International Journal for Research in Engineering Application & Management (IJREAM)
ISSN : 2454-9150 Vol-07, Issue-03, JUNE 2021

Voice Based Insulin Dosage Calculator for visually impaired

Atharva Joshi[1], Jagdish Kini[2], Vignesh Moorthy[3]

[1,2,3]B.E. Student, Dept. of Computer Engineering, SIES GST, Nerul, Navi Mumbai, Maharashtra, India.

***Abstract*— Diabetes places dietary burdens on those who suffer from it. Managing these burdens often requires performing calculations. Insulin dosage calculators have been developed to facilitate these calculations, but fail to address accessibility issues presented by visual impairment, often associated with diabetes. The device presented here is designed to provide an accessible insulin calculator for the visually impaired. This is primarily accomplished through a voice-based interface. For calculating the carbohydrate, the user may speak the name and portion size of the food to be consumed. A word recognition algorithm matches the spoken name with one stored in a food database on the device. From the database, the number of calories contained in the food is found. Using this calorie value, we calculate the carbohydrate intake by the user. This data, along with a weight, current blood sugar level, and target blood sugar level, is used to compute a recommended bolus dose, which is then presented to the user. We have also kept a text-to-speech model so that it will be an advantage to visually impaired people. It is expected that this device will improve the visually impaired ability to manage their diabetes.**

Keywords*— *Diabetes, voice module, insulin dosage calculation, Text to speech

I. INTRODUCTION

Diabetes is estimated to affect 9.3 percent of 9.3 percent the world. Of those 40% – 45% people are visually impaired. Technical innovations create many possibilities in supporting the treatment of people with diabetes. Diabetes is one of the chronic diseases that requires a lot of attention from both the patient and the healthcare team. Regardless of the type of diabetes, patients require full information about the disease through continuous education and promotion of health-seeking behaviors as well as regular glucose monitoring, individual treatment plans, and an early diagnosis to prevent the health threats associated with complications of diabetes. Telemedicine provides a number of tools that could be helpful in choosing the right treatment plan, supporting actions to change a patient's lifestyle, strengthening motivation regarding health-related activities, facilitating a patient's ability to self-monitor and control their condition, and achieving the intended therapeutic goal.

This system sought to address the shortcomings of bolus calculators with respect to visually impaired users. Visual impairment is a common complication of diabetes his has the potential to exacerbate the problem as the visual impairment can hinder the user's ability to use the tools available to manage their diabetes, the insulin dosage calculator is one such case.

II. LITERATURE REVIEW

This study aims to investigate speech recognition in a high noise environment. In this proposed a new method, which used speech enhancement combined with a discard feature model. The new method can effectively eliminate the influence of noise on the speech recognition system and obtain a complex environment with a large amount of interference noise. [1]

This paper emphasizes on how to devise an efficient technique that would reduce the time, cost and complexity over the deep learning methods with the guidance of genetic algorithms (GA) through intelligently choosing hyper-parameters of the networks. It has been identified that series of iterations to estimate, tune and re-estimate the hyper-parameters can lead to substantial improvement even with the least computing power, compared to one-go implementation of genetic algorithms done earlier.[2]

In this paper, they have proposed a recurrent Poisson process (RPP) which can be seen as a collection of Poisson processes at a series of time intervals. It aims at allocating the latent acoustic events in continuous time. Such events are efficiently drawn from the RPP using a sampling-free solution in an analytic form.[3]

To train the ASR for MoD, they have experimented with the HMM- based classical approach and Deep- Speech2 on Voxforge dataset. We then fine-tune the Deep- Speech2 model on MoD data. With very limited data and little finetuning of the model, we were able to achieve 14.727% Word Error Rate (WER).[4]

Throughout the insulin pump therapy, decisions of prandial boluses programming are taken by patients individually a few times every day, and, moreover, this complex

 DOI : 10.35291/2454-9150.2021.0342

ISSN : 2454-9150 Vol-07, Issue-03, JUNE 2021

process requires numerical skills and knowledge in nutrition components estimation. The aim of the study was to determine the impact of the expert system, supporting the patient's decision on meal bolus programming, on the time in range of diurnal glucose excursion in patients treated with continuous subcutaneous insulin infusion (CSII).[5]

III. METHODOLOGY

The Methodology is shown using a flowchart below, it shows the steps followed by the system as it gets input from the user.

