Morse Code Communication System Using Microcontroller

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Abstract

This project aims to design and implement a microcontroller-based Morse code communication system, highlighting the historical significance and enduring relevance of Morse code in communication. Morse code's simplicity and effectiveness make it invaluable in situations where traditional communication methods may be impractical. By leveraging the capabilities of a microcontroller, this system automates the generation and decoding of Morse code signals, thereby enhancing communication efficiency and reliability. The goals of the project encompass various aspects such as creating a Morse code communication system that can encode and decode text messages, incorporating efficient algorithms for encoding and decoding, designing user-friendly interfaces for inputting and displaying messages, and conducting thorough testing in different form. This project effectively demonstrates the practical application of Morse code and microcontroller technology in communication systems by combining hardware and software components. The abstract provides a concise overview of the project's objectives, which include the design of efficient encoding and decoding algorithms, the creation of user-friendly interfaces, and comprehensive testing to evaluate performance under various conditions.

Keywords: Morse Code, telecommunication, microcontroller, arduino nano, RF module.

INTRODUCTION

These days, everyone uses Morse code to communicate over great distances in the globe. For dependable wire communication, the military, international shipping, and the train rely on Morse code. Following the development of radio in the 1900s, communication expanded and became more dependable. Businesses rely on it to quickly and easily communicate with their remote clients and staff. the regular usage of the internet for information flow and different methods of interaction ease. Morse code is an antiquated technology that is straightforward, reasonably inexpensive, and independent of contemporary technology. It is employed in times of crisis, grid failure, or conflict. Three times as long as a dot is the dash's duration. After every dash or dot, there is a brief pause of the same length as the dash. A space equivalent to three dots (one dash) separates the word, while a space equal to seven dots separates the words. Dot duration is the fundamental unit of time measurement in code transmission. Making Morse code the easiest and most flexible form of communication that we may utilize for emergency signals by simply turning it on and off using a keypad. Today's globe is seeing an unprecedented rate of technological innovation, which exposes society to a constant stream of new security risks.

Ensuring the safety of one's possessions, including houses, offices, cash, and collectibles, is everyone's top priority. An estimated 2.5 million burglaries occur annually, with house break-ins accounting for 66% of these cases [6]. Additionally, 65% of burglaries occur between the hours of 6 a.m. and 6 p.m., and the average loss per burglary is $2,416 [6], according to the Federal Bureau of Investigation (FBI). In order to lessen the likelihood that someone is home, 65% of burglaries, according to the same survey, take place during the day [6]. Security systems that may offer several security elements inside one system are in high demand due to the growing automation in the field of security. Morse code revolutionized long-distance communication by quickly becoming the predominantmethod, due to its reliability and simplicity. It proved to be incredibly useful in numerous sectors, including commercial communications and military operations. Communication systems are crucial in our modern society because they allow us to convey information across different platforms and distances. Morse code, with its simplicity and effectiveness, remains relevanteven now, especially in situations where other methods of communication are not possible or accessible. Morse code is the method of representing written characters by using combinations of short signal called dots and long signals called dashes, or dits and dahs. he technology effectively translates Morse code messages, allowing communication through encoding and decoding. The receiver unit can be linked either through wired or wireless means to the transmitter unit, which changes text input into Morse code signals. The microprocessor atthe receiving end interprets these signals and converts them back into text for display on a smartphone or other output device.is to make communication easier and more efficient for everyone, regardless of language or technology. The Morse code system, with its unique combinations of dots and dashes, allows messages to be transmitted and understood across different communication mediums, such as a smartphones. In order to fully embrace and utilize modern technology, itis important for all users to understand and utilize Morse code. This is why we use smartphones to send text messages, as they display the messages in a written format. The Rf transmitter send message to Rf receiver and display the message our devices [1].

Morse Code

Sequences of two different signal durations, called dotsand dashes or dits and dahs. It was developed by Samuel Morse and Alfred Vail in the 1830s and 1840s for use with the electric telegraph. Morse code assigns a unique combination of these dots and dashes to each letter of thealphabet, as well as numbers, punctuation marks, andsome procedural signals.

