The Angel-Echo Project

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Outline

- Background of Devices
- Overview of the System
- Goals
- Work on Angel Sensor
- Work on Amazon Echo
- Experiment
- Conclusion

Amazon Echo

- Voice enabled wireless speaker
- Capable of voice interaction, making to-do lists, streaming podcasts, other real time information
- Responds to "Alexa” or "Amazon" or "Echo"

Angel Sensor

- Wearable sensor device
- Tracks health information
- Sensors include:
  - Heart rate
  - Skin temperature
  - Steps
  - And more
- Personalize user health status

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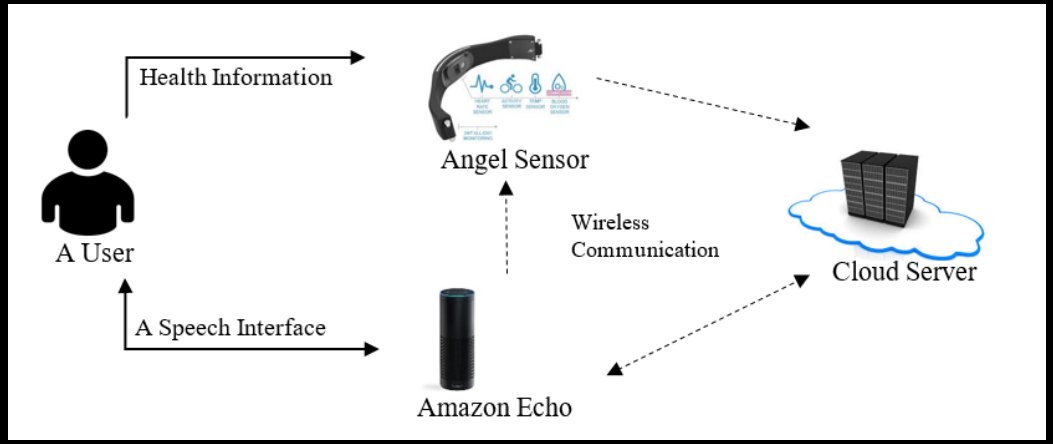
Overview of the System

- Create an interactive health care app
- Use information from the Angel Sensor
- Interact with the Amazon Echo



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Objective 1 (Angel Sensor Part)

- Implement a smart app that monitors health status

Objective 2 (Amazon Echo Part)

- Design a system to receive health status by voice command interface

Objective 3 (Experiments)

- Conduct experiments to analysis the speech recognition accuracy
- Key Results:
  - Test the implemented system on different groups of people
  - Propose a method to show the speech recognition accuracy
  - Compare the results from different groups

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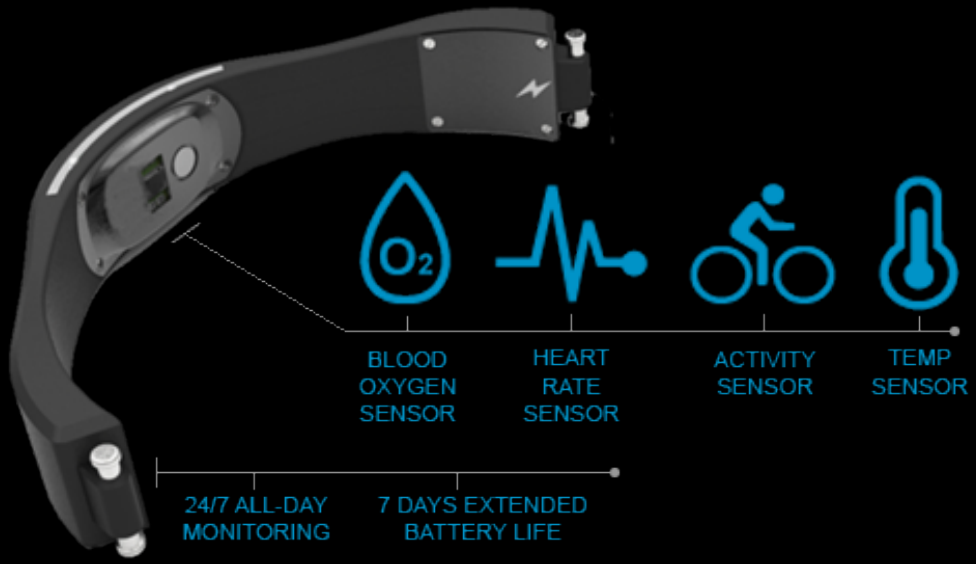
Why the Angel Sensor?

