

Using Python Implemented Azure Machine Learning, IOT Device for any Premises Security Automation.

In this Blog I have defined How Azure ML, Azure Synapse and Azure Virtual Desktop Helped Me Solve Problem of Saving Electricity, Provide Security and helped my Old Grandmother at home to stay peacefully connected with me.

Azure ML based Auto Switch model

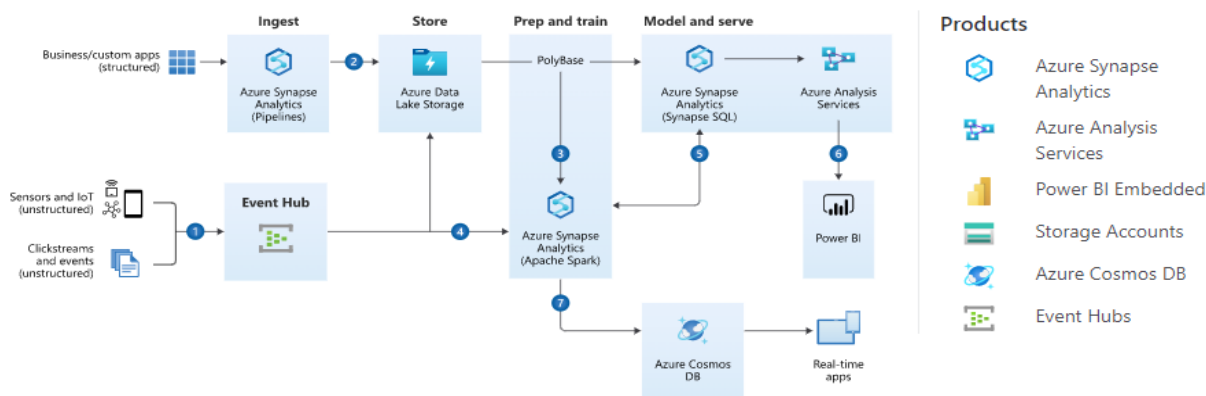
PROBLEM STATEMENT

1. We as a family always had issue for travelling Long and leaving Grandmother alone at home as she found it difficult to even Switch on fan lights in time need and during our unavailability and faced issues in taking Bath as water heater switch was above her reach,
2. I was finding a solution which can easy this issue and help us and even grandma to be peace of mind,
3. The idea came when I was in night shift in adatacenter and wasn't aware that all places have a motion sensor, as I was moving across the lights turn on and after 30 secit turns off.
4. This actual helped me to frame a solution based in Azure and IOT Technology on Azure ML using Raspberry Pi, which can be accessed anywhere any place via your mobile device.

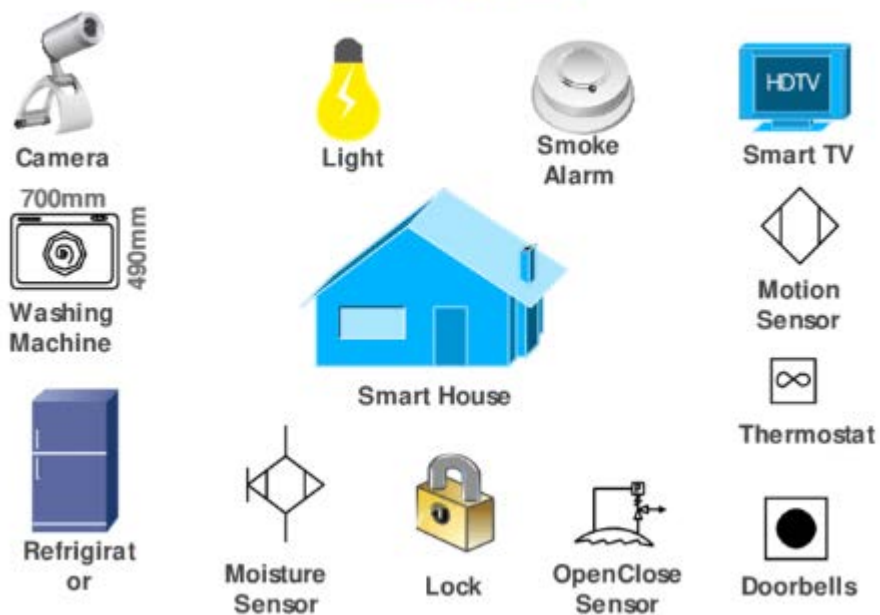
TECHNOLOGY USED AND IMPLEMENTATION

- Python, C#
- Power Switch AND and NOR Gate.
- IoT Edge Gateway
- IoT Hub
- Wi-Fi and Camera Access software
- Azure Synapse
- Azure ML & AKS services
- Azure Virtual Desktop.
- Raspberry Pi Device

SOLUTION ARCHITECTURE:



Smart Home



As per the above problem statement, the best solution is through Azure ML,

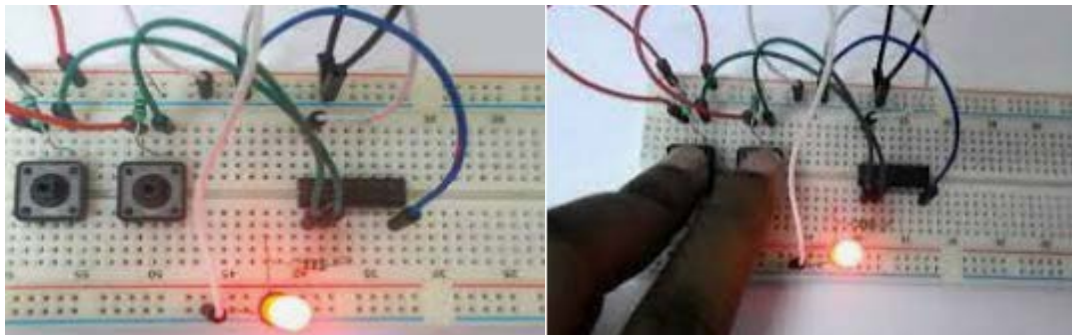
Azure ML Platform Provided me with solution by connecting to IOT Hub via Github and few Coding on Python language and using Raspberry PI to get connected with the devices

