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Morse Code to Text Converter for Paralyzed People

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Abstract: *The main objective of this project is to develop a system for the paralyzed people which they can use for communicating with others. For people with these severe forms of paralysis, a lack of speech can be emotionally devastating. Alternative and augmentative devices allow people to express themselves and to have two-way conversations with caregivers, their loved ones, and others. Assistive technology can help people with varied communication limitations. People with the most severe impairments may be able to speak by using their eyes or another facial feature by directing a device. Devices may be designed only to speak or they may connect to a computer that allows a user to have computer and internet access. In this project we use people's eyes to generate Morse code by which he or she can communicate with others. An eye-tracking device, for example, may track eye movement such as blinking of eye for generating Morse code. Later this Morse code can be converted to normal text using the Arduino microcontroller. The device allows the user to talk to others using only the eyes. Other programs can work with an eye-tracking device to convert text or symbols into speech. One option has more than 11,000 pre-programmed symbols and photos that can be used to create additional symbols. People who cannot speak but have more movement may be able to use their hands to use text-to-voice software.*

Keywords: Paralyzed People.

I. 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 also 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 also the system reads the message to the care taker where in a voice is audible saying what the patient wants.

1.1 Objectives

A. Allow paralysis victims to communicate independently.

Many paralysis victims already use eye blinks as a form of communication. It is common for nurses and caretakers to read a patients eye blinks and decode the pattern. The ALS association even offers a communication guide that relies on eye blinks. Blink To Speak automates this task. The software reads a persons eye blinks and converts them into text. A key feature of the software is that it can be started, paused, and operated entirely with eye blinks. This allows patients to record their thoughts with complete independence. No nurses or caretakers are required to help patients express themselves. Not only does this reduce the financial burden on paralysis patients, but this form of independence can be morally uplifting as well.

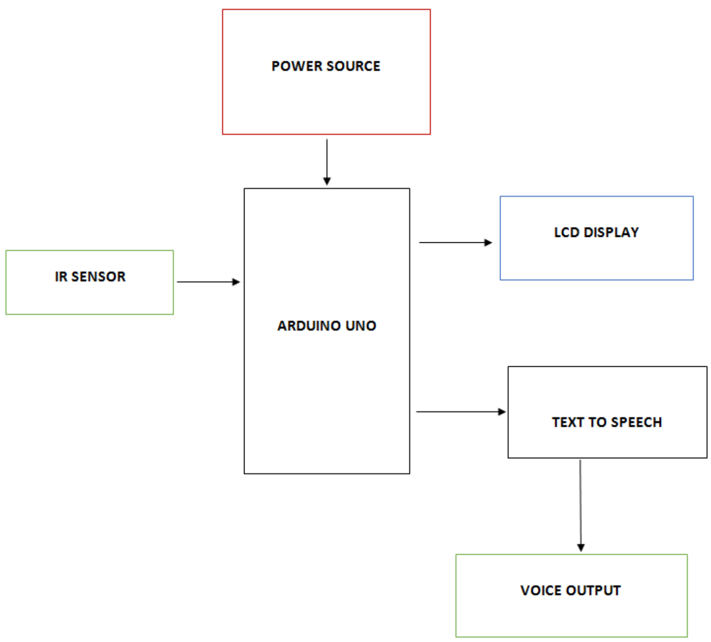
B. Be accessible to people with financial constraints.

Many companies are developing technologies that are controlled by eye movement. These technologies rely on expensive hardware to track a user`s eyes. While these devices can absolutely help LIS victims, they are only available to people

