

Sinhala Chatbot with Recommendation System for Sri Lankan Traditional Dancers

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Abstract— Traditional dancing which originated in the 4th century B.C. is one of the most popular dancing styles in Sri Lanka. Though it has highly developed throughout the years, novel technologies are not much engaged with the development of traditional dancing. Therefore, Sri Lankans still use ordinary methods even for finding choreographers, dance track editors, props providers and costume providers. These have become the most common problems of Sri Lankan traditional dancers. With the objective of giving a computer-based solution for these problems, the paper proposes an information providing website that acts as a location and rating-based service provider recommendation system capable of solving the ‘cold start problem’. Since most of the terms related to traditional dance are in Sinhala, the web system was created in English as well as in Sinhala for ease of use. A Sinhala chatbot has also been introduced to the system, making it easier for any local user to use and a user-to-user private chat system is also proposed to directly communicate with service providers. The system is able to identify the five closest service providers with the highest ratings for users and generate more user recommendations based on location and ratings. Chatbot has achieved a good level of accuracy in directing users and answering user questions.

Keywords: *information providing platform for dancers, place recommendation system, nearest place finding system, Sinhala chatbot*

I. INTRODUCTION

Sri Lankan has been called the “Wonder of Asia” due to its phenomenal natural beauty and multicultural background. Without any doubt

dance is one of the most popular performing art which act as a main element of this culture. The origin of dance in Sri Lanka goes back nearly to 3 B.C where it started as a method to expel natural disasters and sicknesses and as a result of various spiritual belief in gods (Rajapakse, 2004). Up to now, various dance styles have been introduced throughout its development journey and many western dance styles have also been studied by Sri Lankans. As of today, there are mainly three dance styles according to regional variety as, dances of the hill country (known as Udarata Natum), dances of the low country (known as Pahatharata Natum) and Sabaragamuwa dances (known as Sabaragamu Natum) (“Traditional Dances of Sri Lanka | Amaya Resorts & Spas Blog,” n.d.). Other than these main categories, there are some inherent dance styles such as devil dances, folk dances, dance dramas and some foreign dance styles such as kathak, ballet, hip hop, salsa, polka, tango etc. in Sri Lanka (“Dances of Sri Lanka: Culture, History and Where To Watch Them,” n.d.). All these dance practices vary in their styles of movements and steps, in costumes worn by performers, dance props used and, in the rhythms, sounds, songs and instruments used to the dance.

Although Sri Lankan dance is highly developed and popular all over the world now, it is one of the domains of Sri Lanka that is not much connected with modern technologies. While finding for a suitable way, to bridge these two fields, identified the several most common problems of Sri Lankan dancers can be solved using computer-based system. Nowadays, the most common problem of Sri Lankan dancers is the lack of a proper method to find details of dance service providers.

When focusing on current methods of finding dance service providers, the most used method is to ask someone familiar with the dance. The main disadvantage of this method is that they should rely on the scope of that person's knowledge and the recommendation made by one person may not be so reliable. In this kind of situation internet search engines also do not provide significant results as they only display information about few most popular dance service providers usually in the western province. But there is no use of details about a choreographer in Colombo, to a person who are searching for a dance choreographer from Eastern province. On the other hand, there is not even a written/ printed manual database in anywhere about dance service providers in Sri Lanka. Thus, this paper is proposing an intelligent website which provides details about service providers. The system aims to make it easy to find information to Sri Lankan dancers about required dance service providers, quickly and accurately throughout a standard database. In order to achieve the above aim the following key objectives has been identified.

- Computerizing information about Sri Lankan dance choreographers, track editors, costume providers and props providers.
- Allowing users to find the nearest service providers to their preferred location.
- Displaying information of service providers in the detailed vise, summarized vise, and category vise.
- To reduce the user effort on searching for different services many times, providing relatable suggestions about other service providers according to users' locations.
- Implementing Sinhala chatbot to increase the user interaction and user friendliness.

