Automated Billing system from conversational spoken Telugu language

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Submitted By : Dr. Bhagath Parabattina

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Submission Date : 29-Nov-2023

PROPOSAL DETAILS

(SUR/2023/000643)

Dr. Bhagath Parabattina

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Associate Professor (Computer Science and Engineering)

Lakireddy Bali Reddy College of Engineering

L.b.reddy nagar, mylavaram, krishna district, Krishna, Andhra pradesh-521230
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Technical

Scheme :	State University Research Excellence (SERB SURE)
Research Area	Electrical Electronics & Computer Engineering (Engineering Sciences)

Duration :	24 Months	**Contact No :**	+917576917879
Date of Birth	07-Jul-1982		
Nationality :	INDIAN	**Total Cost**	29,73,744

Project Summary :

India is a country where small-scale businesses are prevalent in different places. The vendors of the businesses are under-privileged and mostly do not have appropriate education. The automated billing system is a speech based billing system that can help the illiterates, elderly and physically challenged people. The conventional billing system uses a graphical user interface in which an operator needs to enter the items and their respective costs. The final bill consists of the amount to be paid by the customer. The proposed system is aiming to provide a hands-free automated system that works using a spoken dialog. The system works by understanding the conversational spoken sentences of the seller and consumer and generate the final bill.

Objectives :

- Developing Telugu sentence dataset of conversational speech in a market place
- Developing a real-time speech recognition system that can interpret the human spoken sentences and process them for generating a final bill
- A billing management system that can help under privileged people
- Applying deep learning techniques to help humanity to improve their livelihood

Keywords :

Speech Recognition, Billing System, Vegetable Management, IoT

Expected Output and Outcome of the proposal :

The proposed project is aimed to provide a speech interface for bill generation to help the under-privileged people who are working as vegetables and fruit vendors working at different places. In Andhra Pradesh, there are co-operative markets provided to the farmers where the vegetable sales happen. Digitization of the payment helped partially by providing platforms like Phonepe, BharatPe, GooglePay, etc. The proposed project enhances the payment ability by adding speech interface which can help in calculation of product costs. The project can be realized as a application where a small scale computation device can be used as a portable device.

Suitability of the proposed work in major national initiatives of the Government:

Digital India

Theme of Proposed Work:

Cyber Physical Systems including AI, IOT and Cyber Security

Collaboration Details for last 5 Years :

Planned Collaboration for the proposed work with any foreign   **No**

SNo.	CO-PI Details
1	**M RAM** ramcs8010@gmail.com Associate Professor(Computer Science Engineering) **Lakireddy Bali Reddy College of Engineering** L.B.Reddy Nagar, Mylavaram, ANDHRA PRADESH, KRISHNA *College (Private)* D.O.B : 19 Jul, 1988

Automated Billing system from conversational spoken Telugu language

A project proposal submitted to SERB, India

by

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Abstract

India is a country where small-scale businesses are prevalent in different places. The vendors of the businesses are under-privileged and mostly do not have appropriate education. The automated billing system is a speech based billing system that can help the illiterates, elderly and physically challenged people. The conventional billing system uses a graphical user interface in which an operator needs to enter the items and their respective costs. The final bill consists of the amount to be paid by the customer. The proposed system is aiming to provide a hands-free automated system that works using a spoken dialog. The system works by understanding the conversational spoken sentences of the seller and consumer and generate the final bill.

Objectives

1. Developing Telugu sentence dataset of conversational speech in a market place
2. Developing a real-time speech recognition system that can interpret the human spoken sentences and process them for generating a final bill
3. A billing management system that can help under privileged people
4. Applying deep learning techniques to help humanity to improve their livelihood

1 State of the Art:

The voice based interfaces for different environments such as smart homes, mobile devices, automobiles, etc. are very common. The researchers are focusing on developing the speech based interfaces using latest techniques and tools. Voice based billing systems are useful in helping the under-privileged people to manage the payment process. It is not easy for this group of people to endure through the lifestyle where financial matters are involved. The usage of mobile payment systems are helping partially by taking out the difficult in identifying the currency notes. The facility can be enhanced further by introducing a voice based billing system to help their livelihood in business. This system has significance where farmers are involved in markets where the vegetables and food items are being sold. The systems can also be commercialized by making it available in a super market environment also. Though it is not in a general practice, we can find a few literature in this direction. The challenges in the problem can be listed as follows:

- Availability of less data (Data Acquisition)
- Spoken words are mixed with different dialects of native language
- Evaluating the boundary points

One of the challenges of speech processing problem is the availability of data. Different researchers have been trying to develop the data sets for various speech processing problems

for Telugu language. One of significant problems is emotion recognition. Sasidhar et al. [1] develop an emotion dataset called as IITKGP-simulated emotion speech corpus. The corpus consists of spoken data recorded by actors. Vishnu et al. developed an adaptive emotive speech models for IITKGP speech corpus and IIIT-H Telugu speech corpus. A comparative study was done with the help of different models such as Gaussian Mixture Models(GMMs), Hidden Markov Models (HMMs), Deep Neural Networks (DNNs), etc. The study has proven that a combined approach called as Sub-space Gaussian Mixture Models (SGMMs) performed well on the problem [2]. Esther et al. proposed formant based emotion recognition for IITKGP-SESC Telugu dataset. The authors used different acoustic features such as Zero-crossing rate (ZCR), Short-time signal energy (STE), etc. for identifying the emotions from the spoken Telugu sentences [3].

