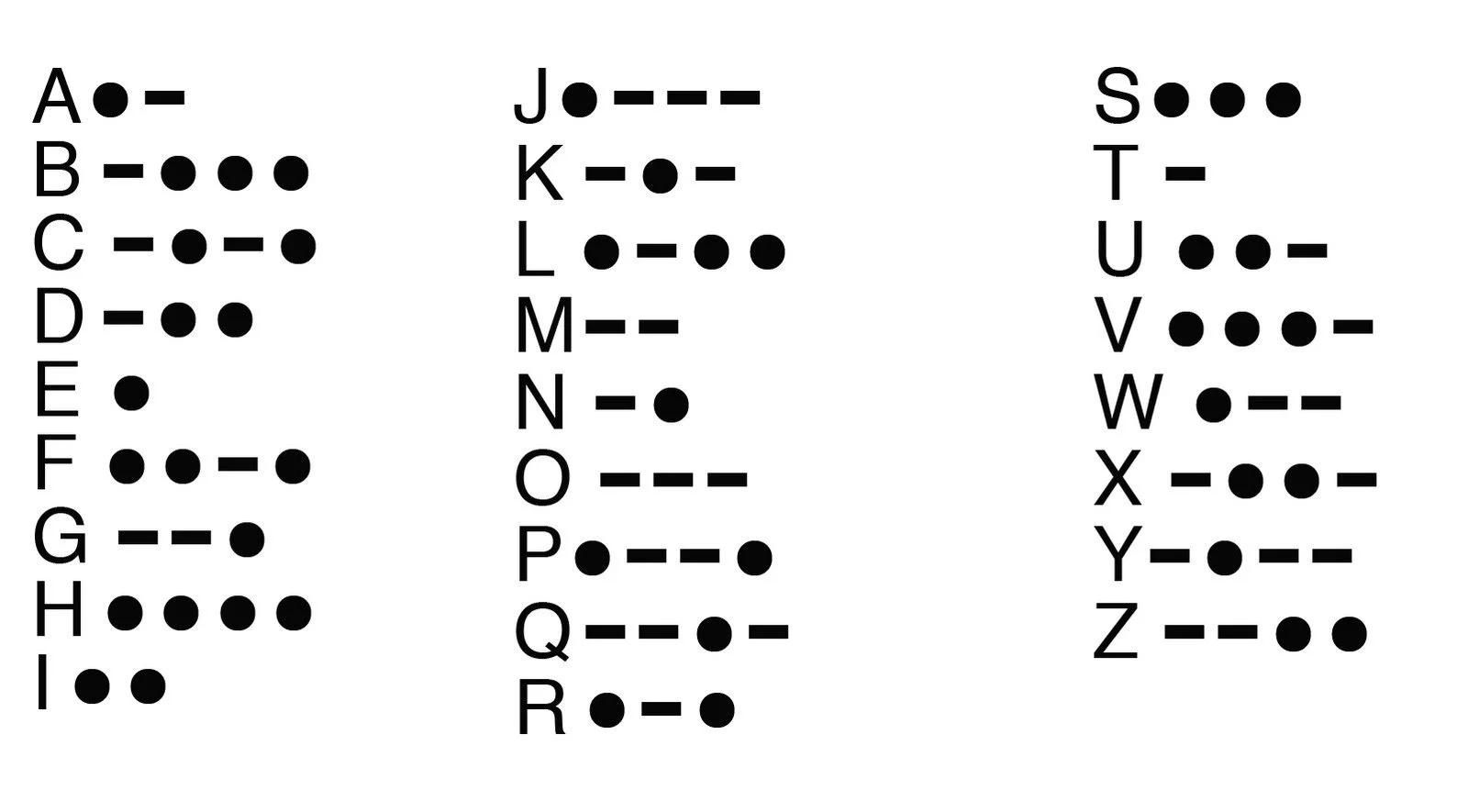
In below picture(fig:3.2) is a chart which helps in better understanding of the morse codes. 

Fig:3.2 Chart of Morse Code.