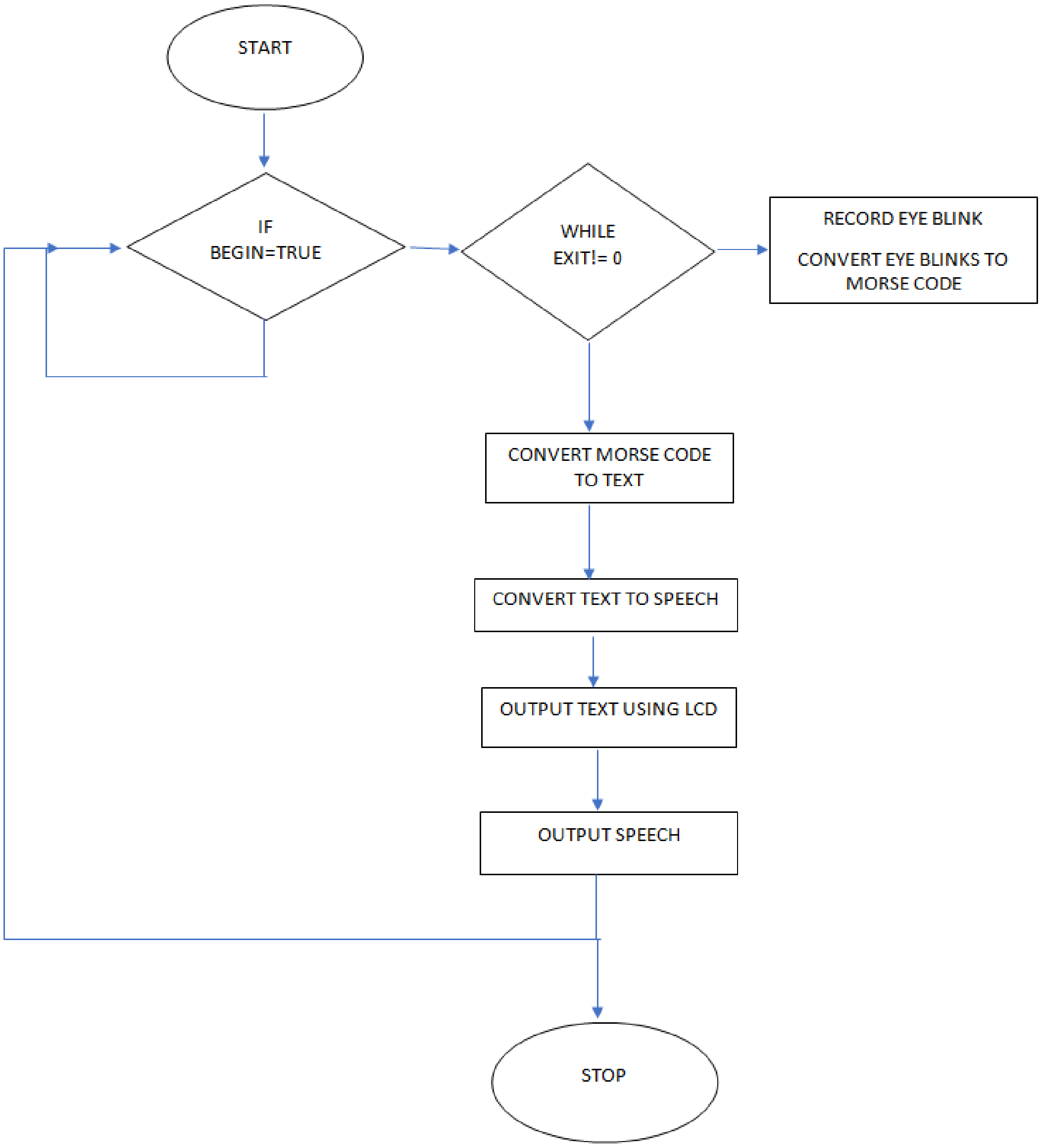
1.2 Proposed System

- 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 definitely 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 a LCD display or even by a loud voice.

1.3 Block Diagram



1.4 Flowchart



1.5 Morse Code and Their Respective Values

Letters

A	. _	N	_ .
B	_ . . .	O	_ _ _
C	_ . _ .	P	. _ _ .

D	_ . .	Q	_ _ . _
E	.	R	. _ .
F	. . _ .	S	. . .
G	_ _ .	T	_
H	. . . .	U	. . _
I	. .	V	. . . _
J	. _ _ _	W	. _ _
K	_ . _	X	_ . . _
L	. _ . .	Y	_ . _ _
M	_ _	Z	_ _ . .