I used Azure Synapse for database connection, Azure Virtual Desktop and in that Horizon Workshop One Connector for connecting to any device anywhere, many services provided under one umbrella as it is offered by Azure. It exceeds the expectations and addresses most of our requirements to connect with our Switch AND & NAND Gate switch connector.

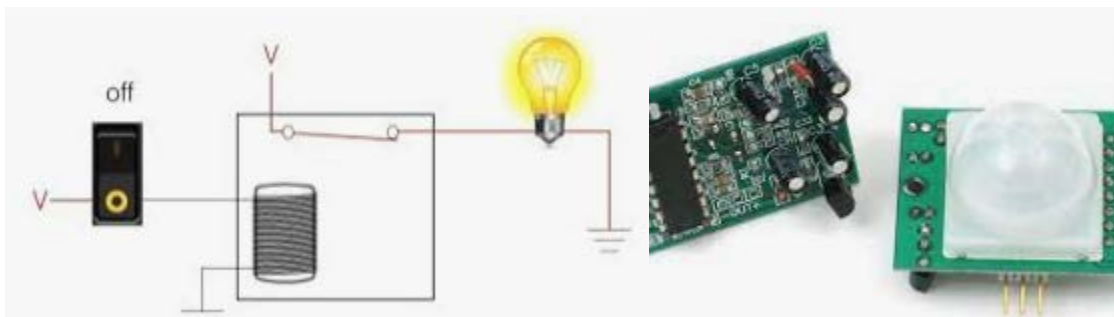
Initially I Used Motion detection devices which are connected via mobile application connected that device To IOT Hub given data and pictures from Azure data lake and Azure Synapse database connected to NoSQL and what next,Wi-Fi connected camera and sensors detecting the motion and I managed all through mobile application easily and switch on lights fan all.

Implementation of The Architecture:

1} And and NAND Gate Switches



2} Need to connect that Wire with a Motion Sensor Machine Device



3} Use the Motion Sensor apps to connect to your Home Camera and Wifi



IoT device provisioning flow is as follows:

1. Device manufacturer adds device registration information to enrolment list in Azure portal.
2. Device passes, identifying information to DPS to prove its identity.
3. DPS validates identity of device by validating registration ID and key against enrolment list entry.
4. DPS registers device with IoT hub and populates device's desired twin state.
5. IoT hub returns device ID information to DPS.
6. DPS returns IoT hub connection information to device and start sending data directly to IoT hub.
7. Device gets desired state from its device twin in IoT hub
8. Device is connected.

The use of Azure Machine Learning

AZURE MACHINE LEARNING INTEGRATED WITH POWER BI



Creating on Machine Learning

A search bar at the top contains the text "machine learning". Below it, the results are organized into sections: "Services", "Marketplace", "Documentation", and "Resource Groups".

- Services:**
 - Machine Learning Studio (classic) web service plans
 - Machine Learning Studio (classic) web services
 - Machine Learning Studio (classic) workspaces
 - Machine learning** (highlighted with a red box)
 - Bonsai
 - HDInsight clusters
 - Virtual machines
 - CloudSimple Virtual Machines
 - SQL virtual machines
 - Virtual machine scale sets
- Marketplace:**
 - Zegami Machine Learning Suite
 - Machine Learning
 - Visual Machine Learning Stack for TensorFlow
 - Machine Learning with Weka
- Documentation:**
 - What is Azure Machine Learning? - Azure Machine Learning ...
 - What is a component (preview) - Azure Machine Learning ...
 - Machine learning fairness (preview) - Azure Machine ...
 - Manage and optimize costs - Azure Machine Learning ...
- Resource Groups:** (empty)

