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NATURAL LANGUAGE BASED HUMAN COMPUTER INTERACTION

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Abstract - *Human Computer Interaction is about how people interact with computer and to what extent computers are or not developed for successful interaction with human beings. Speech and pattern recognition is a user-friendly way to access computer. The proposed system will initialize speech driver and then user input will be taken with the help of microphone. This speech input will be converted into text. Lexical analyzer will take the text input and convert it into tokens which will be stored in symbol table. Parser takes the tokens as input and generates parse tree. Different Linux OS commands can be executed through this speech input. For other activities, keywords will be identified from the speech and corresponding command will get executed. Proposed system will work in two modes: terminal and word processor. In terminal mode it will execute internal and external command. In word processor mode it will perform word processing related operations like open, type, save and exit. System will execute operations in response to speech command.*

Key Words: **Human Computer Interaction (HCI), Natural Language Processing (NLP), Application Programme Interface (API), Speech to text, Libreoffice.**

1. INTRODUCTION

Human Computer Interaction (also referred as HCI) is the field of study of interaction between the computers and users. It studies the ways in which humans make, or do not make, use of computational artifacts, systems and infrastructures. In doing so, much of the research in the field seeks to improve human-computer interaction by improving the usability of computer interfaces. As a field of research, human-computer interaction is situated at the intersection of computer science, behavioral sciences, design, media studies, and several other fields of study. The term was popularized by Stuart K. Card, Allen Newell, and Thomas P. Moran in their seminal 1983 book, The Psychology of Human-Computer Interaction, although the authors first used the term in 1980 and the first known use was in 1975.

2. LITERATURE SURVEY

Mainly every system on related topic proposed by different authors focuses on improving the current scenario of Human Computer Interaction system by use of advanced technology.

Speech based Human Machine Interaction system for Home Automation. This paper presents a speech based HMI system for home by which user can operate and interact with home appliances and machine using speech. The system requires android smart phone with Bluetooth connectivity and convey commands to programming unit through Bluetooth and then programming unit commands controlling unit to operate devices according to user's need [1].

Wheelchair Control Using Speech Recognition. In this a speech controlled wheelchair for physically disabled person is developed which can be used for different languages. Various signal processing techniques are used for improving quality of signal. Isolated words are used, training of words is done and are stored in the database and after training phase, testing phase is carried out [2].

Intuitive human device interaction for video control and feedback. This paper is about the usability of the intuitive interaction method for video delivery system. Hand gestures, speech recognition, finger tracking are used as implicit feedback. Recognition of user emotions and body position is used to derive implicit feedback. Large distance and background noise have negative impact on accuracy [3].

An Interactive Interface between Human and Computer based on Pattern and Speech Recognition. A paper which uses the combination of speech and pattern as new input to provide user friendly access to computer. This system uses SAPI to process voice commands, SR can translate voice commands into text and TTS can speak out text. This system uses SAPI to process voice commands, SR can translate voice commands into text and TTS can speak out text [4].

Speech User Interface for Computer Based Education System. This paper explains speech based interaction with computer for education purpose. The major problem is environmental noise that reduces the performance of the system. This paper explains the removal algorithms to achieve good performance. For noise removal Wiener filter and echo cancellation techniques are used [5].

Human Computer Interaction Using Speech Recognition Technology. This paper describes about the speech recognition technology. A security feature is provided which asks random question to user when logged in. Implements by comparing input string with the inbuilt dictionary [6].

3. METHODOLOGY

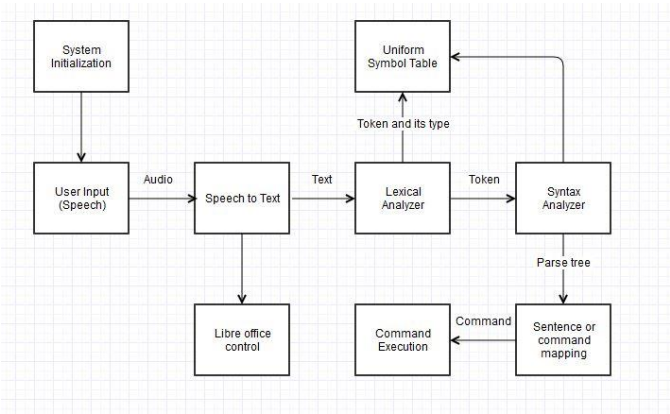

Fig 1: Workflow of the system

As shown in the Fig. 1, firstly hardware initialization is done in which the connection status of microphone is checked. Then the user input is given through speech via microphone.

Then speech to text conversion is done using speech to text API. This text is fetched and passed to lexical analyzer which converts the text into tokens then parser identifies the pattern and generates parse tree followed by sentence and command mapping. Lastly internal/external command and word editor operation based on selected module is obtained.

The purpose of this project is to interact with computer through speech in terms of execution of certain commands and some word editor operations. The user will provide input via speech through connected microphone and then select a mode i.e. terminal mode or word editor mode. The spoken task will be performed accordingly without use of mouse or keyboard.