A study on Telugu Text-To-Speech (TTS) synthesis system was provided by Gangala and Nenavath [4]. A TTS system was implemented by the authors to convert Telugu text to artificial spoken sentences. The system uses very small vocabulary that consists of a few Telugu words. A dialect identification method was developed by Shivaprasad and Sadanandam using GMM and HMM models [5]. The aim of the model is to find out the dialect from the input speech sentence. The accuracy of 84.5% was achieved with the GMM. Spoken Language Identification (SID) problem was addressed by Srinivas et al. for Telugu language. The spoken LID models were developed using the approaches of Support Vector Machine (SVM), Artificial Neural Networks (ANNs), and Deep Neural Networks (DNNs). The study concluded that DNNs performed well for the SID problem [6].

The speech recognition problem for Telugu language for various problems is not well reported in the literature. The problems such as vowel classification, digit recognition, sentence recognition can be found in the recent works. Parabattina et al. studied different feature extraction techniques such as Linear Predictive Cepstral Coefficients (LPCCs) and Melfrequency Cepstral Coefficients (MFCC) with HMM modeling technique for Telugu digit recognition [7]. In [8], the authors continued the digit recognition problem with Convolutional Neural Networks (CNNs) with MFCCs as features. Phoneme boundary detection is an important sub problem in the domain of speech processing. The problem helps in identifying the boundary points between phonetic units. No significant works are reported in the literature for Telugu language. In [9], the authors proposed a phoneme segmentation method for identifying the word boundaries using quadrilaterals. The approach uses geometrical features to identify the boundaries between the words. The authors used Telugu sentence data set[9]. The authors of [10] proposed a HMM based sentence recognition towards controlling smart appliances. A preliminary study on a small data set was done for Telugu sentences. To the best of our knowledge, literature on voice controlled payment system for Telugu language problem is hardly visible. The next section gives explanation of the methodology that will be used in the proposed project.

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2 Work Plan

This section elaborates the project proposal with a brief description of methodology and the different activities with milestones and BAR chart. The Subsection 2.1 gives the overview of the methodology by discussing different modules whereas subsection 2.2 provides a timeline for implementing the modules. The proposed project can broadly consists of two phases in which it can be built and used.

2.1 Methodology

At the time of building stage, the system has a three major modules as listed below:

- Dataset collection
- Feature Extraction
- Modeling
- Testing

The dataset collection involves collecting the data from different people and storing as a recorded sounds. This requires training the speakers by educating them with the right procedure of recording. Once the recorded files are collected, the data needs verification in which the experts check for the recording errors. The recorded data will be labeled which is required for the classification. Finally, the dataset would be ready for the training purpose. The procedure for dataset collection is depicted in Figure 1. The next step is feature
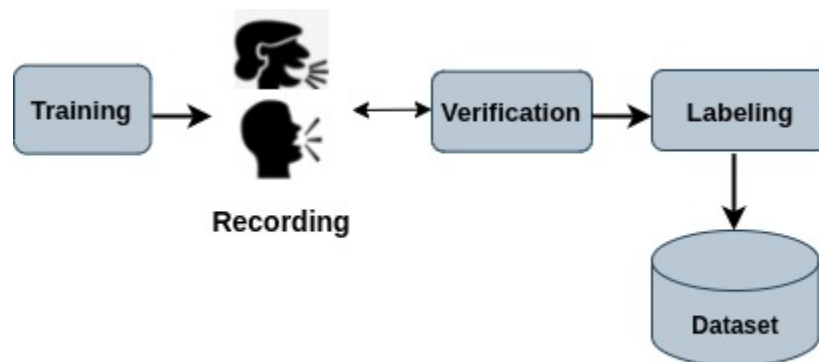

Figure 1: Dataset Collection Process

extraction process in which the essential patterns are understood from the speech sounds. The patterns help in understanding the similarities belonging to the sounds belonging to identical classes. Further, they will be used at the stage of modeling. The present project
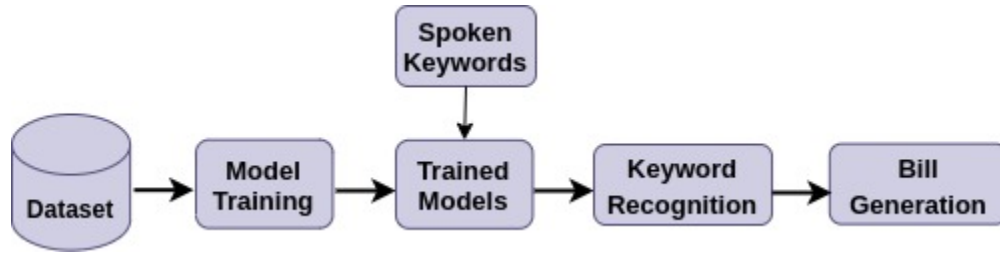
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Figure 2: Modeling

requires to identify the keywords in the a conversational spoken sentences. The keywords must give important information about the items and cost of the items that is required for billing. Therefore, the modeling needs the training process that can train the model to spot the keywords from the conversational speech sentence. Once the model is ready to extract the keywords from a spoken sentences. The keywords are then used for generating the bill required for the customer. The trained model can be tested with a test data kept aside and the proven system can be evaluated in a real-time market environment. The process is described in the Figure 2. The schedule of the different activities is given in Section 2.2.

