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BETTER EDUCATION ACCESS FOR VISUALLY CHALLENGED PEOPLE

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Abstract: According to a survey by NCERT, just 6.86 percent of schools have access to Braille books and audio content, and only 29.16 percent of India's 12 million visually impaired people are involved in the educational system. The majority of books still haven't been converted to Braille, leaving them available for Blind people to read. For visually impaired pupils, a barrier to learning is the expensive cost of Braille books and the poor accessibility of many subject textbooks. Our concept is to create a portable Braille device that would allow us to quickly and cheaply transform the content of any e-book, blog, or news website into Braille. We have created an embedded system that can convert text into grade 1 and grade 2 Braille. We created software for Windows and an app for Android that turns ordinary text into grade 2 Braille comparable text. Additionally, we frequently use wireless transmission to transfer data from a laptop or smartphone to a device. The transformed text is then placed into an SD card. Our embedded system reads the SD card and translates the text to Braille and speech for audio output.

Index Terms **-Visually Impaired, Braille keypad, Arduino, Accessible e-book, SD card Module, Solenoids, Magnets, Speaker, LCD module, Tactile switch, and I2c serial interface adaptor module**

I. INTRODUCTION

In a culture that values information, everyone has the right to create and utilize data. Therefore, it is vital to create a variety of tools that can quickly provide information to everybody. There are 12 million visually challenged people in India and almost 44 million visually impaired people worldwide. This group has a shockingly high rate of illiteracy, much of which is ascribed to the dearth of readily available reading material. Blind and visually disabled people use the Braille tactile writing method. Traditionally, it is written on embossed paper.They can use a Braille writer, such as a portable Braille note taker or a computer that prints with a Braille embosser, to write Braille or they can type it using the original slate and stylus.

A. International Braille standards: Braille is a system of raised dots that blind, visually impaired, or deaf blind persons can read with their fingertips. Those who are not blind or visually challenged typically read Braille with their eyes, such as teachers, parents, and others. A language is not Braille. All languages are written and read using this code. Almost every country in the world uses braille now, and it has been translated into almost all spoken languages.

B. Braille code: Braille codes are created within the Braille cells, which are discrete spaces. As seen in the graphic below, a complete Braille cell is made up of six raised dots that are placed in two parallel vertical rows, each with three dots. The numerals one through six designate the dot placements. There are 64 different combinations using one or more of these six dots.

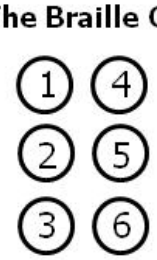

Fig: Braille Cell

II. OBJECTIVE

We chose this initiative to help the blind and visually impaired become more integrated into society by making education more accessible to them. As engineering students, our goal was to develop a technical solution that could aid the blind. We must undoubtedly consider our genuine goals as well as the fundamental requirements that a blind person must meet in order to learn. Additionally, we had to consider what products were already on the market and whether we could replicate them more cheaply.

III. TECHNICAL STACK

This embedded system we have developed is capable of translating text into grade 1 as well as grade 2 Braille. We have developed a Windows Software and android app which converts plain text into grade 2 braille equivalent text. Furthermore, we working on sending the data from PC or Smartphone to the device wirelessly. Then we take the converted text into SD card. The SD card is plugged into our embedded system and the system converts the text into braille and speech as audio output. The embedded system consists of, 1. Arduino Mega, 2. SD card Module, 3. Switching circuitry, 4. Solenoids, 5. Magnets, 6. Speaker, 7. LCD module(Optional), 8. Tactile switch, 9. I2c serial interface adapter module, 10. 24V SMPS. Solenoid, 11. Servo motor. Magnets and Switching circuitry or six Servo motors makes the Converter module. We have developed 2 types of modules. One uses solenoid and the other uses Servo motors.