Numbers

1	. _ _ _ _	6	_ . . . .
2	. . _ _ _	7	_ _ . . .
3	. . . _ _	8	_ _ _ . .
4	. . . . _	9	_ _ _ _ .
5	. . . . .	0	_ _ _ _ _

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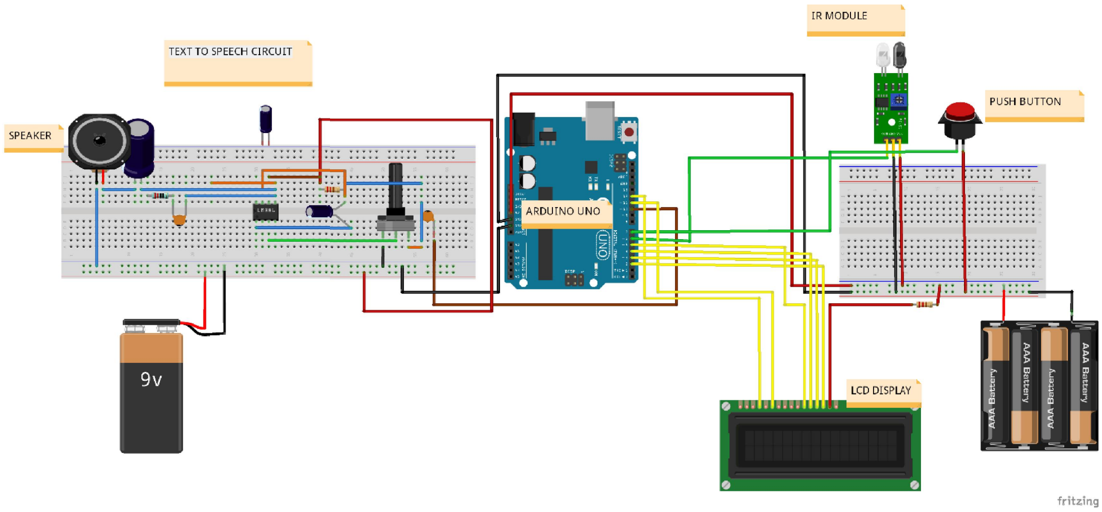
1.6 Circuit Diagram



1.7 Components

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

1.8 Arduino Uno

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP

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header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter. Revision 2 of the Uno board has a resistor pulling the 8U2 HWB line to ground, making it easier to put into DFU mode. Revision 3 of the board has the following new features:

- pinout: added SDA and SCL pins that are near to the AREF pin and two other new pins placed near to the RESET pin, the IOREF that allow the shields to adapt to the voltage provided from the board. In future, shields will be compatible both with the board that use the AVR, which operate with 5V and with the Arduino Due that operate with 3.3V. The second one is a not connected pin, that is reserved for future purposes.
- Stronger RESET circuit.
- Atmega 16U2 replace the 8U2.

"Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform; for a comparison with previous versions, see the index of Arduino boards.

Summary:

- Microcontroller: ATmega328.
- Operating Voltage: 5V.
- Input Voltage (recommended) 7-12V.
- Input Voltage (limits) 6-20V.
- Digital I/O Pins 14 (of which 6 provide PWM output).
- Analog Input Pins 6
- DC Current per I/O Pin 40 mA
- DC Current for 3.3V Pin 50 mA
- Flash Memory 32 KB (ATmega328) of which 0.5 KB used by bootloader
- SRAM 2 KB (ATmega328)
- EEPROM 1 KB (ATmega328)
- Clock Speed 16 MHz

1.9 Schematic and Reference Design EAGLE Files

Arduino-uno-Rev3-reference-design.zip (NOTE: works with Eagle 6.0 and newer) Schematic: arduino-uno-Rev3-schematic.pdf Note: The Arduino reference design can use an Atmega8, 168, or 328, Current models use an atmega328, but an Atmega8 is shown in the schematic for reference. The pin configuration is identical on all three processors.