2.2 Time Schedule of activities giving milestones through BAR diagram

The detailed plan for developing different modules is shown in Table 1 and the BAR graph for the timeline is shown in Figure 3.

| S.No	Task	Duration	Remarks
1.	Dataset Collection	6 Months	Collecting the data from different native Telugu speakers
2.	Feature Extraction	3 Months	Extracting the features from the source speech signals
3.	Modeling the data	3 Months	Preparing the model that can understand keyword in a spoken utterance
4.	Preparing the billing system	6 Months	Implementing the billing system from the extracted keywords
5.	Testing	3 Months	Testing the system in real time
6.	Documentation	3 Months	Documenting the system

Table 1: Plan of action

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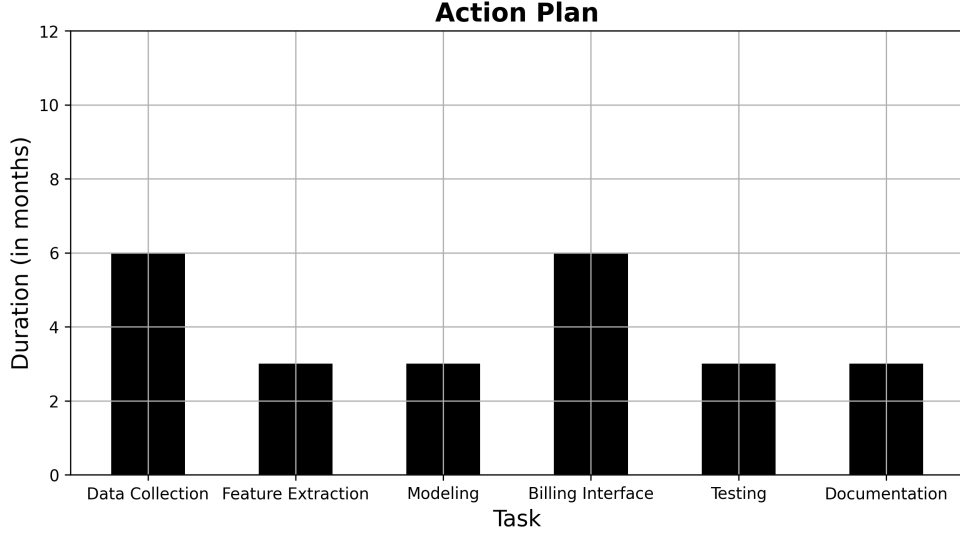
Figure 3: Timeline

3 Suggested Plan of action for utilization of research outcome expected from the project

The proposed project is aimed to provide a speech interface for bill generation to help the under-privileged people who are working as vegetables and fruit vendors working at different places. In Andhra Pradesh, there are co-operative markets provided to the farmers where the vegetable sales happen. Digitization of the payment helped partially by providing platforms like Phonepe, BharatPe, GooglePay, etc. The proposed project enhances the payment ability by adding speech interface which can help in calculation of product costs. The project can be realized as a application where a small scale computation device can be used as a portable device.

4 Expertise:

4.1 Expertise available with the investigators in executing the project:

The principal investigator Dr. P. Bhagath has been working on speech modeling for under-resourced languages from past 10 years. The PI is involved in developing new feature extraction techniques and developing classification models using modern learning models such as HMM, CNN, etc. The Co-PI Dr. M. Sitharam has been working on wireless sensor devices and acquired knowledge in IoT devices. He has been working in the domain for past 10 years. The knowledge can be used to build portable devices by integrating speech

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modeling techniques.

4.2 Summary of roles/responsibilities for all Investigators:

S. No	Name of the Investigators	Role	Responsibilities
1.	Dr. P. Bhagath	PI	Modeling the conversational spoken sentences and building a keyword identification system
2.	Dr. M. Sitharam	Co-PI	Data collection, Building a portable device in which a speech recognition system can be used

Table 2: Investigators Roles and Responsibilities

4.3 Key publications published by the Investigators pertaining to the theme of the proposal during the last 5 years

1. P. Bhagath, M. Pullagura and P. K. Das, "Comparative Analysis of Spoken Telugu digits using MFCC and LPCC via Hidden Markov Models," 2023 10th International Conference on Signal Processing and Integrated Networks (SPIN), Noida, India, 2023, pp. 615-620.

2. P. Bhagath, A. U. M. Rao, B. S. Ram and M. A. K. Reddy, "Telugu Spoken Digits Modeling using Convolutional Neural Networks," 2023 IEEE 13th International Conference on Pattern Recognition Systems (ICPRS), Guayaquil, Ecuador, 2023, pp. 1-7.

3. P. Bhagath and P. K. Das, "Quadrilaterals based phoneme segmentation technique for low resource spoken languages," TENCON 2022 - 2022 IEEE Region 10 Conference (TENCON), Hong Kong, Hong Kong, 2022, pp. 1-6.

4. P. Bhagath, M. Pullagura, P. K. Das, V. K. Yandra and S. S. Thetla, "TELUGU ANKELU: A Telugu Spoken Digits Corpora for Mobile Speech Recognition," 2022 12th International Conference on Pattern Recognition Systems (ICPRS), Saint-Etienne, France, 2022, pp. 1-6.

5. A. Ramteke, B. Parabattina and P. K. Das, "A Neural Network Based Technique for Staircase Detection using Smart Phone Images," 2021 Sixth International Conference on Wireless Communications, Signal Processing and Networking (WiSPNET), Chennai, India, 2021, pp. 374-379.

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6. P. Bhagath, K. Bharti, A. Kotiya and P. K. Das, "Feature Selection using Preclustering via Affinity Propagation for Speech Classification in Low-resource Languages," 2021 IEEE International Conference on Artificial Intelligence in Engineering and Technology (IICAIET), Kota Kinabalu, Malaysia, 2021, pp. 1-6.

7. B. Parabattina, P. Chandra, V. Sharma and P. K. Das, "Voice-controlled Assistance for Robot Navigation Using Android-based Mobile Devices," 2021 Sixth International Conference on Wireless Communications, Signal Processing and Networking (WiSP-NET), Chennai, India, 2021, pp. 21-25.

8. P. Bhagath, S. Parisa, S. D. Reddy and F. Banu, "An Android based Mobile Spoken Dialog System for Telugu language to control Smart appliances," 2021 IEEE XXVIII International Conference on Electronics, Electrical Engineering and Computing (INTERCON), Lima, Peru, 2021, pp. 1-4.

9. Bhagath, P., Jain, M., Das, P.K. (2020). Dynamic Speech Trajectory Based Parameters for Low Resource Languages. In: Bhattacharjee, A., Borgohain, S., Soni, B., Verma, G., Gao, XZ. (eds) Machine Learning, Image Processing, Network Security and Data Sciences. MIND 2020. Communications in Computer and Information Science, vol 1241. Springer, Singapore.

