

**UNIVERSITY GRANTS COMMISSION  
BAHADUR SHAH ZAFAR MARG  
NEW DELHI – 110 002**

**EXECUTIVE SUMMARY OF UGC MINOR RESEARCH PROJECT**

1. NAME AND ADDRESS OF THE PRINCIPAL INVESTIGATOR

Dr. Sonia Sunny, Associate Professor, Dept. of Computer Science  
Prajyoti Niketan College, Pudukad, Thrissur- 680301

2. NAME AND ADDRESS OF THE INSTITUTION

Prajyoti Niketan College, Pudukad, Thrissur, 680301

3. UGC APPROVAL NO. AND DATE

No.F.MRP/12th Plan/14-15/KLCA056 dated 10/12/2014.

1673-MRP/14-15/KLCA056/UGC-SWRO dated 04/02/2015.

4. DATE OF IMPLEMENTATION                      15-02-2015

5. TENURE OF THE PROJECT                        2 Years

6. TOTAL GRANT ALLOCATED                      Rs. 2,33,000/-

7. TOTAL GRANT RECEIVED                        Rs. 2,00,500/-

8. FINAL EXPENDITURE                            Rs 2,40,660/-

**9. TITLE OF THE PROJECT**

**Speech Recognition: Application in Man Machine Interface – Enabling Financial Transactions through ATMs**

**10. OBJECTIVES OF THE PROJECT:**

- The first objective of this work is to design an efficient speech recognition system for access to financial services mainly ATMs using spoken digits for the easy processing and operation of transactions.

- The second objective of the work is to empower the underprivileged and physically challenged people mainly illiterate, blind and such under-privileged sections of the society to avail financial services like ATM facilities in their own native language.

#### **11. WHETHER OBJECTIVES WERE ACHIEVED:**

- A framework to classify the spoken digits into the corresponding classes was developed.
- The speech recognition systems developed could provide an efficient access to the cash transactions in ATMs in English as well as in Malayalam language.
- Combination of the pre-processing and post-processing techniques, feature extraction method and the classifier produced excellent results.

#### **12. ACHIEVEMENTS FROM THE PROJECT:**

- Development of an efficient Automatic Speech Recognition system for financial transactions in ATMs based on spoken digits in English and Malayalam languages.
- Three international Journal Publications
- One International Conference with Proceedings
- Best paper award for the paper in the International conference.

#### **13. SUMMARY OF THE FINDINGS:**

This project work is primarily aimed to bridge the gap between the literate and illiterate in accessing financial services through ATMs using Automatic Speech Recognition. The speech recognition system is developed using five modules/steps.

- **Creation of the databases-** Two spoken digits databases consisting of digits 0-9, one for Malayalam Language and the other for English are created. 500 speakers are selected to utter the digits in both languages. Speakers from various parts of Kerala belonging to different age groups and gender are chosen to have a better generalisation of the recognition results.
- **Pre-processing-** End Point Detection algorithm is exploited to find the boundaries of each spoken digit and the background noises and disturbances are removed using wavelet denoising technique namely soft thresholding.

- **Feature Extraction** – Relevant features are extracted from the pre-processed speech signals using Discrete Wavelet Transforms.
- **Post processing** – The features generated are brought to a range using normalization technique.
- **Classification** – The features obtained after post processing are classified into corresponding speech classes using multi-layer perceptron architecture of Artificial Neural Networks.

The speech databases are created using a popular commercial digital audio editing software called **GoldWave**. The feature extraction, pre-processing and post processing steps of the speech recognition system design are implemented using **MATLAB** which is a high-level language and an interactive environment for numeric and scientific computations, visualisation, application development and programming. The classification part is implemented using a package called **WEKA**, which is an open-source software with a collection of machine learning algorithms developed in JAVA.

