

VOICE OUTPUT DEVICE FOR VERBAL APRAXIA

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Abstract Apraxia of speech (AOS) is a neurogenic communication affecting the motor programming system for speech production. Individuals with AOS demonstrate difficulty in speech production, specifically with sequencing and forming sounds. The Levelt model describes the speech production process in the following three consecutive stages: conceptualization, formulation, and articulation. According to the Levelt model, apraxia of speech would fall into the articulation region. The individual does not suffer from a language deficiency, but has difficulty in the production of language in an audible manner. Notably, this difficulty is limited to vocal speech, and does not affect signed language production. The individual knows exactly what they want to say. Children with congenital verbal apraxia may often understand spoken and written language and may be socially motivated to communicate, but are physically unable to speak. Because there are few, if any, treatments for this condition, children with this disorder are occasionally taught to communicate by using touch-activated voice output devices, which produce spoken words elicited by pressing buttons or touchscreens. However, for toddlers with severe verbal apraxia, commercially available touch-activated voice output systems present several logistical drawbacks. The project ensures a touch screen with an inbuilt images for children, templates and touch pad for extra typing. It will be a great relief for the patients suffering from verbal apraxia.

Keywords— Apraxia of speech(AOS), Articulation, Touch screen

1. Introduction

Apraxia is a motor disorder caused by damage to the brain, in which someone has difficulty with the motor planning to perform tasks or movements when asked, provided that the request or command is understood and he/she is willing to perform the task. Apraxia is an acquired disorder of motor planning, but is not caused by incoordination, sensory loss, or failure to comprehend simple commands. It is caused by damage to specific areas of the cerebrum. Apraxia of speech (AOS) involves the loss of previously acquired speech levels. It occurs in both children and adults who have (prior to the onset of apraxia) acquired some level of

speaking ability. AOS affects an individual's volitional speech and is typically the result of a stroke, tumor, or other known neurological illness or injury. Apraxia may be accompanied by a language disorder called aphasia.

Apraxia is an acquired oral motor speech disorder affecting an individual's ability to translate conscious speech plans into motor plans, which results in limited and difficult speech ability. The 3 levels in the speech production process are conceptualization, formulation and articulation. According to the Levelt model, apraxia of speech would fall into the articulation region. The individual does not suffer from a language deficiency, but has difficulty in the production of language in an audible manner. Notably, this difficulty is limited to vocal speech, and does not affect signed language production.. It consist of image data, message data inbuilt in it. Children suffering from apraxia. may make use of the simple picture information to convey their messages. The project can be extended to a wide range based on the need in biomedical field.

2. Experimental Description

2.1 Project Description

The proposed system is to design and construct a voice output device for the victims of Apraxia using low cost and economically useful materials. This is accomplished by using a GLCD, touch screen, keypad, text to voice converter and speaker. Here the input data may be in the form of text, templates, images etc...The set up will provide a guideline for the victims of Apraxia. Through this system, not only they design a tongue for the patients, but also it makes the people to act normally as others. The design is done with ATMEGA 328. Whenever any text data is given it will be converted to voice output and any images, it will be processed, identified and converted to speech out. For children below six yrs the images are mostly helpful. For the teenagers the templates which is stored in it will be useful and for adults the touch screen to convey more messages will be graceful.

3. Block Diagram

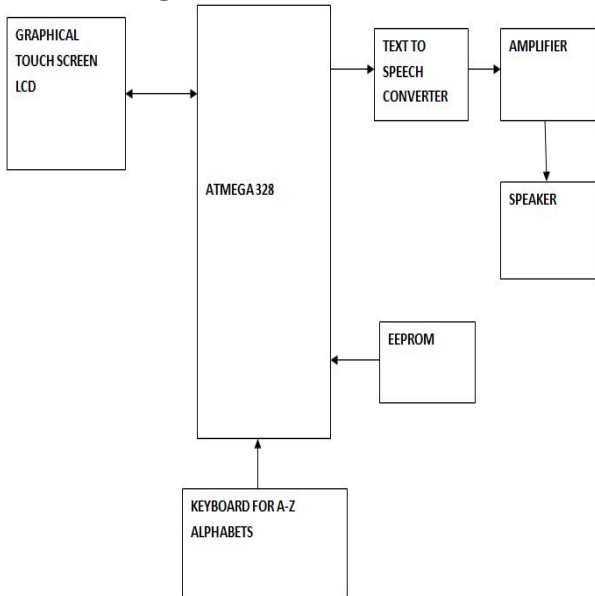


Fig 1: Block Diagram

3.1 Block Diagram Description

The microcontroller consists of an internal ADC module. This ADC module is used to convert the ADC reading from the sensor to a digital value. The ADC provided with microcontroller is of 10 bit resolution, which reads value from 0-1023. The Devices which output the analog variation can communicate with controller using this module .