10. Jain, S., Parabattina, B., Das, P.K. (2020). Speech Signal Analysis for Language Identification Using Tensors. In: Bhattacharjee, A., Borgohain, S., Soni, B., Verma, G., Gao, XZ. (eds) Machine Learning, Image Processing, Network Security and Data Sciences. MIND 2020. Communications in Computer and Information Science, vol 1241. Springer, Singapore.

11. P. Bhagath and P. K. Das, "Graph Eigenvalue based Structural Method towards Phonetic Boundary Detection," TENCON 2021 - 2021 IEEE Region 10 Conference (TENCON), Auckland, New Zealand, 2021, pp. 591-596.

12. P. Bhagath, PK Das, "Phoneme Boundary Analysis using Multiway Geometric Properties of Waveform trajectories towards Low Resource Languages", 1st Joint SLTU and CCURL Workshop, Marseille, FRANCE, 2020, SLTU-CCURL 2020, pages 144-152.

13. P. Bhagath, P K Das, "Characterization of Spoken English Vowels Using Tree Structures", 2019 IEEE Region10 Conference (TENCON), Kochi, India, 2019, pp. 1758-1763.

14. P. Bhagath, P K Das, "Phoneme Boundary Analysis Using Graphs", 2019 IEEE Region 10 Conference (TEN-CON), Kochi, India, 2019, pp. 1758-1763.

15. P. Bhagath, Megha Jain and P K Das, "Dynamic Speech Trajectory based Parameters for Low Resource Languages", CCIS Springer 2020. ISBN: 978-981-15-6315-7

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16. S. A. Devi, M. S. Ram, K. Ranganarayana, D. B. Rao and V. Rachapudi, "Smart Home System Using Voice Command With Integration Of ESP8266," 2022 International Conference on Applied Artificial Intelligence and Computing (ICAAIC), Salem, India, 2022, pp. 1535-1539.

17. Y. Sikhi, M. S. Ram, S. A. Devi, and S. K. Jasti , "Sentimental Analysis through Speech and text for IMDB Dataset," 2022 4th International Conference on Smart Systems and Inventive Technology (ICSSIT), Tirunelveli, India, 2022, pp. 1519-1522.

18. M. S. Ram, V. Srija, V. Bhargav, A. Madhavi and G. S. Kumar, "Machine Learning Based Student Academic Performance Prediction," 2021 Third International Conference on Inventive Research in Computing Applications (ICIRCA), Coimbatore, India, 2021, pp. 683-688.

19. M. S. Ram, C. Reshmasri, S. Shahila and J. V. P. Saketh, "Air Quality Prediction using Machine Learning Algorithm," 2023 International Conference on Sustainable Computing and Data Communication Systems (ICSCDS), Erode, India, 2023, pp. 316-321.

20. M. S. Ram, P. S. Navyatha, R. L. A. Ashitha and S. A. J. Kumar, "Machine Learning based Underwater Mine Detection," 2023 7th International Conference on Intelligent Computing and Control Systems (ICICCS), Madurai, India, 2023, pp. 47-50.

5 List of Projects submitted/implemented by the Investigators

5.1 Details of Projects submitted to various funding agencies:

Dr. PB : Dr. P. Bhagath
Dr. MS : Dr. M. Sitharam

S.No	Title	Cost in Lakhs	Month of submission	PI/Co-PI	Agency	Status
1.	Multilingual Speech Corpora Development for four low-resource Indian languages with applications to Tourism and Healthcare	624	Nov-2021	Co-PI(Dr. PB)	MeitY	Not Recommended
2.	Automatic Annotation of Telugu Sentences using Graph Signal Processing Methods	25.08	Feb-2021	PI(Dr.PB)	SERB under SRG	Not Recommended
3.	A Framework to Integrate Smart Farming, Smart Environment and Smart Factory for Real-time Decision Making	33	Feb-2021	PI(Dr.MS)	SERB under SRG	Not Recommended
4.	Toxic gas detection and waste Segregation in rural environments using IoT and Computer Vision	52.50	Nov-2020	PI(Dr. PB)	DST TDT Division	Not Recommended

5.2 Details of Projects under implementation: 0

S.No	Title	Cost in Lakh	Month of submission	PI/Co-PI	Agency	Status
-	-	-	-	-	-	-

5.3 Details of Projects completed during the last 5 years: 0

S.No	Title	Cost in Lakh	Month of submission	PI/Co-PI	Agency	Status
-	-	-	-	-	-	-

6 Equipment available with the Institute/ Group/ Other Institutes for the project

Equipment available	Generic Name	Model, Make, Year of purchase	Remarks
04 Dell Workstations	Workstations	Dell Vostro 2020	Available for computational work.

Table 3: Details of the equipment

References

[1] S. G. Koolagudi, R. Reddy, and K. S. Rao, "Emotion recognition from speech signal using epoch parameters," in *2010 International Conference on Signal Processing and Communications (SPCOM)*, pp. 1–5, 2010.

[2] V. V. R. Vegesna, K. Gurugubelli, and A. K. Vuppala, "Application of emotion recognition and modification for emotional telugu speech recognition," *Mob. Netw. Appl.*, vol. 24, p. 193–201, feb 2019.

[3] E. Ramdinmawii, A. Mohanta, and V. K. Mittal, "Emotion recognition from speech signal," in *TENCON 2017 - 2017 IEEE Region 10 Conference*, pp. 1562–1567, 2017.

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[4] G. Ramya and N. S. Naik, "Implementation of telugu speech synthesis system," in *2017 International Conference on Advances in Computing, Communications and Informatics (ICACCI)*, pp. 1151–1154, 2017.

