Mathematical Term and Word Recognizer

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***Abstract*— Speech recognition has found little use in recognition of textual material due to the large dictionary and hence large word error rates. Mathematical Term and Word Recognition constricts the speech recognition to math equations; it takes as input math formulas presented in the form of user speech and produces the equations in digital mathematical form. The smaller dictionary and the specific grammar structure of the math equations help restrict the problem of the recognition process. The program has room for smartly guessing words based on the grammar structure and thus resulting in a lower error rate and better recognition.**

***Index Terms*— Speech Recognition, Mathematical symbols, Machine readable format, Graphical User Interface.**

I. INTRODUCTION

Speech Recognition which is also known as automatic speech recognition (ASR). It is a voice recognition system which recognizes the spoken words and phrases and converts them to a machine-readable format. Presently there is no such software which convert spoken mathematical equation or formula into machine readable format. Therefore, our project aim is to recognize the spoken words, phrases and mathematical equations or formulae and convert into machine readable format. Later we will also add additional feature which automatically solve the mathematical equations. This project can also convert words and phrase at the same time which makes this project more challenging Example: - In x2 if we assign square as keyword then we are not able to write square as word. Therefore, to overcome this drawback we need complex grammar structure which solves all the problems.

There is no need to write math, with the help of our model user can speak to the model and then can save it to their system in many formats. Our model can recognize the term of algebra, trigonometry etc.

Even though speech recognition has infiltrated many applications, its use is still limited as a replacement to typing text. [2]People have to speak slowly and clearly and still expect errors when using speech recognition programs. That keeps the keyboard as the first option to text data entry. However, when it comes to math equations, people speak math equations much faster than they could type them or even write them by hand. For this reason, a speech recognizer may serve as a realistic and preferable option to typing math equations.

[1]Also, a speech recognizer that is focused on recognizing only math equations has a very specific dictionary to be followed, with very exact grammatical sentences thus allowing for lower processing time and better results. In other words, the recognizer has room for smartly guessing what the user is saying, hence greatly improving the accuracy of recognition. Having a very specific dictionary means much faster processing, since the system spends less time searching between available options.