For comparison, there is still no local system in Sri Lanka to solve this research problem. But some websites have been implemented to find the nearest choreographer in foreign countries("The 10 Best Dance Choreographers Near Me 2021 // Lessons.com," n.d.) ("The 10 Best Dance Choreographers Near Me (with Free Estimates)," n.d.). But there is no website to find all the basic service providers on the same platform. This method is useful for users looking

for service providers as well as dancers looking for service providers. It is because some unpopular service providers may register as a service provider for the system, which may increase their popularity and sales. In the proposed system, users are recommended about service providers by first comparing location and secondly by considering user ratings. Thus, even a service provider who is new to the system will recommend to users if they do not have ratings.

II. LITERATURE REVIEW

A. Prevalent Methods

As mentioned earlier, this research is mainly conducted to give a solution to Sri Lankan traditional dancers to the problem of lack of method to find details about dance service providers. They are unable to find service providers in an accessible distance and find their contact details because of this issue. While searching about existing methods dancers use to find service providers, mainly identified methods are as followed,

- By asking someone who has knowledge of dance (ex: Ask from a dance teacher)
- By searching the internet

After identifying the present manual methods, the requirement of a proper database with details of Sri Lankan dance service providers was identified. Through this literature review, it was able to identify the earlier applied techniques and methodologies by other researchers to implement similar systems and advantages and drawbacks of them.

B. Nearest Place Finding System

The nearest place and people finding systems are highly growing development to increase the efficiency of people all over the world. It is a much important feature to the proposed system also, as dancers may need to access a service provider at least once. For examples, before planning a dance, the choreographer should check the stage/area of the dance. Most of the time it happens by physically accessing the space as it is the best way to get an idea of the use of space. To get measurements, to correct costume errors, and to get rented costumes

back, the costume providers also need to be in physically accessible distance. Therefore, system should compare a user's input address with service providers' location address to calculate the minimum distance and select the nearest service provider. To investigate the technology behind this function, relevant research publications in various domain were reviewed.

The paper (Ahmed et al., 2017) has been proposed a system with services such as online hotel exploration, reservation and finding the best path to nearest hotel. The researchers have been used Dijkstra Algorithm written in PHP to implement the function of finding nearest hotel.

Another research study (Chamikara, 2013) which has been conducted by four Sri Lankan researchers have been proposed a system to identify the nearest police station to a user location using different methodology. It based on classification technology, and it has been implemented using integration of J48 algorithm with GIS (Geographic Information System) and a GPS (Geographic information system) technique. Users can select their location through the Google map and then the longitude and latitude information of that location has been used to classify that place into predefined police station group. Then the identified nearest police station has been indicated on the map.

C. Recommender System

Recommender Systems are a subset of information filtering systems and are software tools and techniques providing suggestions to the user according to their need. It is a way of reducing the user effort on searching for many items. Thus, it helps to give more user-friendly environment for the websites, and it has become a popular feature of many E-commerce sites.

There are mainly two types of recommendations can be categorized into three main categories as content-based recommendations, collaborative recommendations and hybrid recommendations based on the way they are made (Shah et al., 2017). The idea behind collaborative filtering is people who agree with the evolution of same items in the past are likely to agree again in future. These types of

recommendations are easy to make. Collaborative Recommendations can be further divided into two categories as Neighborhood based, or model based. Content based recommendations are made based on a comparison between content of the item and a user profile data. These types of recommendations are difficult but good at generating recommendations to new users. other type of recommendations are hybrid recommendations which implements as a combination of earlier discussed filtering methods.