[5] S. Shivaprasad and M. Sadanandam, "Dialect recognition from telugu speech utterances using spectral and prosodic features," *International Journal of Speech Technology*, pp. 1–10, 2021.

[6] L. Kumar, "Recognition of spoken languages from acoustic speech signals using fourier parameters," *Circuits Systems and Signal Processing*, 04 2019.

[7] P. Bhagath, M. Pullagura, and P. K. Das, "Comparative analysis of spoken telugu digits using mfcc and lpcc via hidden markov models," in *2023 10th International Conference on Signal Processing and Integrated Networks (SPIN)*, pp. 615–620, 2023.

[8] P. Bhagath, A. U. M. Rao, B. S. Ram, and M. A. K. Reddy, "Telugu spoken digits modeling using convolutional neural networks," in *2023 IEEE 13th International Conference on Pattern Recognition Systems (ICPRS)*, pp. 1–7, 2023.

[9] P. Bhagath and P. K. Das, "Quadrilaterals based phoneme segmentation technique for low resource spoken languages," in *TENCON 2022 - 2022 IEEE Region 10 Conference (TENCON)*, pp. 1–6, 2022.

[10] P. Bhagath, S. Parisa, S. D. Reddy, and F. Banu, "An android based mobile spoken dialog system for telugu language to control smart appliances," in *2021 IEEE XXVIII International Conference on Electronics, Electrical Engineering and Computing (INTERCON)*, pp. 1–4, 2021.

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Budget Details

Institution wise Budget Breakup :

Budget Head	Lakireddy Bali Reddy College of Engineering	Total
Research Personnel	16,80,000	**16,80,000**
Consumables	1,50,000	**1,50,000**
Travel	1,50,000	**1,50,000**
Equipment	4,83,744	**4,83,744**
Contingencies	90,000	**90,000**
Other cost	1,50,000	**1,50,000**
Overhead	2,70,000	**2,70,000**
Total	**29,73,744**	**29,73,744**

Institute　　*Lakireddy Bali Reddy College of Engineering*

Year Wise Budget　　(Amount in INR)

Budget Head	Year-1	Year-2	Total
Research Personnel	8,40,000	8,40,000	**16,80,000**
Consumables	75,000	75,000	**1,50,000**
Travel	75,000	75,000	**1,50,000**
Equipments	4,83,744	0	**4,83,744**
Contingencies	45,000	45,000	**90,000**
Other cost	75,000	75,000	**1,50,000**
Overhead	1,70,000	1,00,000	**2,70,000**
Grand Total	**17,63,744**	**12,10,000**	**29,73,744**

Research Personnel Budget　　(Amount in INR) :

Designation	Year-1	Year-2	Total
Junior Research Fellow *Persons required for data collection and implementation*	8,40,000	8,40,000	**16,80,000**

Consumable Budget　　(Amount in INR) :

Justification	Year-1	Year-2	Total
The wearable equipment like data cables, storage devices, and amount to be used for the stationery purposes.	75,000	75,000	**1,50,000**

Travel Budget　　(Amount in INR) :

Justification (Inland Travel)	Year-1	Year-2	Total
The cost includes traveling to different places to acquire the data and meet people. Conducting meetings between participating institutes for technical discussions	75,000	75,000	**1,50,000**

Equipment Budget　　(Amount in INR) :

Generic Name ,Model No. , (Make)/	Quantity	Spare	Estimated Cost
Keyboard and Mouse HP 350 Compact Multi-Device Bluetooth Wireless Keyboard; Spill-Resistant Swift Pair; OS Auto-Detect (HP) *Wireless keyboards required for all systems*	4	40 %	2,010
Workstation ThinkStation P620 Tower (Lenovo) *High end workstations required for computational purpose*	2	40 %	2,38,138
Monitors Lenovo L32p-30 80.01cms (31.5) UHD USB Type-C monitor (Lenovo) *Monitor required for computational purpose*	3	40 %	29,999
Laptop Yoga Pro 7i 13th Gen (Lenovo) *Required for data collection*	3	30 %	99,990
External Hard disk Western Digital 4TB My Passport Portable External (Western Digital) *required for the recordings*	3	50 %	7,999
Headphone Sennheiser - HD 650 (Sennheiser) *Required for recording the data*	4	40 %	22,450
Printer HP LaserJet MFP M438nda Printer (Hewlett Packard (HP)) *Required for documentation, printing the research articles required for the project.*	1	50 %	83,158

Contingency Budget　　(Amount in INR) :

Justification	Year-1	Year-2	Total
Required for publication	45,000	45,000	**90,000**

Overhead Budget　　(Amount in INR) :

Justification	Year-1	Year-2	Total
Amount required for covering the changes in equipment costs and other charges	1,70,000	1,00,000	**2,70,000**

Other Budget　　(Amount in INR) :

Description/Justification	Year-1	Year-2	Total
Cost required for data collection *This is required to pay the speakers*	75,000	75,000	**1,50,000**

DR. PARABATTINA BHAGATH

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1 Name and full correspondence address

Dr. P. Bhagath, Associate Professor, Department of Computer Science and Engineering, Lakireddy Bali Reddy College of Engineering Mylavaram, NTR District, Andhra Pradesh - 521230.