II. SYSTEM ARCHITECTURE

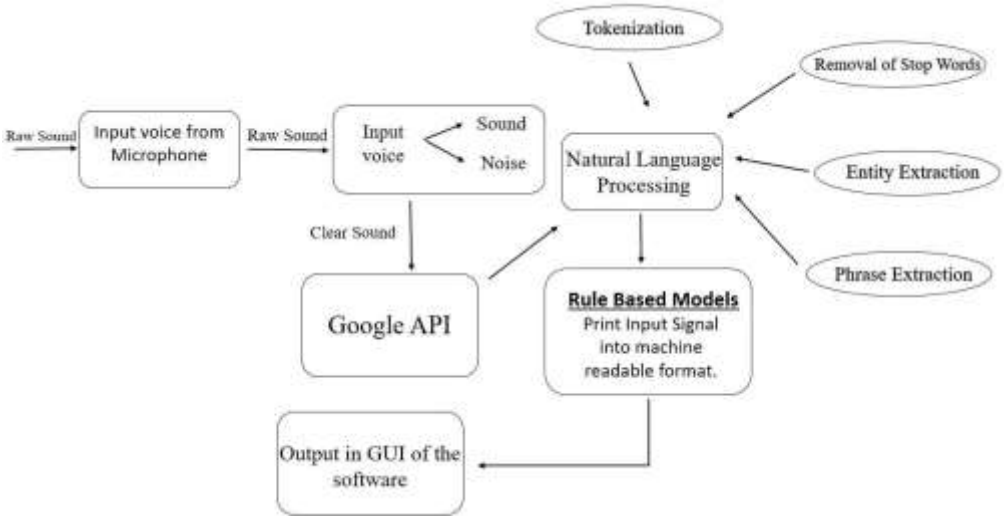

Figure 1.1 System Architecture

Fig. 1.1 shows the system architecture which are often used as a preliminary step to create an overview of the project without going into great detail, which can later be elaborated. It normally consists of overall application dataflow and processes involved. The above diagram has been used for the visualization of data processing and structured design of the prediction system and the work flow. The voice would be captured through external source such as Microphone. Background Noise of the captured audio then will be removed by using Ambient function. The cleared Sound then will be processed through Google's Speech Recognition API. To extract information from the content we will need to rely on some levels of text mining, text extraction, or possibly full-up natural language processing (NLP) techniques. After this Rule Based Model matches the Keywords and print the output as per grammar structured. After the completion of all process the output will showing on the GUI of the Software and the user have some feature to manipulate the output.

III. LITERATURE REVIEW

Earlier there were speech to text converter which were converting the pronounced words from speech into machine language which were not able to correctly recognize the mathematical equations, later there came the mathematical equation recognizer but the accuracy was too less. We went through few of the papers and studied them in detail. The observations of the same are included. The basic objective of the research is to offer a Speech-To-Text interface, where user can speak mathematical terms and the result will be shown on the GUI as same. This project can be big boost for many people, from students to writers who wants to write books on physics and mathematics.

Mathifier – Speech Recognition of Math Equations, Salim N. Batlouni, Hala S. Karaki, Fadi A. Zaraket, Fadi N. Karameh 2011. Currently Mathifier software is available only for research purpose or personal use not for commercially used. Mathematical term and word recognizer can be used commercially and due to which it can benefit people by saving their time and money. Mathifier software is created in java language and our MTWR is created using pure python language.[1]

IV. RESULTS AND DISCUSSIONS

In this project we take input from Microphone and convert that input into Mathematical equations or words.
Power: - for power say "**power ---------- stop**".
Bracket: - for bracket say "**bracket---------- stop**".
Example: - if you want to print " $(x+y)^{123}$ " just say " **bracket x plus y stop power one two three stop**". To print numbers, speak single digit only like for "**1024**" speak "**one zero two four**" not "one thousand twenty-four". You can speak directly squares and cubes like for "a^2" speak "a square" and for "a^3" speak "a cube".

Table 1.1 Algebraic equations

Example	Equations	Speak
1	$x^2+y^2=z^2$	x square plus y square equal z square
2	$x^{111}+bx+239 = z + 99$	x power one one one stop plus bx plus two three nine equal z plus nine nine

Table 1.2 Trigonometric equations

Example	Equations	Speak
1	$\sin^2\theta+\cos^2\theta=1$	Sine square theta plus cos square theta equal one
2	$1+\tan^2\theta=\sec^2\theta$	One plus tan square theta equal sec square theta
3	$1+\cot^2\theta=\text{cosec}^2\theta$	One plus cot square theta equal cosec square theta
4	$\text{Sin}^2(A+B)+\text{Cos}^2(A+B)=1$	Sine square bracket A plus B stop plus cos square bracket A plus B stop equal one

Table 1.3 Integrals

Example	Equations	Speak
1	$\int \sin^2\theta+\cos^2\theta \, d\theta$	Integration sine square theta plus cos square theta d theta
2	$\int (x^2+x+1)dx$	Integration bracket x square plus x plus one stop dx
3	$\int (\text{Sin}^2(A+B)+\text{Cos}^2(A+B))d(A+B)$	Integration bracket sine square bracket A plus B stop plus cos square bracket A plus B stop stop d bracket A plus B stop