In Morse code, each letter of the alphabet and each number is represented by a unique sequence of dots and dashes. For example, the letter "A" is represented by ".-", "B" by "-...", "C" by "-.-.", and so on as shown in Figure 1. The length of each dot is usually considered to be one unit, while the length

of each dash is typically three units. The space between symbols within the same letter is one unit, while the space between letters is three units, and the space between words is seven units [24].

Morse code can be transmitted visually or audibly, with flashes of light, clicks, or tones representing the dots and dashes. It was widely used in early telecommunication systems, including telegraphsand early radio communication [5].
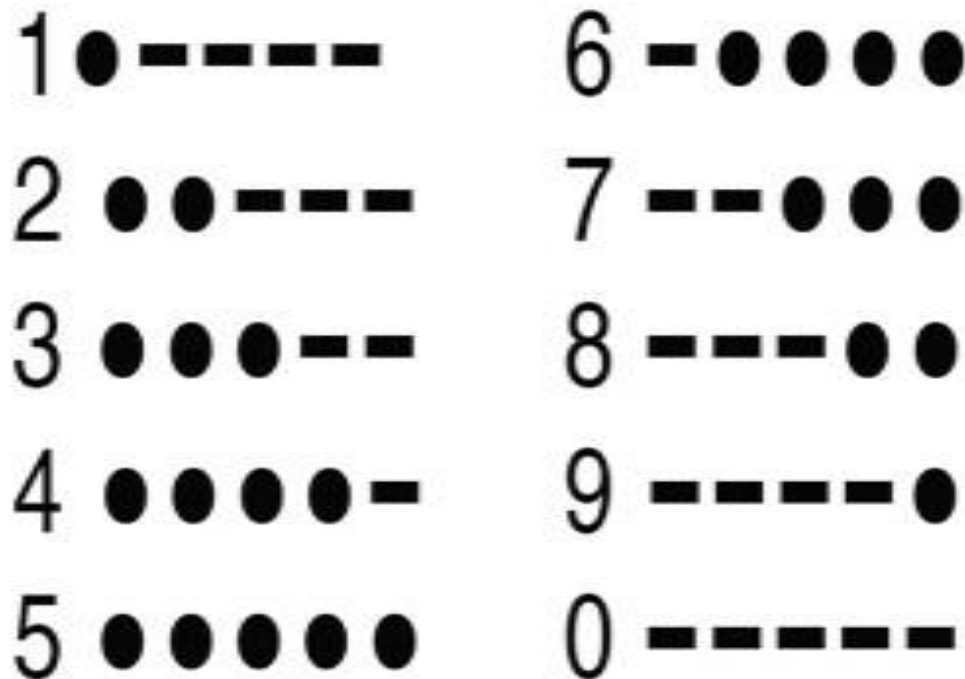

Figure 1: (a) &(b)

Litratuer Survey

Morse code generate using microcontroller with alphanumeric keypad prevention by Bhavana godavarth, M lakshmi, deepth June 2019The morse code isan electronic device i.e used to put the text message in code format

Two way communication system for blind using morse code by Drisya M.K, Sarath Raj July 2021A device is made in which the two conversion i.e the morse code to text and morse code conversion.

Morse code to text converter for paralized people MR. G. Chandrashekar, Mohim Munnai Dec

2021Morse code is not easy task bit in it become iot easier only one person needs to know morse code

Objective
   1. Military and Defense Applications.
   2. Emergency Communication System.
   3. Educational and Training Tools.
   4. Use of transfer messge securily

Components
Arduino Nano
   The Arduino Nano as shown in Figure 2. is equipped with 30 male I/O headers, in The Arduino Nano is equipped with 30male I/O headers, in a DIP-30 -like configuration, which can be programmed using the Arduino Software integrated development environment (IDE), which is common to all Arduino boards and running both online and offline. The board can be powered through a type-B mini-USB

cable or from a 9 V battery [7].

