

## Automated Lab

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**Abstract** - Appropriate usage of resources are the major factor of the society. Power plays a vital role in the resources which are wasted by uneven usages. In school and colleges the power consumption is at large scale. As lab is a place of system where all the peripheral is switched on most of the time and increased the power consumption. Learning is process which can be efficient if it's interesting. Practical implementation of what you learn is the way to innovation. Lab plays a vital role in the practical learning. As these days there are many concepts that needs to be explained by the charts and images. Lab must be equipped with sufficient instrument for learning.

**Key Words:** Raspberry pi, Arduino, Alexa voice services, amazon web services, IOT, RFID, Actuators

### 1. INTRODUCTION

The application of technology in today's laboratories is required to achieve timely progress and remain competitive. Laboratories devoted to activities such as high throughput screening, combinational, chemistry, automated clinical and analytical testing, diagnostics, large scale biorepositories and many others would not exist without advancements in laboratory automation. University offer entire programs that focus on lab technologies. Indiana University - Purdue university at Indianapolis offers a graduate program devoted to laboratory. The Kick graduate institute in California offers a graduate degree with an emphasis on development of assays, instrumentation and data analysis. Fusion of technology and learning make the idea of the Automated lab. An automated lab is a place where there is a learning with less consumption of resources. This idea makes the lab interesting for student and makes it cost-effective to work at large scale by reducing the energy source. A major sector of this model works in the area of making lab automated.

#### 1.1 Literature Survey

##### 1.1.1 AWS Lambda

AWS lambda is an Amazon web service which helps to build a cloud-based service for Alexa skill. AWS Lambda runs the code automatically when needed. When a code is uploaded the AWS lambda service runs the code itself, no external run servers are required. Lambda services execute the code in response to Alexa voice interactions. It also manages to compute resources for use. Lambda supports codes written

in Node.js, Java, Python, C#, or Go. The Node.js and python code can be copied and edited in inline code editor in a lambda console or upload in it in a zip file.

##### 1.1.2 Alexa Voice Services

Alexa voice services are used to build Alexa skill and access cloud-based Alexa capabilities with the support of AVS APIs, software tools, hardware kits, and documentation. AVS is integrated with Amazon's e-commerce environment. Alexa can be used as an AI assistant at home, work or any other environments. It can be used for home automation, Lab automation etc. Alexa connects to online streaming media. If This Then That (IFTTT) is an online service used to automate Web-based tasks so that when user-specified events occur and follow-up tasks are triggered and handled.

##### 1.1.3 Raspberry Pi

The raspberry pi 3 is the latest version with fast processor and double the ram than before. It is most powerful version of pi. The Bluetooth and WIFI module are added to pi without increasing the price. It can also be called as all-in-one board. This pi makes the work easier because of the inbuilt features. It can work as wireless board without any external peripherals. The power source is also increased to 2.5A so that the board can power even more powerful devices from USB ports.

##### 1.1.4 RFID

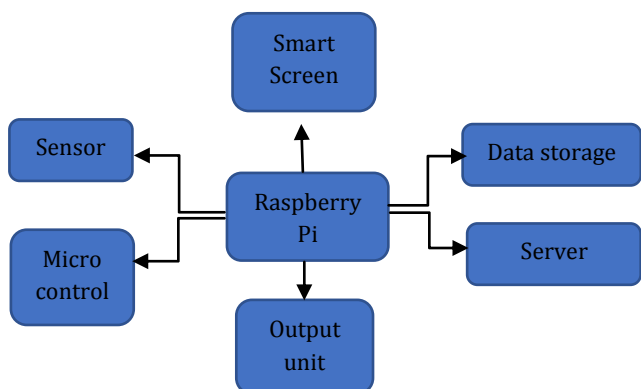
RFID is Radio-frequency identification used to read and capture the information stored on the RFID tag. RFID can read a RFID tag from a long distance. On the tag there are two components of RFID one the microchip that processes and stores the information, two an antenna to receive and transmit signal the tag is encoded by sending a two-way radio transmitter-receiver called as interrogator or reader. It emits a signal on to the tag with the help of antenna. the tag reacts with the memory stored in it. The interrogator will send the information to the RFID computer program.

### 2. PROPOSED MODELLING

The automated lab is equipped with peripheral and device which can reduce the power consumption and act more efficiently at large scale. The lab security is designed on the principle of RFID, to access the lab you need to have a tag

reader defined in the RFID database. Alexa voice services are the major module which can control the lab using voice command and provide a brief introduction to the lab user about the components, types of equipment, unique system, and automation provided inside the lab. To reduce the power consumption lab have been equipped with sensors to monitor the power consumption and the data will be stored in a server using various APIs.