As the working of Morse Code Communication using Arduino is as shown in fig.3.3

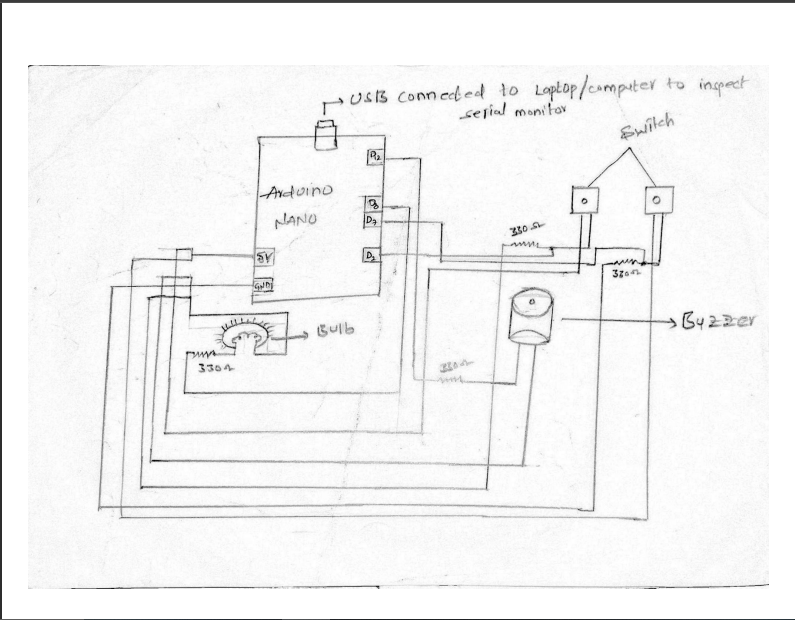
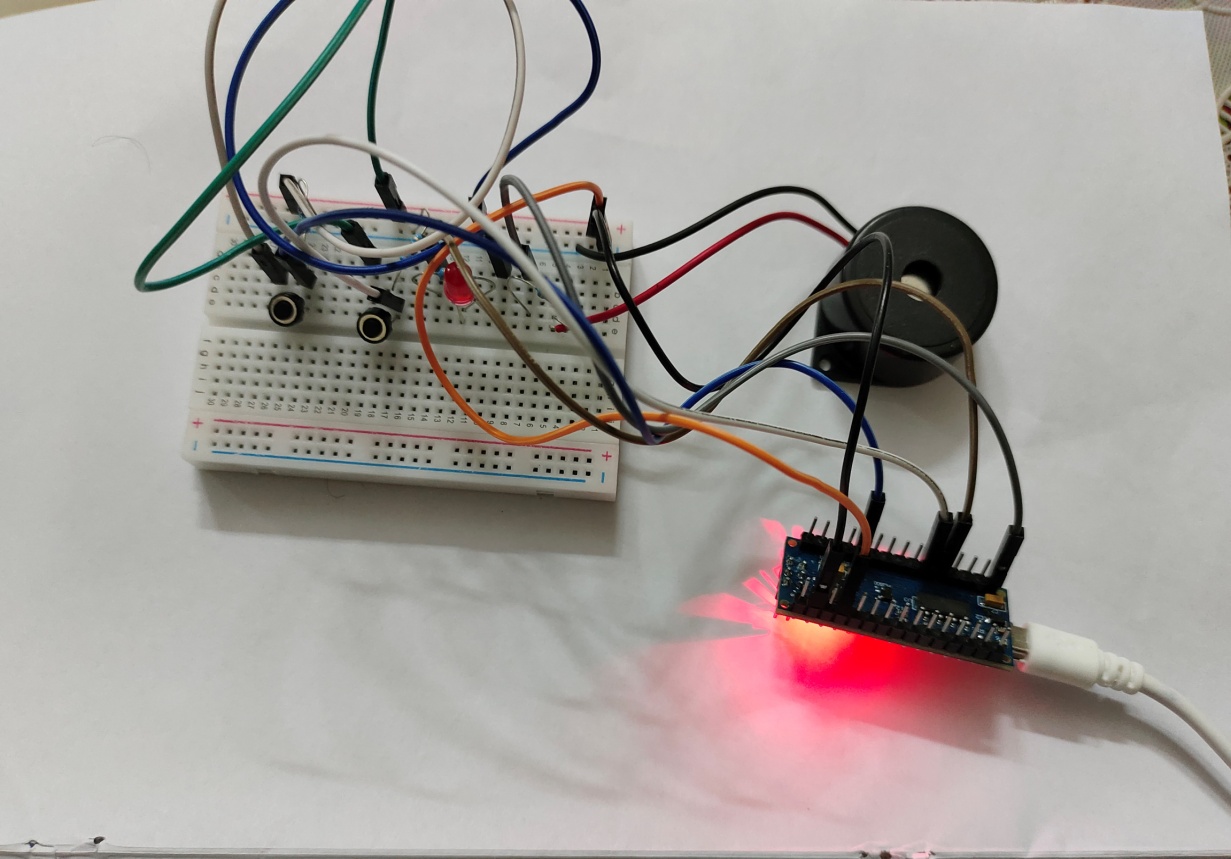