- Open source device
- Unrestricted access to sensor data
- Offers variety of health information
- Bluetooth low energy (BLE)



System Flow Diagram

BLE communication

Sensor data sent to BLE-enabled device

wireless communication

Data is processed and sent to AWS database

Angel Sensor

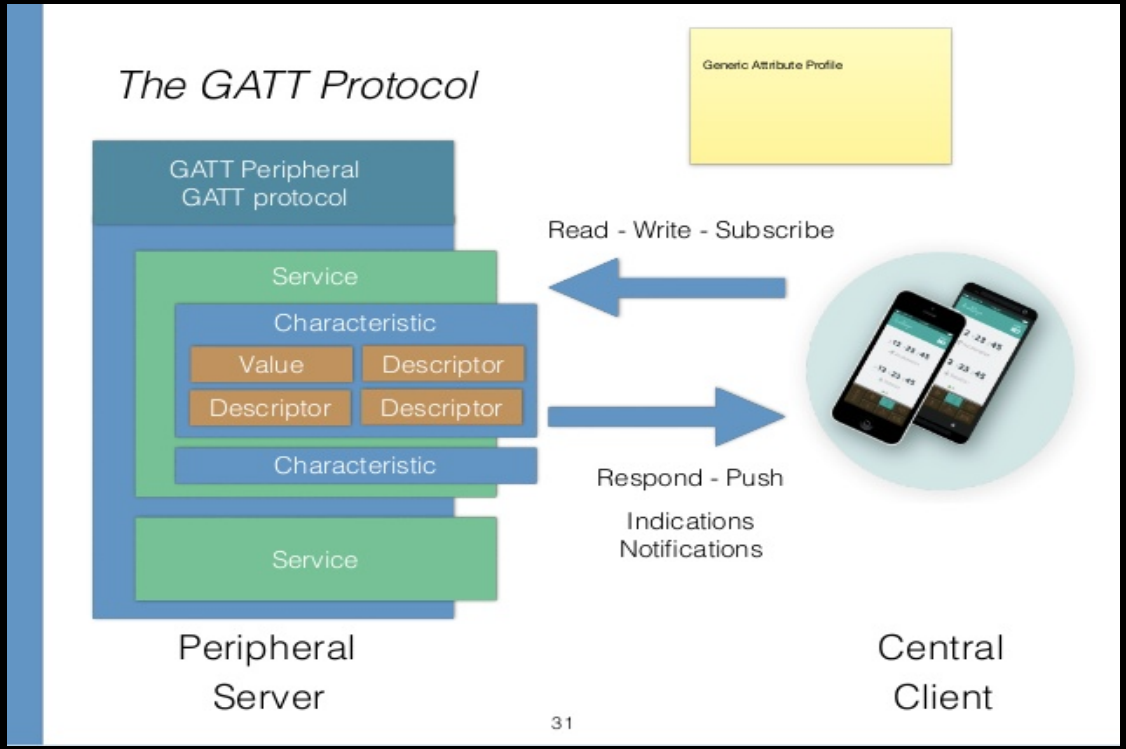
Client Device

DynamoDB

GATT Protocol

- Generic Attribute Profile Service
  - Protocol for data transfer procedures and formats over BLE connected devices
- Attributes
- Handles and UUIDs (Universally Unique Identifiers)
- GATT Hierarchy:
  - Services
    - Characteristics
      - Value
      - Descriptors

GATT Diagram



Subscribing to Characteristics

- PyGattlib python module
- Descriptor attributes
- Notifications (faster)
- Indications (slower)
- In Requester class object, write necessary values to corresponding descriptor attributes
- Pseudo-code with object “req” below where thermometer handle is 26

Write ”01” to enable notifications of value characteristics

Write ”10” to enable indications of value characteristics

```
req.write_by_handle(26, str(2))        # Enable Thermometer indications
```

