Artificial & Computational Intelligence / Published online: Mar 2020
http://acors.org/ijacoi/VOL1_ISSUE2_01.pdf

Artificial & Computational Intelligence

Artificial Intelligence Based Home Automation Using Alexa

Pravin Jaronde[1], Suraj Rebbawar[2]
Depart. of Electronic & Telecommunications,
[1]pravin.jaronde@raisoni.net, [2]rebbawar_suraj.ghrceet@raisoni.net
G H Raisoni College of Engineering, Nagpur, Maharashtra, India

Abstract

This is the age of Industrial Digital Voice Assistants (IDVAs). People are controlling their smart devices through IDVAs using voice. But there is the issue of insecurity of IDVA service with use of Alexa. The insecurity can be cause as any voice will gets accept by Alexa device because of which the smart device gets controlled even if there is not a single person present around. This kind of issue that IDVAs should sense the presence of a person physically detected and only that voice gets processed so that to avoid insecurity. Hence for making the system secure a Virtual Security Button (VSButton) is used, which uses the Wi-Fi technology that can sense any movement of a person inside the home. As soon as it detect that there is a person present inside home the Alexa gets activated and ready to perform its tasks. Hence the result shows that because of inside motion and not for outside motion the work will flow smoothly.

Keywords: Industrial Digital Voice Assistants, Alexa, VSButton, Machine Learning, Sincric.

1. Introduction

Industrial Digital Voice Assistant (IDVA) devices are so popular that now they are found in maximum home. If we are comparing from 2015 (1.1 million) to 2020 (15.1 million), then there is approximately 55% of compound annual growth. People can use this technology for doing their work smartly by using voice commands. Like shopping online, scheduling appointments, making a payment, playing music, ordering foods, checking weather, controlling smart devices (e.g., TV on/off, garage doors, thermostats). It is more convenient to the customers that in place of using hardware like a system to always catch in their hand and has to operate physically by putting their hands, it is only to use their voice command and the things gets happened automatically.

As convenience point of view if it is considered then it is most acceptable but security point if it is considered then it is risky. Because the device can be controlled by any one as it is activated by voice any external can operate it as it is non-authentic. Therefore it should save from acoustic attacks. There must be some sort of security mechanism and provide certain authentication to the customer. The command can be accepted by the Alexa device of any person/machine who speaks the correct authentication word with his/her voice command. No matter whether any persons are around the device it accepts voice commands. The sound pressure level (SPL) above 60dB for all such sounds it work. Here we are using Alexa devices because they are the most popular, portable and

easy to use IDVA devices.

2. Literature Review

Alexa was created by Rohit Prasad, along with colleague Tony Reid. Since May 2016, Prasad has been working as a Vice-President & Head Scientist in Alexa Artificial Intelligence. In November 2014, Alexa first launched on the Amazon Echo. The Echo & Alexa was initially only available to invite Amazon Prime members. General release for the Echo and Alexa was June 2015.

Samuel L. Jackson Is The New Voice Of Alexa, This Is A Definite Need. Amazon's Alexa has been the subject of a lot of debates, on one hand it's a super helpful digital assistant capable of a lot of pretty neat things, on the other hand it's for sure listening to you at all times. Amazon said it uses these conversations to improve Alexa's "understanding of human speech." Bloomberg's report Wednesday said the voice snippets are tied to device serial numbers and the owner's first name. An Amazon spokesperson said Echo devices only make recordings after hearing a wake word like Alexa. It is capable of voice interaction, music playback, making to-do lists, setting alarms, streaming podcasts, playing audio books, and providing weather, traffic, sports, and other real-time information, such as news. Alexa can also control several smart devices using itself as a home automation system.

Amazon launched many new devices in September, 2019 achieving many records while competing with the world's smart home industry. The new Echo Studio became the first smart speaker with 360 sound and Dolby sound. Other new devices included an Echo dot with a clock behind the fabric, a new third-generation Amazon Echo, Echo Show 8, Alexa built-in wireless earphones, Echo buds, Alexa built-in spectacles, Echo frames, a plug-in Echo device, Echo Flex, an Alexa built-in Ring, and Echo Loop.

A companion app is available from Google Play, the Apple App-store, and Amazon App-store. The app can be used by owners of Alexa-enabled devices to install skills, manage alarms, control music, and view shopping lists. It also allows users to review the recognized text on the app screen and to send feedback to Amazon concerning whether the recognition was good/bad. To set up compatible devices a web interface is also available.

