

Design and Implementation of Cloud Native Door Lock System

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Abstract— There is no doubt that the Humans have gained remarkable development in each and every aspect for making his life easier since the days of early men's. Still One of the main concerns of the Modern world is about the Security and Accessibility. Making our homes secure and accessible from far is one of these concerns. Physical keys and lock were the basic requirements of a door but managing these keys are always cumbersome. To overcome these things, we have implemented a solution *Intelligent door Lock* which is smart, secure and has accessibility features by remotely controlling the door using the Alexa (A Virtual assistant device). Virtual assistant enables us to perform various tasks using a single device. Considering this phenomenon, the idea of remote controlling the door can be exploited with the help of Virtual Assistant.

Keywords— AWS, Arduino UNO, Raspberri pi, Lambda function, SNS, Servo motor.

INTRODUCTION

The most natural way to lock and unlock the door is using the physical keys that everyone is acquainted with. The physical keys is a well tested and well known technology to everyone, but it has flaws, a unique key for each lock. For different lock ou have different keys, but as you know carrying a large number of a keys is burden and it increases the chance of keys getting stolen, misplaced or lost.

As Security and accessibility are the main concerns in today's world. In Today's World of IoT(Internet of things) people not only wanted to secure their home but also feel the need to accesss their home and its devices from the remote location. Consider, you have a guest waiting at front of your door and you are not at home, but you wanted to allow him inside your house. Or let say you are doing a very important stuff in your desk and want to know who came to visit you at

the front door without leaving your seat. JUST IMAGINE! If Alexa can do everything for you!!

Yes what you just heard is true. Our goal is to design an Intelligent door lock for secure access control that can replace physical keys with the digital keys on virtual assistant providing wireless and automatic unlocking via Internet connectivity.

LITERATURE REVIEW

There were many automated advanced door locking system has been developed and it's popular for use in commercial buildings and organizations. Some of the well-known and popular door lock security systems using different kind of technologies were as follows:-

Password Based Locks : They were also known as integrated combinational type lock. Thee locks were the programmable electronic code lock devices which are programmed in such a way that it would operate only with the correct entry of predefined digits.

Biometric Based Locks : The palmtop recongnition is used in the biometric based lock. At first, system takes an image of the palmtop then it works on that image by partitioning it and processing it further. At the end, by verify the intended person whose palmtop were authorised for opening the lock.

Smart card Based Locks : This is a model of entryway security framework which is intended to permit an authorized person for getting a safe entryway where a valid card of smart RFID is necessary for ensuring the pass of the door. The RFID card reader detects and check the user accessibility, when the card is brought near the reader, it identifies the radio frequency of the card and thus verifies the key.

Bluetooth Based Locks : Bluetooth based Lock system is bit similar to the survey house innovations that uses the Bluetooth feature avilable in smart devices. The framework using Bluetooth turns out to be simplerand more productive for proper utilization. Such kind of lock systems are generally

based on Arduino platform. The hardware of such framework is the combo of android smart phone and bluetooth module.

OTP Based systems : The proposed method in latest work does not need administrator's help to access the facility if the user knows OTP technique and has a registered mobile phone. Likewise, the OTP is generated and sent to the proprietor's mobile phone whenever user requests to access facility. Then the OTP should enter through keypad on the door, the door will open. In case if the mobile is not available or off then the option to open the door is to answer the security question ask by system.

IMPLEMENTATION OF INTELLIGENT DOOR LOCK.

The Intelligent door lock is implemented using the following Hardware and AWS (Amazon Web Services) Services.

Hardware components are as follow's -:

Raspberry Pi and Raspberry pi Camera Module : It is a single board computer system which has a capability to run linux on it, so which facilitates us to run a python environment which will help us to communicate to AWS and integrate the camera module.

Arduino UNO : It is a Microcontroller board which communicates with our Raspberry pi which can enables us to control the door lock

Amazon Alexa : We are using the Amazon Alexa to take voice input from the user as input and giving back the suitable output to the user and also controlling the door lock.

AWS Services are as follow's -:

AWS Python SDK : It allow us to use Python API (Boto 3) from a Python Environment to communicate with different AWS Services.

Amazon Alexa Skill kit : Alexa skill kit is are defined as the capabilities by the the Amazon Alexa which can be customized by coding. We have desinged our custom skill set for an interactive user experience.

AWS DynamoDB : AWS DynamoDB is a fully managed NoSQL Database solution which helps to store the Person's name and the index which helps us to find the guest easily, The good feature being the low cost and good availability

AWS S3 Buckets : AWS S3 is an object storage solution by AWS which facilitates us to store the images of the user, We are using the the object storage due to its high avilbility and low costs.

AWS IAM : AWS IAM stands for Identity and Access Management which enables us give granular permissions to the the user or a service to access certain AWS Services. Here IAM is used to aaign role to our lambda funtion to give permission to use AWS S3 Bucket, DynamoDB and help us to follow the principle of least privileges in IAM.