Collecting/Handling Data

Data processing

Step 1

Data retrieved as ascii values

Step 2

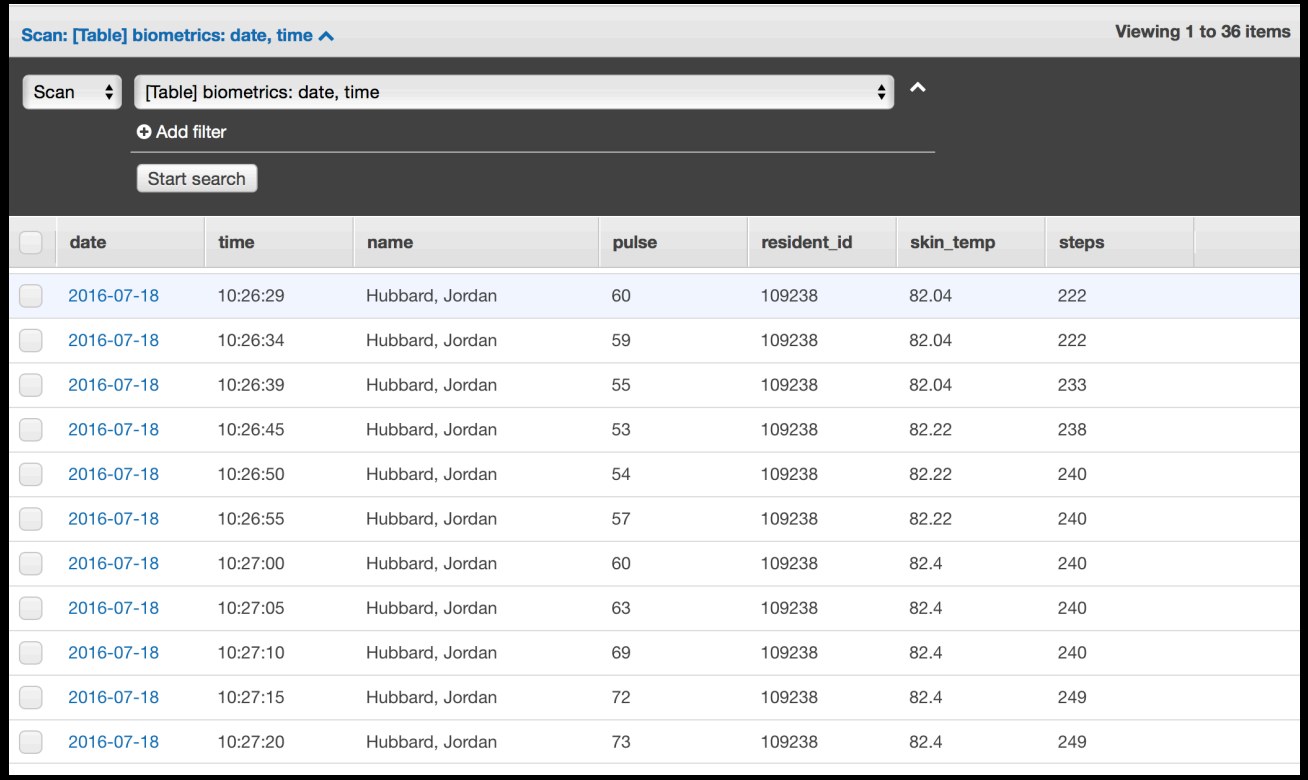
Ascii values are converted to hex (binascii python module)

Step 3

Hex bits are interpreted

Data sent to AWS DynamoDB database

Sample Data



date	time	name	pulse	resident_id	skin_temp	steps
2016-07-18	10:26:29	Hubbard, Jordan	60	109238	82.04	222
2016-07-18	10:26:34	Hubbard, Jordan	59	109238	82.04	222
2016-07-18	10:26:39	Hubbard, Jordan	55	109238	82.04	233
2016-07-18	10:26:45	Hubbard, Jordan	53	109238	82.22	238
2016-07-18	10:26:50	Hubbard, Jordan	54	109238	82.22	240
2016-07-18	10:26:55	Hubbard, Jordan	57	109238	82.22	240
2016-07-18	10:27:00	Hubbard, Jordan	60	109238	82.4	240
2016-07-18	10:27:05	Hubbard, Jordan	63	109238	82.4	240
2016-07-18	10:27:10	Hubbard, Jordan	69	109238	82.4	240
2016-07-18	10:27:15	Hubbard, Jordan	72	109238	82.4	249
2016-07-18	10:27:20	Hubbard, Jordan	73	109238	82.4	249