Fig.3.3 Schematic diagram

**3.2 RESULTS**

The experimental result is as shown in below fig. 3.2



3.2 Experimental result

Successfully worked on MORSE CODE COMMUNICATION using ARDUINO NANO. It was very intresting and effective project to work.I and my Team mates don’t deny that Morse code was the base for evolution of communication to smart phones,mails,laptops and many other devices.It was user friendly and cost effective.It is important to learn the basics of history of communication so that we don’t forget the innovations of past and motivate ourselves to invent/research something which could help the world.This project was cost efficient and reliable.

**3.3 ADVANTAGES**

In the modern age, the Morse code is still as relevant as it was in the days of old. Here are the advantages of Morse code.

1. **Cheap**

Use of the Morse code is a cheaper way to send information over long distances. For over 150 years since information transmits easily over longer distance via radio waves in an easy and cheap way.

1. **Wireless**

The lack of wires has made the application of Morse code diverse since it is silently sent and received at any desirable speed. Its wireless nature makes Morse code receivable though any visible means.

1. It can be sent and received at any speed
2. It can be sent and received silently with light
3. It can be sent and received through vibration
4. It can be spoken (verbal Morse code)
5. It can be sent and received through touch
6. It can be sent and received through any visible means
7. It can be transmitted and received more easily and longer distance over radio waves than speech
8. It challenges the brain
9. It can be used as a communication tool by those who are mute, deaf, physically challenged, paralyzed, etc, using a simple key, on-off switch, head-switch, blinking, etc.
10. It can be fun!

**3.4 DISADVANTAGES**

1. **Learning the Morse Code**

The Morse code is not an easy concept to understand and it is largely a reserve of a few radio programmers. The concept is not easy to learn either and the machines are in scarcity in the modern age. It is also tough to apply in the modern era that is

1. **Time Consuming**

Sending and decoding of the Morse code is time consuming and it is the reason many people put it off. When the transmission of information is at high speeds, the

1. **Interruption**

The Morse code is easy to intercept and it is no longer a reliable option compared to the recent technological inventions. Better technologies are in a position to provide better channels of passing information.

Few people, other than ham radio operators, seem to know or care to learn Morse code.

**CHAPTER 4**

**CONCLUSION**

**4.1 CONCLUSION**

In conclusion, an individual whose passion was nothing more than art was able to invent a telegraph system, which led to many discoveries in the science field, which is still advancing. To many it seems impossible to have a non-science major people be successful in anything science related. However, many people like Morse have come out of college taking only few classes in science and yet have been able to achieve things that many non-sciences major have not even been able to perceive. Morse code might had a small impact in the history because it only helped during the civil war and that too for northern who wanted to stop spreading the slavery. However, due to the invention of telegraph and Morse code, we are able to communication across the world and even type this paper easily. If not for the thoughts and rigorous work behind this invention, we might not be able to enjoy the great new technologies.

**4.2 FUTURE SCOPE**

The future of what you say? Morse code. For the young people among us (as in born with the internet in their stomach), morse code was, and still is although not used in "offical" communications, a way to communicate only with one tone. Letters are composed of long tones (DAH) and short tones (DI). The DAH and DI(T) symbolize the tone when one hears the letter of the airwaves. As an example I will take the letter 'B'. In morse code it is send as one long tone followed by three short ones. When we pronociate the letter is sounds like DAH DI DI DIT. Some people might recognize something like '- . . .' or DASH DOT DOT DOT from their boyscout period, but when spoken it does not sounds like the actual letter being send.