2 Personal Details

Date of Birth   : 07-07-1982
Gender   : Male

3 Academic Details

S. No.	Degree	Year	Subject	University/ Institution	% of Marks
1.	Ph. D.	2020	CSE	IIT Guwahati	-
2.	M. Tech	2010	CSE	IIT Guwahati	7.1 (CPI)
3.	A.M.I.E.T.E	2007	CSE	IETE New Delhi	62.2 %
4.	B. I. T.	2003	I.T	M.A.H.E, Manipal	76%

4 Details of Ph.D

Thesis Title   : *Structural Processing Methods for Speech Signal Analysis*
Supervisor's Name : **Prof. Pradip Kumar Das**
Institution   : Indian Institute of Technology Guwahati
Year of award   : 2020

5 Work Experience

S. No.	Position held	Name of the Institution	From	To	Pay Scale
1.	Associate Professor	LBRCE Mylavaram	Oct 2020	Till date	37400-67000 +AGP 9000
2.	Sr. Assistant Professor	LBRCE Mylavaram	Aug 2020	Oct 2020	15600-39100 + AGP 7000
3.	Teaching Assistant	IIT Guwahati	July 2014	July 2020	35000 (Consolidated)
4.	Assistant Professor	PITS, Ongole	April 2013	April 2014	24000 (Consolidated)
5.	Assistant Professor	RNEC, Ongole	Feb 2011	April 2013	18,000 (Consolidated)

6 Professional Recognitions, Awards, and Fellowships

S. No.	Name of the award	Awarding Agency	Year
1.	Senior Member	IEEE	2022
2.	Radhabhai Kapre Gold Medal	IETE New Delhi	2007
3.	MHRD Fellowship for Ph.D	MHRD	2014-2019
4.	MHRD Fellowship for M.Tech	MHRD	2008-2010

7 Publications

Recent Publications

1. Parabattina Bhagath, A Uma Maheswara Rao, B Sai Ram, M Anil Kumar Reddy, "Telugu Spoken Digits Modeling using Convolutional Neural Networks", 2023 IEEE 13th International Conference on Pattern Recognition Systems (ICPRS), Guayaquil, Ecuador.

2. P. Bhagath, Meghana Pullagura, Pradip K Das "Comparative Analysis of Spoken Telugu digits using MFCC and LPCC via Hidden Markov Models", 2023 10th International Conference on Signal Processing and Integrated Networks (SPIN), India.

3. P. Bhagath, Pradip K. Das,"Quadrilaterals based phoneme segmentation technique for low resource spoken languages", 33rd International IEEE R10 Conference (TENCON 2022), Hongkong, China.

4. P. Bhagath, Meghana Pullagura, Pradip K Das, Vikram Kumar Yandra, Santhi Sri Thetla "TELUGU ANKELU: A Telugu Spoken Digits Corpora for Mobile Speech Recognition", 12th 2022 International Conference on Pattern Recognition Systems (ICPRS 2022), France.

5. P. Bhagath, , "R-Peak Detection from ECG Signals Using FractalBased Mathematical Morphological Operators", 33rd International IEEE Region10 Conference (TENCON) (TENCON 2021), Auckland, Newzealand.

6. P. Bhagath Pradip K. Das,"Graph Eigen value based Structural Method towards Phonetic Boundary Detection", 33rd International IEEE R10 Conference (TENCON 2021), Auckland, Newzealand.

7. P. Bhagath ,Komal Bharti, Abhishek Kotiya, P K Das, "Feature Selection using Pre-Clustering via Affinity Propagation for Speech Classification in low-resource languages", 3rd IEEE International Conference On Artificial Iintelligence in Engineering and Technology (IICAIET2021), Kota Kinabalu, Malaysia.

8. P. Bhagath, Samanvi P, Sasi D R and Fareeda B, "An Android based Mobile Spoken Dialog System for Telugu language to control Smart appliances", IEEE XXVIII International Conference on Electronics, Electrical Engineering and Computing (INTERCON 2020), Peru, South America.

9. P. Bhagath, Savinay Parihar, Pradip K Das , "Speech Recognition for Indian spoken languages towards Automated Home appliances", IEEE 2nd International Conference of Emerging Technologies 2021(2nd INCET 2021).

10. Anurag Ramteke, P. Bhagath, Pradip K Das , "A Neural Network based Technique for Staircase Detection using Smart Phone Images", 6th edition of the International Conference on Wireless Communications, Signal Processing and Networking (WiSPNET-2021), Chennai.

11. P. Bhagath, Phool Chandra, Vanshali Sharma, Pradip K Das, "Voice-controlled Robot navigation system using Android-based hand-held devices", 6th edition of the International Conference on Wireless Communications, Signal Processing and Networking (WiSPNET-2021), Chennai.

12. P. Bhagath, PK Das, "Phoneme Boundary Analysis using Multiway Geometric Properties of Waveform trajectories towards Low Resource Languages", 1st Joint SLTU and CCURL Workshop, Marseille, FRANCE, 2020, SLTU-CCURL 2020, pages 144-152.

13. P Roy, P. Bhagath, PK Das, "Gender Detection from Human Voice Using Tensor Analysis", 1st Joint SLTU and CCURL Workshop, Marseille, FRANCE, 2020, SLTU-CCURL 2020, pages 211–217.

14. P. Bhagath, P K Das, "Characterization of Spoken English Vowels Using Tree Structures", 31st International IEEE Region10 Conference (TENCON), Kochi, India, 2019, pp. 1758-1763.

15. P. Bhagath, P K Das, "Phoneme Boundary Analysis Using Graphs", 31st International IEEE Region10 Conference (TENCON), Kochi, India, 2019, pp. 1758-1763.

Book Chapters

1. P. Bhagath, Megha Jain and P K Das, "Dynamic Speech Trajectory based Parameters for Low Resource Languages", CCIS Springer 2020. ISBN: 978-981-15-6315-7.

2. Subham Jain, P. Bhagath, PK Das, "Language Identification using Tensors", CCIS Springer 2020, ISBN: 978-981-15-6315-7.

<p align="center">**PROFORMA FOR BIO-DATA (to be uploaded)**</p>

1.   Name and full correspondence address: **Dr. M. Sitha Ram**

                     Associate Professor, Dept.of CSE,

                     Lakireddy Bali Reddy College of Engineering(A),

                     Mylavaram, Krishna, Andhra Pradesh-521230.