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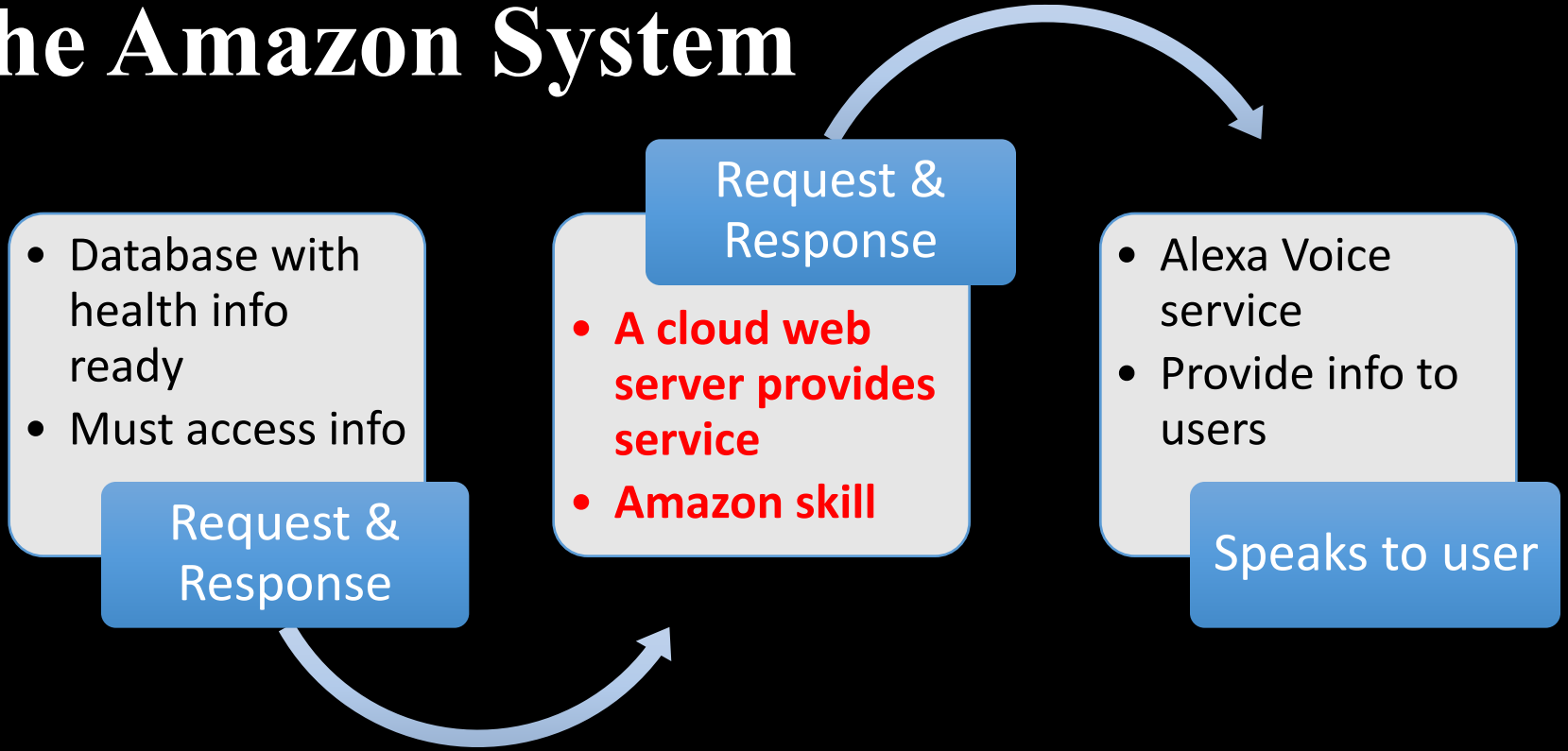
Amazon Echo Procedure

The Amazon System



Need a web server run a skill program to provide service.

First try with **Amazon Lambda server**, then **lab server**.

