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Speech to text conversion & display using Raspberry Pi

*M. Sudhakar[1] Vandana Khare[2] D Vijay Krishna Kanth[3]
Department of ECE[1]
CMR College of Engineering & Technology[1]
Hyderabad, India[1]
Corresponding Author: M. Sudhakar

Abstract: *There has been a relentless effort to process the speech for a wide range of applications. Speech recognition and conversion to text is extremely useful in many applications. Speech has not been used much in the field of electronics and computers due to the complexity and variety of speech signals and sounds. However, with modern processors, complex algorithms and methods we can process speech signals to convert to text. This paper deals with display of text from speech on a monitor using Android mobile, Bluetooth and Raspberry Pi. This application is quite useful in classrooms and presentations. A speech-to-text conversion and display can also improve system accessibility by providing data entry options for blind, deaf, or physically handicapped users. The code for application program in raspberry pi is written using Python programming language. AMR (Android Meets Robots) Voice application software is used for speech to text conversion in android mobile. The speech is converted into text file and the same is sent to Raspberry Pi through Bluetooth device which in turn is displayed on the monitor. The application developed is currently the most useful and flexible approach to speech conversion into text and display.*

Keywords: *Speech to text display, AMR Voice App, Raspberry Pi.*

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I. Introduction

With the rapid development of computer technology, contemporary Human-Computer Interaction (HCI) devices/ techniques [1] [2] have become indispensable in individuals' daily lives. HCI devices/techniques such as computers, consumer electronics, mobile devices, etc., have also dramatically altered our living habits. The ease with which an HCI device or technique can be understood and operated by users has become one of the major considerations while selecting such a device. Therefore, it is necessary for researchers to develop advanced and user-friendly HCI technologies which are able to effortlessly translate users' intentions into corresponding commands without requiring users to learn or accommodate to the device. Technologies are being developed which are able to intuitively express users' intentions, such as handwriting, gestures, and human body language, to naturally control HCI devices. These technologies have many applications in the fields of remote control, virtual reality, sign language, signature authentication[3], sport science[4], health care, and medical rehabilitation[5].

II. Proposed System

The block diagram of the developed systems is given in Figure 2. The core processor used in Raspberry Pi 3 Model B. Android mobile has been used to input the speech which needs to be converted into text and then to be display on the monitor. AMR Voice App has been used in the android mobile for speech to text conversion. The converted text file sent to the Raspberry Pi 3 controller via Bluetooth. The text file is received by Raspberry Pi from HC-05 Bluetooth module via UART. The text file is displayed in the monitor connected to 1080HDMI port of the micro controller.

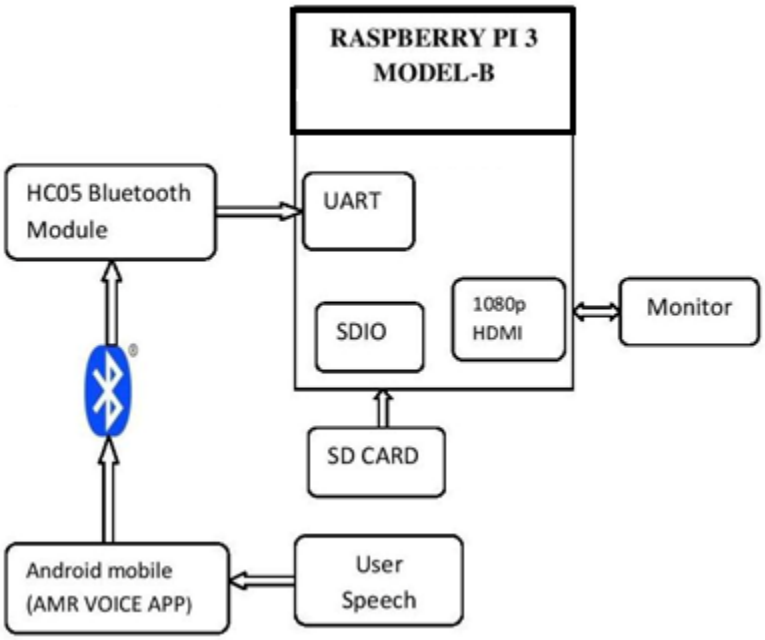

Figure 1: Block Diagram

III. Hardware

Raspberry Pi Core Module

The core module of the system is realized using a Raspberry Pi 3 board; it's a $ 35 bare-bones computer designed and developed by the Raspberry Pi Foundation, the Pi 3 features[6] a BCM 2837 System-on-Chip which includes a Quad-Core 64-Bit ARM Cortex A7 CPU clocked at 1.2 GHz paired with 1 GB of RAM. It also has VideoCore IV GPU for graphical processing applications, it also includes four USB ports for peripherals and 40 Pin General Purpose Input Output (GPIO) pins for interfacing the Pi with external electronic circuits, these GPIO pins are used to interface the Pi to the door lock module. The Raspberry Pi is designed to run various Linux based operating systems and has Raspbian as its official operating system and Python as its official programming language.

