A

Mini Project Report

on

“MORSE CODE TO TEXT CONVERTER FOR PARALYZED PEOPLE”

Submitted By,

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Lonere – 402 103

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In the fulfilment of B. Tech. in Electronic & Telecommunication Engineering course of Dr. Babasaheb Ambedkar Technological University, Lonere (Dist.-Raigad) in the academic year 2023-2024.

Department of Electronic & Telecommunication Engineering

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CERTIFICATE

This is to certify that the minor project entitled "Morse Code to Text Converter for Paralyzed People" has been carried out by **Mr. Rahul Narendra Ipte (2130331372503)** and **Miss. Diksha Pundlik Kharvilkar (2130331372505)** is record of Bonafide work carried out by them under my guidance in the fulfilment in Electronic & Telecommunication Engineering course of Dr. Babasaheb Ambedkar Technological University, Lonere (Dist. Raigad) in the academic year 2023-2024.

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Place: Lonere

ACKNOWLEDGEMENT

I thank **Dr. Sanjay L. Nalbalwar** Head of Electronic and Telecommunication Engineering Department, for his valuable suggestion and cooperation in the completion of the technical Minor Project.

I thank **Ms. Mohini R. Mehta**, Professor of Electronic and Telecommunication Engineering Department, for her valuable suggestions in the completion of the technical Minor Project.

I thank **Prof. Kunal Kamble**, Assistant Professor of Electronic and Telecommunication Engineering Department, and coordinator of the Minor project, for his valuable suggestions in the completion of the technical Minor Project.

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ABSTRACT

The primary goal of this project is to create a communication system tailored for individuals with severe paralysis, providing them with a means to interact with others. For those experiencing profound speech limitations, the emotional impact can be profound. Alternative and augmentative devices play a crucial role in enabling individuals to express themselves and engage in meaningful conversations with caregivers, family members, and the broader community. Assistive technology, designed to address diverse communication challenges, proves especially valuable. Among the most severe cases, individuals may utilize features such as eye or facial movements to operate communication devices.

These devices can serve the sole purpose of speech or connect to computers, granting users broader access to technology and the internet. In this project, eye movements, particularly blinking, are leveraged to generate Morse code, facilitating communication. An eye-tracking device is employed to track these movements, and the Morse code is subsequently translated into regular text using an Arduino microcontroller. The innovative design empowers users to communicate solely through their eyes. Additional programs can collaborate with eye-tracking devices to convert generated text or symbols into speech. For instance, a comprehensive option provides access to over 11,000 pre-programmed symbols and images, with the flexibility to create custom symbols. For individuals with more movement capabilities, text-to-voice software can be employed, offering an alternative means of communication for those unable to speak.

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LIST OF ABBREVIATIONS

MND	Motor Neuron Disease
HCI	Human Computer Interaction
HMI	Human Mobile Interaction
LCD	Liquid Crystal Display
USB	Universal Serial Bus
IR	Infrared
TTS	Text-to-Speech
IDE	Integrated Development Environment
LED	Light Emitting Diode
RAM	Random Access Memory
EEPROM	Electrically Erasable Programmable Read-Only Memory
IC	Integrated Circuit
PWM	Pulse Width Modulation

CHAPTER 1
INTRODUCTION

1.1 Introduction

Motor neuron disease (MND) is a medical condition where the motor neurons of the patient are paralyzed and is incurable. It also leads to weakness of muscles with respect to hand, feet, or voice. Because of this, the patient cannot perform his voluntary actions and it is very difficult for patients to express his or her needs. Tetraplegia is also one such condition where people cannot move parts below their neck. In this electronic era, solutions for patients with above mentioned diseases are found, one such innovation is the proposed system explained throughout.

The proposed system can be used to control and communicate with other people through eye blinks. In the recent years due to the rapid advancement in the technology there has been a great demand of human-computer or human mobile interaction (HCI or HMI). Eye blink is a quick action of closing and opening of the eyelids. Blink detection is an important enabling component in various domains such as human-computer interaction, mobile interaction, health care, and driving safety. For example, blink has been used as an input modality for people with disabilities to interact with computers and mobile phones.

The proposed system detects the voluntary blinks of the patient and accordingly sends the message about the requirement to the care taker and gives the voice output via call to the caretaker. System uses an inbuilt infra-red sensor to capture the eye movements of the patient and with the help of microcontroller in the system it generates a Morse code of patient's desire. The system identifies the Morse code and then sends a message to the care taker of what the patient wants and the system reads the message to the care taker where in a voice is audible saying what the patient wants.