The proposed system takes user location as input from the users and provide recommendations based on that location and ratings of service providers to users. The paper (Han, 2012), has been proposed an exploitation model of personalized recommendation system based on Multi-Agent Collaboration system. This multi agent system has been proposed with multiple agents to perform different tasks. Basically, two algorithms have been used to in this system to generate recommendations. Collaborative filtering algorithms have been used as the recommendation algorithm to comparatively analyze user's past interests and behaviors with other target users. Thus, the system has been based on both client-client and project-project relationships. A similarity algorithm also has been used in the system to predict the similarities between users. But according to the paper (Ghanwat and Chacko, 2017) collaborative filtering methods are less effective in providing solutions to the cold start problem and data sparsity Problem. It is because this method generates recommendations by analyzing earlier user preferences or similar user behaviors, which reduces the chance of generating accurate recommendations of new user/item. Thus, they have been proposed an approach which combined review text and rating to generate recommendations. They have been used machine learning techniques to predict user ratings on unknown items according to the aspects that user is interested. The architecture behind that was, they have implemented a model to find the aspects and sentiments in the user reviews. After analyzing the sentiments in reviews that system has been created a profile for item and user by presenting

important characteristics of the item and user. Finally, they are calculated using decision tree algorithm to predict the ratings.2

D. Chatbot

Chatbot is one of the novel applications of Artificial Intelligence which act as virtual agents on software applications. It is a software application which can communicate with user in natural languages. The key technology behind this application is Natural Language processing. Chatbots interact with human users and simulates conversations through text messages or voice outputs. The most famous examples for chatbots are Alexa from Amozon, Siri from Apple, Cortana from Microsoft, Google Assistant etc (Smutny and Schreiberova, 2020). In the proposing localized system, users may need more interactive proper guidance to work with the system due to the novelty of this kind of application. Therefore, a chatbot application was implemented to answer user questions.

The paper (Jayalath et al., 2019) has been implemented to provide information about ayurvedic plants, their information and information about doctors and their locations. As it was a localized system, they have implemented a Sinhala chatbot as virtual assistant to answer user questions. The chatbot intent and patterns have been defined in plain JSON files. For the classification of user input and recognition of intent tensorflow and Python have been used. Though chatbot applications are very useful in increasing the interactivity of the system, the large number of questions receiving from users may leads to some misbehaviors. As a solution for this problem a system has been proposed (Calvaresi et al., 2019) a chatbot to answer questions efficiently and handle thousands of messages simultaneously which has been implemented using Multi-Agent Framework. That chatbot has been implemented in social network webpages for smoking cessation. The paper has been proposed a multi agent approach with common modules and structures for all the agents. Thus, instead of single chatbot, multiple chatbot applications worked on the same goal simultaneously to increase the efficiency.

III. METHODOLOGY AND DESIGN

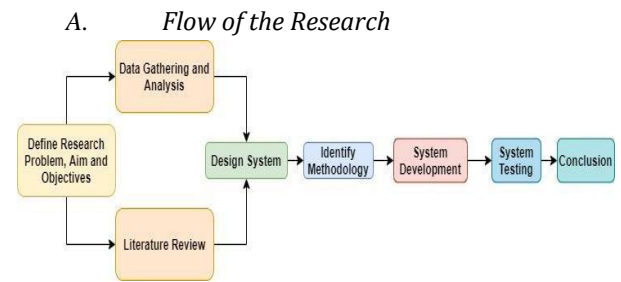


Figure 1. Flow of the Research, Source: Author

B. *Requirement Gathering and Analysis*

This Study was started by identifying what are the exact problems of Sri Lankan dancers that needed be addressed. For that purpose, a very simple survey was conducted using 91 dancers (“E-Guide Application for Dancers,” n.d.). The survey kept as simple as possible to ensure that it was easy for each participant to respond. With the obtained results from this survey the research objectives were defined and then started to design the proposed system to fulfill each of them. Identified main problems of Dancers are as follows,

- Finding a Dance Choreographer
- Finding a Dance Track Editor
- Finding a Dance Costume Provider
- Finding a Dance Props Editor

After identifying the research problem, it was broken down into several sub questions to identify that what should be the exact objectives of the project to achieve the project aim. Following research questions were formulated with the aim of identifying areas that need to be studied in more depth to find a proper solution to the research problem. They pinpoint exactly what to find out and gives a clear focus on the research study. Also, these research questions highlight the key features of the proposed system to cover all user requirements.