BlueTooth-HC05-Modules

HC-05 module [7] is an easy to use Bluetooth SPP (Serial Port Protocol) module[8], designed for transparent wireless serial connection setup. Bluetooth is a wireless technology standard for exchanging data over short distances (using short-wavelength UHF radio waves in the ISM band from 2.4 to 2.485 GHz) from fixed and mobile devices, and building personal area networks (PANs). Bluetooth range is approximately 10 meters.

Figure 2: BlueTooth-HC05-Modules

IV. Software

Set the Slave default Baud rate as 9600 in python programming. 8 Data bits, 1 Stop bit and no parity bit is used for operation of HC-05 module. PIO9 and PIO8 can be connected to red and blue led separately. When master (Android phone) and slave (HC-05 module) are paired [9], red and blue led blinks 1time/2s in interval, during disconnection only blue led blinks 2 times/s. Auto-connect to the last device on power using default

option. Permit pairing device to connect as default. By default, Auto-pairing PIN as "1234". This password can be changed as the user requirement. Bluetooth HC-05 module is connected to the controller as UART pin. In project, Bluetooth HC-05 module is used as serial communication between the Android phone (AMR APP to convert user speech to text [10]) and the Raspberry pi 3 controller. Bluetooth HC-05 module is to receive the converted speech text from the AMR App (Android phone). The received text is transmitted to the controller through UART pi connection. The received text or string from controller is displayed on the monitor in the format as *Hello world#.

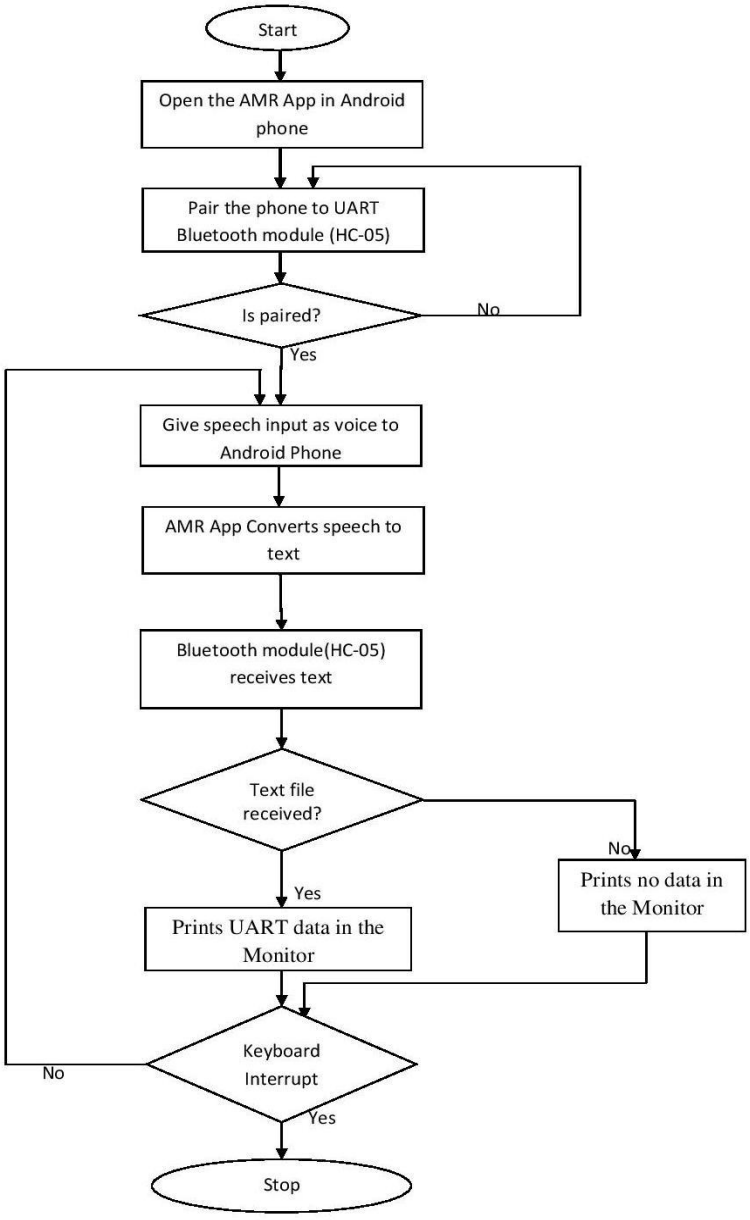

Figure 3: System Algorithm

AMR Voice App in Android Phone:

AMR Voice [11][12] app takes the voice as input from android phone[13] and converts it into text string using Android mobiles internal voice recognition (Google Voice App) and sends this converted text serially over Bluetooth. Uses android mobiles internal voice recognition to pass voice commands to your robot Pairs with Bluetooth Serial HC05-Modules and sends in the recognized voice as a string. This HC05 received string is displayed on the terminal screen of monitor connected through raspberry pi3 controller. For example if you say Hello the android phone will return a sting *Hello# to your Bluetooth module. *and # indicate the start and stop bits Can Be used with any controller which can handle strings.