Figure 2. 2D model of Arduino nano

RF Module

RF amplifiers are used in RF and microwave systems to boost signal power from input to output. Amplifiers are widely used componentsin RF/microwave transmitter and receiver designs for wireless communications and manyother RF/microwave applications such as test and measurement, radar and others. Mini- Circuits offers a broad selection of RF amplifiers including power up to 100W (P1dB up to +50 dBm), low noise (LNAs), high linearity, variable gain, pulse amplifiers, 75 Ohm (CATV), and more. With over 500 models in stock for same day shipment includingrack mount, coaxial, MMIC surface mount and bare die formats, chances are we have a solution for your needs [9].
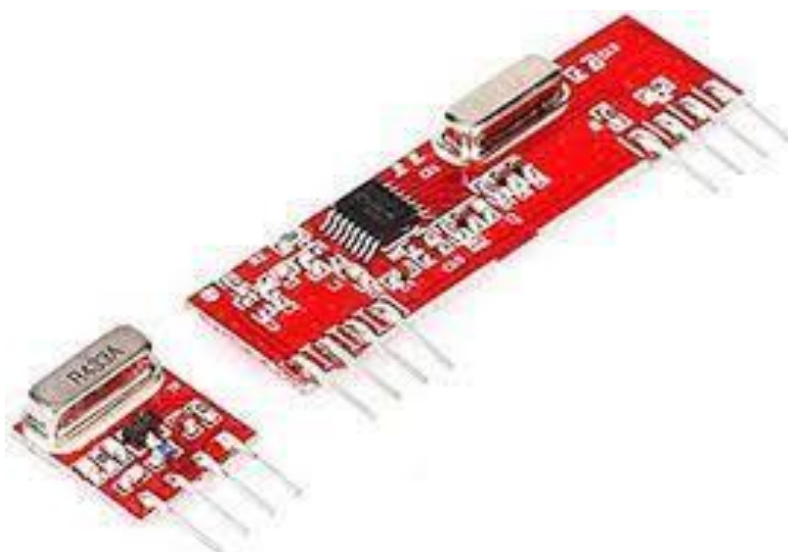


Figure 3. 2D model of RF module

Push Buttons

A push-button (also spelled pushbutton) as shown in Figure 4. or imply button is a simple switch mechanism to control some aspect of a machine or a process. Buttons are typically made out of hard material, usually plastic or metal. The surface is usually flator shaped to accommodate the human finger or hand, so as to be easily depressed or pushed [810].

Figure 4. 2D model of Push buttons

Node MCU

The Node MCU board as shown in Figure 5. utilizes the ESP8266 microcontroller, equipped with a high-performance 32- bit Tensilica processor that operates at speeds of up to 80 MHz. This microcontroller provides ample processingcapability and memory capacity, making it ideal for various IoT The NodeMCU board also offers severalGPIO pins, which are versatile and can be utilized to connect and interact with external sensors, actuators, and other devices. These pins support both digital input/output and analog input functions.The ESP8266 NodeMCU is a highly adaptable and affordable platform that is ideal for creating Internet of Things (IoT) projects.It provides WiFi connectivity, a generous number of GPIO pins, and can seamlessly work with well-known development environments such as the Arduino IDE. Its user-friendly nature and wide range of available resources make it a perfect option for both newcomers and seasoned developers The ESP8266 NodeMCU is a highly adaptable and affordable platform that is ideal for creating Internet of Things (IoT) projects.
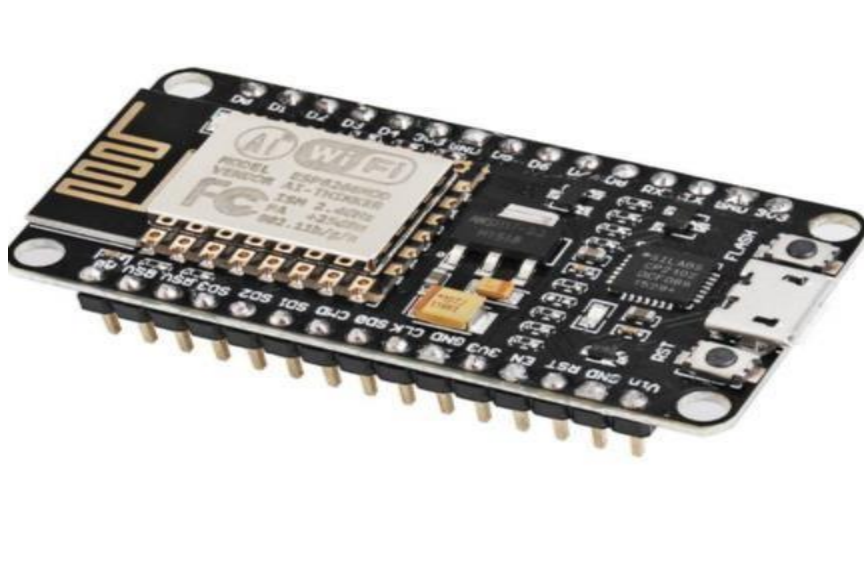
Figure 5. 2D Model of Node mcu