A keypad is interfaced with the microcontroller in order to send type different words.

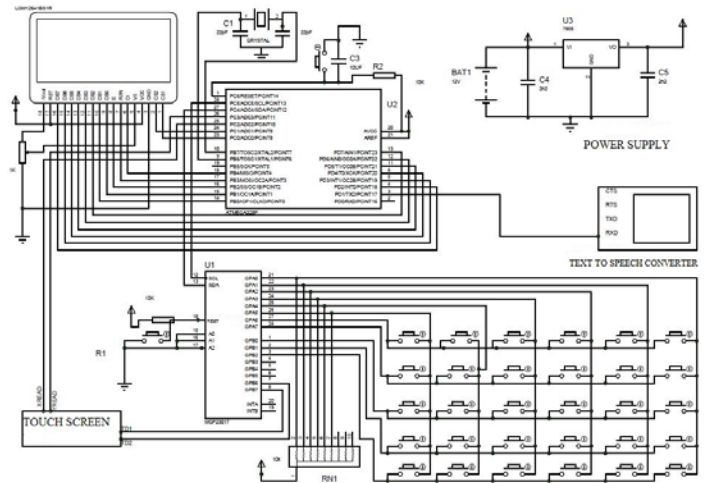
A text to speech module is used to speak the text data. Input any serial text data in English language, and it will start speaking.

The graphics LCD is made of lots of pixels. For example very small graphics display of 1/16th VGA also known as QQVGA display has 160 pixels in one direction and 120 pixels in another director so total 19200 pixels. The LCD as name suggests is made of liquid crystals. The liquid crystals are the heart of the display and the display operation depends on the manipulation of the light mainly its polarization. The ambient light passes through the front polarizer, the front polarizer removes all of the light rays except the one polarized vertically. The polarizer works in the exactly same way as in polarized sun glasses. Then light goes through the liquid crystals and it gets 90° turn. Then it goes through the rear polarizer gets reflected back and follows the same process and comes back in the front. If light gets out of the front then we will not see any image

The liquid crystal orientation can be changed by changing charge applied on it. The charge is applied through some metal electrodes shaped like target image. For pixel in graphics LCD it will be square. In this example the charge change results in no twist through liquid crystals. Because of that when the light reaches the rear polarizer it gets blocked due to vertical polarization

on horizontal polarizer. As light does not get reflected back that particular pixel will be displayed as dark.

3.2 Circuit Diagram



3.3 Circuit Diagram Description

The basic circuit of the microcontroller consist of a power supply unit, External Crystal oscillator and a reset circuitry . The power supply consist of a voltage regulator which is used to regulate the voltage to a fixed voltage of 5v .Normally 7805 voltage regulators are used for this purpose. Normally the crystal oscillator provided with the microcontrollers is of 16MHz and to 22pf capacitors are used with the microcontroller as decoupling capacitors for decreasing the noise.

The reset circuitry used here consist of a switch and a resistor normally a HIGH signal is present in the mCLR pin of the microcontroller. When the switch is pressed, a LOW presents at the pin and microcontroller gets reset and as there is a resistor provided in circuit the Vcc and Ground never get direct short while resetting.

4. Algorithm

- Step0: start
- Step1: Include the required header files (GLCD, USART, PORT EXTENDER).
- Step2: Declare the variables that are used in the code.
- Step3: initialize LCD and set OUTPUT and INPUT pins
- Step4: Initialize Serial communication
- Step5: Read Keypad
- Step6: Speak typed word on command
- Step7: Load image to GLCD from memory
- Step8: If touch is detected speak name of image otherwise scroll image
- Step9: Continue the loop infinitely
- Step10: stop

5. Stimulation

We had used Arduino as the programming software of the microcontroller. It is based on the embedded C

language. There are many features provided by this software programming environment such as it is easy to use, very compact and efficient code, hardware and software libraries, comprehensive documentation, software simulator, hardware simulator, hardware debugger support. It is very easy to program a microcontroller in an Arduino board. No burning of programs into the IC is required here. The USB compatibility is provided in most Arduino board and by just copying the program into the microcontroller memory we can load the program.

6. Conclusions

The concerned project gives the detailed view on the voice output device for the children affected with verbal apraxia. It helps to attain more detailed idea about the same. The device formulated here will help a lot to the patients to convey their ideas, messages and so on to others. The project ensures an overall remedy for apraxia. The device consists of a touch screen, a keypad, speaker and so on. With these low cost items the project will be accomplished. It opens a great door to the biomedical world to enhance the system. The device will be portable with low cost system so that the common man can make use of it.

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