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9. [https://www.rs-online.com/designspark/10-things-to-consider-when-purchasing-buzzers-and-sounders#:~:text=Electromechanical%20buzzers%20use%20a%20bare,is%20(617%2D3081)%20](https://www.rs-online.com/designspark/10-things-to-consider-when-purchasing-buzzers-and-sounders#:~:text=Electromechanical buzzers use a bare,is (617%2D3081) ).
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**APPENDIX**

This Program is for demonstration of MORSE CODE Communication

which was use to send information secretly using codes of combinations dots ‘.’ and dashes ‘-’

By

JATOTH BHANU NAIK (2205A41252)

\*/

#define SIZE 26

const int ledPin=8;

const int speakerPin=12;

const int dotButton=2;

const int dashButton=7;

String morseCode="";

String text="";

int characterAscii=0;

int startPos=0, endPos=0;

int startPos1=0, endPos1=0;

String characterCode="";

int dashButtonState=0;

int dotButtonState=0;

//Array of MorseCode for letters of English Language A to Z

String letters[SIZE]={

// A to I

".-", "-...", "-.-.", "-..", ".", "..-.", "--.", "....", "..",

// J to R

".---", "-.-", ".-..", "--", "-.", "---", ".--.", "--.-", ".-.",

// S to Z

"...", "-", "..-", "...-", ".--", "-..-", "-.--", "--.."

};

void setup() {

// put your setup code here, to run once:

//Getting things Ready

pinMode(ledPin, OUTPUT);

pinMode(dotButton, INPUT);

pinMode(dashButton, INPUT);

Serial.begin(9600);

Serial.println("\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*");

Serial.println(" Demonstration of Morse Code ");

Serial.println("\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* ");

Serial.println("\Instructions");

Serial.println("1. First Write Your Morse code");

Serial.println("2. When you are done Write 1 on above input box and Press Enter or click Send Button ");

Serial.println("3. For Space between letters write 2 and Press Enter ");

Serial.println("4. For Space between words write 3 and Press Enter ");

Serial.println("5. Thats all Translation of Morse Code will then be Shown ");

Serial.println("\\Enter Your Morse Code Here ");

}

void loop() {

// put your main code here, to run repeatedly:

while(Serial.available() > 0 )

{

int ascii=Serial.read();

switch(ascii)

{

case 49: // 49 is Ascii value of 1

Serial.print("\ ");

morseCode.concat('#');

// Placeing # at the end of morseCode to simplify further processing

Serial.print("\Your Morse code Translation : ");

endPos1=morseCode.indexOf('#');

while(endPos1 < morseCode.length() )

{

extractLetters(morseCode.substring(startPos1,endPos1));

// This function would extract Letter as name suggest and would convert code to text SIMPLE!

startPos1=endPos1+1;

if(startPos1 == morseCode.length() )

{

break;

}

endPos1= morseCode.indexOf('#', startPos1);

}

startPos1=0;

endPos1=0;

text=""; // For New Translation

morseCode="";

Serial.println("\\Enter Your Morse Code Here ");

break;

case 50: // 50 is Ascii value of 2

morseCode.concat("@");

Serial.print("@");

delay(200);

break;

case 51: // 51 is Ascii value of 3

morseCode.concat("#");

Serial.print("#");

delay(200);

break;

}

}

process();

}

void turnONLedSpeaker()

{

//Turn ON LED

digitalWrite(ledPin, HIGH);

tone(speakerPin, 4699, 300); // tone(speakerPin, frequency, duration in milliSec)

}

void process()

{

dotButtonState=digitalRead(dotButton);

dashButtonState=digitalRead(dashButton);

if(dashButtonState == HIGH)

{

turnONLedSpeaker();

morseCode.concat("-"); // Storing code in variable morseCode with the help of concatenation function

Serial.print("-");//Prints User entered Code

delay(200);

}

else if(dotButtonState == HIGH)

{

turnONLedSpeaker();

morseCode.concat(".");

Serial.print(".");

delay(200);

}

else

{

//Turn OFF LED

digitalWrite(ledPin, LOW);

}

}

char convertIntoText(String characterCode)

{

characterAscii=65;

for(int index=0; index<SIZE; index++)

{

if(characterCode == letters[index])

{

return characterAscii;

}

characterAscii++;

}

}

void extractLetters(String words)

{

words.concat('@'); // Placeing @ at the end of word to simplify further processing

endPos=words.indexOf('@');

//Loop to extracting single character morse Code from string of word

while( endPos<words.length() )

{

characterCode=words.substring(startPos, endPos);

//Now CharacterCode will now convert in text

text.concat(convertIntoText(characterCode));

startPos=endPos+1;

characterCode="";

// if condition is just to terminate loop when our extracting single character code is complete thats all

if(startPos == words.length() )

{

break;

}

endPos=words.indexOf('@', startPos);

}

Serial.print(text);

Serial.print(" ");

startPos=0;

endPos=0;

text="";

}