LCD Display:

Liquid Crystal Display as shown in Figure 6. is known as LCD. In electrical equipment like televisions, computer monitors, andvarious instrumentation displays, this kind of flat-panel display is frequently utilized. LCDs operate on the principle of modifying light as it passes through molecules of liquid crystal. In reaction to an electric current, these molecules align, allowing or obstructing light flow to produce text. LCD technology has significantly transformed the display landscape, offering versatility, reliability, and cost-effectiveness across numerous applications. It continually advances to meet the demand for enhanced resolutions, color accuracy, andenergy efficiency without sacrificing performance [11].

Figure 6. LCD Display

F. Buzzer

Applying an electrical signal to an electronic device, like a buzzer, can produce sound.Typically, a piezoelectric element is used as the primary component, generating sound waves when it vibrates in reaction to an electric current Applying a voltage to the buzzer causes the piezoelectric element or electromagnetic coil to vibrate, generating sound waves in the air and producing an audible tone.2D model of buzzer is shown in Figure 7.

Figure 7. 2D model of buzzer

Working Methodology

The input interface allows the user to input the messagethey wish to send. This interface is connected to a microcontroller, such as an Arduino nano. The input interface can be either a physical interface, like a push button, or a software interface on a mobile device.

The controller utilizes a transmitter to send a Morse codemessage. the transmitter employs radio frequency to transmit the message to the receiver. When the message is being sent, the buzzer is activated to provide an alert, and the LED also blinks. Each character in the message is represented by a distinctive combination of dots and dashes. The RF transmitter module is operated by a control system to wirelessly transmit a message in Morsecode. The message is encoded onto a radio frequency carrier signal and then sent through the air. In order to ensure efficient transmission of the signal, the RF transmitter module might need to be connected to additional circuitry that properly interfaces with the controller. Once the signal is transmitted, it is captured byan RF receiver module at the receiving end. This modulecan be linked to another controller unit such as Arduino nano to carry out additional processing. The captured signal is then demodulated in order to extract the Morse code message. The MCU on the receiving side interprets the Morse code message by converting into message format for understanding.