Create the Workspace now

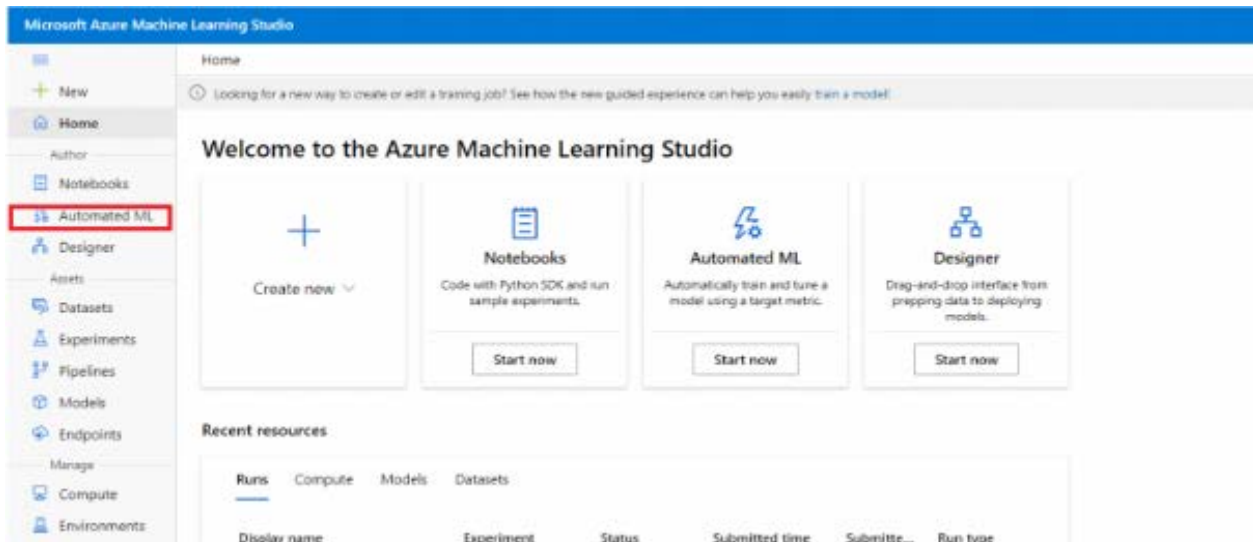
The screenshot shows the Azure portal interface for a "Machine learning" resource. The "Create" button is highlighted with a red box. Below the button are various management actions like "Manage view", "Refresh", "Export to CSV", "Open query", "Assign tags", "Delete", and "Feedback". There are also filter buttons for "Subscription", "Resource group", and "Location".

Click on button to review

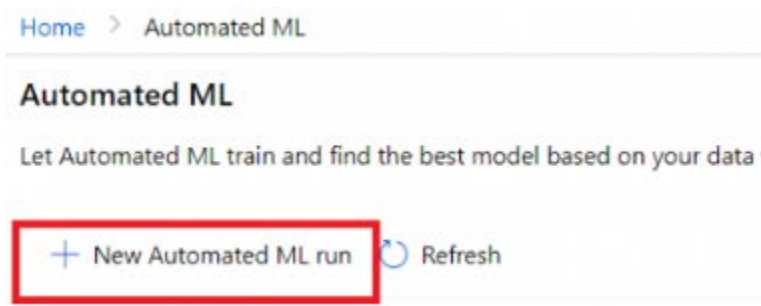
The screenshot shows the "Machine learning" workspace creation form. The form includes the following fields and options:

- Subscription:** Data - Sana & Ayush
- Resource group:** Sana_Task (with a "Create new" link below it)
- Workspace details:** Specify the name and region for the workspace.
 - Workspace name:** MachineLearningDemo
 - Region:** West US 2
 - Storage account:** (new) machinelearnin2517949407 (with a "Create new" link below it)
 - Key vault:** (new) machinelearnin0134092201 (with a "Create new" link below it)
 - Application insights:** (new) machinelearnin0763594457 (with a "Create new" link below it)
 - Container registry:** None (with a "Create new" link below it)

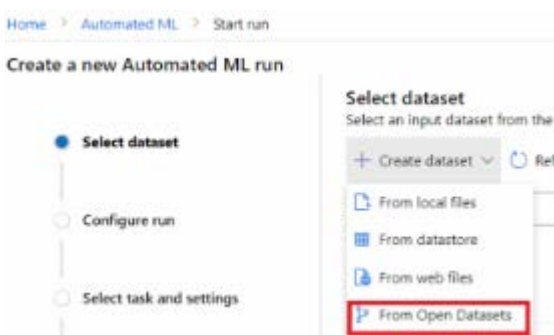
Create an Automated ML



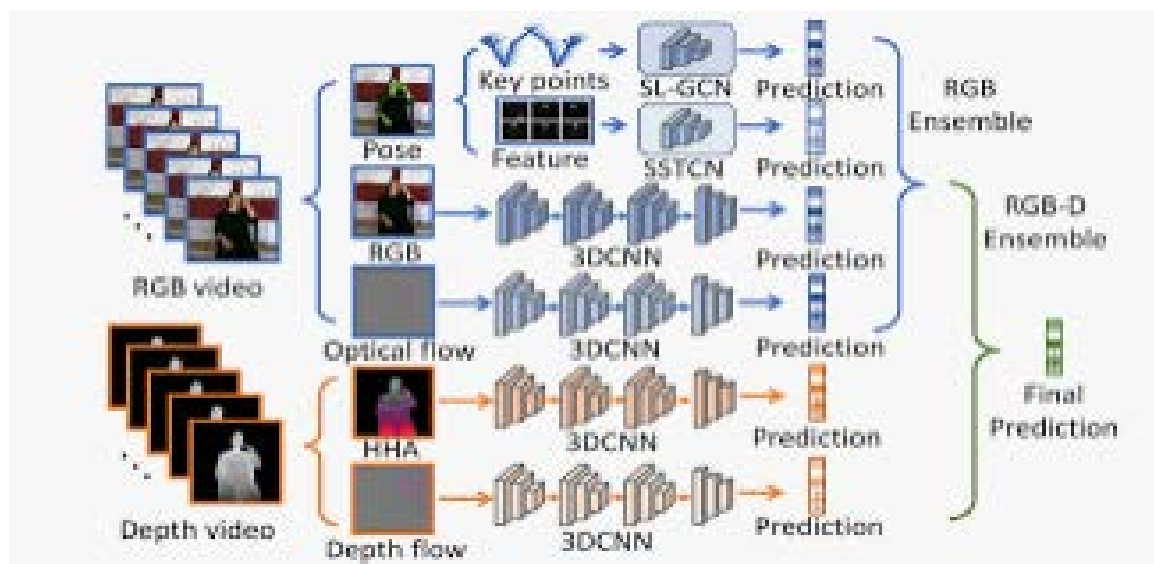
Click on New Automated ML



Put the Images on Datasheet.



