

Performance Analysis of Weather Information System

Performance Analysis of Weather Information Service

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Outline

- Weather Service Overview
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- Sample Dialog
- Log Files analysis of Weather Service Prototype Version
- Modifications in Weather Service Version 0
- Log Files analysis of Weather Service Version 0
- Future Directions

Performance Analysis of Weather Information System

Weather Service Overview

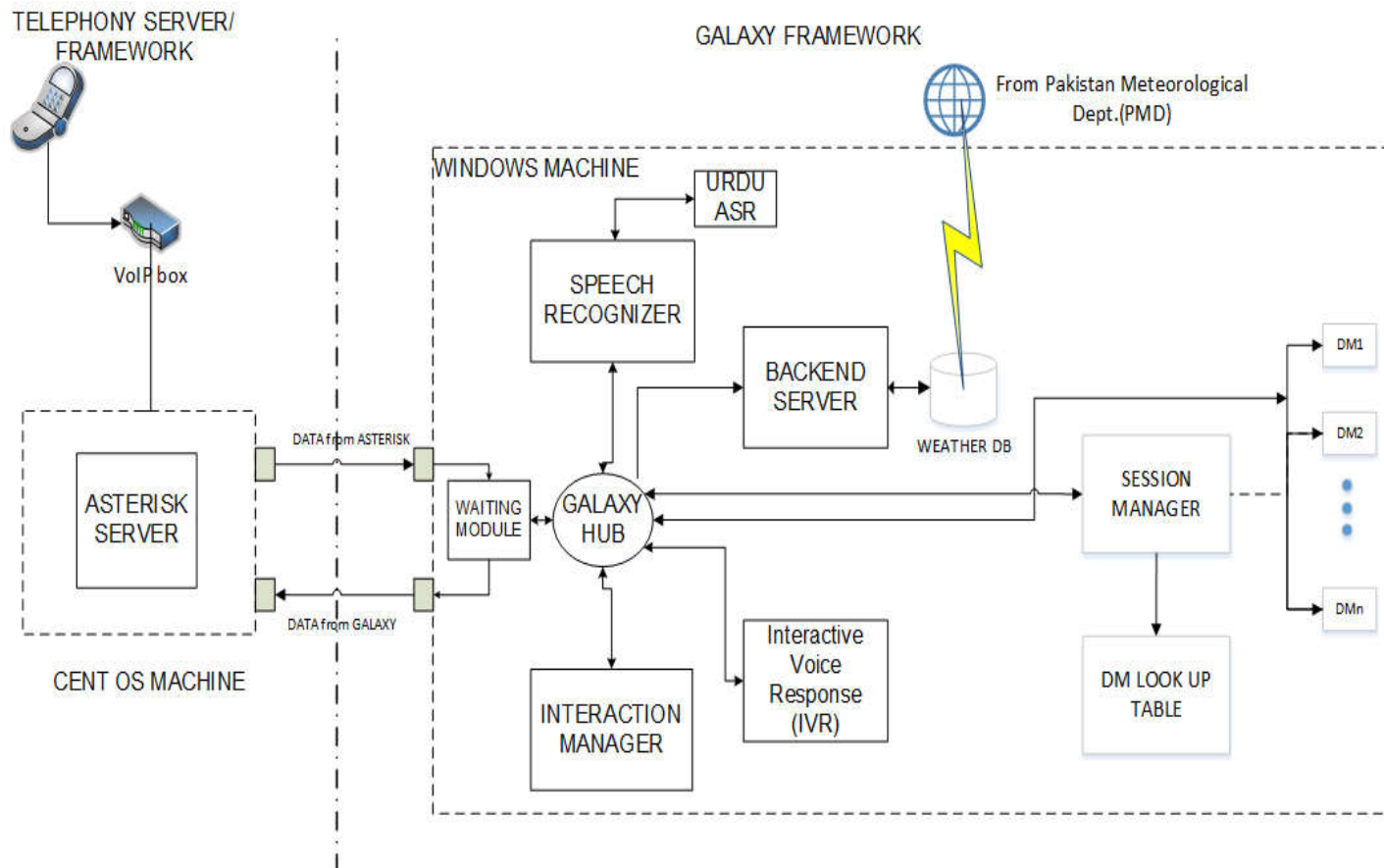
A weather information system where a user calls and is greeted by the system, then asked for a district name. The system provides the next 24 hour forecasted weather information of the desired district.

