Developing IoT Applications

What is IoT ?

The Internet of Things (IoT) refers to a system of interrelated, internet-connected objects able to collect and transfer data over a wireless network without human intervention.

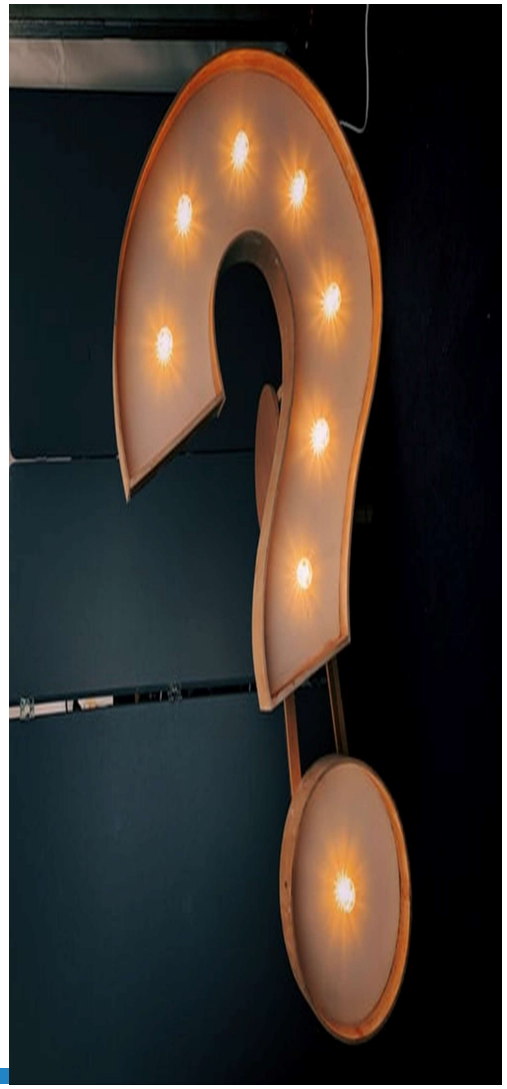
The internet of things (IoT) is a computing concept that realizes the idea of daily physical objects being connected to the internet and being able to identify themselves to other devices. The term used to be closely identified with RFID as the method of communication, and it quickly expanded to include other sensor technologies, wireless technologies or QR codes.

IoT is significant because an object that can represent itself digitally becomes something greater than the object by itself. No longer does the object relate just to its user, but it is now connected to surrounding objects and database data. When many objects act in unison, they are known as having "ambient intelligence.“

Today, businesses are IoT-motivated by the prospects of increasing revenue or reducing operating costs by improving efficiencies. Or, businesses might be driven by a need for regulatory compliance. Regardless of the reasons, IoT device deployments provide the data and insights needed to streamline workflows, visualize usage patterns, automate processes, meet compliance requirements, and compete more effectively in a changing business environment.

Key Planning Considerations :

- Is the device/sensor fixed or mobile?
- What is the level of security required at the device level?
- Does the IoT data need to be analyzed in real time?
- Do the network and IT system need to control activity at the device or is it mainly passive?
- Does the device or sensor have access to AC power?



Four Pillars of IoT

- Visibility
- Analysis
- Automation
- Repeatability

Major activities of the lifecycle planning are :

Initiating	Planning	Executing & Controlling	Closing
Request Project 1.1	Conduct kickoff / Planning Meeting 2.1	Manage project schedule & budget 3.1	Conduct closeout Activities 4.1
Conduct project classification Assessment 1.2	Conduct planning meeting 2.2	Identify and Manage Project issues & Risks 3.2	Archive project Artifacts 4.2
Develop Project Charter 1.3	Plan schedule and resources 2.3	Manage communication (Report status) 3.3	Transition to Support 4.3
Approve Project Charter 1.4	Develop Supplemental Plans 2.4	Manage Changes 3.4	
	Approve Project Plans 2.5	Maintain Project Artifacts 3.5	
	Setup Project repository 2.6		

Networks in IoT :

Bluetooth **provides built-in wireless communications for many devices such as smartphones but has a limited range and reliability challenges.**

Wi-Fi is universally available for PCs, phones and tablets but requires a lot of power for ongoing connectivity.

Ethernet **enables high-speed LAN connections in almost all campus and branch locations but requires a physical cable to connect to IoT devices.**

In addition, the communications industry has invented a number of new networking technologies designed specifically for connecting IoT devices.
These include :

IoT cellular, for which there are several standards such as LTE-M, NB LTE-M, and NB-IOT.

Low power wide area networks, such as SigFox and LoRa, which are built specifically to address the requirements of low power (battery only) IoT devices.

ZigBee is a wireless standard designed to connect machine-to-machine networks at low cost and low power requirements.