Put all the files in Azure ML datasheet.



Integrate the model into Power BI

We need to make our Power BI engine compatible with Python

- In Power BI Desktop, Go to File -> Options and Settings -> Options -> Python Scripting
- Now, under the option Detected Python Home Directories give the folder location where your Python is installed

Options

GLOBAL

- Data Load
- Power Query Editor
- DirectQuery
- R scripting
- Python scripting**
- Security
- Privacy
- Regional Settings
- Updates
- Usage Data
- Diagnostics

Python script options

To choose a home directory for Python, select a detected Python installation from the drop-down list, or select Other and browse to the location you want.

Detected Python home directories:

C:\Users\IFF\AppData\Local\Programs\Python\Python310

[How to install Python](#)

To choose which Python integrated development environment (IDE) you want Power BI Desktop to launch, select a detected IDE from the drop-down list, or select Other to browse to another IDE on your machine.

Detected Python IDEs:

Default OS program for .PY files

Below are the Python Scripts.

Tests a function for converting a color image to grayscale.

```

"""
from images import Image

def grayscale(image):
    """Converts the argument image to grayscale."""
    for y in range(image.getHeight()):
        for x in range(image.getWidth()):
            (r, g, b) = image.getPixel(x, y)
            r = int(r * 0.299)
            g = int(g * 0.587)
            b = int(b * 0.114)
            lum = r + g + b
            image.setPixel(x, y, (lum, lum, lum))

def main(filename = "smokey.gif"):
    image = Image(filename)
    print("Close the image window to continue. ")
    image.draw()
    grayscale(image)
    print("Close the image window to quit. ")
    image.draw()

main()

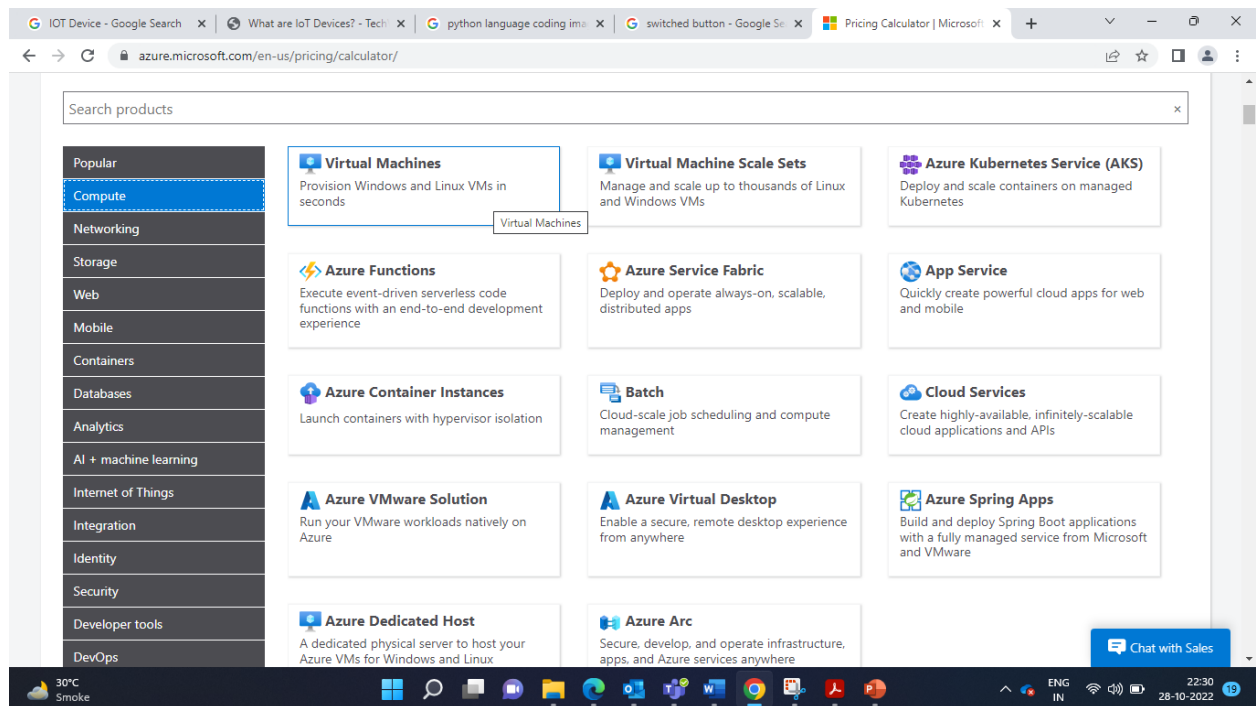
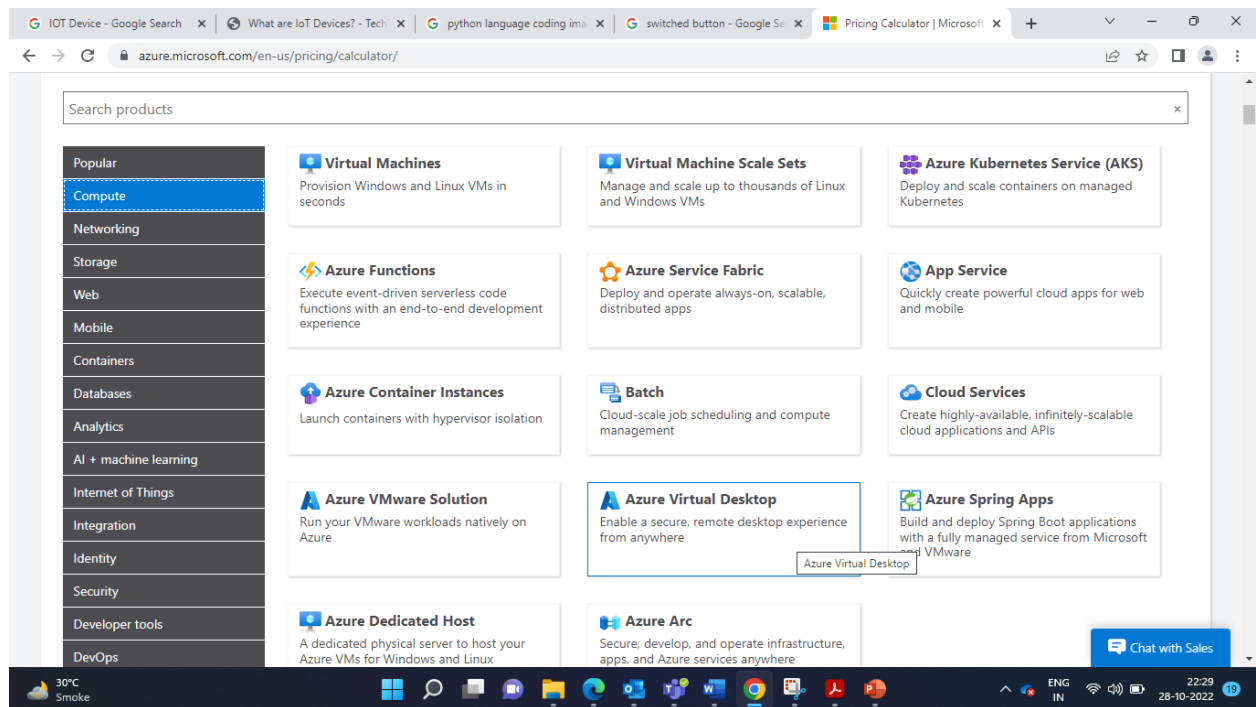
```

```

...
global displayWidth, displayHeight, radius
size(displayWidth/4*3, displayHeight/4*3)
background(0)
noFill()
stroke(255,10)
radius = height/2
def draw():
    global Totaldeg, radius
    center_x = width/2
    center_y = height/2
    for l in range(5):
        beginShape()
        for i in range(Totaldeg):
            noiseFactor = noise(i*0.02, float(frameCount)/150)
            x = center_x+radius*cos(radians(i))*noiseFactor
            y = center_y+radius*sin(radians(i))*noiseFactor
            curveVertex(x, y)
            center_x = random(0,width)
            center_y = random(0,height)
        endShape(CLOSE)
    radius-=1
    if radius <= 0:
        noLoop()