Environment	Indoor
Accents	From all over Pakistan ¹
Telephone	All famous cell phone brands
Channel	Mobilink, Ufone, Telenor, Warid, Zong, PTCL
Age	18 – 50 years
Vocabulary	District names(139), Yes/No

¹ <http://www.cle.org.pk/dialog1/images/pakistan-district.gif>

Performance Analysis of Weather Information System

System Architecture



Telephony Server/Framework

- Following hardware and software components are required:
 - Telephone line
 - Linksys-spa-3102
 - An x86-based Computer
 - Trixbox software ¹
- Telephony Server uses Trixbox. Trixbox core technologies include:
 - CentOS - The Linux distribution on which Trixbox is built ²
 - Asterisk - Provides the core Private Branch Exchange (PBX) functionality
 - FreePBX - Provides a web interface for managing and configuring Asterisk through a web browser

¹ <http://sourceforge.net/projects/asteriskathome/files/trixbox%20CE/trixbox%202.8/>

² <https://www.centos.org/download/>

Galaxy Framework

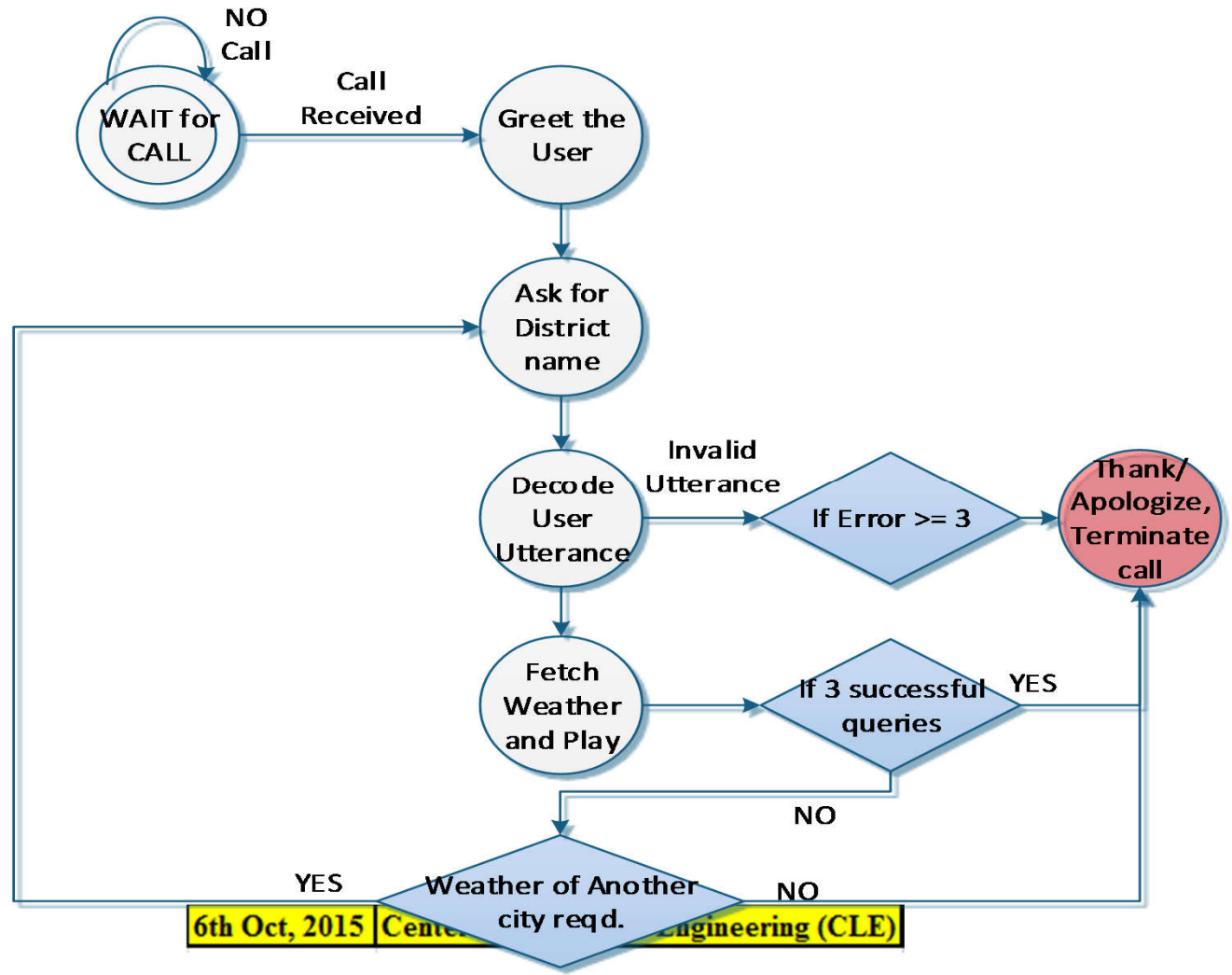
- Following hardware and software components are required:
 - An x86-based Computer
 - Binary Executable files
- Major Modules working in Galaxy are:
 - Interactive Voice Response (IVR)
 - Speech Recognizer
 - Backend Server
 - Dialog Manager