- Question 1: What is the computer-based solution that can be given to solve the research problem?
- Question 2: What kind of information should the system provide?

- Question 3: What should be the most important functions of the proposing system?
- Question 4: How to use novel concepts and technologies to increase the efficiency and user friendliness?

C. Proposed System Design

1) Overall System Architecture: The overall system architecture defines the how the components of the system are related. The architectural design is given in a layered architecture under the three layers of presentation layer, application layer and database layer.

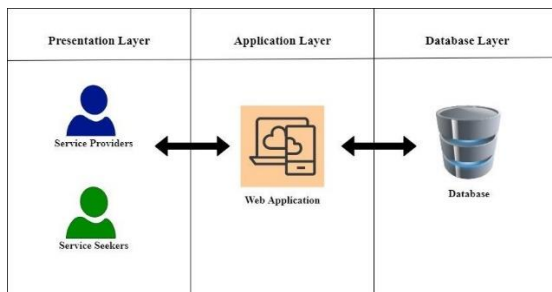


Figure 3. Overall System Architecture
Source: Author

2) Modular Architecture:

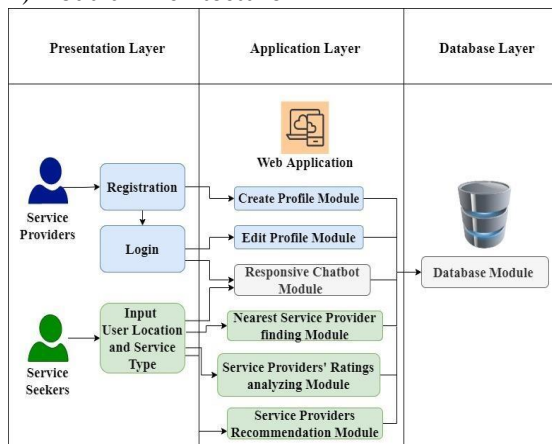


Figure 2. Modular Architecture
Source: Author

D. Data Gathering

Data gathering phase was an important and hard step which had to gone through while developing this computerized database of service providers' details. As mentioned earlier, there is no even a manual database to collect this

information. Therefore two google forms has been created in both English and Sinhala medium to gather details and distributed it among service providers ("Collecting Information about Sri Lankan Traditional Dance Service Providers,," n.d.) ("ශ්‍රී ලංකාවේ නර්තන ව ඵේවා පයන්තන් පිළිබඳ විකාරකුරු රැ ඵේ කිරීම,," n.d.). But very few of them came forward to fill it, though the google form did not request any sensitive data of them. Thus, had to contact each service provider personally to gather data. It was also a difficult process to make time to meet them physically due to their busy schedules. Finally had to collect them over the phone or emails to gather required information and it was a time-consuming process.