Design of HCI using Natural Language speech. Speech will be converted into sentence. Further these sentences are used to generate tokens by lexical analyzer. Parser will use generated tokens to match grammar and action corresponding to grammar will be executed. Further, Linux commands and LibreOffice operations are executed.

3.1 Deployment Environment

It is a computer system in which a computer program or software component is deployed and executed. For this, we have to define the following two things:

3.2 Software Requirement

(a) Speech API (Python speech recognizer using libraries nltk, pyaudio, speech recognition)

(b) Fedora

(c)Lex & Yacc installed

3.3 Hardware Requirement

(a) Microphone

(b) Processor intel core 2 duo and above

(c) 32 or 64 bit processor

(d) GNOME version 3.9.0 and above

3.4 Functional Requirements

It includes functions performed by specific screens, outlines of work-flows performed by the system, and other business or compliance requirements the system must meet. The functional requirements are as follows

1) System Initialization

With system boot terminal will be activated. The script is written in /.config/autostart/gnome-terminal.desktop which results in activation of terminal. After this in /etc/bashrc script is written for changing the default directory to project directory and program is executed in background.

2) Speech Recognition

Starting with the first module firstly a speech recognizer is needed. For speech recognizer we have used a python speech recognizer which is by Google. This speech recognizer needs libraries like nltk, pyaudio, speech_recognition.

3) Linux command execution

Certain command list is prepared and the sentences are broken down into tokens and passed to the parser. The corresponding command is matched with the natural sentences spoken and the command is executed.

4) Feedback for command execution

A voice feedback is given for successful command execution.

5) LibreOffice

The command for opening Libre Office through terminal is “libreoffice”. This command is spoken and is listened via our speech recognizer and typed on terminal. This opens Libre office and enters into typing mode, the text spoken further will be written in document file. And if specific keyword is spoken with words “save” and “exit”, the document will be saved and closed accordingly.

For saving the file key simulation of (ctrl+s) is done and for closing the file key simulation of (alt+f) is done at background.

For typing part a small code is written with the help of robot class in which all ascii characters are taken and key press and key release function is used.

3.5 Major Classes

3.5.1 Keysimulation

We have used key simulation for simulating keys which are required to be pressed during operation via speech.

Firstly we have used KeyEvent library in java. (import java.awt.event.KeyEvent). An event which indicates that a keystroke occurred in a component.

3.5.2 Robot class

And robot() class is used. The Robot class in the Java AWT package is used to generate native system input events for the purposes of test automation, self-running demos, and other applications where control of the mouse and keyboard is needed. The primary purpose of Robot is to facilitate automated testing of Java platform implementations. In simple terms, the class provides control over the mouse and keyboard devices.

4. RESULTS AND DISCUSSION

1) The system starts via terminal as soon as the machine is booted in fedora

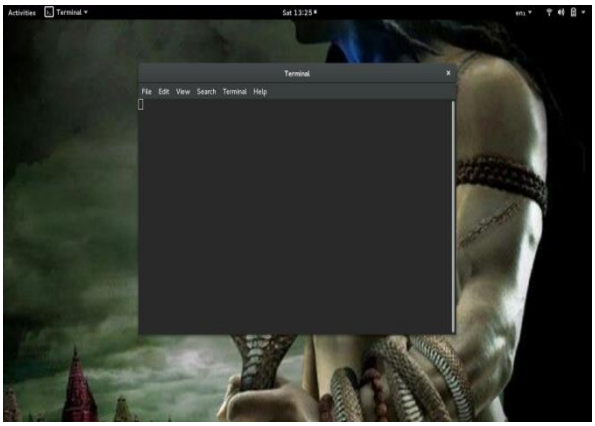

Fig 2: Terminal starts on booting.

2) Speech recognition is started

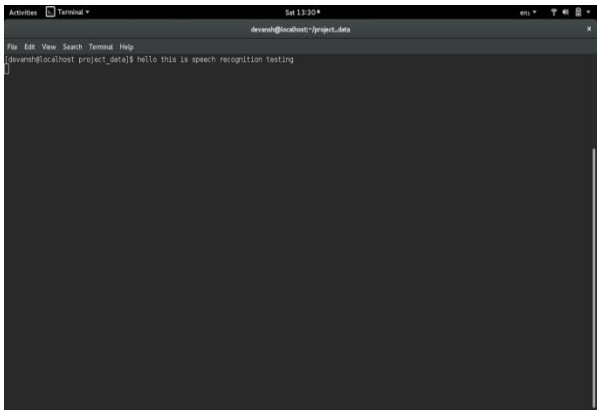

Fig 3: System recognizes the speech.