- At the start of the application user is supposed to mention the mention the weight in kg, current blood sugar value, target blood sugar using voice input. The voice input given by the user will be recognized by the speech to text module.
- After this the user has to provide the food name and portion of food eaten by the user using voice input.
- Using this food names, we search for the corresponding calorie value from the data base and calculate the total calorie value. If the user eats more than one food item then the carbohydrate value gets added to the previous carbohydrate value and total carbohydrate value is found.
- If a certain food is not found then the user can provide the corresponding food name as a suggested food.
- After this based upon the total calories, we find the required amount of insulin that is to be taken using insulin dosage formula.
- The amount of insulin calculated by the user is then provided to the user using the text to speech module.

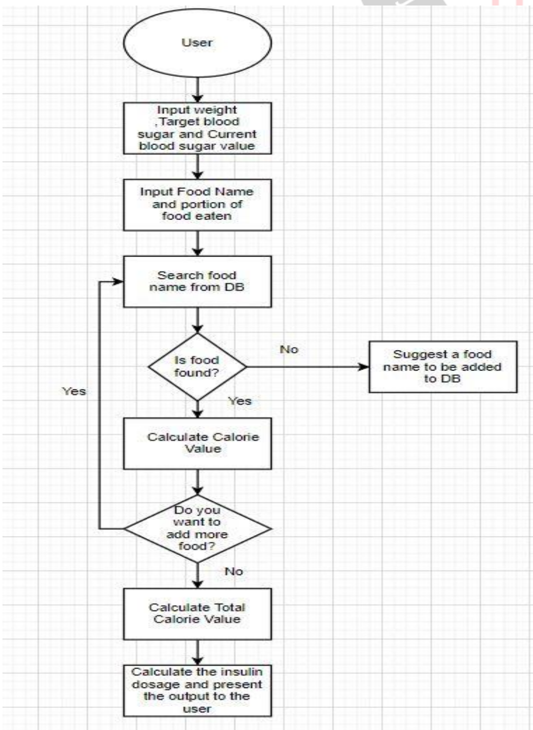

Fig 1. Flowchart

IV. PROPOSED SYSTEM

Design of our Proposed system:

DFD Level 0:

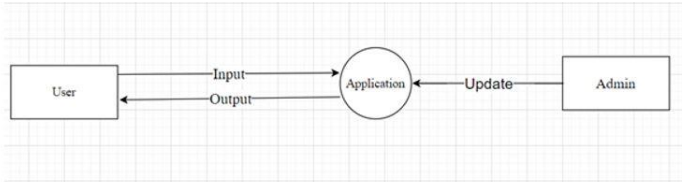

Fig 2. DFD Level 0

DFD Level 1:

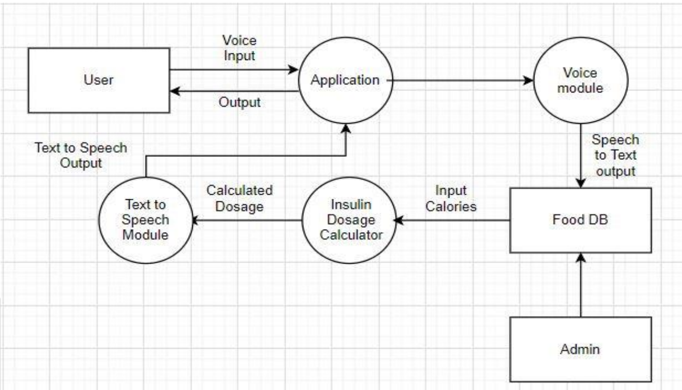

Fig 3. DFD Level 1

The main objective is to make the system voice-based interface. The user may speak the name and portion size of the food to be consumed. A voice module matches the spoken name with one stored in a food database on the device. From the database the quantity of calories contained in the food are found. Using this calorie value, we can get the carbohydrate content present in the food. This data, along with weight, current blood sugar level and target blood sugar level, is used to compute a recommended bolus dose, which is then presented to the user. We have also provided text to speech module so that it will be another advantage for the visually impaired people.