Raspberry Pi	Model A	Model B	Model B+	Model A+
Price:	$24.99	$39.99	$29.99	$19.99
Release Date	February, 2013	April, 2012	July, 2014	November, 2014
Chip:	Broadcom BCM2835			
Processor:	ARMv6 single core			
Processor Speed:	700MHz			
Voltage and Power draw	600mA @5V			
GPU	Dual Core video core IV Multimedia Co-Processor			
Size	85x56mm			65x56mm
Memory	256MB SDRAM	512MB SDRAM		
Storage	SD Card	SD Card	Micro SD Card	
GPIO	26	26	40	
USB 2.0	1	2	4	1
Ethernet	None	10/100mb Ethernet RJ45 Jack		None
Audio	Multi-Channel HD Audio over HDMI, Analog Stereo from 3.5mm Headphone Jack			

Types of Sensors :

These three features should be at the base of a good sensor :

- It should be sensitive to the phenomenon that it measures
- It should not be sensitive to other physical phenomena
- It should not modify the measured phenomenon during the measurement process

Sensor Types

There is a wide range of sensors we can exploit to measure almost all the physical properties around us. A few common sensors that are widely adopted in everyday life include thermometers, pressure sensors, light sensors, accelerometers, gyroscopes, motion sensors, gas sensors and many more.

A sensor can be described using several properties, the most important being:

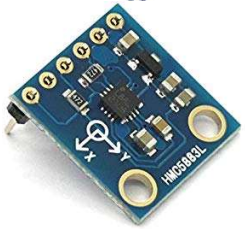
1. **Range:** The maximum and minimum values of the phenomenon that the sensor can measure.
2. **Sensitivity:** The minimum change of the measured parameter that causes a detectable change in output signal.
3. **Resolution:** The minimum change in the phenomenon that the sensor can detect.

Different types of Sensors :

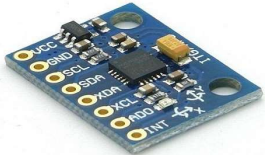
Alcohol Sensor

IR Optical Sensor

Gas Sensor



Magneto meter



Gyroscope Sensor

Finger Print Sensor

Different types of Sensors :