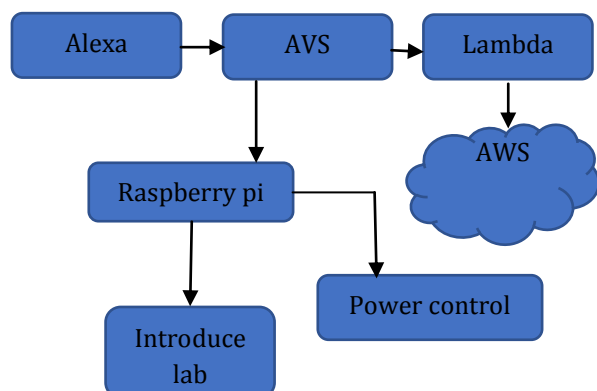
**3. SYSTEM DESIGN**



**Fig -1:** Function Diagram

All the component and modules are connected to the raspberry pi. Raspberry Pi here works as central processing for all the various modules. The sensors data and the Alexa automation all operation is performed in the raspberry pi. Smart Screen is connected to raspberry pi using HDMI and VNC viewer which can connect and share the screen on both the monitor and screen. Raspberry Pi work as a listener to voice command services, the command converted to JSON execution. AWS lambda executes the JSON command and sends the output command to Alexa voice services.

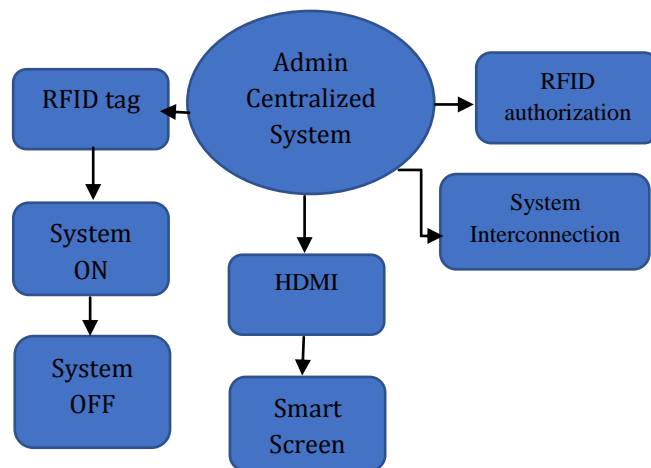
**4. FUNCTION MODULE**



**Fig -2:** Flow Diagram for Alexa Voice Services

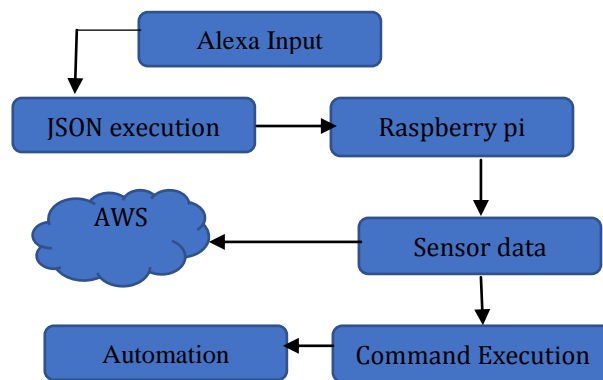
Using Alexa SDK, the raspberry pi is configured to work as Alexa. The Raspberry Pi is connected to 3.5 mm audio jack which will take audio command as input in raspberry pi. On the provided product ID and Client ID, the listener communicates with Alexa Voice Services. AWS Lambda Function executes the command in the form of JSON

command and provides with the stored function from the Lambda. Alexa Function is designed with the utterances for an introduction to the lab and controlling the automation appliance like light and another system after the authorization of the user.



**Fig -3:** Structure diagram for modules

RFID works as a gate pass for authorization to access all the system and appliance in the lab. All the system in the lab is centralized using a raspberry pi as if some user may want to share the desktop for common work share, interconnection work as sharing data and screen. At the same time, the RFID authorize the to enable automation in the lab. Collection of the complete module makes a structure of automated lab with a smart screen which can also connect to the centralized system.



**Fig -4:** Architectural Diagram for Alexa Working

Alexa work as input mode where the command is given by actuators and voice commands. These commands are executed in the raspberry pi using the python script. Commands are converted into JSON program to execute output stored in AWS lambda Service. AWS provides the service to execute serverless compute facilities. Required output operation is performed using the output appliance or voice output from the Alexa.

Alexa performs input operation and processes the data to AWS Lambda serverless compute service for storage and JSON execution. The command data are converted to JSON

and required output is executed else if automation the command is processed to actuators or appliance via raspberry pi. At same time sensors data are stored on the AWS RDS Relational Database System for further reference.

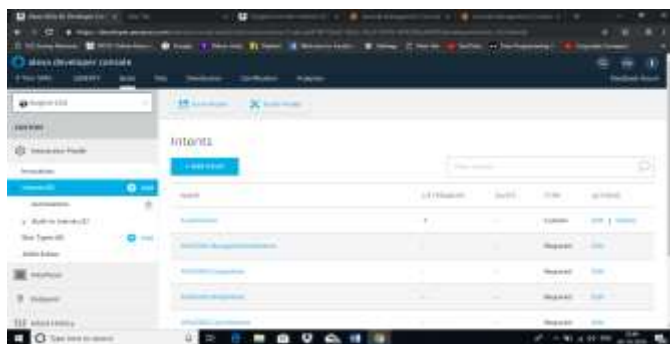
Amazon Developer account is used to create a product to implement automation like Echo Dot of Amazon. The product can be used as Naming the AVS.