1.2 Proposed System

- The proposed project aims to bring out a solution for the paralyzed people to communicate without any harm to their body externally or internally. It overweighs the previously developed prototypes in this field because none of the components are in direct contact with the patient's body hence it will prove to be safer.
- This system recognizes when the patient wants to talk and starts functioning accordingly. For this a start stop function is bind with the system.
- The same can be accessed by the user using eyes.
- When the user gives the command to start the system starts generating Morse codes from the user's eye blinks until the user completes the statement.
- Later this Morse code is converted to plain text by the system.
- This plain text can be outputted using an LCD display or even by a loud voice.

CHAPTER 2
BLOCK DIAGRAM

2.1 Block Diagram

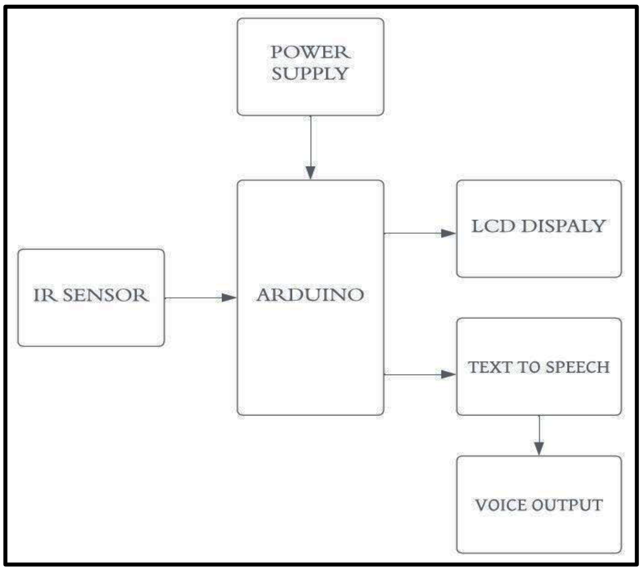

Fig. 2.1 Basic Block Diagram

2.2 Block Diagram Description

The basic block diagram of the morse code to text converter for paralyzed people is shown in the above figure. Mainly this block divided into the two-parts input part & the output part consists the following essential blocks:

- Power Supply
- Arduino UNO R3
- IR Sensor
- LCD Display
- Text-to-Speech Converter Circuit
- Speaker

2.2.1 Power Supply:

Here we used +5V DC power Supply from computer USB or battery. The main function of this block is to provide the required amount of voltage to essential circuit. +5V is given to IR sensor, LCD display. I use 9V battery for the speaker for powerful output.

2.2.2 Arduino UNO R3:

An Atmel ATmega328P microcontroller is a 40 pin DIP package. It has 16 KB programmable flash memory, static RAM of 1 KB and EEPROM of 512 Bytes. There are 14 digital I/O pins and 6 Analog I/O pins.

2.2.3 IR Sensor:

An infrared (IR) sensor is a device that detects infrared radiation in the form of heat. It is commonly used for proximity sensing, object detection, and temperature measurement. IR sensors find applications in various fields, including security systems, automation, and consumer electronics.

2.2.4 LCD Display:

An LCD display (16x2) is a liquid crystal display with 16 columns and 2 rows, providing a total of 32 characters. Widely used in electronic projects and devices, it offers a simple interface for presenting alphanumeric information, making it popular in digital devices like Arduino-based projects and embedded systems.

2.2.5 Text-to-Speech Converter Circuit:

A Text-to-Speech (TTS) converter circuit transforms written text into spoken words. It typically involves a microcontroller, speech synthesis chip, and speaker, enabling electronic devices to audibly communicate information. TTS circuits are employed in applications like accessibility aids, navigation systems, and voice-enabled devices.

2.2.6 Speaker:

A speaker is a transducer that converts electrical signals into sound waves, producing audible output. Commonly used in audio systems, speakers consist of a diaphragm, magnet, and coil, vibrating to generate sound. They play a crucial role in various devices, from home audio setups to mobile phones and public address systems.

CHAPTER 3
COMPONENTS

3.1 List of Components

1. Arduino UNO
2. IR Sensor Module
3. 16x2 LCD Display
4. Text-to-Speech Converter Circuit
5. Speaker

3.2 Description of Components

3.2.1 Arduino UNO

An Arduino is an open-source microcontroller development board. Arduino consists of both a physical programmable circuit board and a piece of software, or IDE (Integrated Development Environment) that runs on computer, used to write, and upload computer code to the physical board.

