

Speech Recognition System

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Embedded system

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Introduction

- Converts spoken language into text
- Uses machine learning or signal processing techniques

Objective

- Develop a system that can recognize and respond to human voice commands
- Improve human-computer interaction

Working Principle

- Sound input via microphone
- Preprocessing (noise reduction, feature extraction)
- Pattern recognition using ML models
- Output as text or command

System Components

- Microphone / Input device
- Preprocessing unit (MFCC, FFT)
- Classifier (HMM, Neural Networks)
- Output Module

Technologies Used

- Programming: Python / MATLAB / C++
- Libraries: SpeechRecognition, PyAudio, TensorFlow
- Hardware: PC / Raspberry Pi / Arduino

Process Flow

- Voice Input → Feature Extraction → Model Processing → Text Output / Action

Sample Code

- `import speech_recognition as sr`
- `r = sr.Recognizer()`
- `with sr.Microphone() as source:`
- `print("Speak now...")`
- `audio = r.listen(source)`
- `text = r.recognize_google(audio)`
- `print("You said:", text)`

Applications

- Voice Assistants (Siri, Alexa)
- Voice-controlled devices
- Accessibility tools
- Smart homes and automation

Challenges

- Accents and dialects
- Background noise
- Multiple speakers
- Real-time processing

Future Scope

- Emotion recognition via voice
- Multilingual support
- Integration with IoT devices
- Real-time voice translation

Conclusion

- Enhances user-machine interaction
- Wide applications in modern tech and daily life