Alexa and Google Assistant can help their users apply to jobs at McDonald's using voice recognition services on September 2019, which is the world's first employment service using voice command service. The service is available in the United States, Spain, Canada, Ireland, France, Germany, Italy and the United Kingdom. On September, 2019 Amazon announced that Alexa will soon be able to mimic celebrities' voices including Samuel L. Jackson, costing $0.99 for each voice. In 2019, Alexa started replying to Spanish voice commands in Español.

3. Proposed Methodology

Indoor Human Activity/Motion Sensing based on Wi-Fi technology. By using Wi-Fi technologies there are several related works which study how to detect the motion of a person inside home. The RSS (Received Signal Strength) based system has been propose by Kosba et al to detect human motions by RASID. However, because of some limitations of RSS (i.e., providing coarser granularity of wireless channel information than CSI), RASID is mainly designed to detect relative larger motions, e.g., instead of small motions, walking, e.g., wave a hand. To recognize nine whole-home gestures, Pu et al. leverages Doppler shift, requiring specialized receiver that extracts carrier wave features which is not mentioned in current Wi-Fi systems. However, on top of off-the-

shelf equipment, VS Button is developed.

The CSI-sensing and supervised machine learning techniques adopted by Zeng et al. to identify four types of indoor motions. Wang et al. leverages CSI to detect fine grained human activities like walking/cooking. There are two limitations for CSI-based motion recognition techniques to be used in this work. First, as per as the changes in the environment is concern they are more sensitive to that, example moving the furniture and sensitive to the human location. Second, they requires laborious pre-training process. Differ from them, there is just one-time set up of a parameter in case of VS Button. It detects outlier from the unstable CSI stream and dynamically adapts CSI baselines, which are used to indicate the conditions of no indoor motions, to different environments over time. However, for gesture recognition, they are absent in the prior studies monitoring CSI values. They can recognize only different gestures, and due to its required detection of small CSI variations, also very sensitive to the environment changes.

Mangled & Inaudible Voice Attack, Mangled voice attack is first proposed and then further it was developed. They show that the software voice assistant (i.e. Google voice) can receive voice commands on phones that are unrecognizable to human but interpretable by the voice assistants. The attack works if adversaries (speakers) to be not more than 3.5 meters far away from the phones and the victims do not notice the hearable mingle voice commands. Differ from them; instead of software voice assistants on smart phones we study home digital voice assistants. That using scenarios and security issues are different. For example, the IDVA users leave the home DAV devices at home users and usually they have their smartphones with themselves. The Amazon Echo is provided because of inaudible voice commands. The attacks require two strong perquisites, which may be barely satisfied in practice, so they are not our focus. First, a customized ultrasound microphone generates the inaudible voice commands. Second, the separation between customized microphone and the Alexa device should not be more than 2 meters.

4. Simulation Tool

The tool used for simulation of programming is JAVASCRIPT.

Input Modules:- Alexa Module, Amazon Developer, SINRIC NODEMCU ESP8266

Output Module:-Relay Board (4-port), Unit Module

The syntax of JavaScript is the set of rules that define a correctly structured JavaScript program.

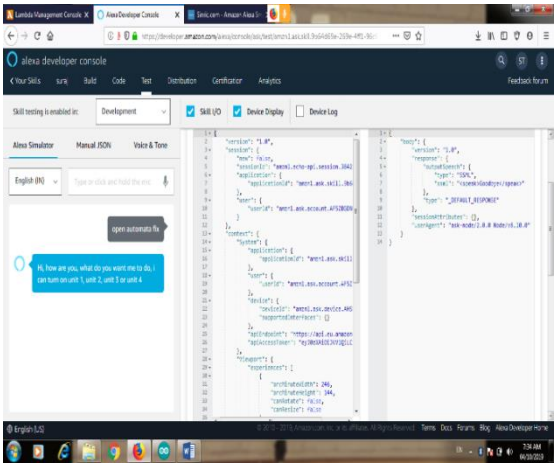
The examples below make use of the log function of the console object present in most browsers for standard text output.