Figure 5: AMR Voice app icon as seen in the mobile

V. Experimental Results

The android application along with Raspberry Pi setup for speech to text conversion has been tested vigorously for its performance. The performance of the developed system has been found to satisfactory. The speech has been converted to text and the same displayed with great consistency under varying conditions. The speaker can used this device from a maximum distance of 10 m due to the Bluetooth constraints. The display of text converted from the speech is shown in figure 6 below.

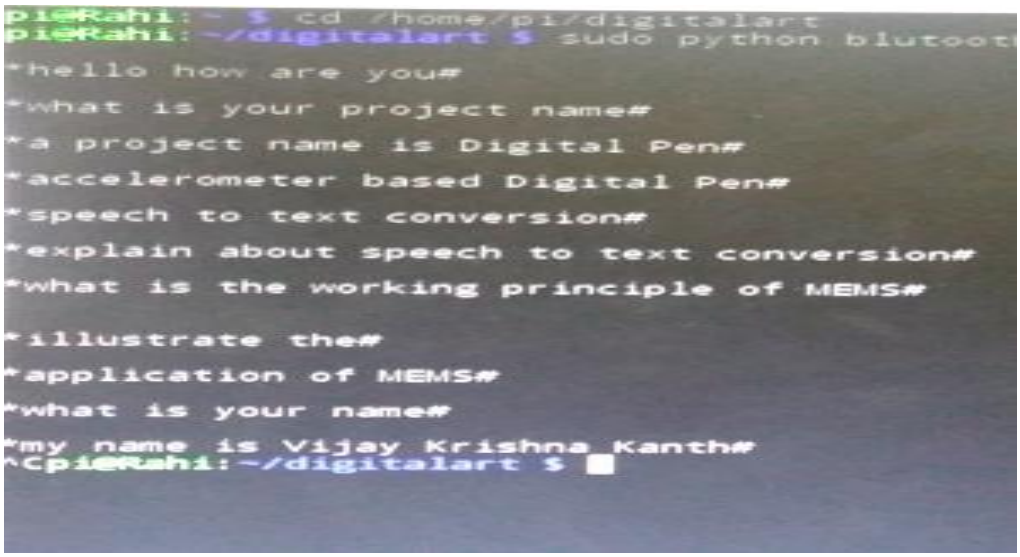

Figure 6: Display of Text converted from Speech

VI. Conclusion

Speech to text conversion application has been successfully implemented using Raspberry Pi. This application is useful for presentations in conferences and classrooms. Android mobile with AMR App is used along with Bluetooth HC-05 module has been used in this Application to display text on the Monitor. The conversion of speech to text and display has been observed to be consistent and reliable.

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AUTHORS' BIOGRAPHY

Dr. M. Sudhakar[1]: Graduated from JNTU College of Engineering, Hyderabad in 1979, with specialization in ECE. He completed his M.Tech from Indian Institute of Technology Madras in 1986 with the specialization in Instrumentation, Control & Guidance. Obtained doctoral degree from Annamalai University. Successfully headed R&D Project assigned by IAF on "Mathematical Modelling & Simulation of Aero Engine Control System" at Aeronautical Development Establishment, Bangalore and Gas Turbine Research Establishment, Bangalore. He is presently working as a Professor in the department of ECE and Dean (Planning & Development) at CMR College of Engineering & Technology, Hyderabad. He is a Fellow member of IETE and Life member of ISTE.

Mrs. Vandana Khare[2] submitted her Ph D thesis in Communication Engineering at JNTU Hyderabad. She completed M.E (Digital techniques) in 1999 from SGSITS, Indore (M.P) India and B.E in ECE in the year 1994 from GEC Rewa (M.P). She is Associate Professor in ECE at CMR College of Engineering & Technology, Secunderabad. She has 18 years of teaching experience and has published 14 research papers in International Journals & presented 5 papers in National & International Conferences. She is life member of ISTE, IETE & IEEE Technical societies. Her research Interest includes Wireless Communication, Computer Networks, Mobile Computing and Bio-Medical Imaging.

Mr. D. Vijay Krishna Kanth[3] is PG Scholar in the Department of ECE at CMR College of Engineering & Technology. His area of specialization is Embedded Systems.

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