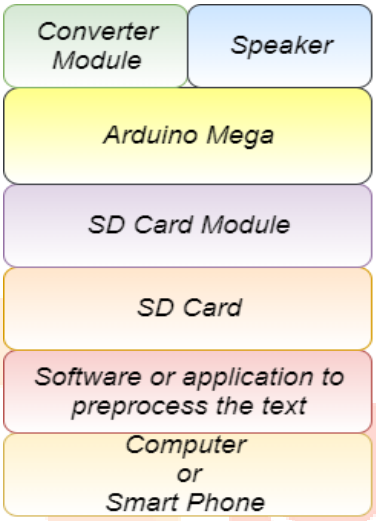

Fig: Technical Stack

IV. METHODOLOGY

We have analyzed the braille codes,grade I as well as grade II. The basic requirementto convert the text into braille was 6 mechanical buttons for each letter. So we had started our experiment with thesolenoids and the magnets. Components used in the device:1. Arduino UNO andMEGA2.N-MOSFET3.Fly back Diode4. SD card module5. Speaker6.Solenoids7. Magnets8.Servomotors9. 12V SMPS10. 3D printed Structures First of all, we started with thecoding. We developed an algorithm for converting text into grade I braille.Further we developed a Windows application for pre-processing the text and makegrade II equivalent braille. Then we moved on to the circuitry and the mechanism. We have designed two modules. This module used solenoid and magnets to create liner motion of the buttons. here's the 3D printed prototype we created.

Now for the sake of experimentation we also used servo motor in the second prototype for the same model. In the second prototype we have used 6 SG90 micro servo motors. All the motors are controlled by the Arduino MEGA. Now the common part of both the prototype was a talk back functionality. The module gives an audio output through speaker for each character. Which can also be used as input into the Bone conduction headphones for any deaf person.

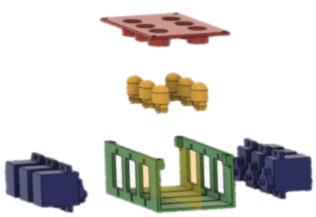

Fig: Exploded View of the Prototype,

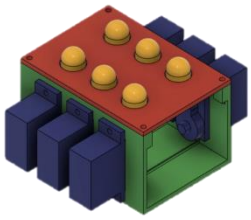

Fig: Assembled View of the Prototype

V. OBSERVATION

We pre-processed the text and saved the file into the memory card and inserted it into the SD card module. And the device is converting each character into braille character and giving the audio output at the same time. Here we are showing our Software which converts plain text into grade 2 braille equivalent text. This is a Screenshot of our software named Isopsephy.

