Intelligent Drone based Personal Assistant using Artificial Intelligence (AI)

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ABSTRACT

Computation has become essential part of our life. The input devices and user interface changes from each generation. But still many users are unable to access information from reliable sources in a convenient way. In this paper, we are implementing digital assistants on mini drones using raspberry pi. This adds mobility and portability to the device. By this model, users can easily obtain responses through voice commands. The output is received from the cloud through Text-to-Speech (TTS) converter. The Arduino acts as flight controller and it is serially interfaced with raspberry using python and hence the drone can also be controlled through voice commands. In order to prevent collision, we are implementing obstacle avoidance system through ultrasonic sensors.

Keywords: *computation, user interface, digital assistants, voice commands, Text-to-Speech, flight controller, serially interfaced, obstacle avoidance*

1. INTRODUCTION

Digital assistants are confined within limited devices. Extending their functionality to other devices makes them portable and efficient. Converting mini drones into assistants gives flexibility to the user. Thus, users can easily perform tasks through voice commands.

Drones (Quadcopters) are the flying machines that has multiple rotors which balances the air through aerodynamics and flight mechanics.

In these four motors, two motors spins clockwise and two motors spins counter-clockwise.

The raspberry we are implementing is light weight and hence this can be easily mounted on the drone. It can be serially connected to Arduino using python. Thus, the raspberry acts as master and the Arduino acts as slave. And the voice inputs are received through USB microphone. Thus, technically the drone acts as a robot that performs tasks given by user.

2. OVERVIEW

Raspberry pi zero w is a $10 mini-computer which has inbuilt Bluetooth and Wi-fi. Raspbian stretch image is extracted to SD card and booted to desktop.SSH (secure shell)is used to create remote connection using port 22. The pi is logged in through user name and password.

Alexa AVS sample app is cloned from github repository through terminal. Then amazon developer account has to be created. Client ID and Client secret are created by adding a new product in Alexa voice service. This account is utilized during the process of setting up Alexa AVS sample app. An automated install script is opened and the setup continues for an hour.

Arduino pro mini is smaller version of Arduino Uno that runs on 5V power supply. The flying instructions of drones are uploaded as sketch through Arduino IDE. Then a Bluetooth module is connected to the board by interchanging tx and rx.
The ultrasonic sensor calculates the least distance from an object and instructs the controller to fly in the opposite direction. Thus, collisions can be avoided.

We can also create an Alexa skill that allows us to create custom vocabulary and skills required for end user.

3. RELATED WORK

Digital assistants available in the market such as Google home, Amazon Echo are heavier and immobile. Hence, we are implementing voice assistant in a light weight device that is portable.
We personally tested the working of amazon assistant in raspberry pi model 3. Flight instructions are compiled and tested in Arduino Uno. The working of ultrasonic sensor is also checked using bread board.

3.1 PROPOSED SYSTEM

In this system, we are going to implement AVS device SDK architecture in raspberry pi.

AVS (Alexa Voice Service) SDK architecture is utilized for communication between user and cloud.

The audio signal processor sends input to the shared data stream and further processes the signal to audio input processor which converts analog signals to digital signals

Wake word engine detects the keyword from the user and triggers signal to audio input processor.

Alexa communication library sends and receives responses through the cloud using AVS protocol.

Alexa directive sequencer library creates priority to the list of commands given by the user Capability agent sends output to the media player which is received as an audio output in speaker board.
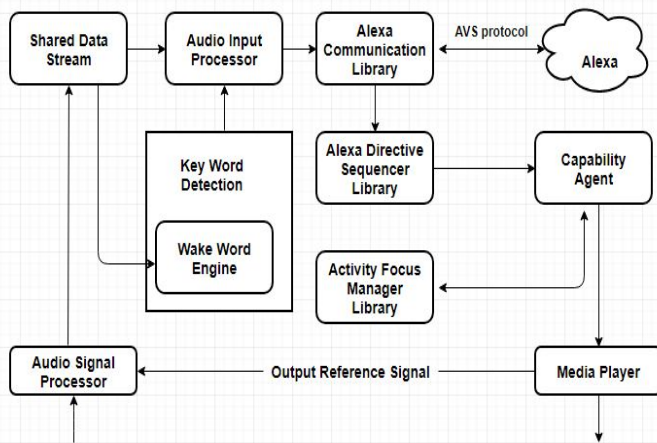

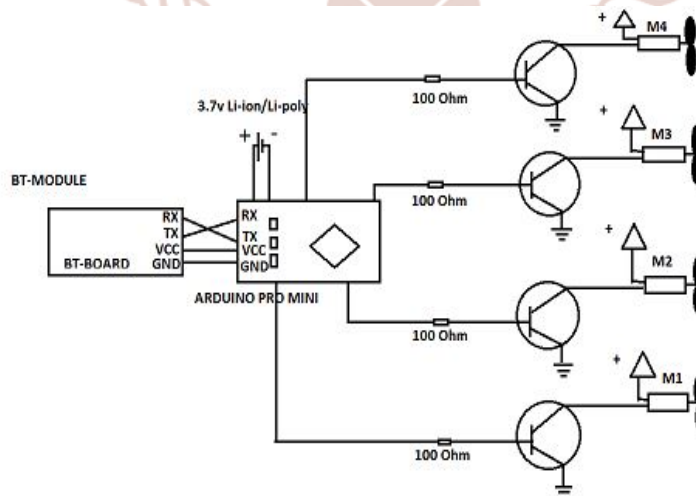**Fig 1:** SDK Architecture

PROPOSED ARCHITECTURE

Fig2: Drone Architecture

3.3 PROGRAM

Alexa AVS sample app:
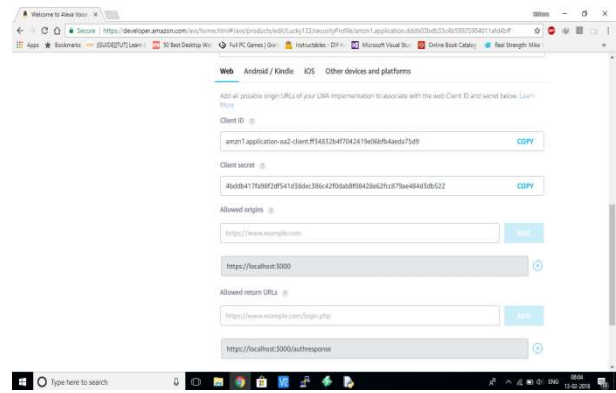https://github.com/alexa/alexa-avs-sample-app