```

Creation of Virtual Machine, Azure Virtual Desktop.



Microsoft Azure Search resources, services, and docs (G+)

Home > IOTProject > Marketplace > Visual Studio 2019 >

Create a virtual machine

Arm64 is not supported with the selected image.

Run with Azure Spot discount

Size * See all sizes

Administrator account

Username * ✓

Password * ✓

Confirm password * Password and confirm password must match.

Inbound port rules

[Review + create](#) < Previous Next : Disks >

Azure IOT hub device provisioning service” (DPS).DPS is helper service for IoT Hub.

Microsoft Azure Search resources, services, and docs (G+)

Home > Azure IoT Hub Device Provisioning Services >

Azure IoT Hub device provisioning service

Microsoft

The Azure IoT Hub device provisioning service is a helper service for IoT Hub that uses the Azure Active Directory for authentication and authorization to help you provision to the right IoT hub without requiring human intervention, allowing customers to provision millions of devices in a secure and scalable manner. [Learn more](#)

Project details

Choose the subscription you'll use to manage deployments and costs. Use resource groups like folders to help you organize and manage resources.

Subscription * ✓

Resource group * Create new

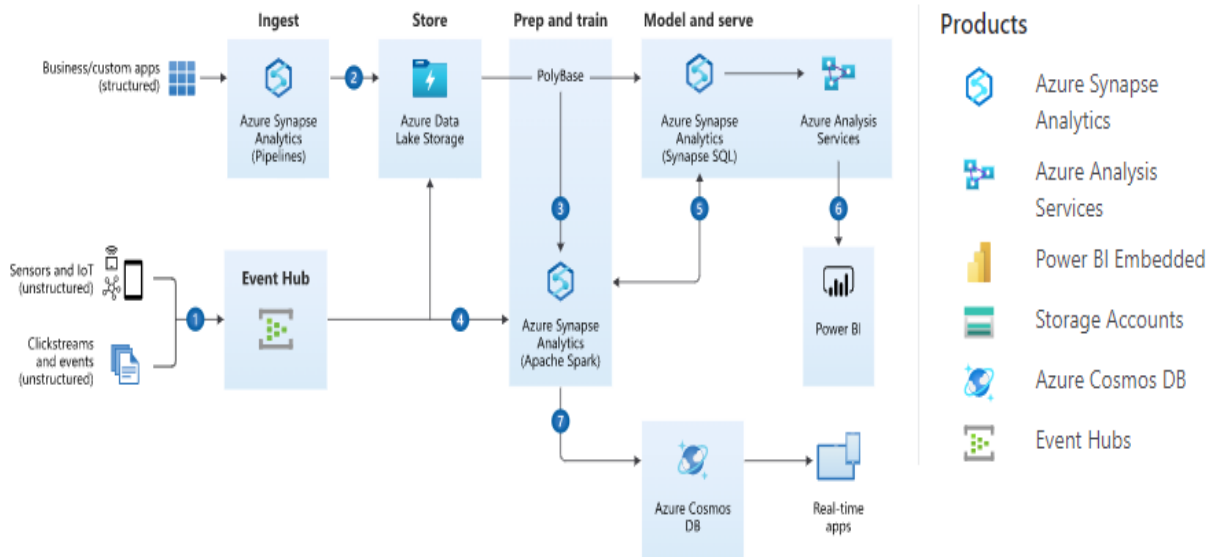
Instance details

Name * ✓

Region * ✓

[Review + create](#) < Previous Next: Networking >

This is how our actual solution will be



Azure IoT hub allows full-featured, scalable IoT solutions. Virtually, any device can be connected to Azure IoT Hub and scale up to millions of devices. Events can be tracked, monitored, such as creation, failure, and connection of devices.

Microsoft Azure Search resources, services, and docs (G+)

Home > IoT Hub >

IoT hub

Microsoft

Create an IoT hub to help you connect, monitor, and manage billions of your IoT assets. [Learn more](#)

Project details
Choose the subscription you'll use to manage deployments and costs. Use resource groups like folders to help you organize and manage resources.

Subscription *

Resource group * [Create new](#)

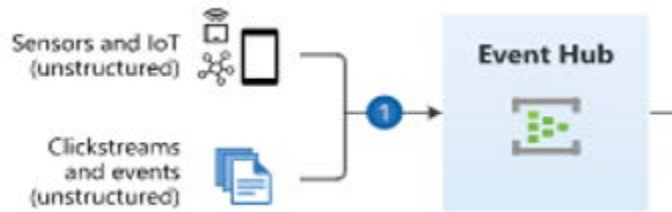
Instance details

IoT hub name *

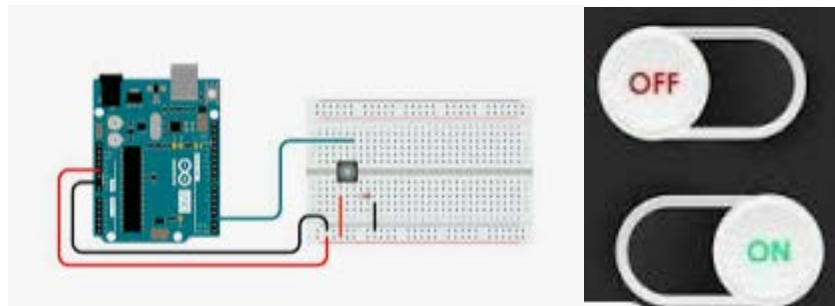
Region *

[Review + create](#) < Previous Next: Networking >

This is how the Mobile Device will be connected with the IOT Device and Event Hub



Display will look like:



Raspberry PI online Simulator.