Speech Recognition

- Two Automatic Speech Recognition (ASR) systems are used.
 - District Name (for which the weather information is required)
 - Affirmation (YES/NO)
- Number of vocabulary items in ASR for district names are 139.
- Hidden Markov Model (HMM) based approach is used for speech recognition.
- An open source toolkit, Sphinx, is employed for recognition purpose.

Performance Analysis of Weather Information System

Dialog Flow



Error Handling

- Following possible errors can occur:
 - 1) User response is inappropriate
 - Silence
 - Multiple words
 - Out of Vocabulary words
 - 2) ASR misrecognition
- In each of the above cases, the system asks the user to say the desired district name again.
- In case system encounters error 3 times during a call, the system drops the call with a goodbye message.

Sample Dialog

سٹم: محکمہ موسمیات کی موسمی پیشن گوئی میں خوش آمدید۔

سٹم: آپ کس شہر کے موسم کا حال جاننا چاہتے ہیں؟

کالر: لاہور

سٹم: اگلے ۲۴ گھنٹوں کے دوران لاہور کا موسم بوند باندی کے ساتھ جزوی طور پر ابر آلود رہنے کا امکان ہے۔

زیادہ سے زیادہ درجہ حرارت ۳۵ ڈگری سینٹی گریڈ رہے گا جبکہ کم سے کم ۲۴ ڈگری سینٹی گریڈ رہے گا

سٹم: کیا آپ کسی اور شہر کے موسم کا حال جاننا چاہتے ہیں؟ یاں یا نہیں میں جواب دیجئے۔

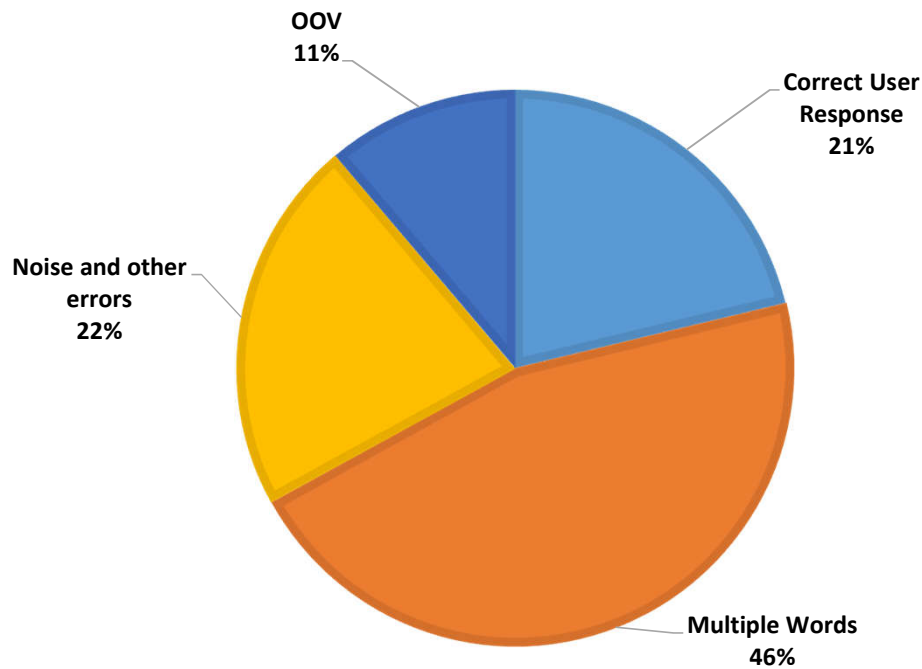
کالر: نہیں

سٹم: آپ کا کال کرنے کا شکریہ۔

Performance Analysis of Weather Information System

Log Files Analysis of Weather Service (Prototype Version)