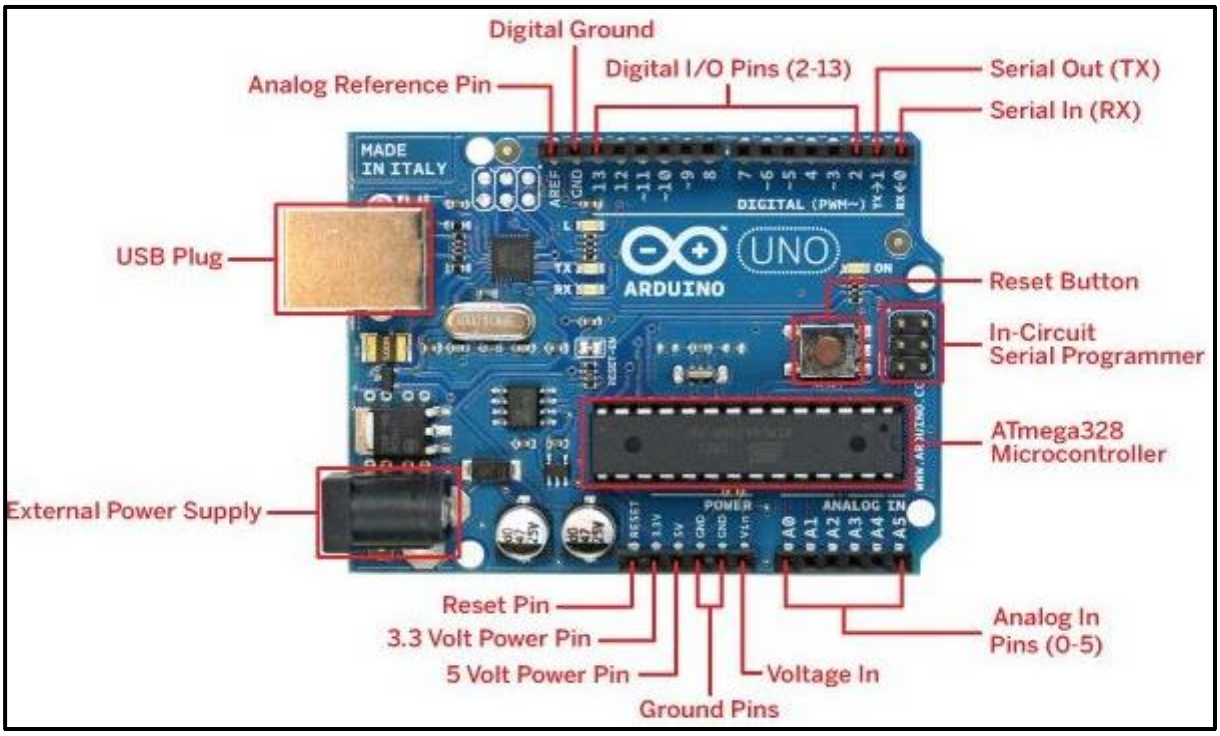

Fig. 5.1: Arduino UNO

The board features an Atmel ATmega328 microcontroller operating at 5V with 2KB of RAM, 32KB of flash memory for storing programs and 1KB of EEPORM for storing parameter. The clock speed is 16 MHz, which translates to about executing about 3,00,000 lines of C source code per second. The board has 14 digital I/O pins and 6 analog inputs pins.

Arduino UNO R3 Specifications:

- It is an ATmega328P based Microcontroller
- The Operating Voltage of the Arduino is 5V
- The recommended input voltage ranges from 7V to 12V
- The i/p voltage (limit) is 6V to 20V
- Digital input and output pins-14
- Digital input & output pins (PWM)-6
- Analog i/p pins are 6
- DC Current for each I/O Pin is 20 mA
- DC Current used for 3.3V Pin is 50 mA
- Flash Memory -32 KB, and 0.5 KB memory is used by the boot loader
- SRAM is 2 KB
- EEPROM is 1 KB
- The speed of the CLK is 16 MHz
- In Built LED
- Length and width of the Arduino are 68.6 mm X 53.4 mm
- The weight of the Arduino board is 25g

3.2.2 IR Sensor Module

IR sensor is an electronic device, that emits the light to sense some object of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation. These types of radiations are invisible to our eyes, but infrared sensor can detect these radiations.

The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode. Photodiode is sensitive to IR light of the same wavelength which is emitted by the IR LED. When IR light falls on the photodiode, the resistances and the output voltages will change in proportion to the magnitude of the IR light received.