The screenshot shows the 'Raspberry Pi Azure IoT Online Simulator' interface. On the left, a virtual Raspberry Pi board is connected to a breadboard with a sensor and a red LED. The breadboard is connected to the Pi's GPIO pins. On the right, there is a code editor with the following JavaScript code:

```

1 /*
2  * IoT Hub Raspberry Pi NodeJS - Microsoft Sample Code - Copyright (c) 2017 - Licensed MIT
3  */
4  const wpi = require('wiring-pi');
5  const client = require('azure-iot-device').Client;
6  const Message = require('azure-iot-device').Message;
7  const Protocol = require('azure-iot-device-mqtt').Mqtt;
8  const BME280 = require('bme280-sensor');
9
10 const BME280_OPTION = {
11   i2cBusNo: 1, // defaults to 1
12   i2cAddress: BME280.BME280_DEFAULT_I2C_ADDRESS() // defaults to 0x77
13 };
14
15 const connectionString = '[Your IoT hub device connection string]';
16 const LEDPin = 4;
17
18 var sendingMessage = false;
19 var messageId = 0;
20 var client, sensor;
21 var blinkLEDTIMEOUT = null;
22
23 module.exports = {
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```

Below the code editor, there are 'Run' and 'Reset' buttons. A help text box below the buttons reads: 'Click "Run" button to run the sample code(When sample is running, code is read-only). Click "Stop" button to stop the sample code running. Click "Reset" to reset the code.We keep your changes to the editor even you refresh the page.' The 'Run' button is currently disabled.



What is Raspberry Pi?

The Raspberry Pi is a tiny computer about the size of a deck of cards. It uses what's called a system on a chip, which integrates the CPU and GPU in a single integrated circuit, with the RAM, USB ports, and other components soldered onto the board for an all-in-one package.

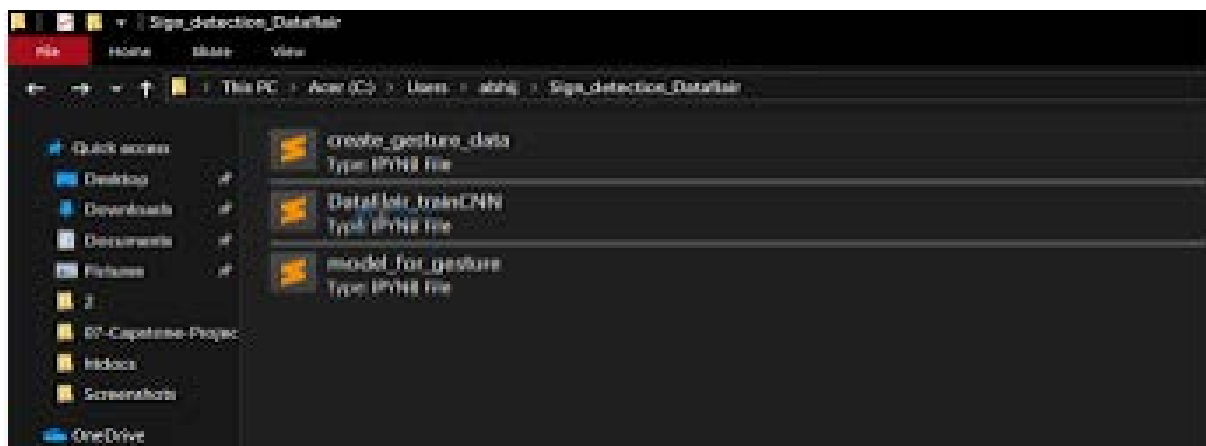
Add a Resource Group

- **A Resource Group is logical container where you are creating your Azure resources. It is created in specific region and contain resources created in other regions.**

The screenshot shows the Microsoft Azure portal interface. In the left-hand navigation pane, the 'Resource groups' link is highlighted with a red circle and the number 1. In the main content area, the 'Add' button is highlighted with a red circle and the number 2. Below the 'Add' button, there are options for 'Edit columns', 'Refresh', 'Assign tags', and 'Export to CSV'. The main content area also shows a table of resource groups with columns for 'NAME', 'SUBSCRIPTION', and 'LOCATION'. The table contains two rows of data:

NAME	SUBSCRIPTION	LOCATION
aahIBingSearch	documentation...	West US
AML-Training	documentation...	West US