Speech-to-text module

We have created our Speech to Text module in android studio using the speech recognizer class. First, we started by creating the layout for our voice module. In the layout we first we created the mic using the vector asset property of the Android studio. After this we created the Text box and the Edit box using the EditText and TextView property of the Android Studio. We have used the TextView for placing the mic and EditText for getting its output. After creating the layout for the speech module, we start the process of speech to text conversion by providing the permission needed for the process. Basically, we need two permissions for speech module i.e., Internet Permission and the Audio Record Permission. We obtain the Internet permission for using the internet of the user and the Audio record permission for recording the user speech so that afterwards we can use this speech for speech to text conversion. After providing the permission we setup the

 DOI : 10.35291/2454-9150.2021.0342

speech recognizer class. For setting up the speech recognizer class first we need to initialize the class and then create an intent for recognizing the speech. After this we setup the listener to listen to the user speech and convert it into text. For setting up the listener we need 3 methods i.e., Beginning of speech method, OnResults method and OnTouchListener method. After doing the above all processes, we can convert the speech to text.

Text-to-speech method

We have created our Text to Speech module in android studio using the TextToSpeech class. First, we started by creating the layout for our Text to Speech module. In the layout we first we created the play using the vector asset property of the Android studio. After this we created the Text box and the Edit box using the EditText and TextView property of the Android Studio. We have used the TextView for placing the play and Edit- Text for getting its output. After creating the layout for the Text to Speech module, we start the process of text to speech conversion by initializing the TextToSpeech class. After initializing the TextToSpeech class we setup the initListener method. For setting up the initListener method first we needto call the method and then define an if condition for checking the success of TextToSpeech class. After this we setup the language for our module. For setting up the language we need setLanguage method and provide the Locale as a parameter to the method. Once the language is set, we call the speak method of the class to speak the text.

Insulin Dosage Calculation

We convert the weight provided by the user in kilograms to pounds.

Weight in pound = Weight in Kg * 2.2

We divide the weight in pounds by 4 to calculate the total daily insulin dosage requirement.

Total insulin dosage requirement = Weight in pound / 4

Carbohydrate coverage ratio

Carbohydrate coverage ratio = 500 / Total insulin dosage requirement

The insulin needed to cut down the total calorie

Insulin for carbohydrates = Calorie intake / Carbohydrate coverage ratio

Correction factor

Correction factor = 1800 / Total insulin dosage requirement

Insulin needed to cut down the blood sugar

Insulin for blood sugar = (Current Blood Sugar – Target Blood Sugar) / correction factor.

Total Insulin dosage = Insulin for carbohydrates + Insulin for blood sugar

V. RESULTS AND DISCUSSIONS

We have created 3 layouts in our insulin dosage calculation. First layout is the main page where insulin dosage calculation is done. The first page consists of inputs like weight, current blood sugar level, target blood sugar level etc. Second layout is for the calculation of carbohydrate value from the food intake. In this layout the user can has to provide the food name and the portion of food eaten by user for calculating the total carbohydrate value. Third layout is for the user suggestion to add any food in the database. We have kept this layout so that user can suggest food items that are not present in the current database. We have also provided the voice module and text-to-speech module wherever needed.