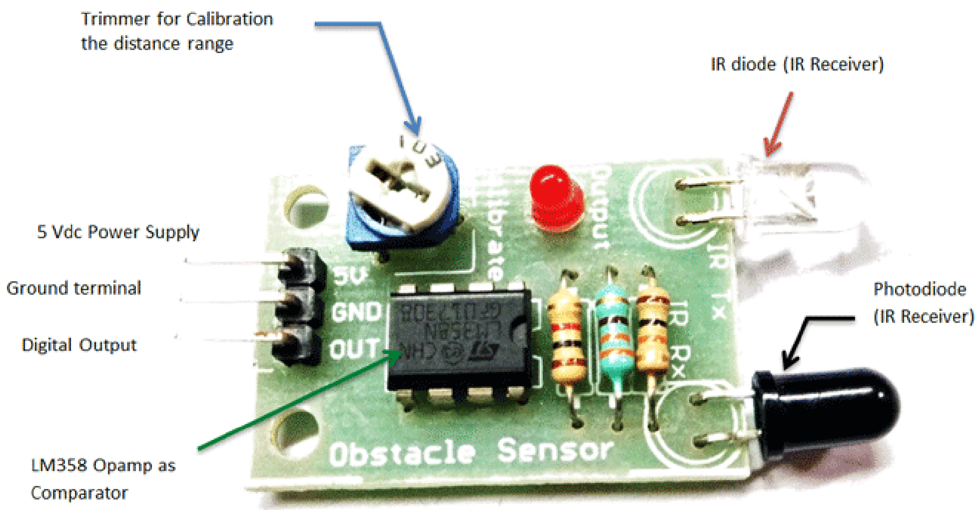
A. Power

The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector. The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts. The power pins are as follows:

- VIN. The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.

- 5V. This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 12V), the USB connector (5V), or the VIN pin of the board (7-12V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage your board. We don't advise it.
- 3V3. A 3.3-volt supply generated by the on-board regulator. Maximum current draw is 50 mA.
- GND. Ground pins.

B. IR Sensor



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

C. 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 centimeters to several feet's, it depends upon the type of IR transmitter and the manufacturer. Some transmitters have the range in kilometers. IR LED white or transparent in color, so it can give out amount of maximum light.

D. 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 color coating on its outer side, Black color absorbs the highest amount of light.

E. 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).

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F. Variable Resistor

The variable resistor used here is a preset. It is used to calibrate the distance range at which object should be detected.

G. IR Sensor Module Features

- 5VDC 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

II. 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 really 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 modeling 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.

Required Components

1. Arduino board
2. A speaker
3. An Amplifier Circuit
4. Regulated Power Supply
5. Connecting Wires

2.1 Circuit Diagram

Here in this Text to Speech converter, we've 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:

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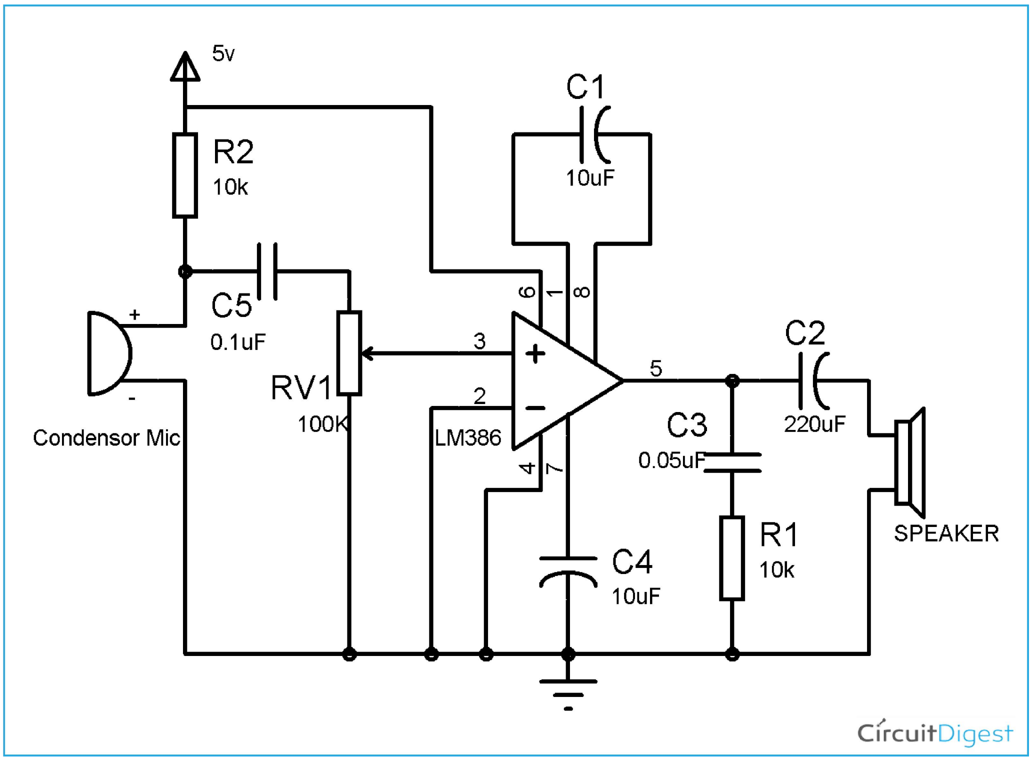

A 100K pot is used to adjust the sound. Adjust it to get a clear sound. If you have any confusion about this circuit then check out LM386 Based Audio Amplifier Circuit. If you don't have the exact value of resistors and capacitors then use the close value ones.

2.2 Liquid Crystal Display

LCD (Liquid Crystal Display) is a type of flat panel display which uses liquid crystals in its primary form of operation. LEDs have a large and varying set of use cases for consumers and businesses, as they can be commonly found in smartphones, televisions, computer monitors and instrument panels.

LCDs were a big leap in terms of the technology they replaced, which include light-emitting diode (LED) and gas-plasma displays. LCDs allowed displays to be much thinner than cathode ray tube (CRT) technology. LCDs consume much less power than LED and gas-display displays because they work on the principle of blocking light rather than emitting it. Where an LED emits light, the liquid crystals in an LCD produces an image using a backlight. As LCDs have replaced older display technologies, LCDs have begun being replaced by new display technologies such as OLEDs.

A. How LCDs work

A display is made up of millions of pixels. The quality of a display commonly refers to the number of pixels; for example, a 4K display is made up of 3840 x2160 or 4096x2160 pixels. A pixel is made up of three subpixels; a red, blue and green—commonly called RGB. When the subpixels in a pixel change color combination, a different color can be produced. With all the pixels on a display working together, the display can make millions of different colors. When the pixels are rapidly switched on and off, a picture is created.

The way a pixel is controlled is different in each type of display; CRT, LED, LCD and newer types of displays all control pixels differently. In short, LCDs are lit by a backlight, and pixels are switched on and off electronically while using liquid crystals to rotate polarized light. A polarizing glass filter is placed in front and behind all the pixels, the front filter is placed at 90 degrees. In between both filters are the liquid crystals, which can be electronically switched on and off.

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LCDs are made with either a passive matrix or an active matrix display grid. The active matrix LCD is also known as a thin film transistor (TFT) display. The passive matrix LCD has a grid of conductors with pixels located at each intersection in the grid. A current is sent across two conductors on the grid to control the light for any pixel. An active matrix has a transistor located at each pixel intersection, requiring less current to control the luminance of a pixel. For this reason, the current in an active matrix display can be switched on and off more frequently, improving the screen refresh time.

Some passive matrix LCD's have dual scanning, meaning that they scan the grid twice with current in the same time that it took for one scan in the original technology. However, active matrix is still a superior technology out of the two.

