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Electronic Braille Reader
Minor Project Report

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Goals achieved till the midsemester:

Till the Midsemester, we were able to implement a part of the software of the Reader. Using LED lights, we were able to mimic the output of the linear actuators that we used in our final product.
We created a 3x2 Matrix that had 2 Braille Alphabets together, as it would imitate a conveyor belt mechanism where the Alphabet would shift from one set to the other.
For the implementation of our Model, we reviewed many micro-controllers and single board CPU's. We singled it down to a Raspberry Pi 3 CPU since we needed a good processor, a good no of GPIO pins and also the support of a great no of libraries. Using the Raspberry Pi 3, on a python script we created a dictionary for all the alphabets of the Braille and it read the .txt file and according to the dots that were supposed to be raised, sent the output to the GPIO pin and the required LED's would glow up in the matrix.
To understand the working of the Braille, we had to conduct research/survey in form of interviewing two visually impaired individuals who gave us insights in terms of the reading styles, no of fingers used and told us more about the limitations regarding the same. Also, in the presentations of the Mid Semester, we got constructive feedback in terms of adding useful features such as text to speech and regulating the size of the product and we have tried to incorporate the ideas to the best of our abilities.

Objective:

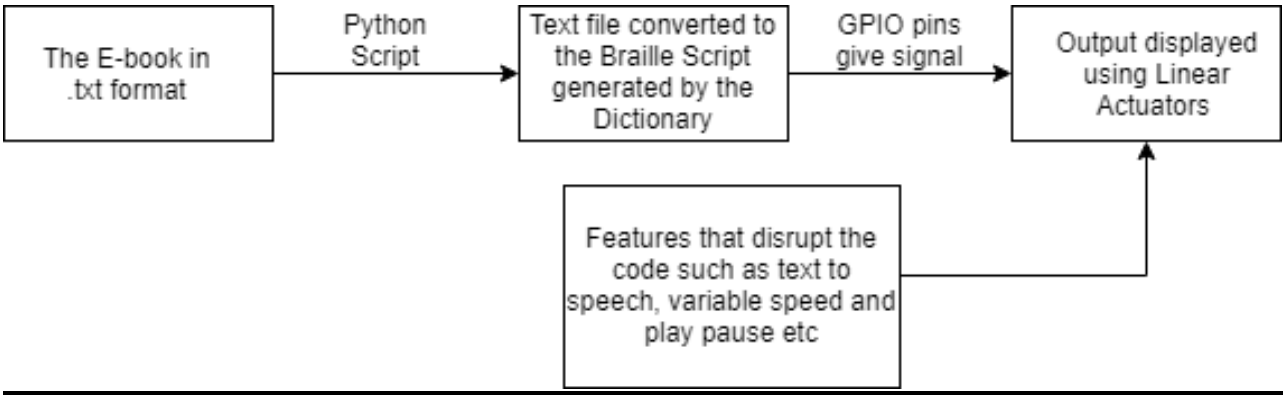
The main Objective of this Project was to develop a cost-effective, concise and user-friendly Electronic Braille Reader. By making use of Linear Actuators, we designed a dynamic tactile Braille dot system, that would be converting the E-book(in .txt format) to the Braille Dots in real time highly customized according to the user's convenience.

Braille:A Brief Overview

Braille is Comprised of 6 Dots in 1 cell, in a matrix of 3x2.
In a cell, there is a variation of 64 characters possible, which majorly comprises of alphabets, special characters, punctuation marks for grade-1 level and abbreviations and contractions of popular words in a grade-2 level braille. A few punctuation marks are represented by 2 cells.

Implementation and Circuit

Here we have designed a flowchart that describes the basic working of the actuators.



A Flow Diagram of the functioning of the actuation

As we can see, using python libraries we convert the .txt to the Braille Dictionary, then the Braille Dictionary gives the required output to the cell no, and then it gives a signal to the actuators. The other features like text to speech and variable speed are incorporated in the code and can be accessed through the buttons on the product.
One of the first challenges that we faced in the implementation of the circuits was that the actuators were operating at 5V, but at the same time, they were drawing a current of up to 1A to do so.
So to drive every individual actuator, we needed a transistor with a high current threshold, and thus we made use of the TIP 122 NPN Darlington Pair Transistor as it had a high collector

current threshold(5A).