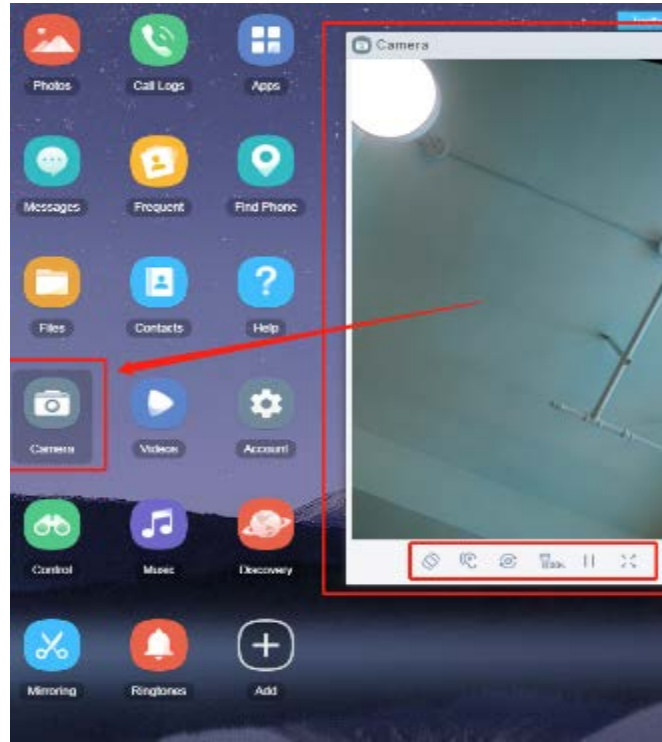
This is how we can be able to monitor the motion and see video.



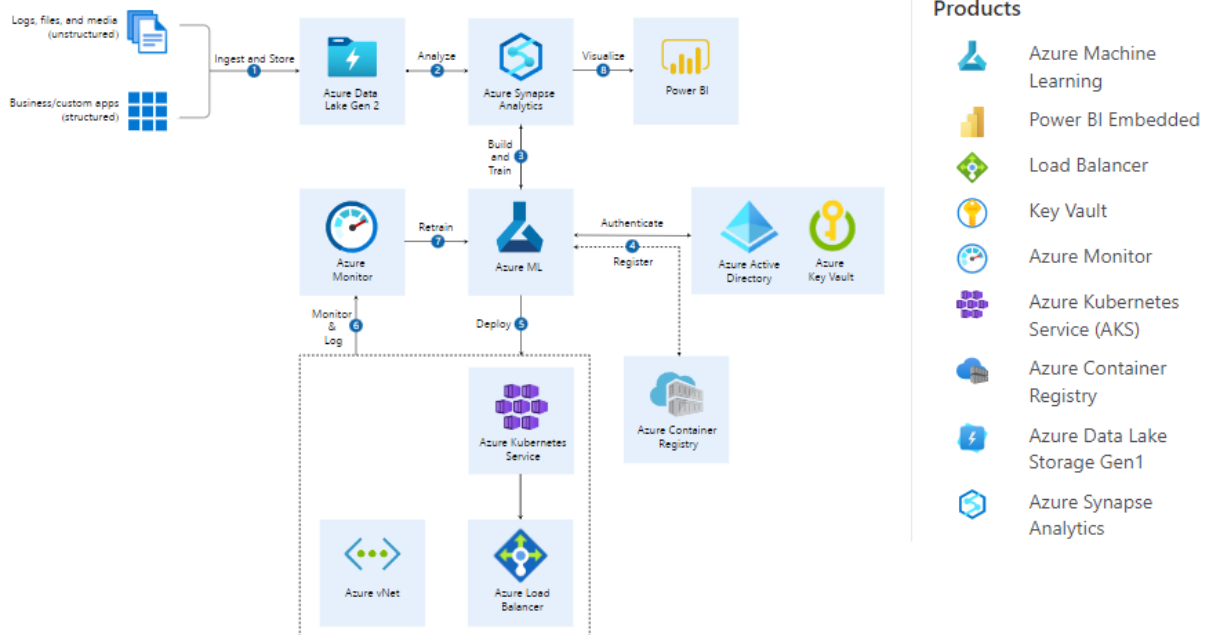
Now everything Set you can Monitor everything from your mobile apps

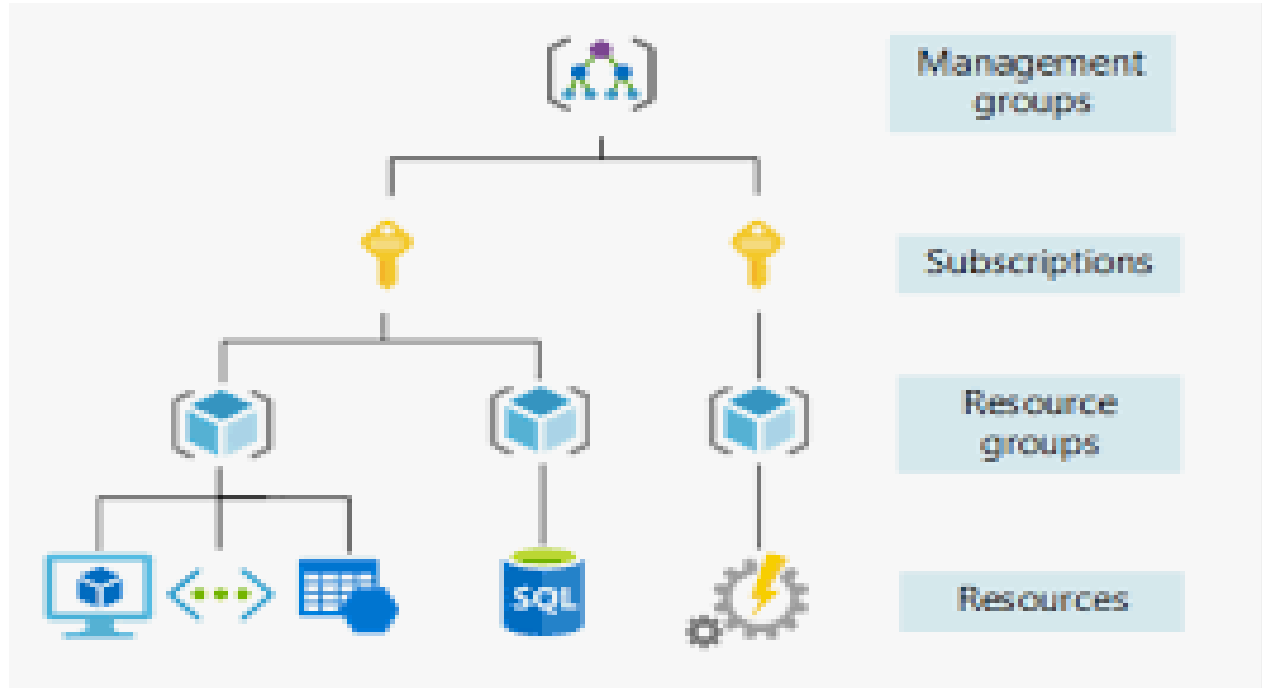


We can even see the Motion Detector from Camera.



This is the entire Architecture of Azure ML in function and Azure Products Used,





Knowledge Sharing and Best Practices

- Use of Azure Virtual Desktop and Horizon on Azure Desktop made easy to get connected with Workspace One Connector of VMware, which helped in Digital Transformation and endpoint connectivity to connect the device from anywhere any location
- You can use any Alternative of Raspberry Pi like below options
 - Onion Omega2+
 - Banana Pi M3.
 - NanoPi NEO4.
 - Arduino UNO
- Use of Machine Learning made easy for Image detection and Use of IOT hub made easy to connect via internet and detect the motion and access the camera
- Use of Azure Data Lake made easy for using NoSQL data and storing data on data lake and store the data captured by camera.

CHALLENGES FACED:

- Switches were not connecting to devices, so i used camera connector and divided it two part to connect switches and camera
- Images were not reflection, so data account needs to be recreated
- Version Control & Latency Issues between Devices
- Raspberry Pi stimulator needs to be connected with you azure for device to perform action and motion and sensor detection to function.
- Integration for seamless real time Streaming.

BUSINESS BENEFIT

- It can be used in Banking sectors for security and for unethical motion detection and as it also has switch control you can close all doors which access on buttons and buzz the alarm bell
- It can be used in Datacenter for security and compliance, and we can use resource to manage the temperate.
- It can be used in Building and Society for security and theft control
- It can be used in malls and in Jewelry shop to detect motion and theft control
- It can reduce the security workload just by managing the application through any device It can be used in Manufacturing sector for automatic switch of machine or sensors can be used accordingly for manufacturing products as per the temperature and environment.

Resources:

<https://learn.microsoft.com/en-us/training/modules/introduction-azure-synapse-analytics/>

<https://learn.microsoft.com/en-us/shows/internet-of-things-show/using-azure-data-lake-to-analyze-iot-data>

<https://azure.microsoft.com/en-in/products/power-bi/>

<https://docs.vmware.com/en/VMware-Workstation-Pro/index.html>

- Mohammed Iliyaas Shaikh