DISTRIBUTION OF CALLS



Analysis of calls

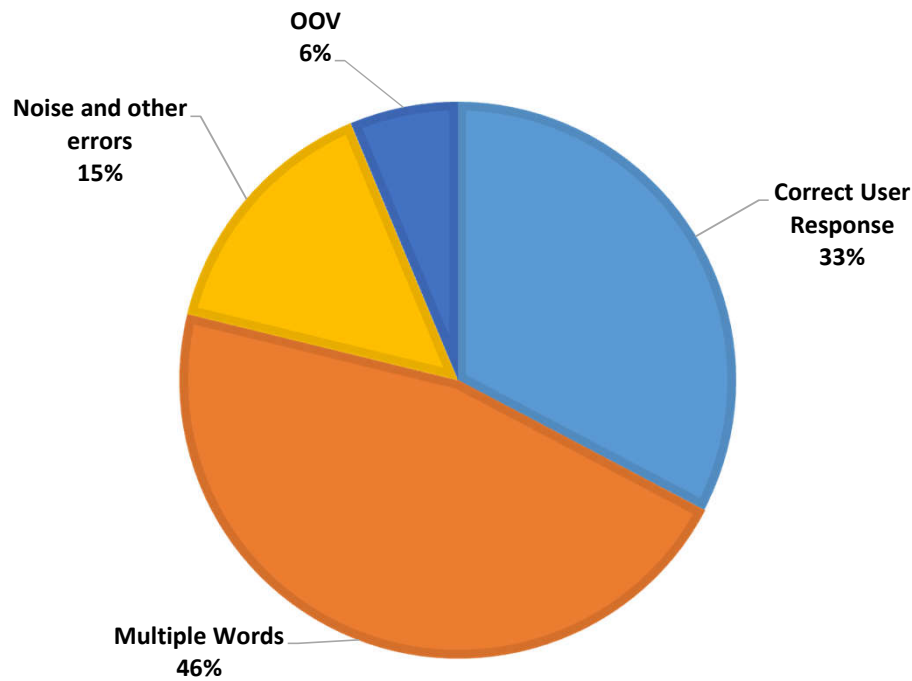
Category	Number of calls	Correctly Detected	Accuracy (%age)
Correct User Responses	207	152	73.4
Multiple Words	464	359	77.3
OOV Words	109	56	51.4
Noise and other errors	213	-	
Total	993	567	57.0

Modifications in Weather Service

- Following modifications were made in weather service:
 1. Integration of new Voice Activity Detector (VAD)
 2. Detection of busy tone
 3. Modifying the error prompt for multiple words
 4. Modifications in OOV detection

Performance Analysis of Weather Information System Log Files Analysis of Weather Service (Version 0)

DISTRIBUTION OF CALLS



Analysis of calls

Category	Number of calls	Correctly Detected	Accuracy (%age)
Correct User Responses	442	361	81.9
Multiple Words	623	579	92.9
OOV words	85	17	20.0
Noise and other errors	201	-	
Total	1351	804	70.3

Comparison of Prototype Version and Version 0

- Improvements in performance
 - Accuracy for recognition of correct response
 - Detection of multiple words
 - Detection of busy tone
 - Improvement in overall success rate
- Degradation in performance
 - Detection of OOV words

Modifications in Weather Service Version 1

- Following modifications were made in weather service:
 - Limiting the user to a single successful query
 - Improving system prompts
 - Improving Loggings of calls

Future Directions

- Adding a short weather summary after welcome prompt
- Get feedback from users
- Elegant back off methods
- Making the system dynamic and time-sensitive
- Improving OOV detection
- Improving the ASR by training the system on speech data with 2 cleaning passes
- Shifting the system to multiple channels

Thank You