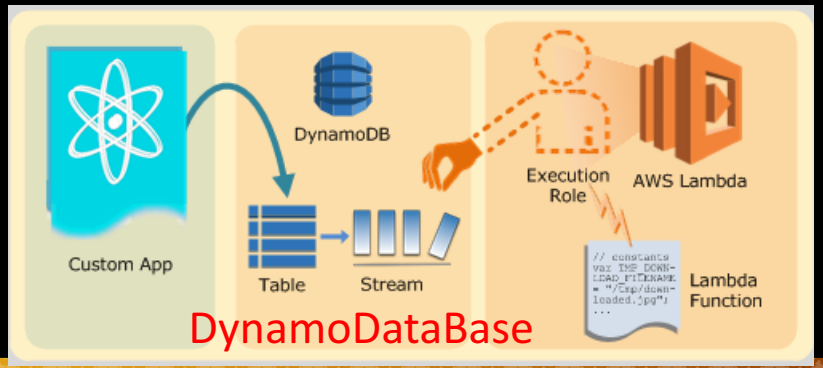
Amazon Skill & Alexa Skill Kit

- **Amazon Echo skill**

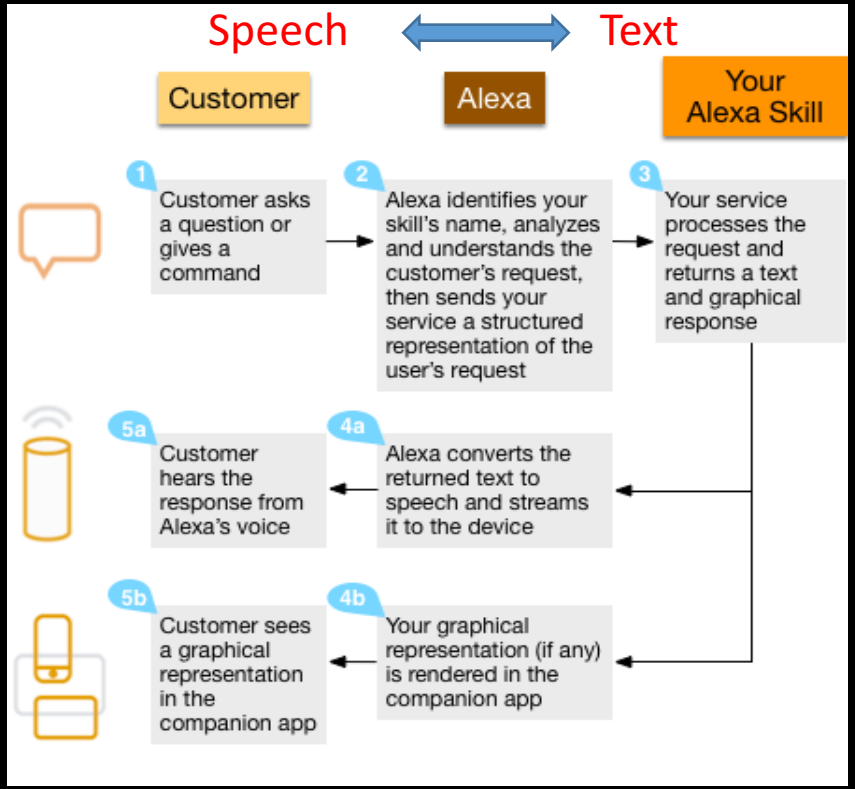
 - is capability that allows users to interact with the device with functionalities of Echo

- **Alexa Skills Kit**

- Collection of self-service APIs, tools, documentation and code samples



Amazon Skill with Alexa Voice Service



- "Alexa" is the wake word
- "Ask…Doctor" is one of the supported phrases for requesting service
- "Doctor" is the invocation name that identifies the service the customer wants
- "What is my heart rate?" is the specific question that elicits response.
- "heart rate" is the keyword invoke heart rate intent.

Amazon Skill with Alexa Voice Service

Intent Schema*

The schema of user intents in JSON format. For more information, see Intent Schema.
Also see built-in slots and built-in intents.

```
    {
      "intent": "StatusIntent"
    },
    {
      "intent": "StepIntent"
    },
    {
      "intent": "HeartRateIntent"
    },
    {
      "intent": "TemperatureIntent",
      "slots": [
        {
          "name": "temptype",
          "type": "LIST_OF_TYPES"
        }
      ]
```

Custom Slot Types

Custom slot types to be referenced by the Intent Schema and Sample Utterances
For general information about custom slots, see Custom Slot Types.
Example: TOPPINGS - cheese | onions | ham (note: newlines displayed as | for brevity)

Type	Values
LIST_OF_TYPES	pulse | steps | step

Sample Utterances*

Phrases end users say to interact with the skill. For better results, provide as many samples a
your Example Phrases on the Description tab.
For more information, see Sample Utterances.

```
StatusIntent what is my status
StatusIntent can you tell me my health status
StatusIntent what is happening with my health
StatusIntent what is going on
TemperatureIntent what is my {temptype}
TemperatureIntent what is my {temptype} count
StepIntent what is my step count
HeartRateIntent what is my heart rate
TemperatureIntent what is my skin temperature
```

LaunchRequest – Maps to onLaunch(). Occurs when a user launches a skill without an intent.

IntentRequest – Maps to onIntent(). Occurs when the user specifies an intent.