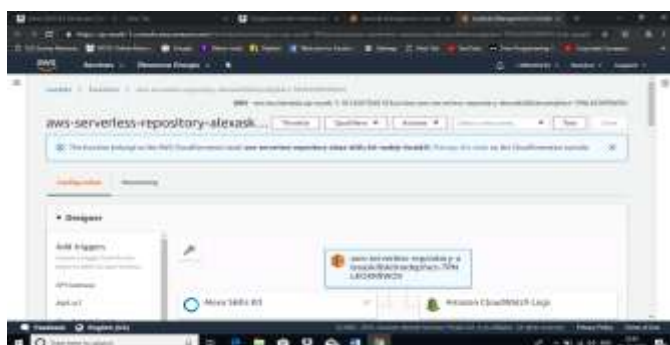
**Fig -5: DEVICE ID FOR AVS DEVELOPER**



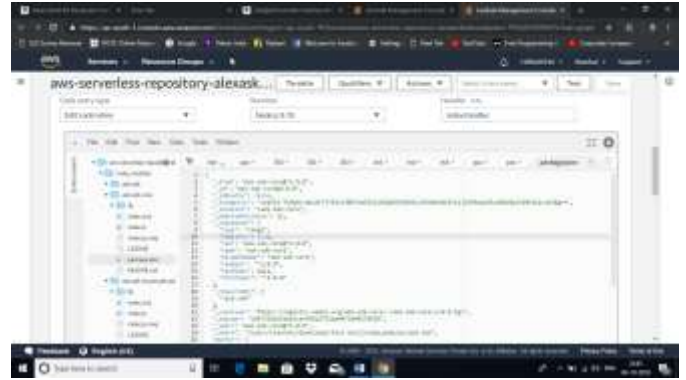
**Fig -6: INTENT DECLARATION**



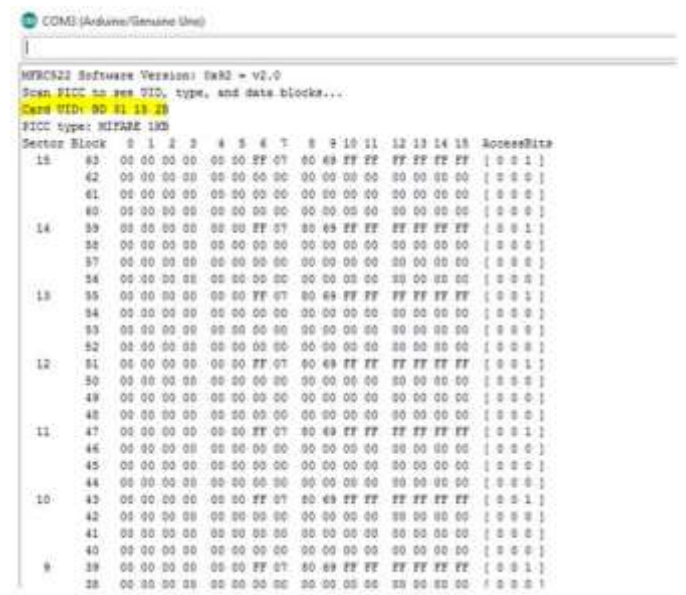
**Fig -7: INTENT AND SLOT DECLARATION**



**Fig -8: AWS LAMBDA FUNCTION FOR AVS**



**Fig -9: JS AND JSON EDITOR FOR AVS COMMANDS**



**Fig -10: RFID OUTPUT**



**Fig -11: RFID UNIQUE CODE**

## 5. CONCLUSION

Hence automated lab is a with all the automation made to reduce the power consumption and to make it efficient to work. Alexa Voice Services make the lab more interesting and helpful with an introduction to the lab. RFID tag makes the lab more secure.

## REFERENCES

- [1] M. Poongothai, P. Muthu Subramanian, A. Rajeswari "Design and Implementation of IoT Based Smart Laboratory", 978-1-5386-5748-5/18/\$31.00 ©2018 IEEE, 2018 5th International Conference on Industrial Engineering and Applications.
- [2] <https://www.amazon.com/ap>
- [3] <https://aws.amazon.com/>
- [4] <https://www.raspberrypi.org/>
- [5] <https://github.com/>
- [6] Shopan Dey, Ayon , Sandip Das,(2016), "Home Automation Using Internet of Thing", IEEE Annual conference on Ubiquitous Computing, Electronics & Mobile Communication Conference (UEMCON),vol.4, no.5.
- [7] Mary Cherian, Hitesh Kumar P,(June 2014), "Implementation of a Secure and Smart Lab with Wireless Sensor Network", International Journal of Science and Research, Vol.3, No. 6.