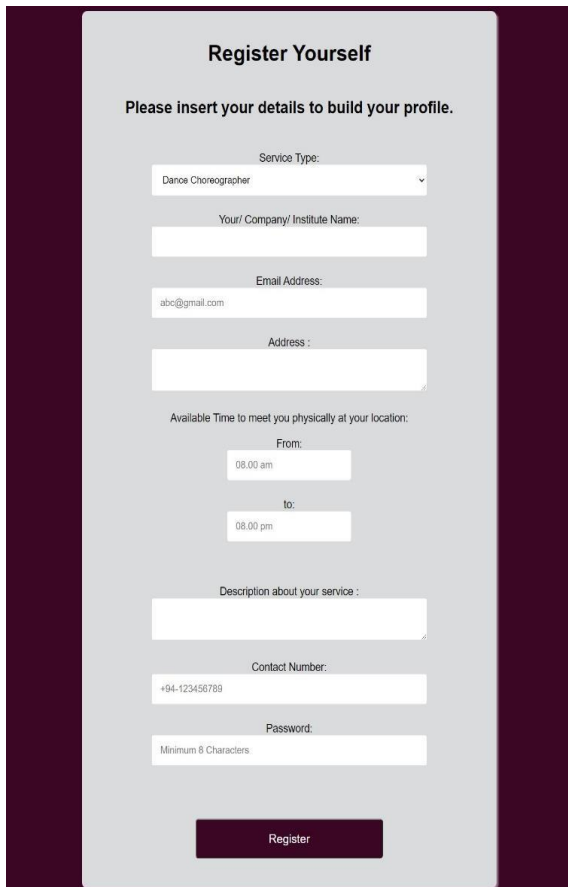
The collected database contained basic information about service providers, such as name, email, address, location, available time to meet them at their location, service description, and contact number. The details are divided into four categories according to the service category of the service providers. In addition, the current ratings and number of reviewers of service providers are extracted from Google Map and social media for testing purposes.

Technology Adaptation

1) *Website Development:* The main requirement according to the identified research problem is a standard database with details of Sri Lankan dance service providers. There occurred the doubt of whether a website or an android application is more appropriate. For this, the early mentioned google survey was used to ask preference of selected 91 dancers. Majority of them were opted for a website over an android application. The website implemented using HTML, CSS, JavaScript and PHP.

2) *Database Architecture:* When computerizing dance service providers information, the next question was what specific information users should know about dance service providers. Thus, at the home page of the website, the system categorized users as service providers or service seekers. Service providers can register into the system by filling the registration form and there collected information such as name, email, contact

number, address, available time, and a simple description about them/their service to show service seekers.



Register Yourself

Please insert your details to build your profile.

Service Type:

Your/ Company/ Institute Name:

Email Address:

Address :

Available Time to meet you physically at your location:

From:

to:

Description about your service :

Contact Number:

Password:

Figure 4. Registration Form
Source: Author

In the data gathering phase, the techniques that have been used are google forms and interviews conducted over the phone. The gathered data was stored in four tables (choreographer table, track editor table, costume provider table and props provider table) of MySQL Database according to the service types selected by service providers. Rather than gathered details the database contains a table which stores rating details of service providers. These rating details were got from google Map. In addition, service seekers' location details also stored in a different table.

3) *Google Map API*: When looking for a service provider, the primary consideration is whether his or her workplace is physically withing reach. Then consider the quality of service and reliability of the service provided. Therefore, this system should primarily offer the service seeker, the service providers closest to

his/her location. The system takes service seeker's location and service providers locations as an input to the system and then they are converted to longitude and latitude coordinates using google geocoding API. These coordinates also stored in particular tables of the database. The distances between these coordinates are calculated together using google Distance Matrix API. The coordinates of service seekers' addresses are determined as source and the coordinates of service providers are determined as the destination. Then service providers, the destinations are sorted into ascending order considering distance with the source. This process ensures providing accurate location-based recommendations to users.

4) *Rating based recommendations*: The system allows service providers to display pictures of their previous works as evidence to give users an idea about the quality of their services. But, because this is not sufficient, "rating", another world-renowned method is selected to provide recommendation about service providers to users. Because factors that measure the quality of service vary from person to person, the use of this method can give an idea of the general opinion of more people. But the problem is the rating value of a service provider should be always checked with the number of rated users. It is because the service provider who has 4.0 rating value obtained from 25 users, will be more suitable than a service provider with 5.0 rating value obtained from 5 users. To solve this problem, some approaches have been used the method of taking simple mean of the ratings. But if there exist small number of ratings, cannot keep much faith in the rating. Thus, instead, of simple mean, the damped mean is calculated by damping the overall mean ("Introduction to Recommender Systems," n.d.). There assume that every service provider is average, and that each additional rating is a proof of whether the service provider is at higher or lower level to the average. Therefore, rating value is analyzed with number of rated users by using following formula.