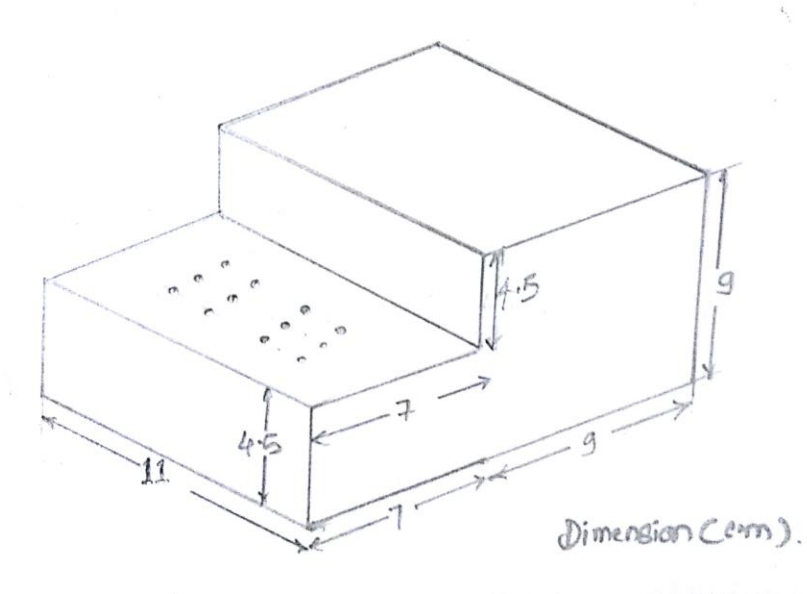
Since we were using an Inductor in the form of the solenoid, we made use of a 1N4007 diode as a flyback diode and we calculated the base resistance to be in the range of 800-1000 ohms.

Though the actuators were 5V/1A, on experimenting we found out that at 4.5V the current was only 0.7 A and even so the actual effect of the actuators was also retained while bringing down the heat dissipation as well as total current required.

In this case, we are using two power supplies of 5V/5A rating each to power each set of solenoids.

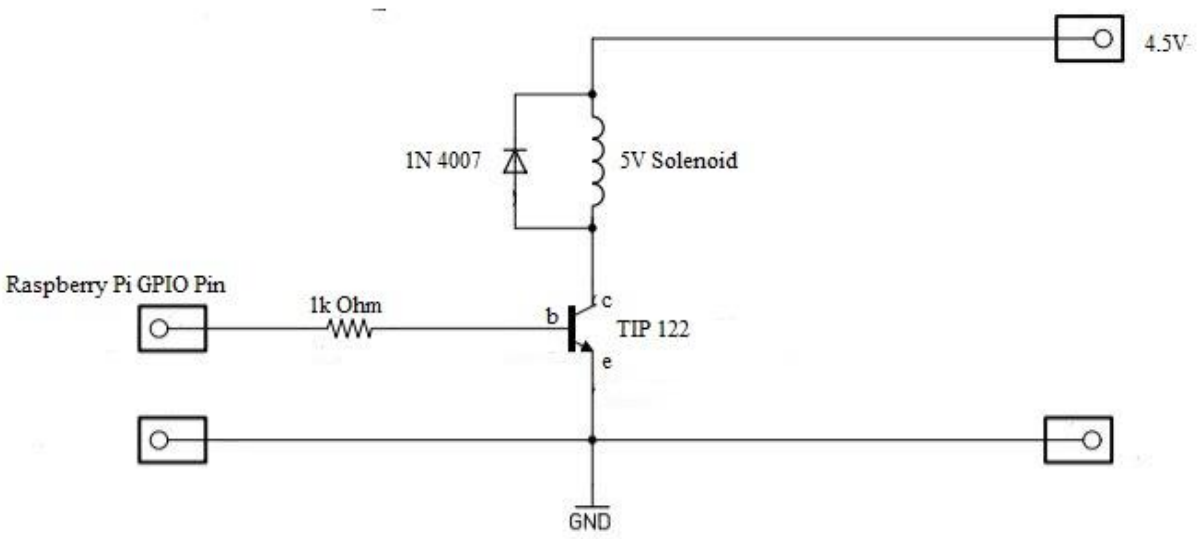
Also, since the solenoids dissipate heat, we made use of the heat sinks at ends of the solenoids to be able to properly disperse the heat out. We have also tried to expend the heat from the actuators by making use of thermal paste as well as insulating the tips of the actuators.