PIR Sensor

Rain Optical Sensor

Photo diode Sensor

Humidity Sensor

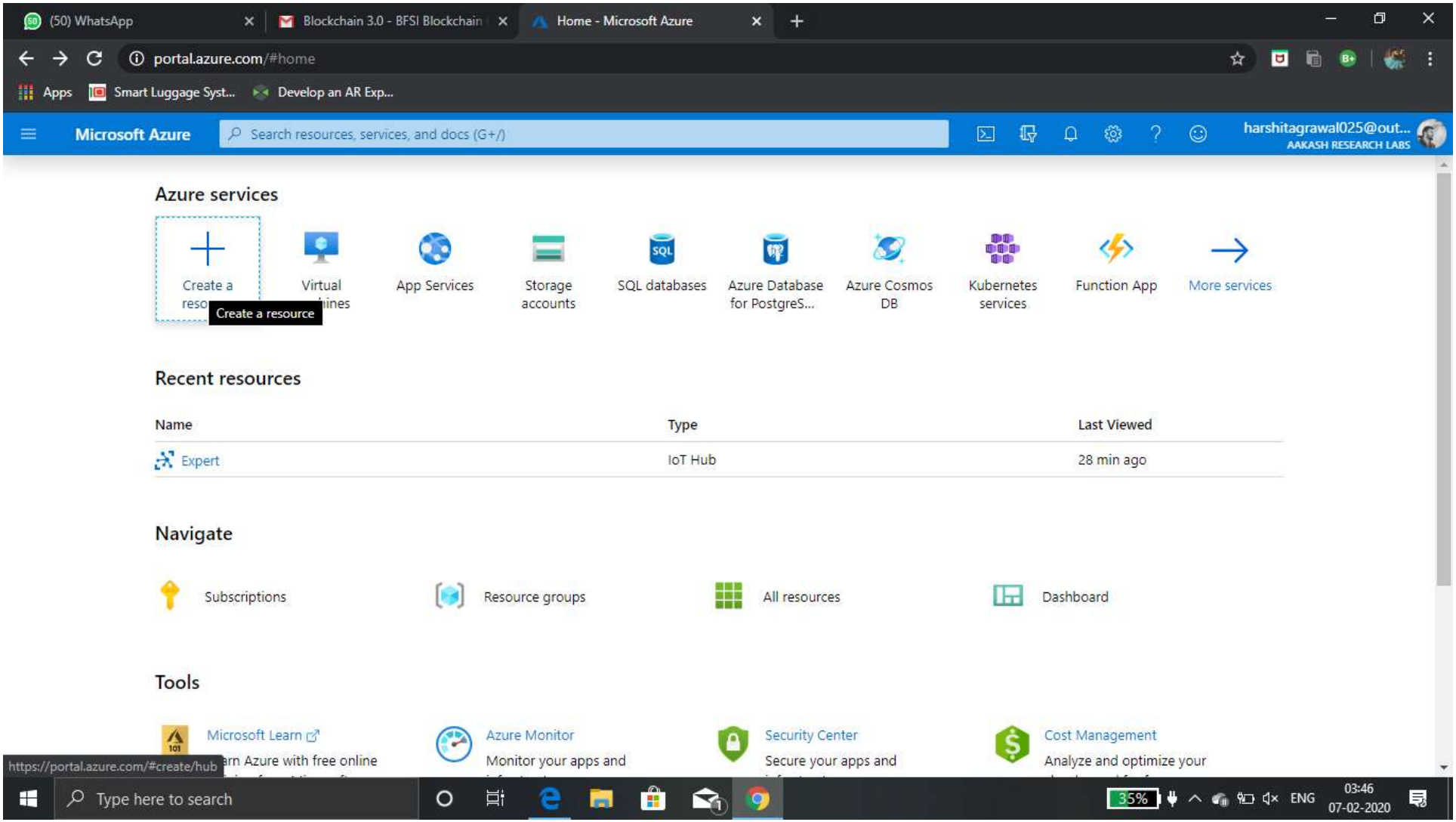
Proximity Sensor

UltraSonic Sensor

Let's get started with cloud

Log-on to azure.portal.com

- Create a new IoT Hub as per the screenshot in the preceding slides.
- Note that creating a new resource requires an active subscription.
- You can sign on for a new subscription on https://azure.microsoft.com
- Login to Azure Portal.
- Choose +Create a resource , then choose Internet of Things
- Click IoT Hub from list on the right. You see the first screen for creating an IoT Hub.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Subscriptions
Resource groups
All resources
Dashboard
Tools
Microsoft Learn
Azure Monitor
Monitor your apps and
Security Center
Secure your apps and
Cost Management
Analyze and optimize your
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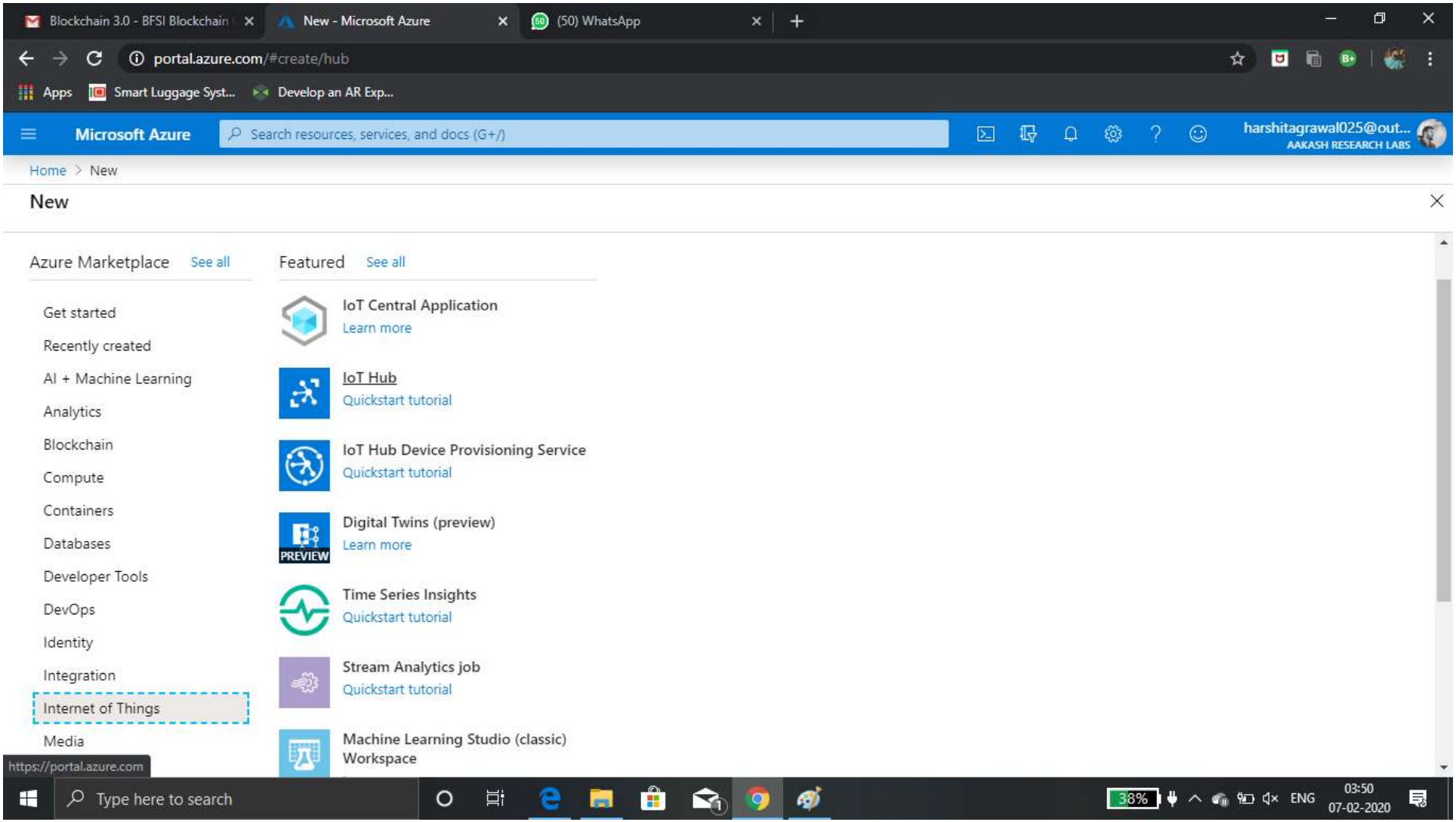
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Learn more
IoT Hub
Quickstart tutorial
IoT Hub Device Provisioning Service
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Digital Twins (preview)
Learn more
PREVIEW
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Quickstart tutorial
Machine Learning Studio (classic) Workspace
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Basics