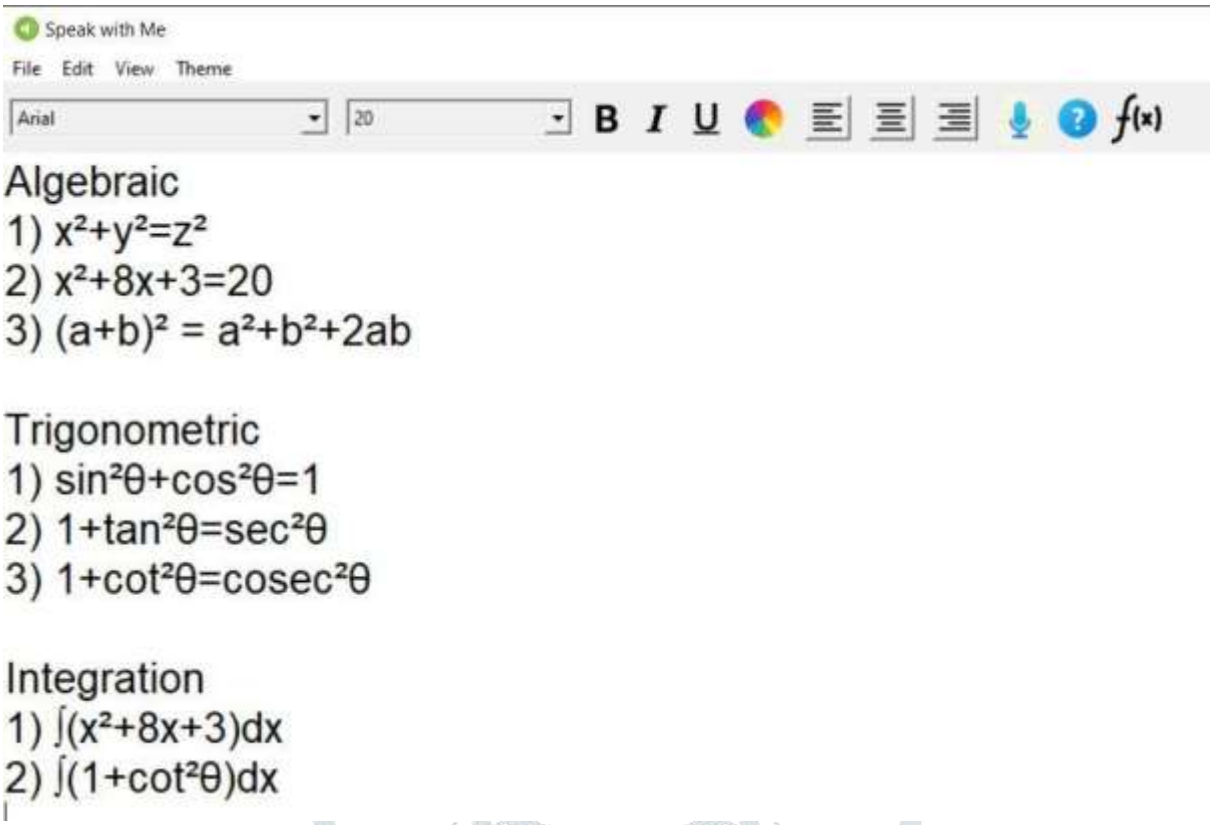

Figure 1.2 Results on GUI

V. CONCLUSION

Recognition and retrieval of mathematical notation are challenging, interrelated research areas of great practical importance. Hence Speech Recognition which is also known as automatic speech recognition (ASR) recognizes the spoken words an phrases and converts them to a machine-readable format. However, the Goal is to recognize appropriate speech (with less noise) and get the input of mathematical phrases correctly; which is achieved by Natural language processing and rule based models. We conclude by outlining expected developments and numerous opportunities for future research in this area. In general terms, we predict that future research will enhance the ability of recognition and retrieval systems to process a broad scope of notations and dialects, to exhibit robustness to noise, and to provide flexible, effective user interfaces.

VI. FUTURE WORKS

The Scope of Mathematical Term and Word Recognizer is vast, we have made sure to cover each area while implementing the project, but there is still some area which need to be given some more attention. One such area is during the recognition of Fractions and Roots, the model easily recognizes such equation, but during fraction and root, the model prints picture of equation which is immutable. As for now, the result which is obtained through speech can be saved only in Word and Text, but there is a scope of adding other format such as PDF as well.

VII. REFERENCES

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