B. Types of LCDs

Types of LCDs include:

- Twisted Nematic (TN)- which are inexpensive while having high response times. However, TN displays have low contrast ratios, viewing angles and color contrasts.
- In Panel Switching displays (IPS Panels)- which boast much better contrast ratios, viewing angles and color contrast when compared to TN LCDs.
- Vertical Alignment Panels (VA Panels)- which are seen as a medium quality between TN and IPS displays.
- Advanced Fringe Field Switching (AFFS)- which is a top performer compared IPS displays in color reproduction range.

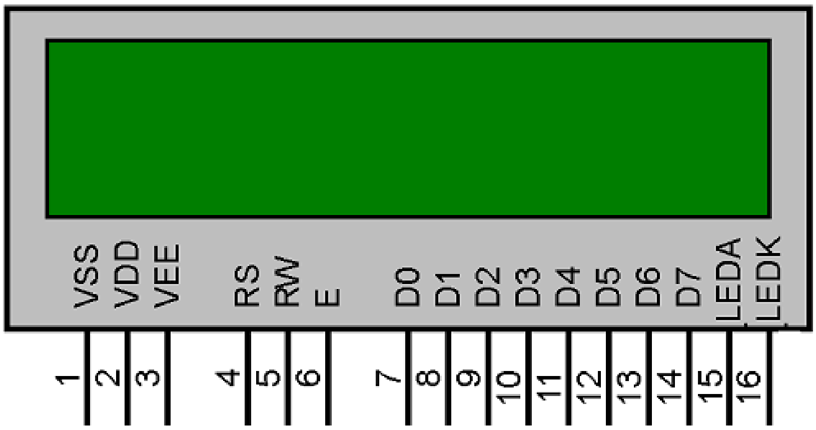

Figure: Pin Diagram

2.3 Pin Descriptions

Vcc, Vss and Vee:

While Vcc and Vss provide +5V and ground respectively, Vee is used for controlling LCD contrast.

RS Register Select:

There are two very important registers inside the LCD. The RS pin is used for their selection as follows.

If RS=0, the instruction command code register is selected, allowing the user to send a command such as clear display, cursor at home, etc.

If RS=1, the data register is selected, allowing the user to send data to be displayed on the LCD.

R/W, read/write: -

R/W input allows the user to write information to the LCD or read information from it.

R/W = 1 for reading.

R/W= 0 for writing.

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EN, enable:

The LCD to latch information presented to its data pins uses the enable pin. When data is supplied to data pins, a high–to-low pulse must be applied to this pin in order for the LCD to latch in the data present at the data pins. This pulse must be a minimum of 450 ns wide.

D0 – D7:

The 8–bit data pins, DO – D7, are used to send information to the LCD or read the contents of the LCD's internal registers. To display letters and numbers, we send ASCII codes for the letters A–Z, a-z numbers 0-9 to these pins while making RS=1. There are also instruction command codes that can be sent to the LCD to clear the display or force the cursor to home position or blink the instruction command codes.

We also use RS = 0 to check the busy flag bit to see if the LCD is ready to receive information. The busy flag is D7 and can be read when R/W=1 and RS=0, as follows: if R/W = 1, RS = 0. When D7= 1 (busy flag = 1), the LCD is busy taking care of internal operations and will not accept any information.