- **Subscription :** Select the subscription to use for your IoT hub.
- **Resource Group :** You can create a new resource group or use an existing one.

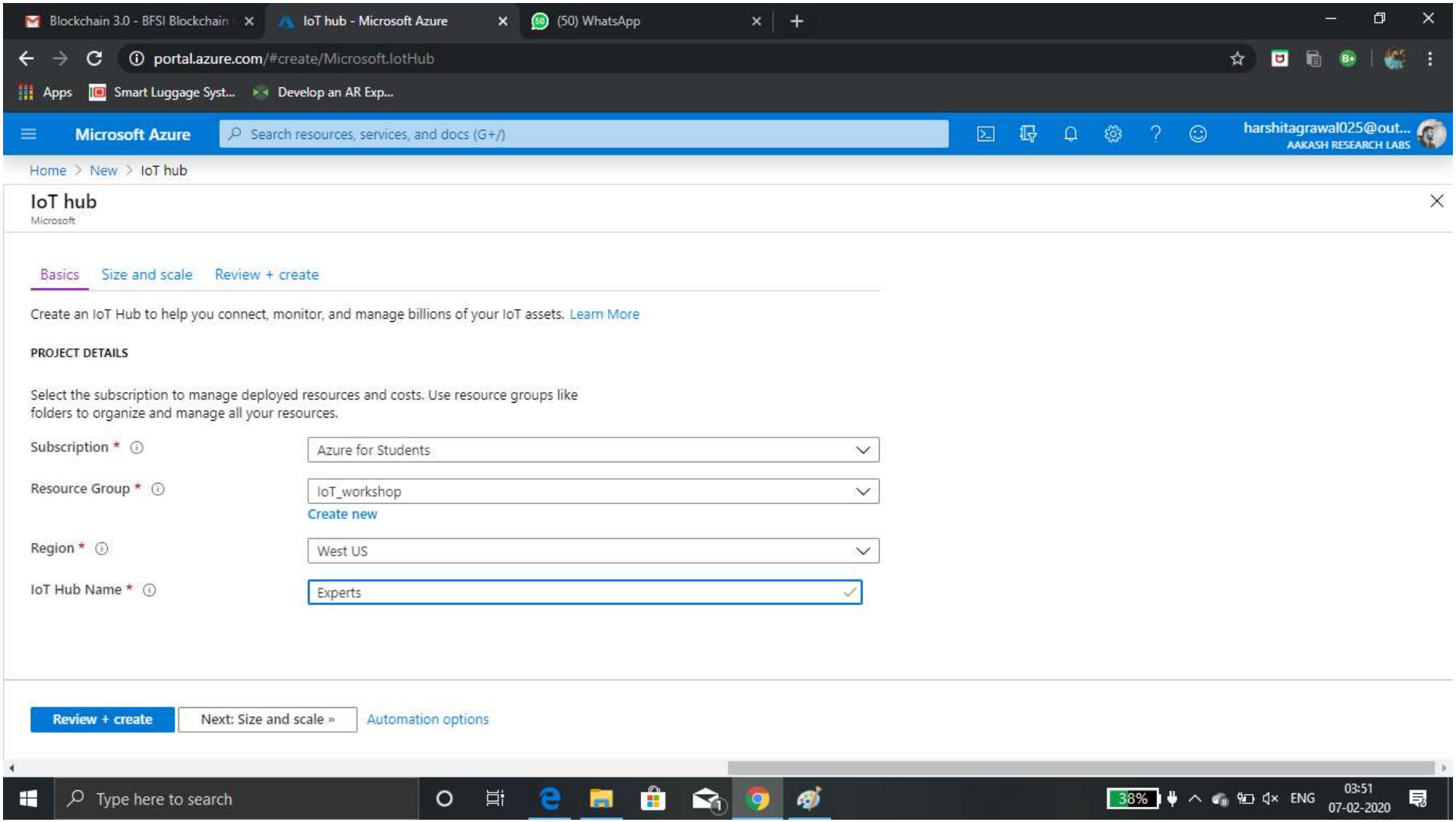
To create a new one, click Create new and fill in the name you want to use.