2.   Email(s) and contact number(s): ramcs8010@gmail.com, 7207277782, 7989671839.

3.   Institution: **Lakireddy Bali Reddy College of Engineering(A),**

4.   Date of Birth: **19-07-1988**

5.   Gender (M/F/T): **Male**

6.   Category : **OBC**

7.   Whether differently abled (Yes/No): **NO**

8.   Academic Qualification (Undergraduate Onwards)

	Degree	**Year**	**Subject**	**University/Institution**	**% of marks**
1.	B.Tech	2009	CSE	JNTUK	67.69
2.	M.Tech	2013	CST	ANDHRA UNIVERSITY Campus	90
3.	Ph.D	2020	CS&SE	ANDHRA UNIVERSITY Campus	--

9. Ph.D Thesis Title: "**Design and Implementation of Trust based Clustering and Routing Algorithms for Wireless Sensor Networks**"

    Guide: **Prof. Kuda Nageswra Rao,**
                 Professor and Head,
             Department of CS & SE, AUCE(A),
          Andhra University, Visakhapatnam-530003.

    University: **Andhra University**

    Year of Award: **2020**

10. Work experience (in chronological order).

S.No.	Positions held	Name of the Institute	From	To	Pay Scale
1	Associate Professor	Lakireddy Bali Reddy College of Engineering	DEC 2020	TILL DATE	Basic pay 45,000 (37,400-67000)
2	Senior Assistant Professor	Lakireddy Bali Reddy College of Engineering	Aug 2020	Dec 2020	Basic pay 28,000 (21,200-55,00)
3	Research Scholar (FT)	Andhra University	Apr 2014	Mar 2020	35,000
4	Assistant Professor	Gopal Reddy College of Engineering and Technology	Jul 2009	Nov 2011	9,000

11. Professional Recognition/ Award/ Prize/ Certificate, Fellowship received by the applicant.

S.No	Name of Award	Awarding Agency	Year
1	Award of Excellence in Education	IAECT	2020
2	Best Researcher award	IJIEMR, SSRN	2020
3	Assistant professor Eligibility Test	UGC	2015
4	Assistant professor Eligibility Test	APSET	2016
5	Junior Research Fellow	NFOBC-MHRD	2015
6	Senior Research Fellow	NFOBC-MHRD	2017

12. **Publications**

1. **"Trust based Cluster Head Selection and Secure Routing in Wireless Sensor Networks using Cat Swarm Optimization and Firefly Algorithms**" Journal of Advanced Research in Dynamical & Control Systems, Vol. 12, Issue-02, 2020, pp. 387-400.
2. **Cluster Head And Optimal Path Selection Using K-GA And T-FA Algorithms For Wireless Sensor Networks"** IEEE Proceedings on 4th International Conference on Electronics, Communication and Aerospace Technology - ICECA 2020, pp. 1476-1483.

3. "**Trust Based Cluster Head Selection With Secure routing Algorithm For Wireless Sensor Network**" International Journal of Advanced Science and Technology, Vol. 28, No. 20, 2019, pp. 19-30.

4. "**The Comparative Study on Trust Management and Reputation System in Wireless Sensor Networks**" International Journal of Management, Technology and Engineering, Volume IX, Issue IV, APRIL 2019, ISSN NO : 2249-7455 , Page No: 2287 – 2292

5. **"An Optimized Ring Based Clustering Protocol In Heterogeneous Wireless Sensor Networks**" International Journal of Engineering Research and Application (IJERA), Vol. 8, Issue 11, Nov 2018, pp 49-56, ISSN : 2248-9622

6. "**A Study on Exploitation and Prevention for PHP vulnerability in web applications**" Journal of Emerging Technologies and Innovative Research (JETIR),Volume 6, Issue 6, JUNE 2019, ISSN NO : 2349-5162, Page No: 638 – 644

7. **"Robotic Process Automation of Reports Segregation using Uipath"** International journal of research in electronics and computer engineering (IJRECE), Vol.7, Issue.1, MAR 2019, pp.2348-2364, (ISSN: 2393-9028).

8. "**Fictitious Node Deployment to Prevent Routing Attacks on OLSR Protocol**" International Journal of Research in Electronics and Computer Engineering (IJRECE), Vol.7, Issue.1, JAN 2019, pp.2365-2369, (ISSN: 2393-9028).

9. **"Clustering Algorithms with EMD for Microarray Image Segmentation"** International Journal & Magazine of Engineering Technology Management and Research (IJMETMR) Vol. 2, Issue no. 9, SEP, 2015, pp.1323-1327, (ISSN No: 2348-4845)

10. "**Data management using Virtualization in Cloud Computing"** International Journal & Magazine of Engineering Technology Management and Research (IJMETMR) Vol. 2, No.9, SEP 2015, pp. 172-177, (ISSN No: 2348-4845).
.

13. Detail of patents.

S.No	Patent Title	Name of Applicant(s)	Patent No.	Award Date	Agency/Country	Status
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14. Books/Reports/Chapters/General articles etc.

S.No	Title	Author's Name	Publisher	Year of Publication
1	**"Data Preparation, Data Preprocessing & Data Wrangling: Key Skills to become a Data Scientist**	**M. Sitha Ram, Sk.Johny Basha, S.Srinivasa Reddy**	**Immortal Publications**	**2020**

To

    The Secretary
    SERB, New Delhi

Sir

I <u>Dr. P. Bhagath</u>

herby certify that the research proposal titled <u>AUTOMATED BILLING SYSTEM FROM CONVERSATIONAL SPOKEN TELUGU LANGUAGE</u> submitted for possible funding by SERB, New Delhi is my original idea and has not been copied/taken verbatim from anyone or from any other sources. I further certify that this proposal has been checked for plagiarism through a plagiarism detection tool i.e. <u>TURNITIN</u> approved by the Institute and the contents are original and not copied/taken from any one or many other sources. I am aware of the UGCs Regulations on prevention of Plagiarism i.e. University Grant Commission (Promotion of Academic Integrity and Prevention of Plagiarism in Higher Educational Institutions) Regulation, 2018. I also declare that there are no plagiarism charges established or pending against me in the last five years. If the funding agency notices any plagiarism or any other discrepancies in the above proposal of mine, I would abide by whatsoever action taken against me by SERB, as deemed necessary.