Results

Execution of output on LCD display after applying proposed methodology is shown in Figure 8.
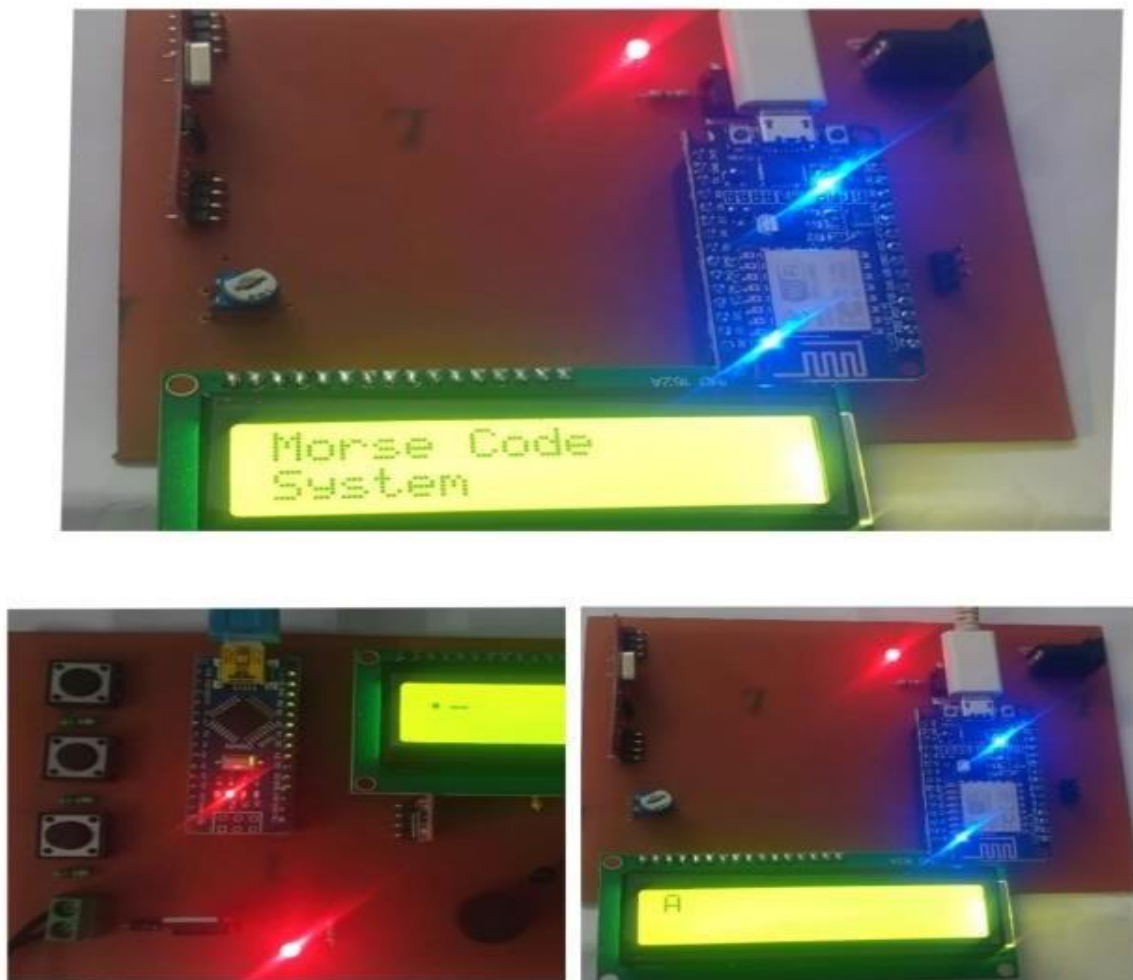
Figure.8 Outputs on LCD display

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CONCLUSION

Morse code communication systems that rely on controllers provide a flexible and effective way to send messages using a microcontroller or a similar programmable device. These systems offer multiple benefits, such as being easy to use, dependable, and adaptable to different communication techniques and settings. These systems utilize Morse code, which uses dots and dashes to represent characters, to efficiently encode and decode messages. This makes them suitable for various applications. Morse code systems controlled by an RF transmitter can transmit messages and offer a reliable communication solution that can becustomized to meet specific needs and requirements.

FUTURE SCOPE

Morse code communication systems have potential uses in medical and healthcare environments. These include monitoring patients, emergency response systems, and communicating with patients who have limited mobility or speech impairments. By integratingwith medical devices and telemedicine platforms, healthcare professionals can remotely monitor and communicate with patients.

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