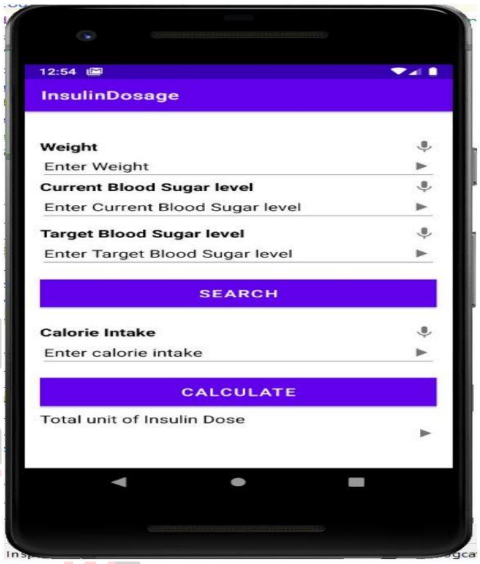

Fig 4. Layout 1 of the app

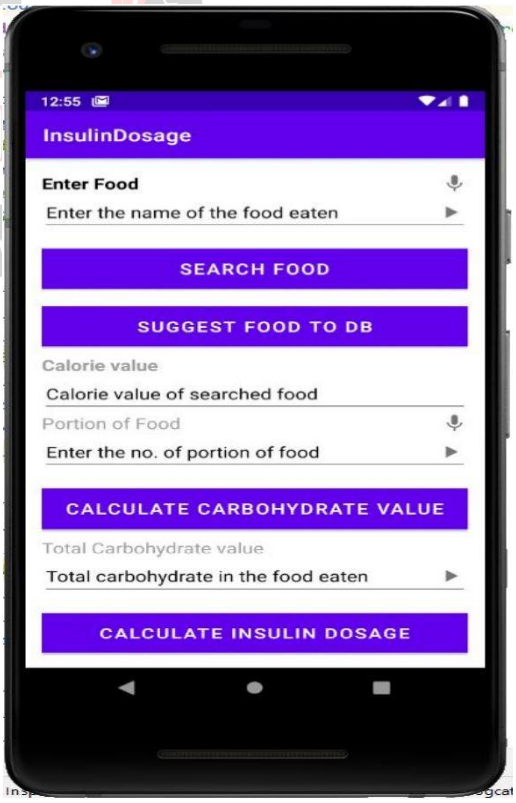

Fig 5. Layout 2 of the app

 DOI : 10.35291/2454-9150.2021.0342

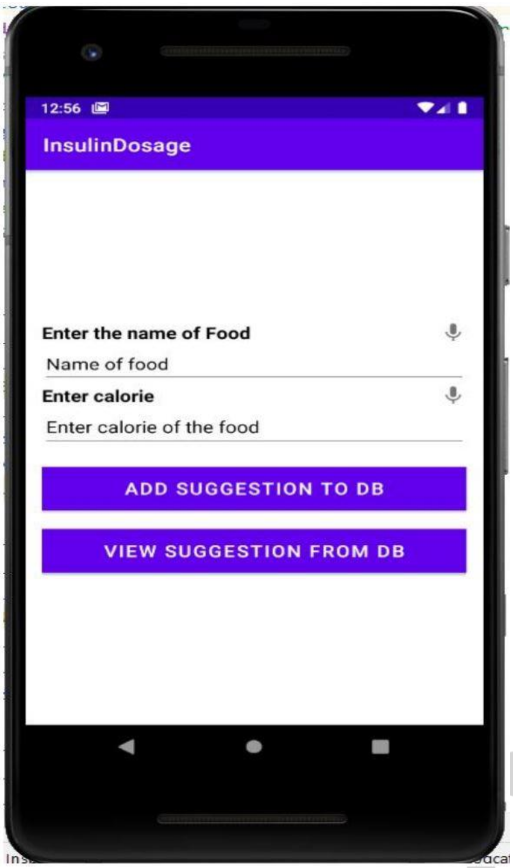

Fig 6. Layout 3 of the app

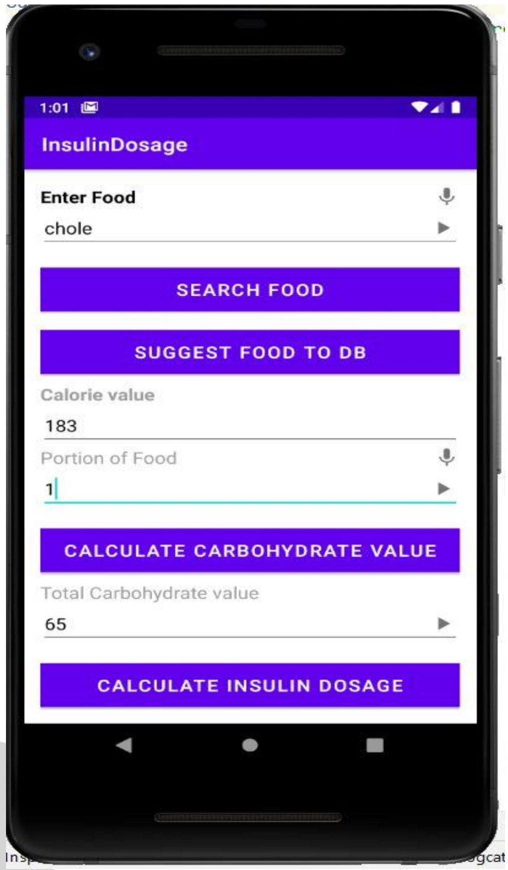

Fig 8. Page for calculating carbohydrate value

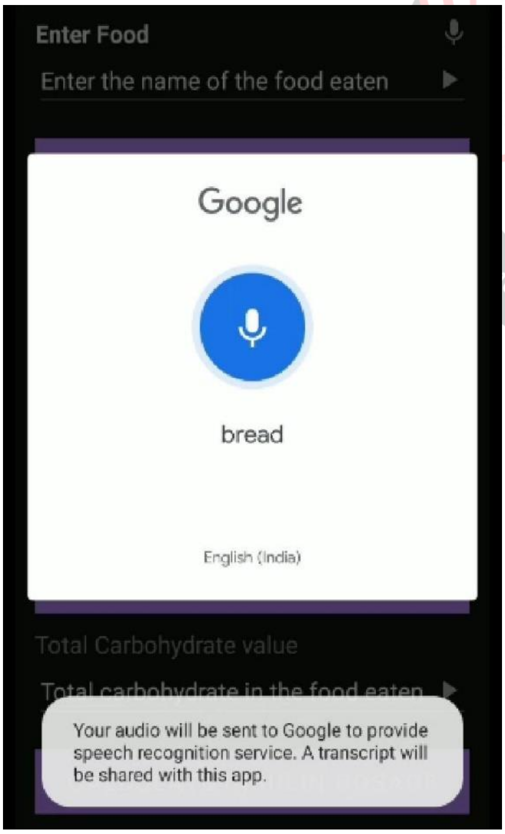

Fig 7. Speech recognized by the app

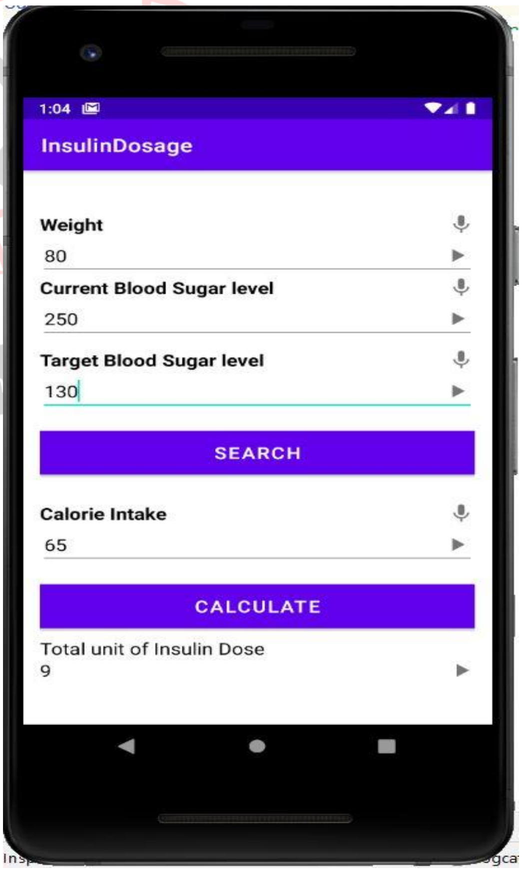

Fig 9. Calculated insulin dosage value

 DOI : 10.35291/2454-9150.2021.0342

ISSN : 2454-9150 Vol-07, Issue-03, JUNE 2021

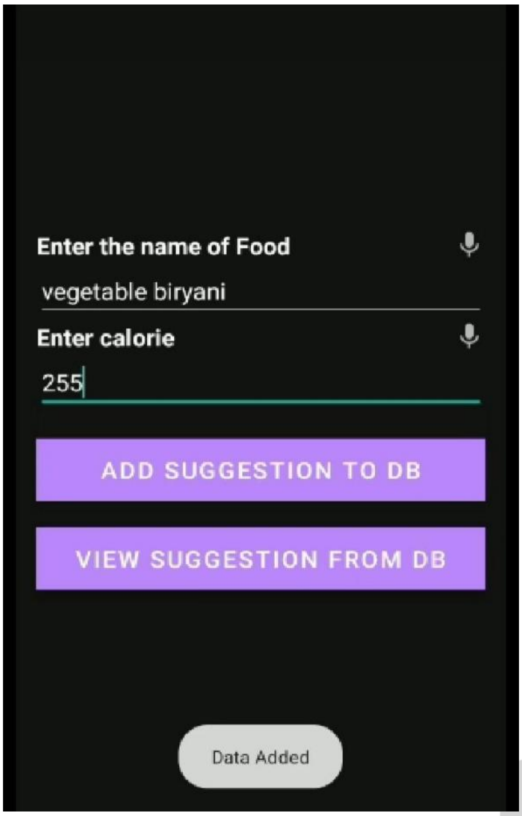

Fig 10. Adding user suggested food to the database

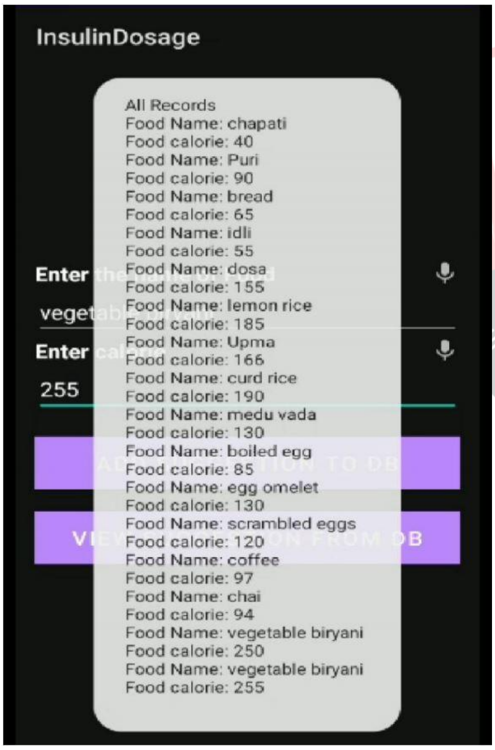

Fig 11. Viewing Suggested Food Items

VI. CONCLUSION

The proposed system will provide the correct insulin dosage value that is to be administered by the user based upon the food and servings input provided by the user. The system provided here can correctly identify the speech spoken by the user. In