3) Linux commands are executed via speech

i) ls command for listing files

ii) ps command for listing processes

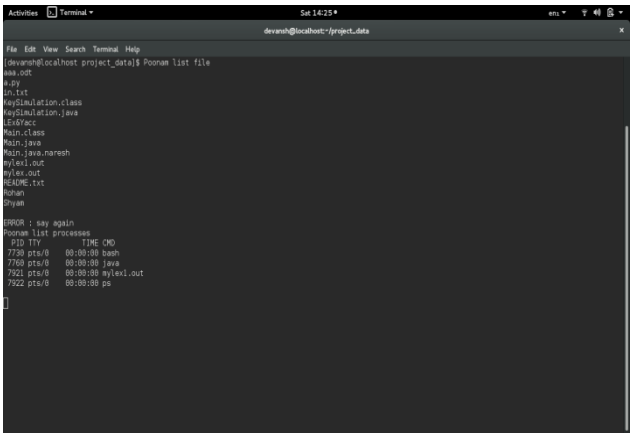

Fig 4: Execution of "ls" and "ps" commands

iii) mkdir command for making directory

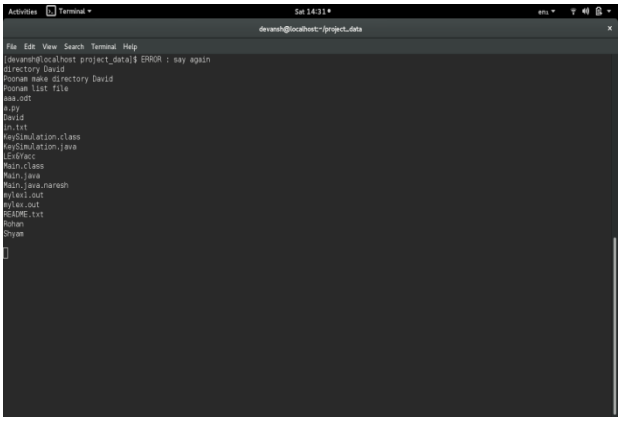

Fig 5: Execution of "mkdir" command.

4) Libre Office module

i)Open

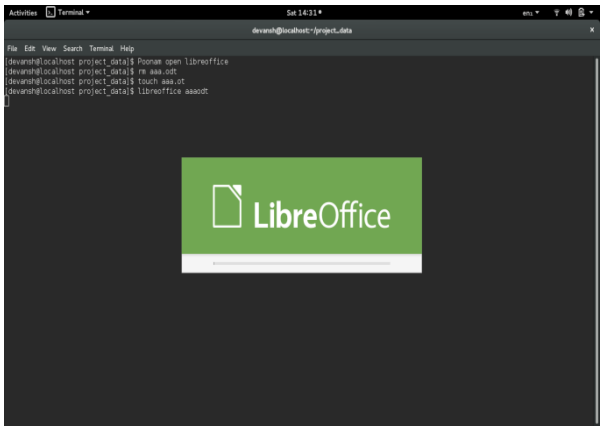

Fig 6: Opening Libreoffice.

ii) Type

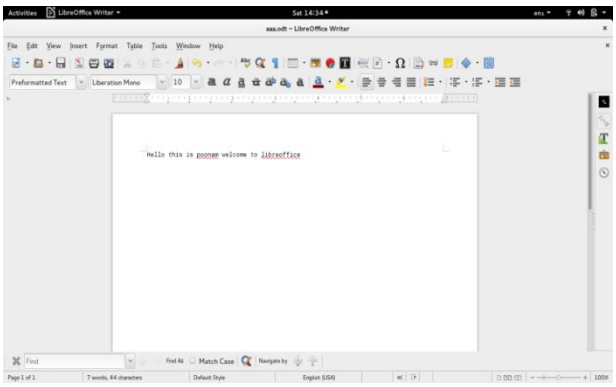

Fig 7: Typing in LibreOffice through speech input.

iii) Save

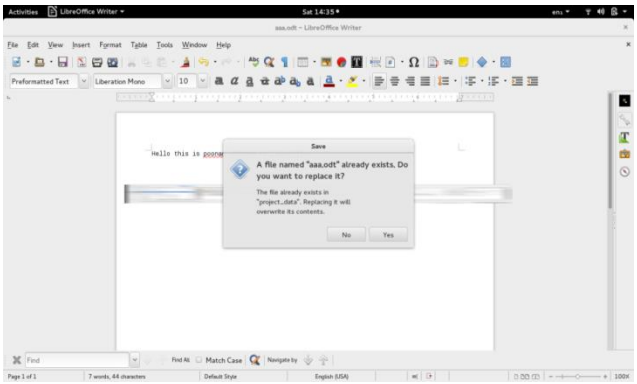

Fig 8: Saving typed document in LibreOffice.

4. CONCLUSION AND FUTURE WORK

The selected Linux internal and external commands are executed successfully via speech. Open, type, save and quit operations of Libre Office are performed using speech. In future command list can be expanded and eventually all terminal controls can be executed through speech. And even all functionalities of Libre Office can be tried to be executed via speech.

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