Arduino sketch:
https://docs.google.com/document/d/14cjFdHRhV598
lPmZm1-dGg6-
Z6dFCxTRgDY6tFRUXIA/edit?usp=sharing

Python code:
https://github.com/skidder/arduino-raspberry-pi-serial

4. SYSTEM REQUIREMENTS

4.1. HARDWARE REQUIREMENTS
- Raspberry pi zero w
- Speaker PHAT
- USB microphone
- SD card
- Arduino pro mini
- Bluetooth module
- Coreless motors (4 units)
- Ultrasonic sensors
- PCB (Printed Circuit Board)
- Transistors (2N2222)
- Diodes
- Resistors (100 Ohm)
- 9V battery

4.2. SOFTWARE REQUIREMENTS
- Raspbian OS (Jessie or Stretch)
- Alexa AVS sample app
- Arduino IDE
- Putty
- VNC viewer
- SD formatter
- Etcher

5. OUTPUT
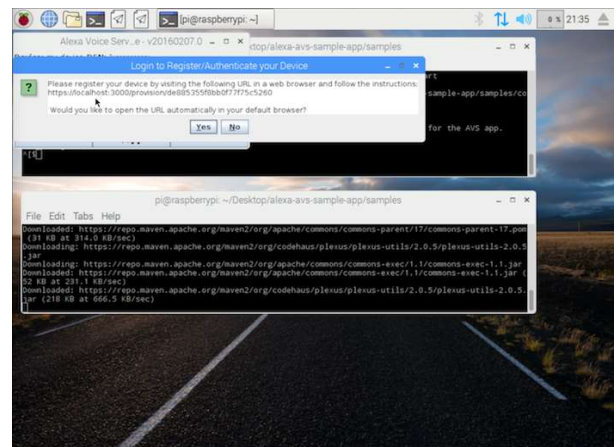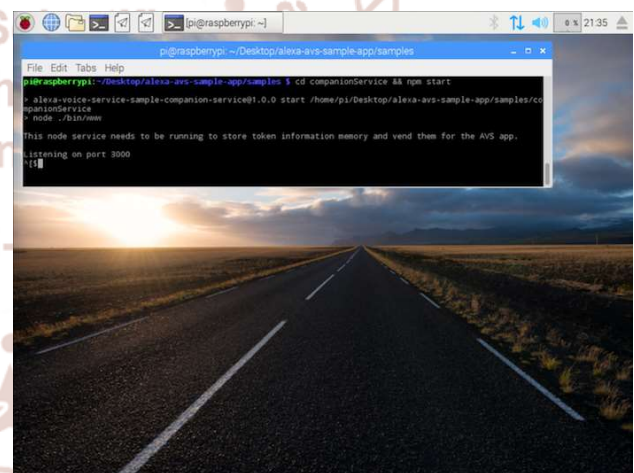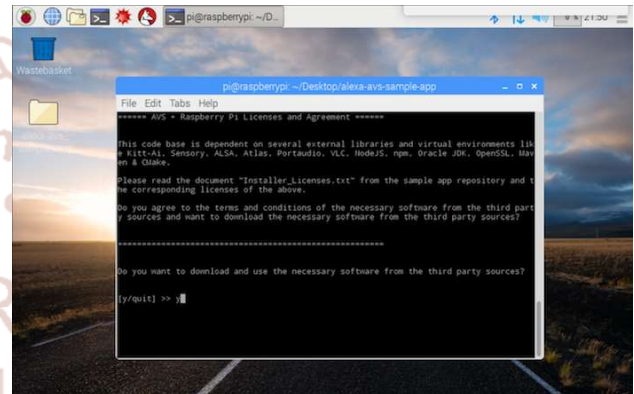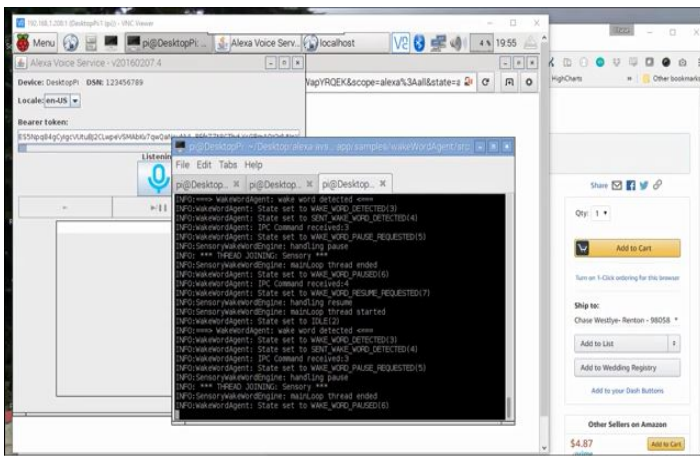
6. CONCLUSION

This may seem resemblance to some of the voice assistants in fiction movies such as Jarvis in Iron man. But this was a growing field in automated systems and robotics. In our future developments, we will try to implement machine learning algorithms in our system through neural networks and deep learning.

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