<div align="right">

27.11.23

Signature of PI with date

Name / designation

Associate Professor
Department of Computer Science & Engineering
Lakireddy Balireddy College of Engineering
MYLAVARAM-521 230, A.P. INDIA

</div>

BOARD OF SECONDARY EDUCATION
ANDHRA PRADESH

N 200629

SECONDARY SCHOOL CERTIFICATE

PC/16/0119846/2

CERTIFIED THAT PARABATTINA BHAGATH

S/O . P PEETAR

Bearing Roll No. 0297656

belongs to Z P HIGH SCHOOL, ZARUGUMALLI

has appeared and PASSED at the SSC EXAMINATION held in MARCH, 1997 with

FIRST **division and** TELUGU as the medium of instruction

DATE OF BIRTH OF THE CANDIDATE	DAY		MONTH	YEAR			
07/07/1982	ZERO	SEVEN	JUL	ONE	NINE	EIGHT	TWO

THE CANDIDATE SECURED THE FOLLOWING PERCENTAGE OF MARKS

SUBJECT	Marks secured (in Figures)	Marks secured (in Words)
FIRST LANGUAGE (TELUGU)	76	SEVEN SIX
THIRD LANGUAGE - ENGLISH	82	EIGHT TWO
MATHEMATICS	72	SEVEN TWO
GENERAL SCIENCE	77	SEVEN SEVEN
SOCIAL STUDIES	69	SIX NINE
TOTAL	376	(THREE SEVEN SIX)
SECOND LANGUAGE (HINDI)	67	SIX SEVEN
GRAND TOTAL	443	(FOUR FOUR THREE)

Marks of Identification

1. A mole above the right wist
2. A mole on the right knee-cap.

Head of Institution with School Stamp

Date of Issue by the Board 26/05/1997.

SECRETARY
BOARD OF SECONDARY EDUCATION

HYDERABAD

Any corrections in the certificate will not be entertained after 3 years from the date of issue.

Any unauthorised correction in the certificate will result in cancellation of certificate.

<u>Certificate from the Investigator</u>

<u>**Project Title:**</u> **Automated Billing System from conversational spoken Telugu language**

It is certified that

1. The same project proposal has not been submitted elsewhere for financial support.

2. We/I undertake that spare time on equipment procured in the project will be made available to other users.

3. We/I agree to submit a certificate from Institutional Biosafety Committee, if the project involves the utilization of genetically engineered organisms. We/I also declare that while conducting experiments, the Biosafety Guidelines of Department of Biotechnology, Department of Health Research, GOI would be followed in toto.

4. We/I agree to submit ethical clearance certificate from the concerned ethical committee, if the project involves field trails/experiments/exchange of specimens, human & animal materials etc.

5. The research work proposed in the scheme/project does not in any way duplicate the work already done or being carried out elsewhere on the subject.

6. We/I agree to abide by the terms and conditions of SERB grant.

Name and Signature of Principal Investigator: **Dr. P. Bhagath**

Date: 27-11-2023

Place: Mylavaram

Name and Signature of Co-PI (s) (if any): **Dr. M. Sitharam**

Date: 27-11-2023

Place: Mylavaram

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
(AUTONOMOUS)
Approved by AICTE, NEW DELHI. Affiliated to JNTUK, KAKINADA

(Accredited by NAAC with "A" Grade and NBA [(CSE, IT, ECE, EEE & ME) under Tier-I)]
MYLAVARAM-521230, NTR Dist, A.P., Tel: 08659-222933, 934, 223936 Fax: 08659-222931
Email: lbcemym@lbrce.ac.in, principal@lbrce.ac.in | Website: www.lbrce.ac.in

Endorsement from the Head of the Institution of PI
(To be given on Institution Letter head)

This is to certify that:

1. Institute welcomes participation of Name: **Dr. P. Bhagath** Designation: **Associate Professor** as the Principal Investigator and **Dr. M. Sitharam** as the Co- Investigator/s for the project titled **Automated Billing System from conversational spoken Telugu language** and that in the unforeseen event of discontinuance by the Principal Investigator, the Co-Investigator will assume the responsibility of the fruitful completion of the project with the approval of SERB.

2. The PI, **Dr. P. Bhagath** is a permanent or regular employee of this Institution.

3. The project starts from the date on which the Institution receives the grant from SCIENCE & ENGINEERING RESEARCH BOARD (SERB), New Delhi.

4. The investigator will be governed by the rules and regulations of the Institution and will be under administrative control of the Institution for the duration of the project.

5. The grant-in-aid by the SCIENCE & ENGINEERING RESEARCH BOARD (SERB), New Delhi will be used to meet the expenditure on the project and for the period for which the project has been sanctioned as mentioned in the sanction order.

6. No administrative or other liability will be attached to SCIENCE & ENGINEERING RESEARCH BOARD (SERB), New Delhi at the end of the project.

7. The Institution will provide basic infrastructure and other required facilities to the investigator for undertaking the research project.

8. The Institution will take into its books all assets created in the above project and its disposal would be at the discretion of SCIENCE & ENGINEERING RESEARCH BOARD (SERB), New Delhi.

9. The Institution assumes to undertake the financial and other management responsibilities of the project.

Seal of Institution

Signature 28/11/23

Registrar of University/Head of the Institution
PRINCIPAL
Lakireddy Bali Reddy College of Engg.
MYLAVARAM-521 230.

Date: 28/11/23