The JavaScript standard library lacks an official standard text output function. Given that JavaScript is mainly used for client-side scripting within modern Web browsers, and that almost all Web browsers provide the alert function, alert can also be used, but is not commonly used. Contents Java-script is a functional language meaning that functions are the primary modular units of execution. Functions are obviously very important in Java-script. When talking about functions, the terms parameters and arguments are often interchangeably used as if it were one and the same thing but there is a very subtle difference.

Parameters are variables listed as a part of the function definition. Arguments are values passed to the function when it is invoked.

Why should we bother about this minute difference?

Well for starters, JavaScript does not throw an error if the number of arguments passed during a function invocation is different than the number of parameters listed during function definition. This should make it clear that parameters and arguments should be treated as two different entities.



JAVASCRIPT Syntax:-

The JavaScript syntax is loosely based on the Java syntax. Java is a full blown programming environment and JavaScript could be seen as a sub-set of the Java syntax.

Having said this, that is where the similarities end — Java and JavaScript are two totally different things. By learning JavaScript you will become familiar with terms such as variables, functions, statements, operators, data types, objects etc. It would take much more than a short tutorial to cover the complete JavaScript syntax. However, this tutorial covers the syntax basics that will enable you to code JavaScript in a proficient manner.

5. Purposed Model

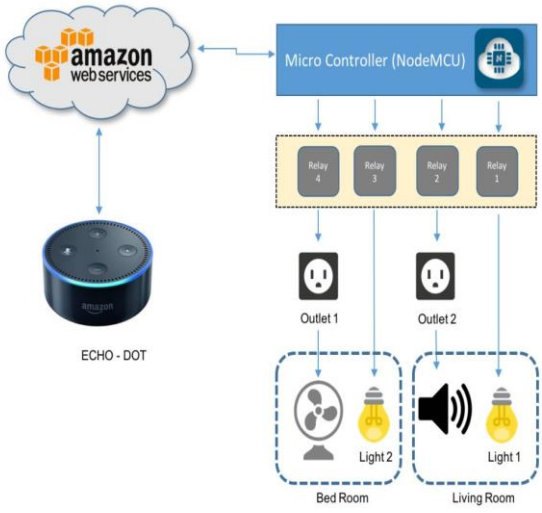


Figure 2: Project Architecture Block Diagram

Against the acoustic attacks it is proposed to protect IDVA devices. Still there are few challenges to address. For example, the factors like age, illness and tiredness are the cause to change human's voice. Because of this it may require a re-training process time to time. It is also found that the human's voice can be duplicated as it is by computers with the help of deep learning in addition to biometric-based voice authentication mechanism, for that a DVA user should wears a skin touched voice-enabled device. When the user speaks voice commands, so along with voice because of the wearable sensor it can collect the vibrations signal also and continuously match it with each other by the DVA. This approach hurt the user convenience as the extra wearable devices also needed. The solution for that is a VSButton which can well address all of the above challenges also take care of user's convenience. Where the IDVA device is deployed the VSButton authenticates users that they are inside the home and not outside. As a result, the remote acoustic attacks adversaries cannot launch. So variant human voice, extra deployment cost or the scarifying of user inconvenience (e.g., put wearable devices) reduced by use of VSButton.

6. Implementation of Hardware

Alexa assistant is used in Amazon speaker(Echo, Echo dot, Plus). Play music, read the flash news and much more things can be done using virtual assistant. When we give instructions to the Alexa then it perform the operation. For interfacing Amazon Alexa and Node MCU, we will be using an Amazon skill called Sincric. Before starting we need to create the account in Sinric, where Sinric is a website which allows for linking your development boards like ESP8226, RaspberryPi, ESP32 or Arduino with Amazon Alexa. After creating account you have to login into it. To create a new smart Industry device you have to click on

the Smart Home Device Add button. You can create as many devices which you want to control. In this case, I have created four Smart home devices.

For proposed work we are using Node MCU Wi-Fi module. Arduino IDE board is using for programming. Here Alexa itself asking a question to the user, and when user giving instructions to the Alexa, It perform its tasks. In the If condition enter your device 1 ID from Sinric website is taken.

In this case, it was 5b13a012870d4c3a139be009. Do the same for all the four devices in both turn-on and turn off function.