$$R = \frac{\sum_u r_{ui} + k\mu}{n + k}$$

In this formula $\sum_u r_{ui}$ stands for the sum over users of users' rating for particular service provider, and n refers to the number of ratings. The k value refers to an assumed value that represents additional number of ratings which are added to each service provider at the global mean μ . When there are small number of ratings, this k factor damps some extreme positive ratings, and as the number of ratings grows, this effect will reduce, and the real mean will begin to appear ("Non Personalised Recommender System in Python | by Ankur

Tomar | Medium," n.d.). This μ is calculated by taking the average rating value of all the service providers of particular service type. The formula for calculate μ is as follows,

$$\mu = \frac{\sum_p r_{pi}}{N}$$

In this formula by $\sum_p r_{pi}$ stands for the sum of all the same kind of service provider's ratings and N stands for number of service providers. By using these two formulas, the cold start problem of new service providers is also solved. After the service providers are listed according to the distance, five service providers among them who have the highest rating values calculated from above mentioned formula, are displayed to the user on the integrated map.

5) *User- user Private chat system:* By clicking on particular user on the map they are directed to profile of that service provider. There service seekers can see images of earlier services, description about services and other basic information such as contact details. In addition, service seekers can send private messages to that service provider using private chat system. This private chat system is designed using PHP language.

6) *Sinhala Chatbot:* This is a localized system and since the traditional dance of Sri Lanka deals with the Sinhala language, it was decided to activate a Sinhala chatbot to increase

the user friendliness and interaction of the website. The Chatbot was developed using Dialogflow. This chatbot is able to direct users to appropriate place in the system.

IV. DISCUSSION

Sri Lankan dancing is not much used novel technologies to solve the problems in dancing. As a result of this most of the processes related to dancing is still done in manual inappropriate ways. The selected problem in this study is inconsistency of a proper database/ method to find details about dance service providers. Therefore, an information providing platform is proposed as a computerized database with easy access to users.

The system basically focused on providing recommendations about service providers to the service seekers. A hybrid approach which combined location-based recommendations and rating-based recommendations is used to provide more appropriate. Google API s are used for generating locationbased recommendations and, calculated damped means of ratings are used to generate rating-based recommendations by avoiding cold start problem.

The following figure displays the initial ratings and number of reviewers of service providers. There exist service providers with no ratings and reviews which leads to cold start problem.

| | name | ratings | number-of-reviews |
|----|---|---------|-------------------|
| 0 | ImzyS Dance Loft | 5.0 | 5.0 |
| 1 | Rhythm World Dance Studio | 5.0 | 4.0 |
| 2 | Deanna School of Dancing | 4.4 | 55.0 |
| 3 | Cool Steps Dance Studio Colombo | 4.3 | 45.0 |
| 4 | Dance With Hiruni | 0.0 | 0.0 |
| 5 | Antonio's Dance Circle | 5.0 | 1.0 |
| 6 | INVINCIBLE DANCE STUDIO | 4.9 | 46.0 |
| 7 | Budawatta Dance Troupe | 0.0 | 0.0 |
| 8 | Sparrows Dance Studio | 4.4 | 23.0 |
| 9 | Dance with Anidha | 5.0 | 4.0 |
| 10 | Danceworld School | 5.0 | 1.0 |
| 11 | Ruhunu Kala Ayathanaya | 4.5 | 4.0 |
| 12 | Uma Dancing Academy | 4.1 | 8.0 |
| 13 | Footwork Dance Studio | 0.0 | 0.0 |
| 14 | Sway Dancers | 5.0 | 43.0 |
| 15 | Salvo Dance Group | 4.0 | 9.0 |
| 16 | Chitrasena School of Dance | 3.8 | 6.0 |
| 17 | Chandana Wickramasinghe Dancer's Guild | 4.0 | 17.0 |
| 18 | Royal Dancing Academy | 5.0 | 6.0 |
| 19 | Meranga Fine Arts Ensemble - Traditional dance... | 5.0 | 4.0 |
| 20 | Hansani Dancing Academy | 0.0 | 0.0 |
| 21 | DanceInspire - Dance Studio & Academy | 4.8 | 25.0 |
| 22 | Nayani Dance School | 0.0 | 0.0 |
| 23 | TRITHAL DANCE STUDIO | 5.0 | 1.0 |
| 24 | ranga gamage dance studio | 0.0 | 0.0 |
| 25 | Ranara Academy | 5.0 | 6.0 |
| 26 | Saranga Dance & Drum academy | 0.0 | 0.0 |