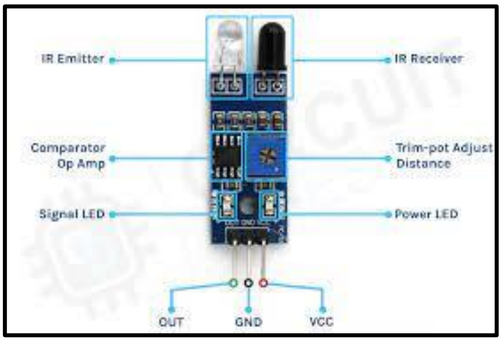

Fig. 5.2: Infrared Sensor Module

The IR sensor module consists mainly of the IR Transmitter and Receiver, Op-amp, Variable Resistor (Trimmer pot), output LED along with few resistors.

i. **IR LED Transmitter**

IR LED emits light, in the range of Infrared frequency. IR light is invisible to us as its wavelength (700nm – 1mm) is much higher than the visible light range. IR LEDs have light emitting angle of approx. 20-60 degree and range of approx. few centimetres to several feet's, it depends upon the type of IR transmitter and the manufacturer. Some transmitters have the range in kilometres. IR LED white or transparent in colour, so it can give out amount of maximum light.

ii. **Photodiode Receiver**

Photodiode acts as the IR receiver as its conducts when light falls on it. Photodiode is a semiconductor which has a P-N junction, operated in Reverse Bias, means it start conducting the current in reverse direction when Light falls on it, and the amount of current flow is proportional to the amount of Light. This property makes it useful for IR detection. Photodiode looks like a LED, with a black colour coating on its outer side, Black colour absorbs the highest amount of light.

iii. **LM358 Op-Amp**

LM358 is an Operational Amplifier (Op-Amp) is used as voltage comparator in the IR sensor. the comparator will compare the threshold voltage set using the preset (pin2) and the photodiode's series resistor voltage (pin3).

Photodiode's series resistor voltage drop > Threshold voltage = Opamp output is High

Photodiode's series resistor voltage drop < Threshold voltage = Opamp output is Low

When Opamp's output is high the LED at the Opamp output terminal turns ON (Indicating the detection of Object).

IR Sensor Module Features:

- 5V DC Operating voltage
- I/O pins are 5V and 3.3V compliant
- Range: Up to 20cm
- Adjustable Sensing range
- Built-in Ambient Light Sensor
- 20mA supply current
- Mounting hole

3.2.3 16x2 LCD Display

The term LCD stands for Liquid Crystal Display. It is one kind of electronic display module used in an extensive range of applications like various circuits & devices like mobile phones, calculators, computers, TV sets, etc. These displays are mainly preferred for multi-segment light-emitting diodes and seven segments. The main benefits of using this module are inexpensive; simply programmable, animations, and there are no limitations for displaying custom characters, special and even animations, etc.

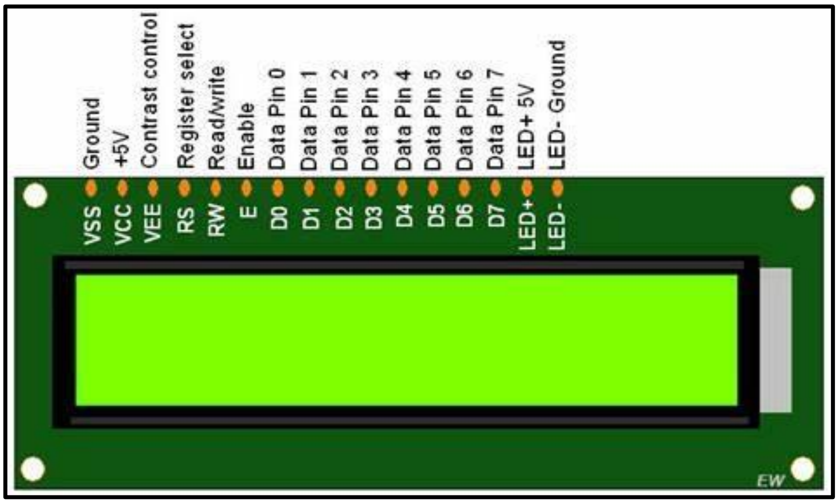

Fig. 5.3: 16x2 LCD Display

Pin Configuration:

- Pin1 (Ground/Source Pin): This is a GND pin of display, used to connect the GND terminal of the microcontroller unit or power source.
- Pin2 (VCC/Source Pin): This is the voltage supply pin of the display, used to connect the supply pin of the power source.
- Pin3 (V0/VEE/Control Pin): This pin regulates the difference of the display, used to connect a changeable POT that can supply 0 to 5V.
- Pin4 (Register Select/Control Pin): This pin toggles among command or data register, used to connect a microcontroller unit pin and obtains either 0 or 1(0 = data mode, and 1 = command mode).
- Pin5 (Read/Write/Control Pin): This pin toggles the display among the read or writes operation, and it is connected to a microcontroller unit pin to get either 0 or 1 (0 = Write Operation, and 1 = Read Operation).
- Pin 6 (Enable/Control Pin): This pin should be held high to execute Read/Write process, and it is connected to the microcontroller unit & constantly held high.
- Pins 7-14 (Data Pins): These pins are used to send data to the display. These pins are connected in two-wire modes like 4-wire mode and 8-wire mode. In 4-wire mode, only four pins are connected to the microcontroller unit like 0 to 3, whereas in 8-wire mode, 8-pins are connected to microcontroller unit like 0 to 7.
- Pin15 (+VE pin of the LED): This pin is connected to +5V
- Pin 16 (-VE pin of the LED): This pin is connected to GND.

Features:

- The operating voltage of this LCD is 4.7V-5.3V
- It includes two rows where each row can produce 16-characters.
- The utilization of current is 1mA with no backlight
- Every character can be built with a 5×8-pixel box
- The alphanumeric LCDs alphabets & numbers
- Is display can work on two modes like 4-bit & 8-bit
- These are obtainable in Blue & Green Backlight
- It displays a few custom generated characters

3.2.4 Text-to-Speech Module

Text-to-speech or TTS system converts normal text into Speech. This tech enables the system to speak out the text in a human voice. There are many examples of Text to Speech conversions like the announcements at public transport, the customer care calls, voice assistants in your smartphones, or the navigation menu of any machine. You can even find the TTS in Microsoft Word where you set it to speak out the text written in the document.

The **first step in TTS is pre-processing or normalization**. This step involves the conversion of the symbols, numbers and abbreviations into words that can be read by the machines like '?' will be converted into "question mark."

The **second step involves the conversion of normalized text into phonemes or phonetic transcripts**. The phonemes are the small parts of spoken words i.e., these are the sounds that make sentences. This step is essential so that machine can speak the words as humans do.

The **last step is the synthesis of phonemes into spoken voice**. This step can be achieved by different methods like by recording the human voice for different words/phrases or by generating basic sound frequencies and pile them up as phonemes or by copying human speaking mechanism.

TTS works with nearly every personal digital device, including computers, smartphones, and tablets. All kinds of text files can be read aloud, including Word and Pages documents. Even online web pages can be read aloud.

Developing text-to-speech capability includes some unique challenges. Especially in the English language, where a great number of homonyms have varied pronunciations, computer programs rely on probability modelling to guess the desired pronunciation of a word in digital text. The program also has to convert units of text into phonemes, the smallest units of speech pronunciation. The result is that many text-to-speech technologies are less than infallible, although developers have made vast progress on these technologies over several years.

Over time, experts have observed some best practices for TTS development. These include phoneme bases and concatenative approaches with predictive analytics. The best programs are also able to work with minimal memory requirements and are easy to set up.

Developers continue to work on TTS resources for any given language, working through the major challenges of ambiguity and other obstacles to more accurate rendering.

Here in this Text to Speech converter, we have used an amplifier circuit to reduce the noise and get a clear sound. The amplifier circuit is made by using the IC LM386. Circuit diagram for it is shown below:

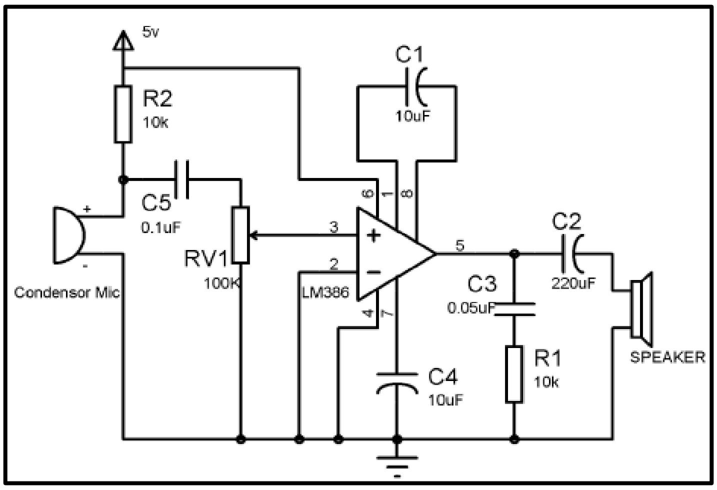

Fig. 5.4 Text-to-Speech Converter Circuit Diagram

A 100K pot is used to adjust the sound. Adjust it to get a clear sound. If you have any confusion about this circuit then check out LM386 Based Audio Amplifier Circuit. If you do not have the exact value of resistors and capacitors then use the close value ones.