To use an existing resource group, click Use existing and select the resource group from the drop-down list.

- **Region:** This is the region in which you want your hub to be located. Select the location closest to you from the dropdown list.

- **IoT Hub Name:** Put in the name for your IoT Hub. This name must be globally unique. If the name you enter is available, a green check mark appears.

The IoT hub will be publicly discoverable as a DNS endpoint, so make sure to avoid any sensitive information while naming it.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Size and scale
Review + create
Create an IoT Hub to help you connect, monitor, and manage billions of your IoT assets. Learn More
PROJECT DETAILS
Select the subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.
Subscription *
Azure for Students
Resource Group *
IoT_workshop
Create new
Region *
West US
IoT Hub Name *
Experts
Review + create
Next: Size and scale »
Automation options
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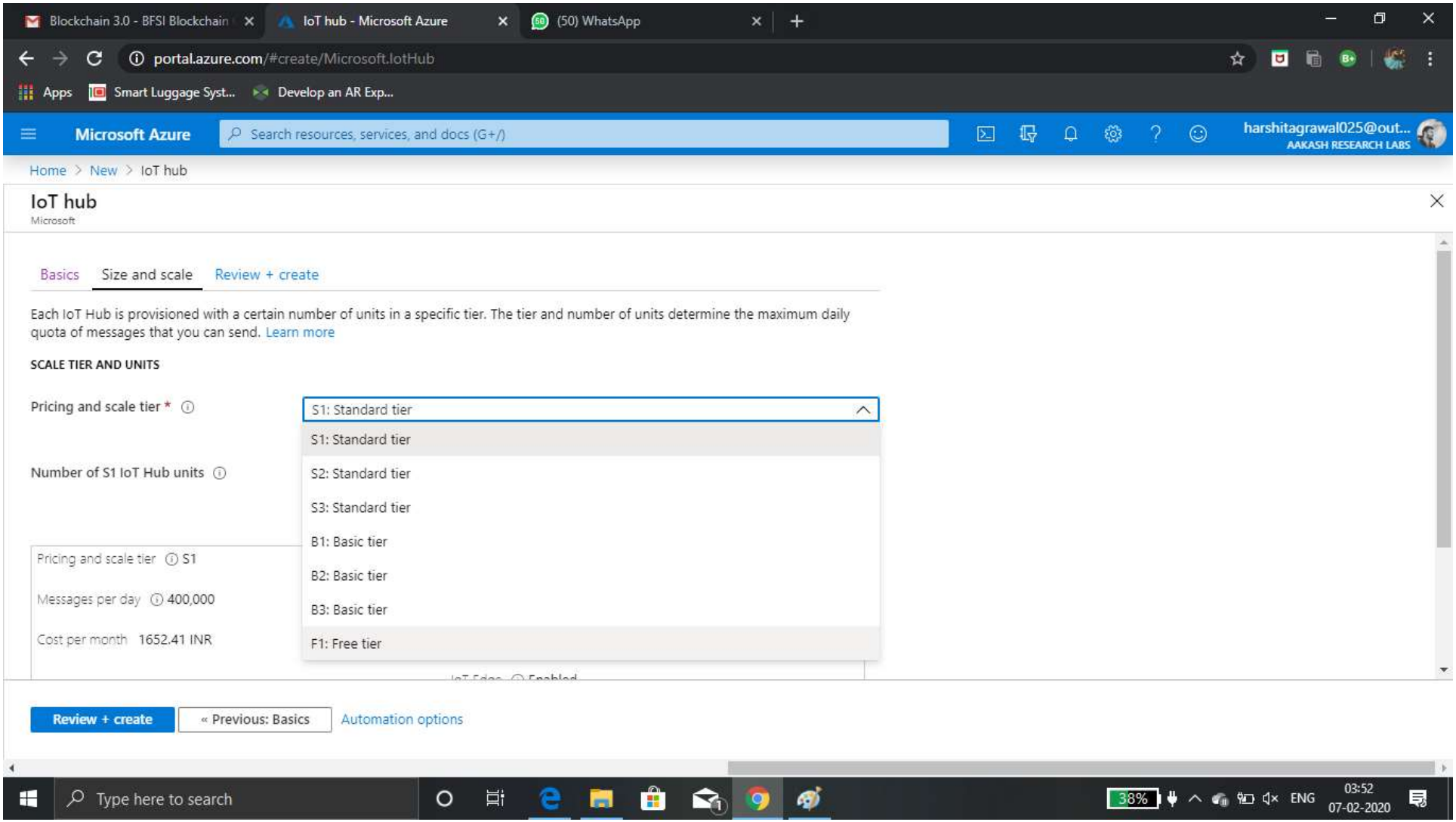
Next : Size and Scale