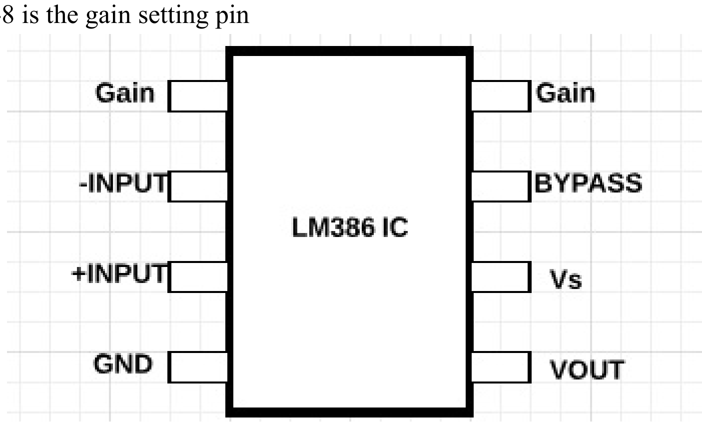
LM386 IC

The IC LM386 is a low-power audio amplifier, and it utilizes low power supply like batteries in electrical and electronic circuits. This IC is available in the package of mini 8-pin DIP. The voltage gain of this amplifier can be adjusted to 20, and the voltage gain will be enhanced to 200 by employing external components like resistors as well as capacitors among the pins 1 & 8. When this amplifier uses a 6V power supply for the operation then the static power drain will be 24 milliwatts to make the amplifier for an ultimate operation of the battery. This amplifier consists of 8-pins where pin-1 and pin-8 are gain control pins of the amplifier, and this IC is most widely used IC that allows a customer to increase volume.

2.4 IC LM386 Pin Configuration

The IC LM386 audio amplifier consists of 8-pins where each pin of this IC is discussed below.

- Pin1 (Ga+-gain Pin): Pin-1 is gain pin, used adjust the amplifier gain by connecting this IC to an external component capacitor.
- Pin2 (+IN-Non-inverting): Pin-2 is the non-inverting pin, is used to provide the audio signal.
- Pin3 (+IN): Pin-3 is the inverting terminal and it is normally connected to ground.
- Pin4 (GND): Pin-4 is a ground pin connected to the ground terminal of the system
- Pin5 (Vout): Pin-5 is the output pin, used to provide amplified output audio, and allied to the speaker.
- Pin-6 (VCC or VSS): Pin-6 is connected to the power
- Pin-7 (Bypass): Pin-7 bypass pin is used to connect a decoupling capacitor.
- Pin-8 (Gain): Pin-8 is the gain setting pin



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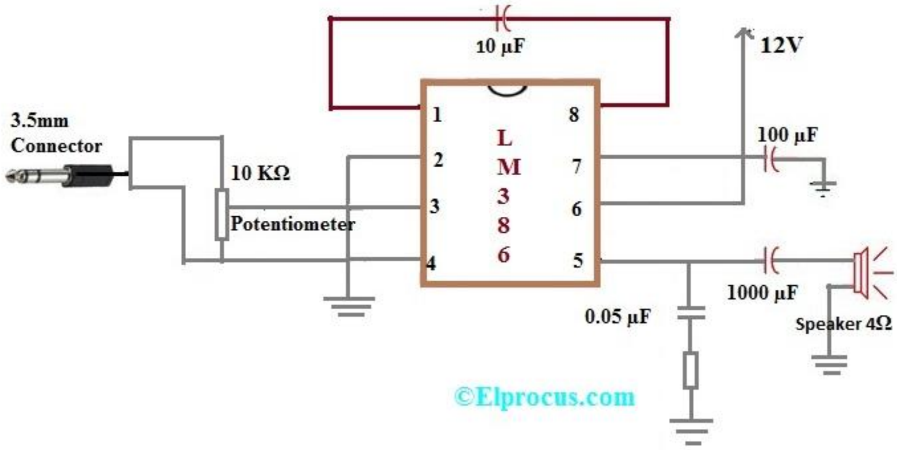
A. LM386 Audio Amplifier Circuit Diagram and Working

The Audio amplifier can be built with LM386 IC, capacitors like 100 µF, 1000 µF, 0.05 µF, 10 µF, Potentiometer – 10 KΩ, resistor-10 KΩ, power supply-12V, speaker-4Ω, breadboard, and connecting wires. Basically, this Audio Amplifier includes 3-functional blocks such as Power as well as Output, Bypass, gain control. Designing of this circuit design is so simple. At first, connect the two power supply pins namely pin4 & pin6 to GND as well as voltage correspondingly.