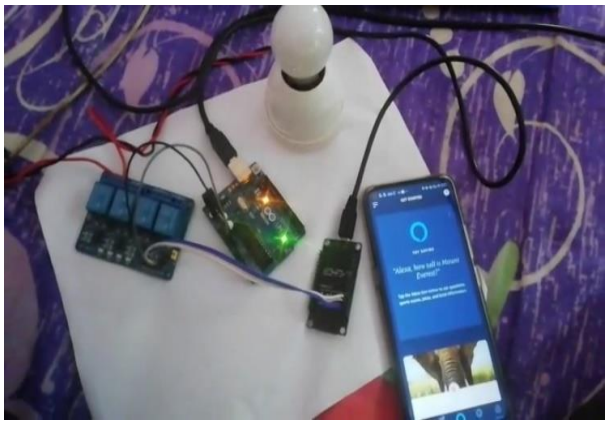


Figure 3:Hardware Implementation

Once everything is done select the correct board and upload the sketch.The NodeMCU will automatically connect to the Wi-Fi network.

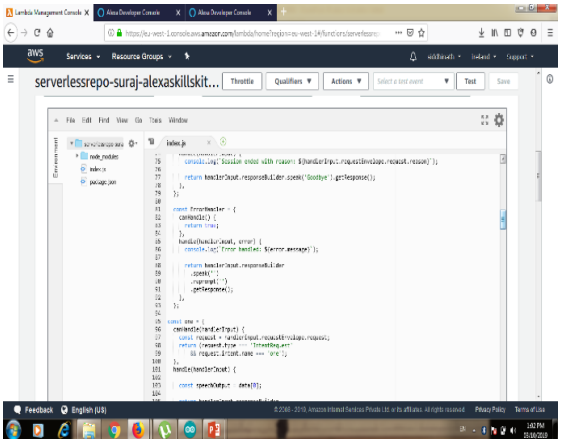


Figure 4:Lambda Management Console

Make sure your Wi-Fi is turned on and your Echo device is connected to the same device. Now open the Alexa App in your Smartphone. Go to the Skills & Games section and search for Sinric skill and enable it. Now search for devices or just ask to alexa "Alexa, discover devices". By listening this voice, it will show the number of available devices(In this case we have four devices).As per your convenience you can also rename the device to whatever you want like light, fan, cooler, etc. The circuit is very simple, but follow the precautions while connecting AC load to the relays.

7. Result and Discussion

The main purpose of this proposed work is by voice commands IDVAs enable people to control their smart devices and get living assistance. However, there are some security related issues. In propose work, there are several security vulnerabilities by considering the case study of Alexa. It involved Alexa devices, Alexa service providers, and third party Alexa service developers. But here there is a authentication issue, which can be easily overcome. Even though there is no person is physically present shill by accepting voice command it works. This can be easily transfer to the third party voice services, this considered by Alexa that it is voice command for it. We consider to propose an extra factor authentication to secure the IDVA service that is the actual physical presence. Whenever there is a physical presence of any person nearby then only an IDVA device can accept voice commands. And hence the concept of Virtual Security Button (VSButton) comes forward to sense the physical presence detection of a person. With the help of Alexa device we designed it. The propose work with experimental results proved that the accurate detection using VSButton can be easily done in both the laboratory and inside home settings. This is the start of our little experiment and for future

scope we are expecting the same technology can be used in industrial purpose also where multiple devices can be control with convenience and authentication.

References

[1] D. Watkins, "Strategy analytics: Amazon, google to ship nearly 3 million digital voice assistant devices in 2017," https://www.strategyanalytics.com/strategyanalytics/news/strategy-analytics-press-releases/strategy-analytics-ressrelease /2016/10/05/strategy-analytics-amazon-google-to-ship-nearl y-3-million-digital-voice-assistant-devices-in-2017#.WQtiX eXyuUk,2016.

[2] "Amazon: Alexa devices were best-selling products from any manufacturer," https://marketingland.com/ amazon-alexa-devices-best-selling-products-manufacturer-199446, 2016.

[3] "Amazon alexa hits 10,000 skills," https: // www.wired .com /2017/02/amazon-alexa-hits-10000-skills-plenty-room-grow/, 2017.

[4] H. Feng, K. Fawaz, and K. G. Shin, "Continuous authentication for voice assistants," arXiv preprint arXiv: 1701.04507, 2017.

[5] D. Petro, "Rickrolling your neighbors with google chromecast," in Black Hat, 2014.