AWS SNS : AWS SNS is Asynchronous PUB/SUB based meseging platform that helps us to send messages to the users. We are using it here to send mail to the user with the image and its name on request.

Amazon Rekognition : AWS rekognition is an image analysis offering by AWS which facilitates us to use pretrained Face rcgnition models in our project without taking care of training the model.

AWS Amazon Polly : AWS Polly is a service that helps us to turn text into the real human voice. Here it integrates with our Alexa which helps us to deliver a good User Experience.

AWS Lambda : AWS lambda is Serverless Compute Solution by AWS which help us to run a code with a certain environment and its dependencies without managing the infrastructural needs. Here AWS lambda function helps to trigger various codes in the Rasberry Pi to take certain actions accordingly.

AWS IoT : AWS IoT core is a managed offering by te AWS which acts as the communication hub for the various iot devices. It here helps us to connect and authenticate our Rasperry Pi to AWS anservices and help us to operate the door lock.

WORKING CONCEPT OF PROJECT

Once a visitor arises to your gate and press the calling switch, it accomplishes 3 tasks:

1. It takes a image of the visitor and upload it to AWS S3 Bucket and S3 Bucket generate a SNS notice.

2. It directs an electronic mail with the snapshot to the house proprietor.

3. It directs a welcoming text to AWS Polly and at that moment play the audio acknowledgment for the visitor returned by the Polly.

Afterwards receiving the notice from AWS SNS or receiving the electronic mail, house proprietor can ask Alexa to announce the guest by appealing a routine Alexa skill "Door Guard" and saying:

Alexa, enquire door guard who is at the entrance? Or

Alexa, ask door guard who came?

Alexa activates a Lambda function and Lambda function does the subsequent jobs:

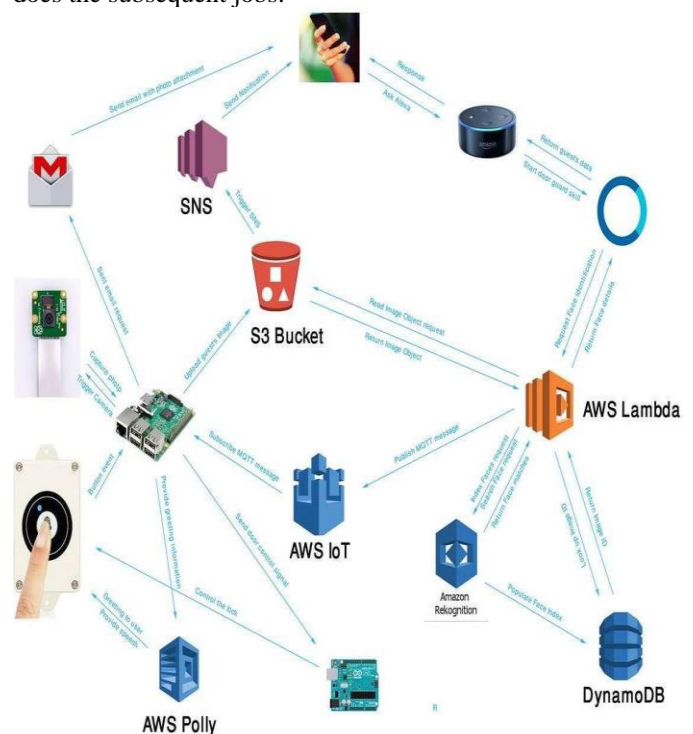


Fig- Block Diagram of System

1. Read the Photograph uploaded to the S3 Bucket.
2. Directs a face examination request for the doppelgänger to AWS Rekognition.

3. Next receiving face matches outcome return by Rekognition, Lambda search for the name to AWS DynamoDB and return the name to the Alexa if found.

4. Alexa offers the name to the house proprietor and proprietor can yet again call the Alexa to open the gate for the visitor.

5. In this case Lambda directs an open door command to AWS IoT to a precise MQTT topic.

6. Raspberry Pi accepts this MQTT command and directs to Arduino via serial port. Arduino opens or close the latch accordingly.

- Read the image uploaded to the S3 Bucket.
- Sends a face examination request for the image to AWS Rekognition.
- After receiving face matches result return by Rekognition, Lambda search for the name to AWS DynamoDB and return the name to the Alexa if found.

Alexa delivers the name to the house proprietor and proprietor again call the Alexa to open the gate for the visitor. In this case Lambda sends an open door command to AWS IoT to a specific topic. Raspberry Pi receives this command and sends to Arduino via serial port. Arduino control the lock accordingly. The block diagram provided can helps for better understanding.

CONCLUSION

Our Solution gives a basic idea of how to control home security for smart home especially for door key locks. It also provides easy access to the guest list and accessibility features from remote location. This project is based on AWS and Arduino Platform both of which were Open source software resulting in inexpensive implementation rate and reasonable for a Middle class people's. Accomplishment of wireless connection in microcontroller permits the system installation in more easy. The system has been designed and prototyped to control door condition using an Alexa echo dot and a stable internet connection. We have designed a simple prototype in this paper but in future it can be extended to many other regions as well .

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