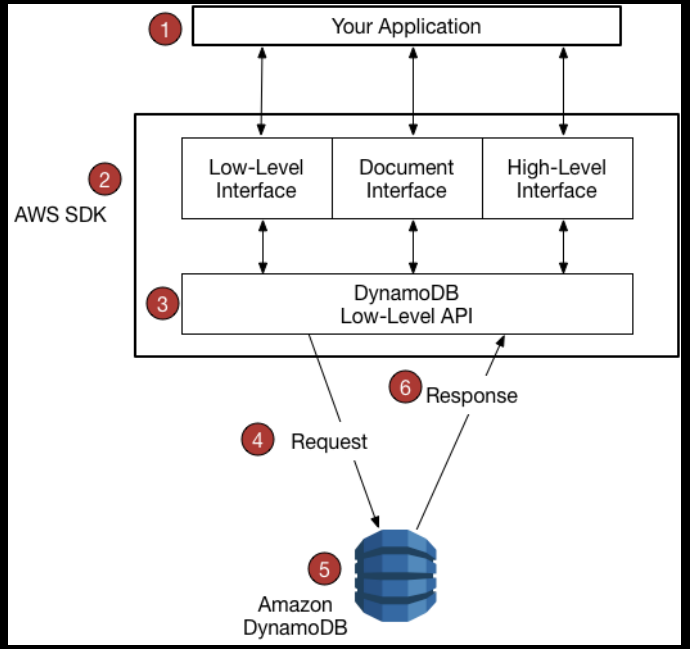
SessionEndedRequest – Maps to OnSessionEnded(). Occurs when session ends.

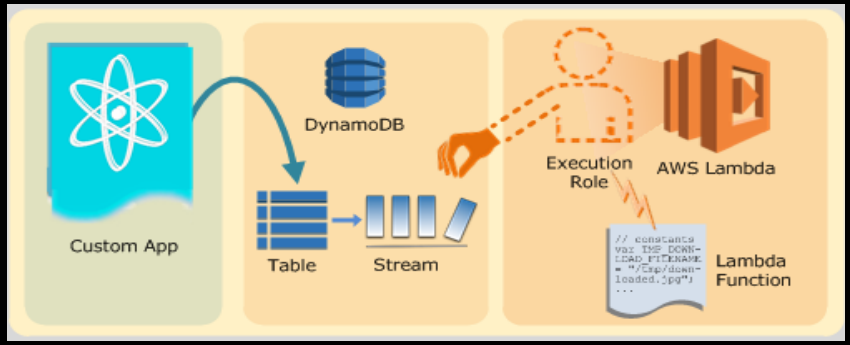
StatusIntent:
Get both pulse and step count info, generate a feedback statement

HeartRateIntent:
Get pulse info, generate a feedback statement

StatusIntent:
Get step count info, generate a feedback statement

Amazon Skill with Amazon DynamoDB






```
var docClient
= new AWS.DynamoDB.DocumentClient();
docClient.query(Table information);
Save the information fetched;
```

Resulting Skill

Ask: What is my pulse?

Amazon
Voice
Service

Skill on Amazon
Lambda Service

Data in Database

	timestamp	name	pulse	resident_id	skin_temp	steps
	2016-06-30 11:13:06	Hubbard, Jord...	58	109238	83.12	228

Setting Up a Server

- Outside server would run code and access database
- Issues:
  - Issuing certification for server
  - Finding remote endpoint
- Eventually transitioned back to AWS Lambda Services
  - Runs code in response to events such as changes in data
- Used Amazon DynamoDB as database to enter information

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Experiment

- Test accuracy of voice recognition capabilities
- Recruited members from two age groups
  - 18 – 30
  - 65 and older
- Compare voice recognition results
- Sense of phrases to focus on

Procedures

- Used Amazon Echo skill
- Created list of phrases
  - Tested key words
  - Tested different sounds
- Had subjects read sentences in controlled environment
- Made adjustments to procedure along the way

Experiment

- Currently female voices picked up more accurately
  - Tested way more females than males
- Certain words picked up incorrectly often
  - Pulse → Pause
  - Enhance
  - Health → House
- Ideas about sounds to avoid

Results

Percentage of Words Missed	Older Adults (65 and older)	Younger Adults (18 – 30)
Male	10.9%	3.9%
Female	7.66%	5.58%
All	8.75%	4.6%

Number of Words Missed	Older Adults (65 and older)	Younger Adults (18— 30)
Male	42	22
Female	59	21
All	101	43
Total Words	1155	940

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Conclusion

- Successfully implemented goals
- Experiment provided useful feedback
- Hopefully can improve application and have more detailed experiment

Thank you!