- On this screen, you can take the defaults and just click Review + create at the bottom.
- **Pricing and scale tier:** You can choose from several tiers depending on how many features you want and how many messages you send through your solution per day.
- The free tier is intended for testing and evaluation. It allows 500 devices to be connected to the IoT hub and up to 8,000 messages per day. Each Azure subscription can create one IoT Hub in the free tier.
- **IoT Hub units:** The number of messages allowed per unit per day depends on your hub's pricing tier. For example, if you want the IoT hub to support ingress of 700,000 messages, you choose two S1 tier units.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Review + create
Each IoT Hub is provisioned with a certain number of units in a specific tier. The tier and number of units determine the maximum daily quota of messages that you can send. Learn more
SCALE TIER AND UNITS
Pricing and scale tier *
S1: Standard tier
S1: Standard tier
S2: Standard tier
S3: Standard tier
B1: Basic tier
B2: Basic tier
B3: Basic tier
F1: Free tier
Number of S1 IoT Hub units
Pricing and scale tier S1
Messages per day 400,000
Cost per month 1652.41 INR
Review + create
« Previous: Basics
Automation options
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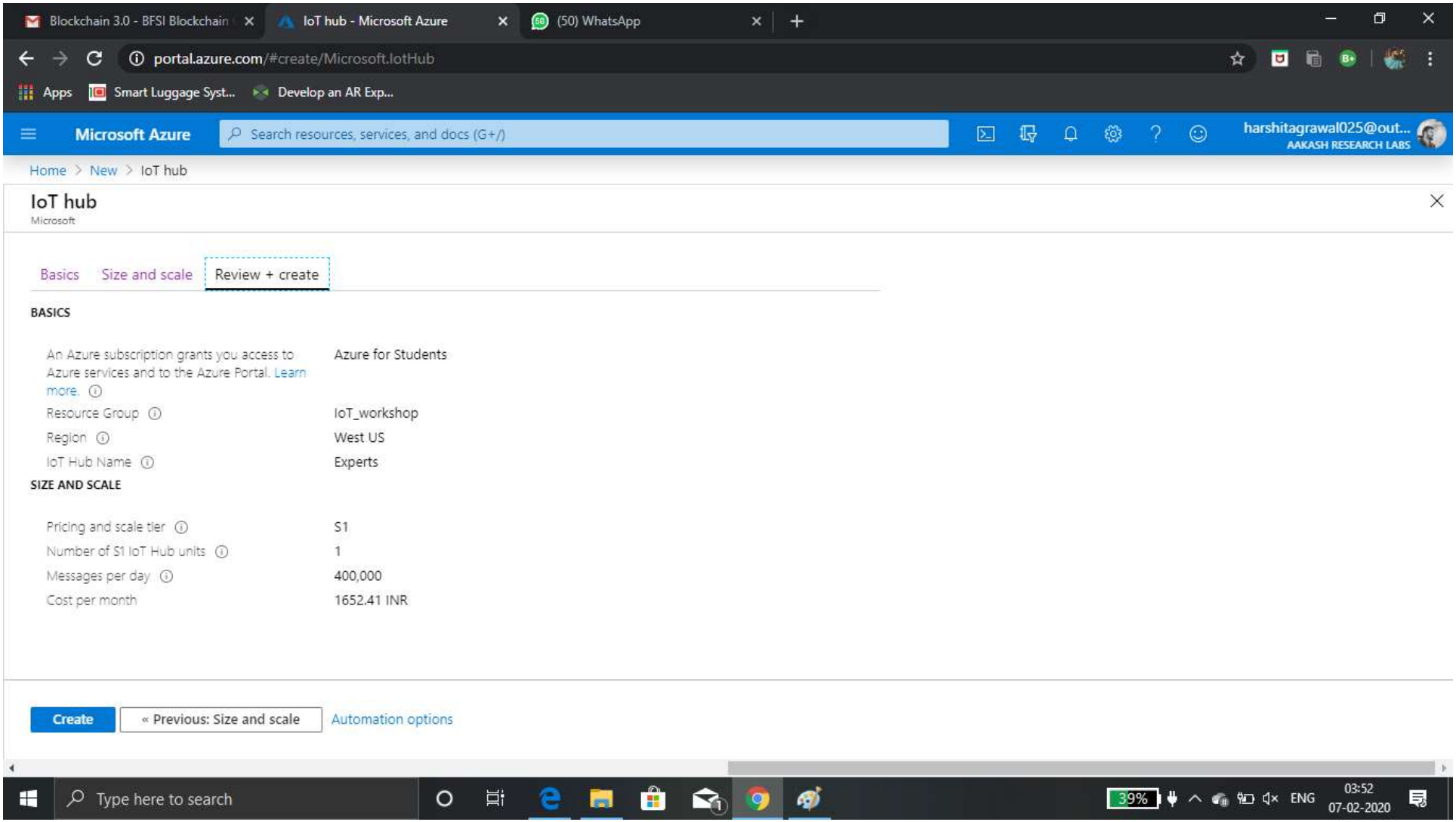
Next: Review + Create