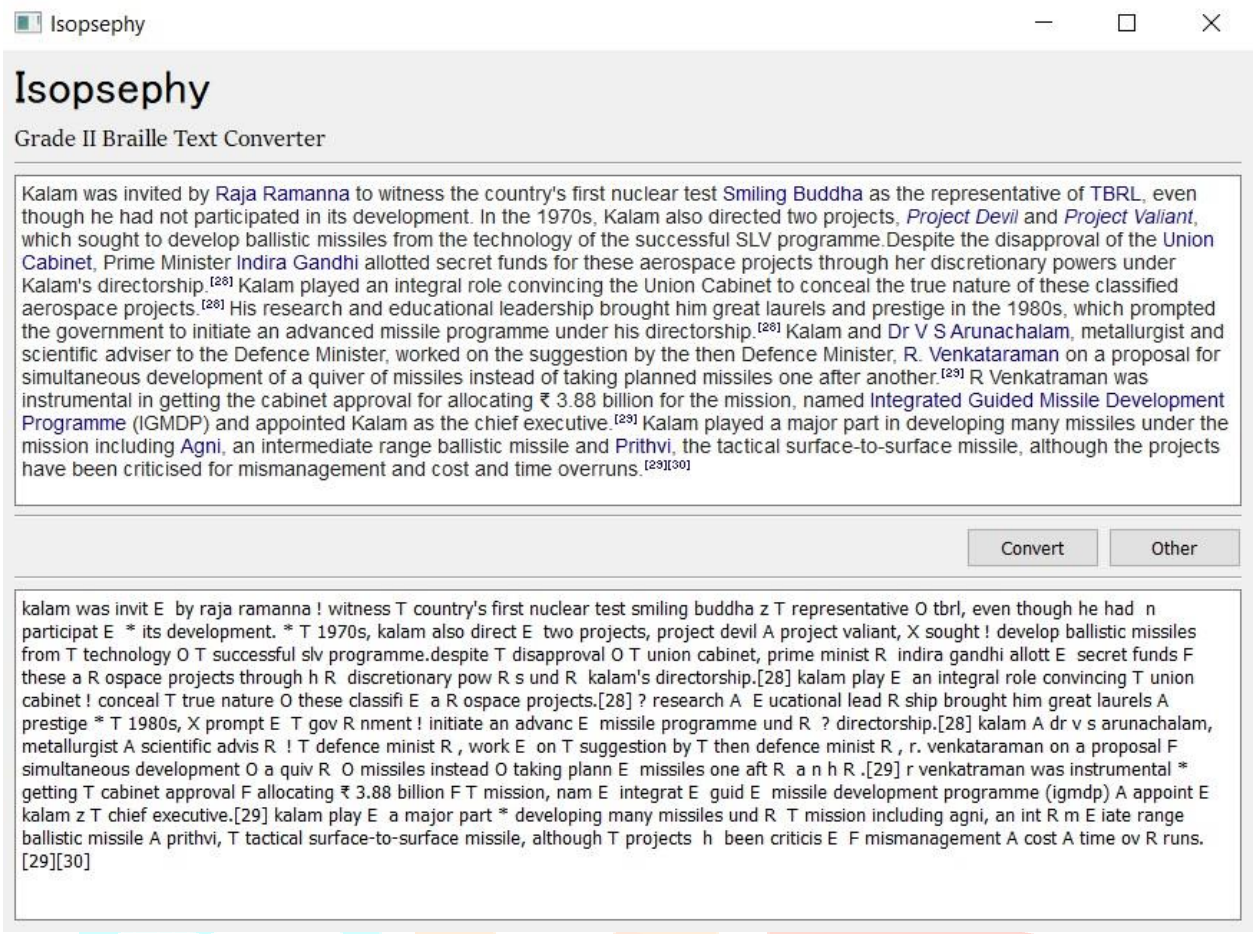

Fig: Isopsephy a Software for grade II Braille Text converter

VI. Use Cases

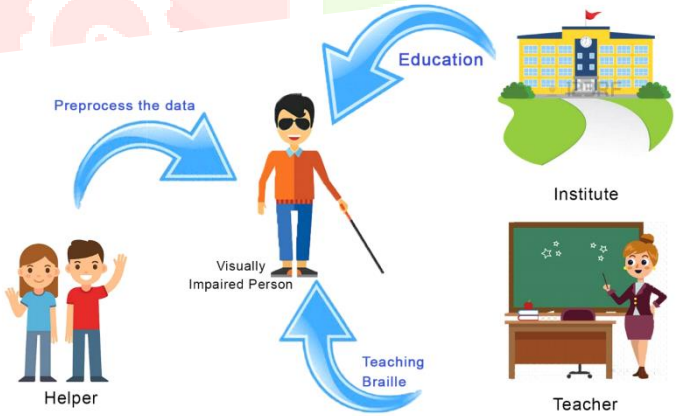

Fig: Use Cases

Fig: Our Prototype

1. There should be a person(helper) who will preprocess the text and save it in a SD card using PC or Smart Phone. The preprocessing is only required if the visually impaired person prefers Grade 2 Braille. No preprocessing is required for the Grade 1 Braille.

2. Once the preprocessing is done, he need to plug the SD card into the device and turn it on.

3. Then the Visually impaired person will be able to read as well as hear the text.

4. We have designed this device in such a way so that, it can also be used in the schools or any other institutions for teaching and learning Grade 1 Braille. So a Braille teacher can also take advantage out of it.

VII. Acknowledgment

Thanks to Senior Technical Officer Kumar Amitabh at NIELIT Agartala,

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