For the box, we have made use of a container made out of plywood so that there is proper airflow as well it helps the product to be lightweight.

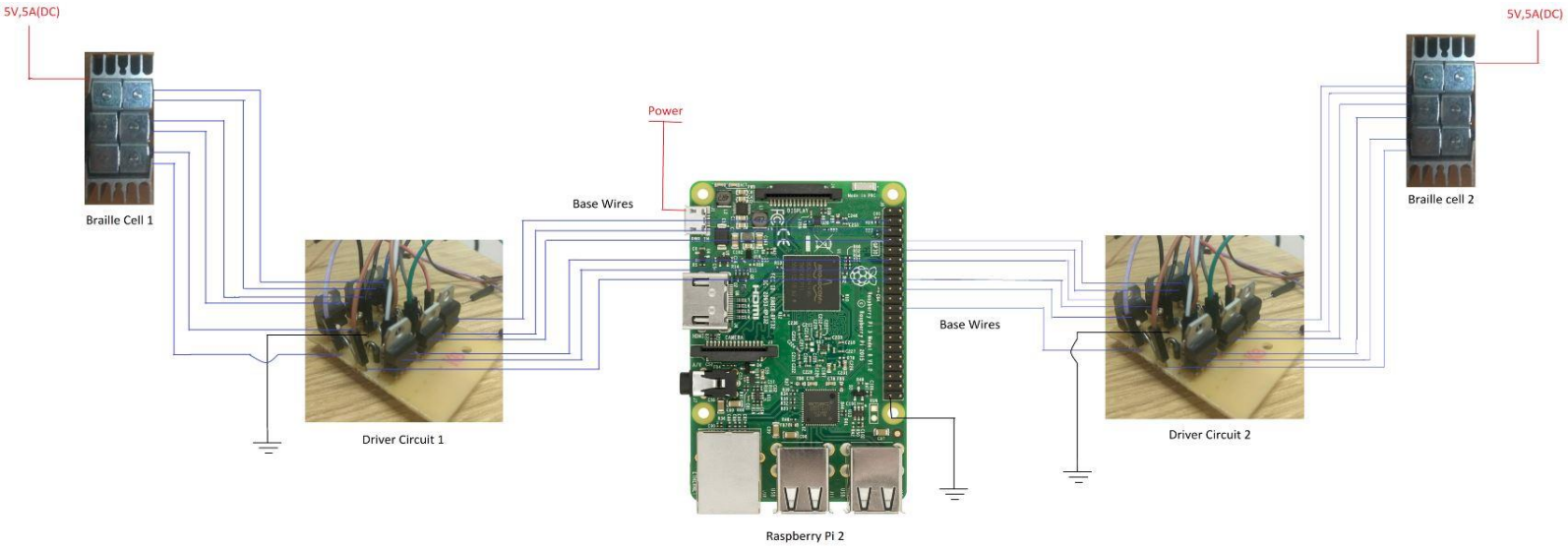


The Plywood Casing

Circuit Diagrams:



The Solenoid Driver Circuit



A representation of the connections

Features:

In this Model we have tried to make this as user-friendly as possible and incorporated a variety of features:

1. Variable Speed Control
2. Text to Audio
3. Play/ Pause Feature

These have been added keeping in mind their accessibility and feasibility to a visually impaired person.

1. **Variable Speed Control**

   By turning the switch ON/OFF the user can switch between the High and the Low speed which pertains to the speed in which the letters would change positions.

2. **Text to Audio**

   Making use of the python libraries as well as integrating the text to speech code, the person can plug in their headphone into the Raspberry Pi and instead of using

Braille can switch to the voice output of the text file.

3. **Play/Pause**

   Flicking the switch, a person can Play or Pause the book on demand while reading.

Demonstration:

The Device will be enclosed in a wooden box. A use will be able to read the braille language by keeping their fingers over the actuators. The Actuators will be driven by the Solenoid Driver Circuit. They have a feature of listening to the book instead of reading the braille.
Also, in case of disruption, they can pause the book at any time.