- Click Create to create your new IoT hub. Creating the hub takes a few minutes.
- The summary screenshot (on next slide) will give you a downloadable template as well, on clicking the 'Automation Options'.
- The template is available as:
  - Azure Resource Manager Template
  - Parameters
  - Command Line Interface
  - PowerShell
  - .NET
  - RUBY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An Azure subscription grants you access to Azure services and to the Azure Portal. Learn more.
Azure for Students
Resource Group
IoT_workshop
Region
West US
IoT Hub Name
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SIZE AND SCALE
Pricing and scale tier
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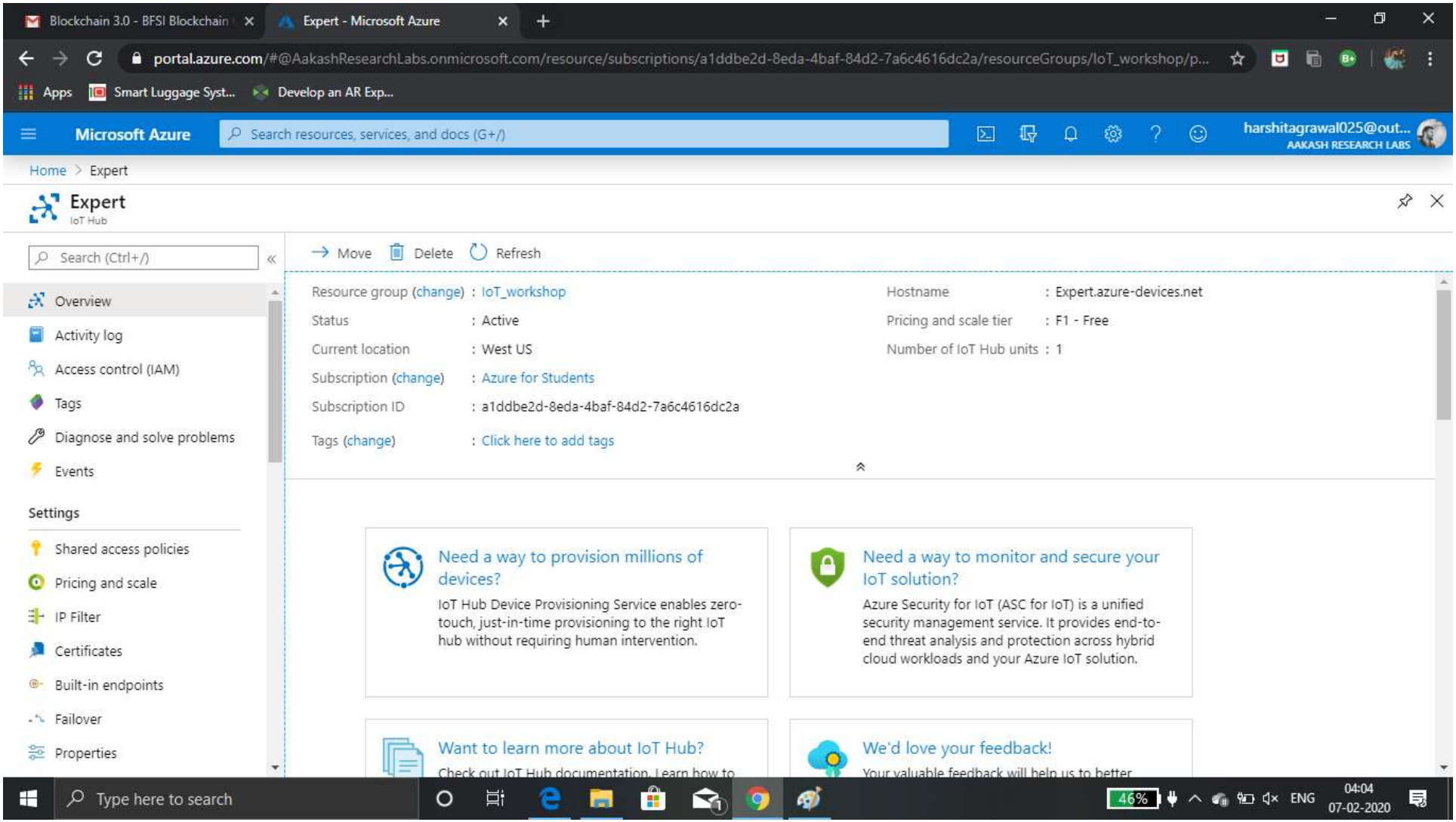
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Events
Settings
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Pricing and scale
IP Filter
Certificates
Built-in endpoints
Failover
Properties
Move
Delete
Refresh
Resource group (change) : IoT_workshop
Status : Active
Current location : West US
Subscription (change) : Azure for Students
Subscription ID : a1ddbe2d-8eda-4baf-84d2-7a6c4616dc2a
Tags (change) : Click here to add tags