After that, connect the input from any kind of audio sources such as a mobile phone or a microphone. Here this circuit uses a mobile phone as the audio source with the help of the 3.5mm connector. This connector will be having three connections like the ground right and left audio. This LM386 IC is a simple amplifier and connects the right or left audio to this amplifier using an audio source with the ground terminal. The input level in this circuit can be controlled by connecting a potentiometer to the input. In addition, a capacitor will be connected to the input in series to remove the DC components. This IC gain will be adjusted to 20, and connect a capacitor (10 µF) between the two pins 1 & 8 of this IC then the gain will be enhanced to 200

Even though the datasheet of audio amplifier advises the bypass-capacitor at the 7th pin is an option, we form that connecting a capacitor (100 µF) was truly helpful because it assists in the noise reduction. For the connection of output, a capacitor (0.05 µF) and a resistor (10 Ω) will be connected in series among the GND as well as a 5th pin of the IC. This forms a Zobel network, a filter including a capacitor and resistor will be utilized for adjusting the input impedance. The speaker connection can be done with the help of impedance ranges from 4 Ω to 32 Ω, because the IC can drive any type of speaker in this range. The audio amplifier circuit uses a speaker (4 Ω). This speaker can be connected using a capacitor (1000 µF) was really useful because it removes the unnecessary DC signals.

B. Electrical Characteristics of LM386 IC

- The voltage gain of this amplifier can be set from 20 to 200 with a range of voltage supply 4volts to 12volts or 5volts to 18 volts based on the model. There are three amplifier models are available in the market namely LM386N-1, LM386N-3, & LM386N-4
- For LM386N-1: Minimum voltage is 4V, Maximum voltage is 12V, Minimum o/p power is 250 mW and typical o/p power is 325mW.
- For LM386N-3: Minimum voltage is 4V, Maximum voltage is 12V, Minimum o/p power is 500 mW and typical o/p power is 700mW.
- For LM386N-4: Minimum voltage is 5V, Maximum voltage is 18V, Minimum o/p power is 500 mW and typical o/p power is 1000mW.
- The inputs of the amplifier are referenced by ground whereas the output routinely biases toward one half of the voltage supply. The low static current of the amplifier is 4mA and the harmonic distortion will be up to 0.2%

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2.5 Power Supply (Battery)

A **battery** is a source of electric power consisting of one or more electrochemical cells with external connections for powering electrical devices such as flashlights, mobile phones, and electric cars. When a battery is supplying electric power, its positive terminal is the cathode and its negative terminal is the anode. The terminal marked negative is the source of electrons that will flow through an external electric circuit to the positive terminal. When a battery is connected to an external electric load, a redox reaction converts high-energy reactants to lower-energy products, and the free-energy difference is delivered to the external circuit as electrical energy. Historically the term "battery" specifically referred to a device composed of multiple cells; however, the usage has evolved to include devices composed of a single cell.

Primary (single-use or "disposable") batteries are used once and discarded, as the electrode materials are irreversibly changed during discharge; a common example is the alkaline battery used for flashlights and a multitude of portable electronic devices. Secondary (rechargeable) batteries can be discharged and recharged multiple times using an applied electric current; the original composition of the electrodes can be restored by reverse current. Examples include the lead-acid batteries used in vehicles and lithium-ion batteries used for portable electronics such as laptops and mobile phones.

Batteries come in many shapes and sizes, from miniature cells used to power hearing aids and wristwatches to small, thin cells used in smartphones, to large lead acid batteries or lithium-ion batteries in vehicles, and at the largest extreme, huge battery banks the size of rooms that provide standby or emergency power for telephone exchanges and computer data centers.

Batteries have much lower specific energy (energy per unit mass) than common fuels such as gasoline. In automobiles, this is somewhat offset by the higher efficiency of electric motors in converting electrical energy to mechanical work, compared to combustion engines.

III. WORKING

This system consists of three sections:

- Input
- Processing
- Output

3.1 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 color 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".

This 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.

3.2 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 actually 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 uses 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.

3.3 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.

IV. Conclusion

Using Morse code for communication is not an easy task, but with this system it becomes lot easier as only one person needs to know Morse code. The rest of the transcription process is done by a microcontroller. Detecting eye blink is a challenging process. This is due to the movements of eye ball and artificial lighting which may confuse the system. Here we resolve this problem by adjusting the distance between the eyes and the sensor.

V. 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 also 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.