*The main highlights of this project work are:*

- ATM transactions are made easy. Even an illiterate person who has no knowledge about the ATM can communicate with the ATM in his/her own native language.
- Most of the speech recognition works concentrate only on the key stages of recognition namely feature extraction and classification. But in this work, along with these two techniques, two more techniques namely pre-processing and post processing techniques are used which produced better recognition accuracy.
- Combination of Discrete Wavelet Transforms and Artificial Neural Networks produced good recognition accuracy than other feature extraction techniques and classifiers.
- It was found that the performance of any speech recognition system with high accuracy relies heavily on many factors such as the database used, pre-processing techniques adopted to remove the background noise, the feature extraction technique selected to extract features from the speech signals, the post processing methods applied on the feature vector set obtained and most importantly the pattern classifier used for classification.

Since cash transactions through ATMs demand high security and privacy, the speech recognition system developed alone cannot guarantee much privacy and security. So in order to add more security to the transactions, biometric recognition methods like finger print recognition, iris recognition etc. can be combined with speech recognition.

#### **14. CONTRIBUTION TO THE SOCIETY:**

Our country has been making giant strides in Science and Technology. However the ability to reach out to millions who are scattered in the desolate villages in India who do not have access to basic financial services has to be empowered. Automatic Speech Recognition especially in the financial world is still a challenging and difficult task when it comes to real world applications as money could be lost in the process. Depending on the very complexity of operations, the requirements for each application are varied and different. Researchers are therefore trying new paradigm shifts in speech to make it faultless. This work intends to enhance the performance of the already existing methods to improve the recognition rate.

With financial innovations hovering around the educated class and language barriers, this project helps to break the barriers of education and language and help proliferation of access to financial services in a very smooth and convenient way where technology delivers at the doorstep of the oppressed and marginalised people. Access to financial services in a secure manner helps to gain financial independence and keeps the common man away from the bondages of money lenders and middle men.

With speech recognition in place, financial services touch points which were cluttered around the cities and the elite class will now move towards the far flung areas discovering the treasure at the bottom of the pyramid. This project work by making access to financial services easier to the large masses of people as a corollary helps in channelizing the small savings of the millions into the national pool of funds through Banks and helps in nation building activities. Thus the project provides customers especially the illiterate people an easy and efficient method to avail the cash transactions through ATMs in their own native languages.

#### **15. PUBLICATIONS OUT OF THE PROJECT:**

##### **International Journals**

1. **Sonia Sunny**, Financial Transactions in ATM Machines using Speech Signals, International Journal of Engineering Research and Application, Vol. 7, Issue 1, Part 4,

pp.25-28, January 2017.

2. **Sonia Sunny**, Sreekala M, Speech Recognition in ATMs: Application of Linear Predictive Coding and Support Vector Machines, International Journal for Research in Applied Science & Engineering Technology (IJRASET), Volume 5 Issue III, pp. 545-548, March 2017
3. **Sonia Sunny**, Voice Enabled ATMs and Deployment of Wavelets for Recognition and Authentication of Voice Based Inputs, International Journal of Pure and Applied Mathematics (IJPAM), Volume 118 No. 17, pp. 747-757, 2018. (Scopus Indexed )

### **Conferences**

1. Voice Enabled ATMs and Deployment of Wavelets for Recognition and Authentication of Voice Based Inputs, *Proceedings of Joint International Conference on Artificial Intelligence and Evolutionary Computations in Engineering Systems (ICAIECES-2017) & Power, Circuit and Information Technologies (ICPCIT- 2017)*, organized by Department of EEE, CSE and ECE, Madanapalle Institute of Technology & Science (MITS), Madanapalle, India during 27-29 April 2017.

### **Best paper award**

1. Received the **Best paper award** in the *Joint International Conference on Artificial Intelligence and Evolutionary Computations in Engineering Systems (ICAIECES-2017) & Power, Circuit and Information Technologies (ICPCIT- 2017)*, organized by Department of EEE, CSE and ECE, Madanapalle Institute of Technology & Science (MITS), Madanapalle, India during 27-29 April 2017 for the paper entitled “Voice Enabled ATMs and Deployment of Wavelets for Recognition and Authentication of Voice Based Inputs”.

Dr. Sonia Sunny  
PRINCIPAL INVESTIGATOR

Dr. Shaijan Paul  
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