3.2.5 Speaker

Power audio speakers, also known simply as speakers, are transducers that convert electrical signals into sound waves. They play a crucial role in audio systems, delivering high-quality sound for various applications such as music playback, home theatre systems, public address systems, and more.

Fig. 5.5: Speaker

CHAPTER 4
CIRCUIT DIAGRAM

Components

- Arduino Uno
- IR sensor module
- LCD display
- Capacitor
- Resistor
- Speaker
- Power supply
- Lm386 IC
- Connecting wires
- Text to speech circuit

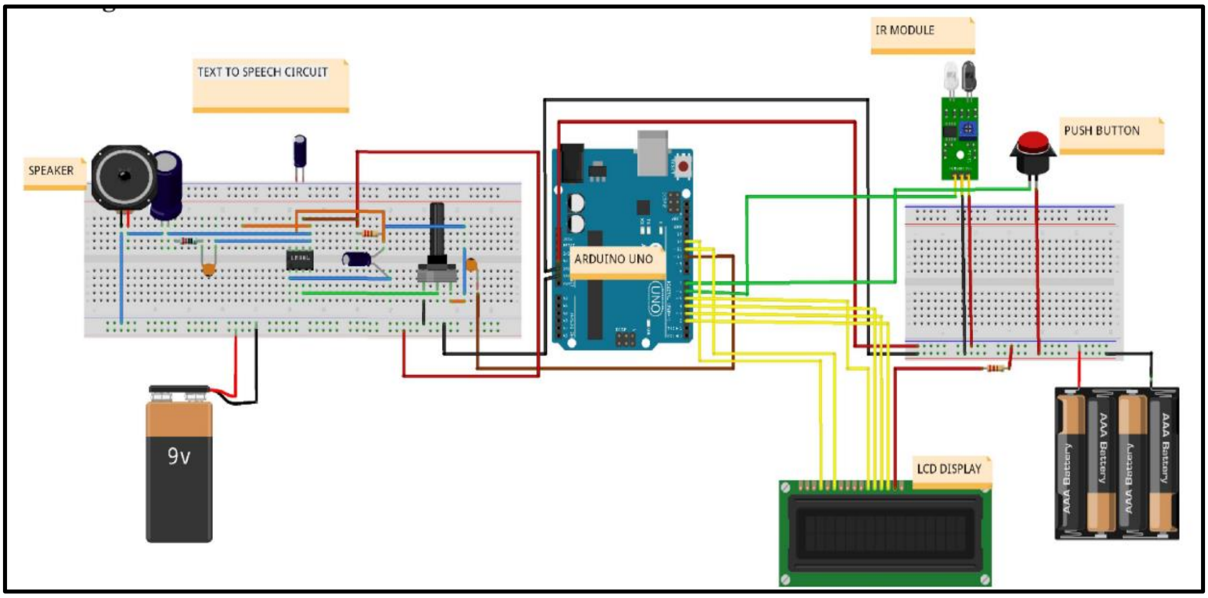

Fig. 3.1 Circuit Diagram

Connection

1. All the components are connected to the Arduino uno.
2. To connect LCD VSS to the GND and VDD to the 5V.
3. To use the LCD backlight, connect the backlight Anode to the 5V and connect the backlight cathode to the GND through a 220Ω resistor.
4. Since we are not using the read function connect the LCD R/W pin to the GND too.
5. VCC is the power supply pin for the IR sensor which we connect to the 5V pin on the Arduino.
6. OUT pin is a 5V TTL logic output.
7. LM386 is amplifier IC, some coupling and filtering capacitors and resistors as other supported circuitry.
8. One push button is used to turn ON/OFF the circuit.
9. Batteries are used as an external power supply to LCD and speaker. But can be connected to Arduino also for supply.