Figure 5. Initial Ratings and Reviews of Choreographers

Source: Author

The figure below shows the median ratings calculated by considering both their initial rating and the number of reviewers. Choreographers who do not have initial ratings or reviews have been also given a rating value in this system and thus, the cold start problem has been solved.

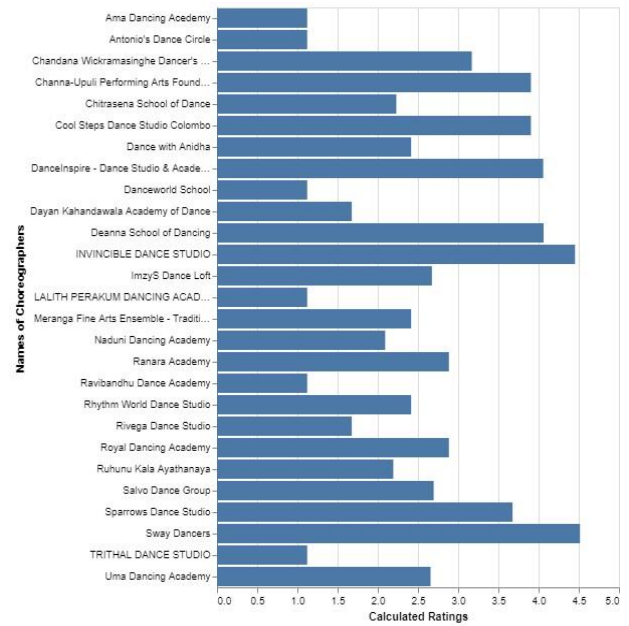


Figure 6. Generated rating values using damped mean.

Source: Author

To increase the interactivity of the system Sinhala Chatbot is designed. System also provide ability to have a private conversation with service providers to service seekers. The system evaluation process has basically done under the following categories: Recommendation evaluation, Verification of system functionality, Verification of the accuracy of chatbot responses and evaluate the performance of the user-user chat system.

V. CONCLUSION AND FUTURE WORKS

There are many ways to use novel technologies for solving problems of Sri Lankan dancers. This research study selected the problem of inconsistency of standard database with details of Sri Lankan dance service providers. The Paper is proposed a web system to avoid the difficulty of finding information about Sri Lankan dance service providers due to the lack of an appropriate database. The web system is capable of providing reliable recommendations about service providers to users and allows them to communicate with them through a private chat system. A Sinhala chatbot system was also suggested to make the system easier for every local user to use. The limitations of this system are it is only focused on Dance Service Providers around Colombo to limit the scope of the project. This system can be

further improved by adding details about service providers all over the country into the system. Also, researchers can add more features to the system such as ability to see the costumes of costume providers in 3D view using Virtual Reality technologies.

ACKNOWLEDGEMENT

I would like to express my heartiest gratitude to supervisors of this research study Dr. ADAI Gunasekara and Miss. GAI Uwanthika for their constant support, kind guidance and motivation. I would also like to thank for all lectures of Faculty of computing at KDU for their advice that helped me to make this a success. It would never have been possible for me to take this work to completion without their incredible support and encouragement. Last not the least my heartiest thanks for all the colleagues who helped to success this research.

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