case if a specific food is not available in the database, then the user can the food item in the suggestion part. The suggested food provided by the user will be later added into the database by the admin. The output of the insulin dosage is also provided as speech output. The system mentioned here is easy to use. This system will help in improving the health of the diabetic patients.

VII. FUTURE SCOPE

The system can be made more efficient for the user by taking all the necessary inputs at once through a voice input. The food database can be increased so that all the required food item is present. The layout can be more attractive.

REFERENCES

[1] Chunling Tang 1, Min Li “Speech Recognition in High Noise Environment”

[2] Mohsin Uddin Anwar, Liakot Ali “Boosting Neuro Evolutionary Techniques for Speech Recognition”

[3] Hengguan Huang, Hao Wang, Brian Mak “Recurrent Poisson Process Unit for Speech Recognition”

[4]Ranjodh Singh, Hemant Yadav, Mohit Sharma, Sandeep Gosain, Rajiv Ratan Shah “AUTOMATIC SPEECH RECOGNITION FOR REAL TIME SYSTEMS”

[5] Ewa Pańkowska, Piotr Ładyżyński, Piotr Foltyński, and Karolina Mazurczak “A Randomized Controlled Study of an Insulin Dosing Application That Uses Recognition and Meal Bolus Estimations”

[6] Aaron Niche, Godfrey A. Mills “VOICE RECOGNITION USING ARTIFICIAL NEURAL NETWORKS AND GAUSSIAN MIXTURE MODELS”

[7] Piotr Ladyzynski, Janusz Krzymien, Piotr Foltynski, Monika Rachuta, Barbara Bonalska “Accuracy of Automatic Carbohydrate, Protein, Fat, and Calorie counting based on Voice Descriptions of Meals in People with Type 1 Diabetes”

[8] R. Thiruvengatanadhan “Speech Recognition using AANN”

[9] Moritz, N., Hori, T., Le Roux, J. “Triggered attention for End-to-End Speech Recognition”

[10] Yogesh Kumar, Navdeep Singh “A Comprehensive view of Automatic Speech Recognition System – A Systematic Literature Review”

[11] Neha Jain, Somya Rastogi “Speech Recognition Systems – A Comprehensive Study of Concepts and Mechanisms”

 DOI : 10.35291/2454-9150.2021.0342