CHAPTER 5
WORKING

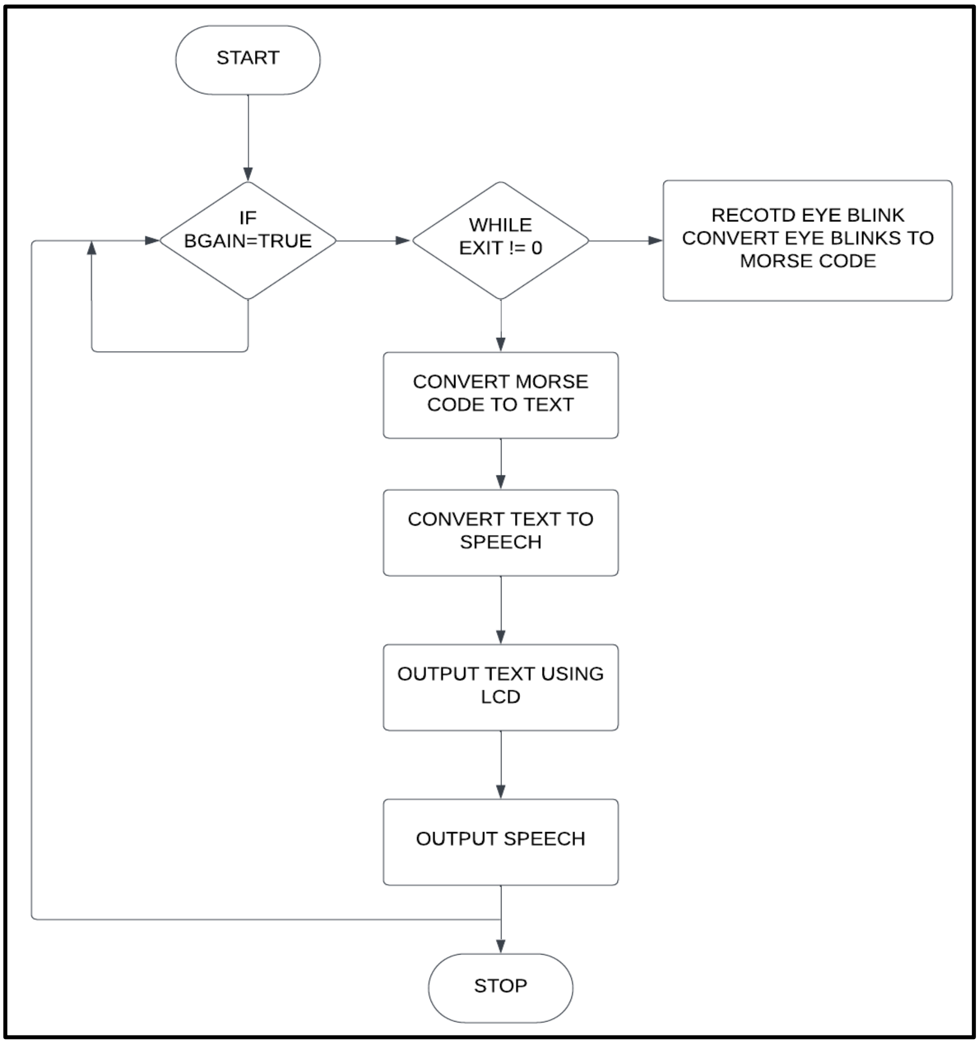

Fig. 4.1 Flow Chat

This system consists of three sections:

- Input
- Processing
- Output

5.1 Input

An IR sensor is used for providing inputs to the system. This sensor module is supposed to keep Infront of the patient's eyes. When the patient holds his blinking for about five seconds the system starts recording the eye blinking pattern. The IR sensor module emits infrared radiation to the patient's eyes. When the eyes are open the IR, rays are not reflected as the black colour absorbs all radiations, and when the eyes are closed the IR rays gets reflected. This reflected ray is received at the receiver terminal of the IR sensor module. So, when the patient blinks his eyes, a digital signal is recorded in the IR module. So basically, it means when the eyes are open no signal is received at the receiver terminal which is recorded as the value "zero" and when the eyes are closed a signal is received at the receiver terminal which is recorded as "one." These zeroes and ones are transmitted to the processing unit where it is considered as Morse code. You can also use a push button for supplying the digital signals.

5.2 Processing

As the input from the IR sensor reaches the microcontroller the processing section starts. Here there are two functions: Begin and End. When the patient does not blink his eye for 5 seconds the begin function gets activated. It refers to the point that the patient wants to make a statement. So, when the begin function is activated the digital signals from the IR module is considered as a Morse code. That is if the patient blinks his eyes four times the digital signal will be "1111". Which is in similar with the Morse code "….." The only difference is that the Morse code uses dashes and dots and here the digital signals use zeroes and ones. So, we consider digital signals as Morse code and assign values to each set of signals. For example, in Morse code "…." Indicates the value 'H' or 'h'. Similarly, we assign the value 'H' to the digital signal "1111". This is repeated for the entire set of alphabets and numbers. As a result, when a set of digital signals reaches the microcontroller, it converts the signals into plain text. Later this text is converted into speech using the text to speech module which is embedded with this system. This speech signals as well as the text is transferred to the output devices. When the patient closes his eyes for five seconds the end function gets activated. Hence, no more digital signal is recorded. Which indicates that the patient has concluded his statement.

5.3 Output

The output section consists of two devices: speaker and an LCD display. When the processing part is completed, the microcontroller transfers the resulted text and speech to the output devices. So, the Text is transferred to the LCD display where the text is displayed and the speech is transferred to the speaker where it gives the audio output

CHAPTER 6
ADVANTAGES

1. Enhanced Accessibility:

   The technology significantly enhances accessibility for paralyzed individuals, providing them with a reliable and non-intrusive means of communication using eye blinking.

2. Empowering Communication:

   The converter empowers paralyzed individuals by offering them a means to communicate independently, reducing dependence on others and fostering a sense of control over their communication.

3. Improved Quality of Life:

   By enabling effective communication, the technology contributes to an improved quality of life for paralyzed individuals, enhancing their ability to express needs, thoughts, and desires.

4. Customization for Individual Needs:

   The Morse code system allows for customization, adapting to the specific needs and abilities of each user. This flexibility ensures a tailored and efficient communication experience.

5. Non-Intrusive and Portable Design:

   The non-intrusive nature of eye-blink input, combined with a portable design, makes the technology comfortable for users and facilitates communication in various settings, promoting user convenience and flexibility.

CHAPTER 7
APPLICATIONS

1. The communication aid, through Morse code to text conversion, enables non-verbal expression, providing a valuable means for paralyzed individuals to convey thoughts and needs.
2. Assistive technology incorporating Morse code to text conversion is seamlessly integrated into communication devices, empowering paralyzed individuals to easily interact with caregivers and professionals.
3. Depending on the design, the device can be made portable, allowing users to carry it with them and communicate in various environments.
4. The system's interface can be customized based on user preferences, allowing individuals to adapt the device to their unique needs.
5. In emergency situations, where speech might be challenging, the Morse code converter can be used to send distress signals or call for help.
6. The system can serve as an educational tool for individuals to learn Morse code, providing a new skill set and avenue for personal development.
7. Integrating a speaker allows for text-to-speech functionality. The converted text can be audibly announced, providing an additional layer of communication.
8. The device could be used in research and development studies to understand the effectiveness of Morse code communication for individuals with physical disabilities.

RESULT

Sr. No.	Images of the result	Detail
Result No. 1		When Morse code is given to Arduino as '.' The **Headache** massage will appear.
Result No. 2		When Morse code is given to Arduino as '. _' The **Help** massage will appear.
Result No. 3		When Morse code is given to Arduino as '. _ . .' The **Leg pain** massage will appear.
Result No. 4		When Morse code is given to Arduino as '. . .' The **Stomach-ache** massage will appear.
Result No. 5		When Morse code is given to Arduino as '_ _ _ .' The **Getting Board** massage will appear.

Result No. 6		When Morse code is given to Arduino as '. . _ .' The **Fresh air** massage will appear.
Result No. 7		When Morse code is given to Arduino as '. _ _' The **Washroom** massage will appear.
Result No. 8		When Morse code is given to Arduino as '. .' The **Itching** massage will appear.
Result No. 9		When Morse code is given to Arduino as '_ . . .' The **Bathroom** massage will appear.
Result No. 10		When Morse code is given to Arduino as '_' The **Thirsty** massage will appear.
Result No. 11		When Morse code is given to Arduino as '. . . .' The **Hungry** massage will appear.

Table No. 1: Result Table

Crafting messages uniquely for each patient's needs enhances the personal touch. Utilizing Text-to-Speech (TTS) ensures an inclusive experience with both visual and audible communication. This tailored approach aims to boost engagement and support, contributing to overall well-being.

CONCLUSION

The Morse code to text converter designed for paralyzed individuals presents a valuable solution to address communication challenges faced by those with limited mobility or speech impairments. This assistive technology not only empowers paralyzed individuals to independently convey messages using Morse code but also opens opportunities for enhanced communication, education, and emergency signalling. By integrating user-friendly components such as an IR module, a 16x2 LCD, and a speaker, the converter becomes an accessible and cost-effective tool, offering a customizable interface for a range of applications. Ultimately, this innovative device contributes to improving the quality of life for paralyzed individuals, fostering independence, and providing a means of communication in various contexts.

FUTURE SCOPE

As far as the future of this system is concerned, an alarm can be set when the caretaker misses to attend the call or miss to view the message. This alarm will alert the caretaker and he can respond to it immediately. Another improvisation can be of setting the IOT devices. An IOT device can be set in a way such that the patient is able to operate light switch and regulate the fan with the help of blinks which will reduce the work of caretaker and patient feels independent. Also, we can use a camera instead of IR sensor by which the patient can add more instructions with eye movements. For example, the patient can scroll through a mobile phone or computer using eye movements.

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