Hostname : Expert.azure-devices.net
Pricing and scale tier : F1 - Free
Number of IoT Hub units : 1
Need a way to provision millions of devices?
IoT Hub Device Provisioning Service enables zero-touch, just-in-time provisioning to the right IoT hub without requiring human intervention.
Need a way to monitor and secure your IoT solution?
Azure Security for IoT (ASC for IoT) is a unified security management service. It provides end-to-end threat analysis and protection across hybrid cloud workloads and your Azure IoT solution.
Want to learn more about IoT Hub?
We'd love your feedback!
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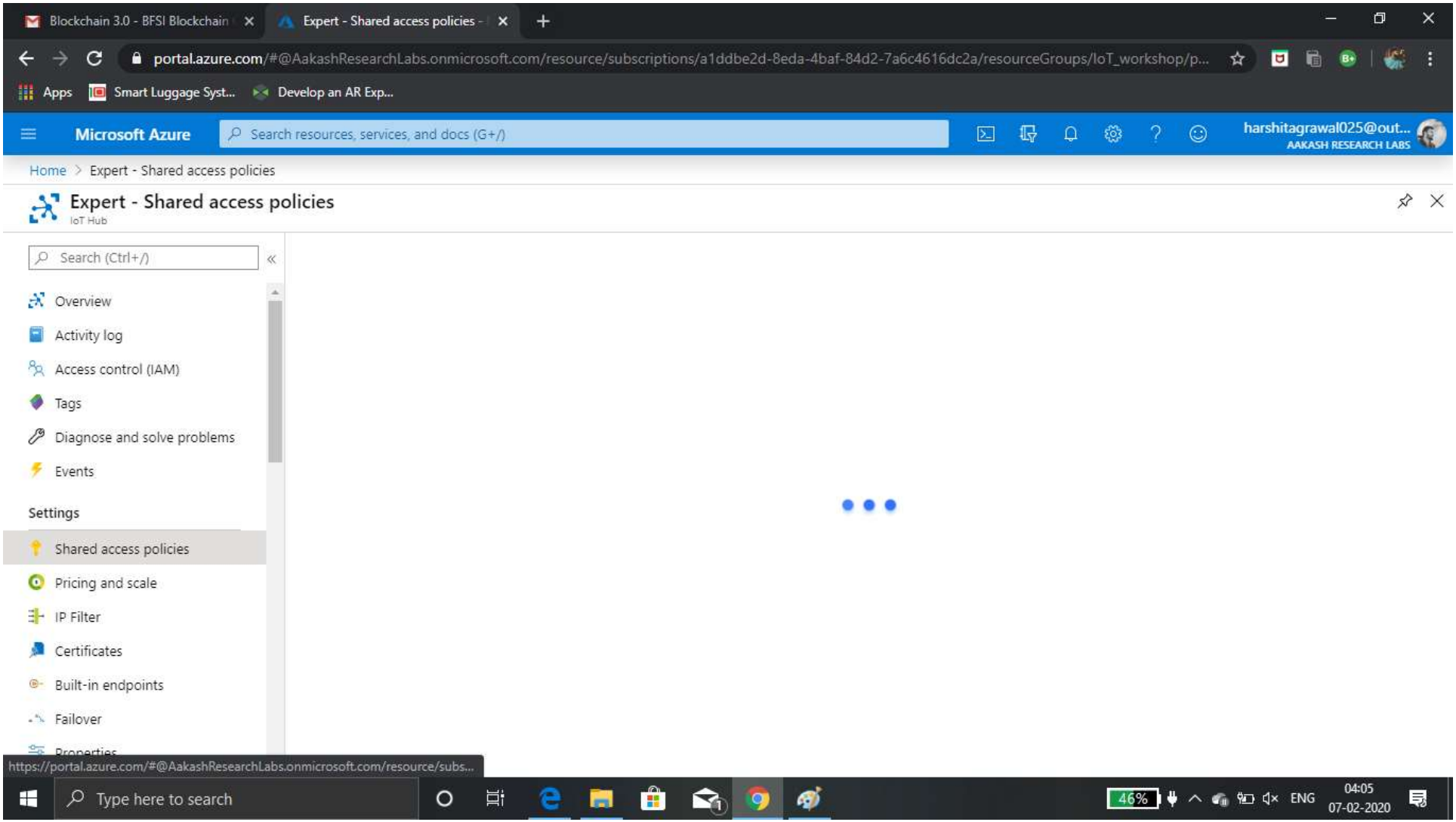
Retrieve connection string for IoT hub

After your hub has been created, retrieve the connection string for the hub. This is used to connect devices and applications to your hub.

- Click on your hub to see the IoT Hub pane with Settings, and so on. Click Shared access policies.
- In Shared access policies, select the IoThubowner policy.
- Under Shared access keys, copy the Connection string -- primary key to be used later.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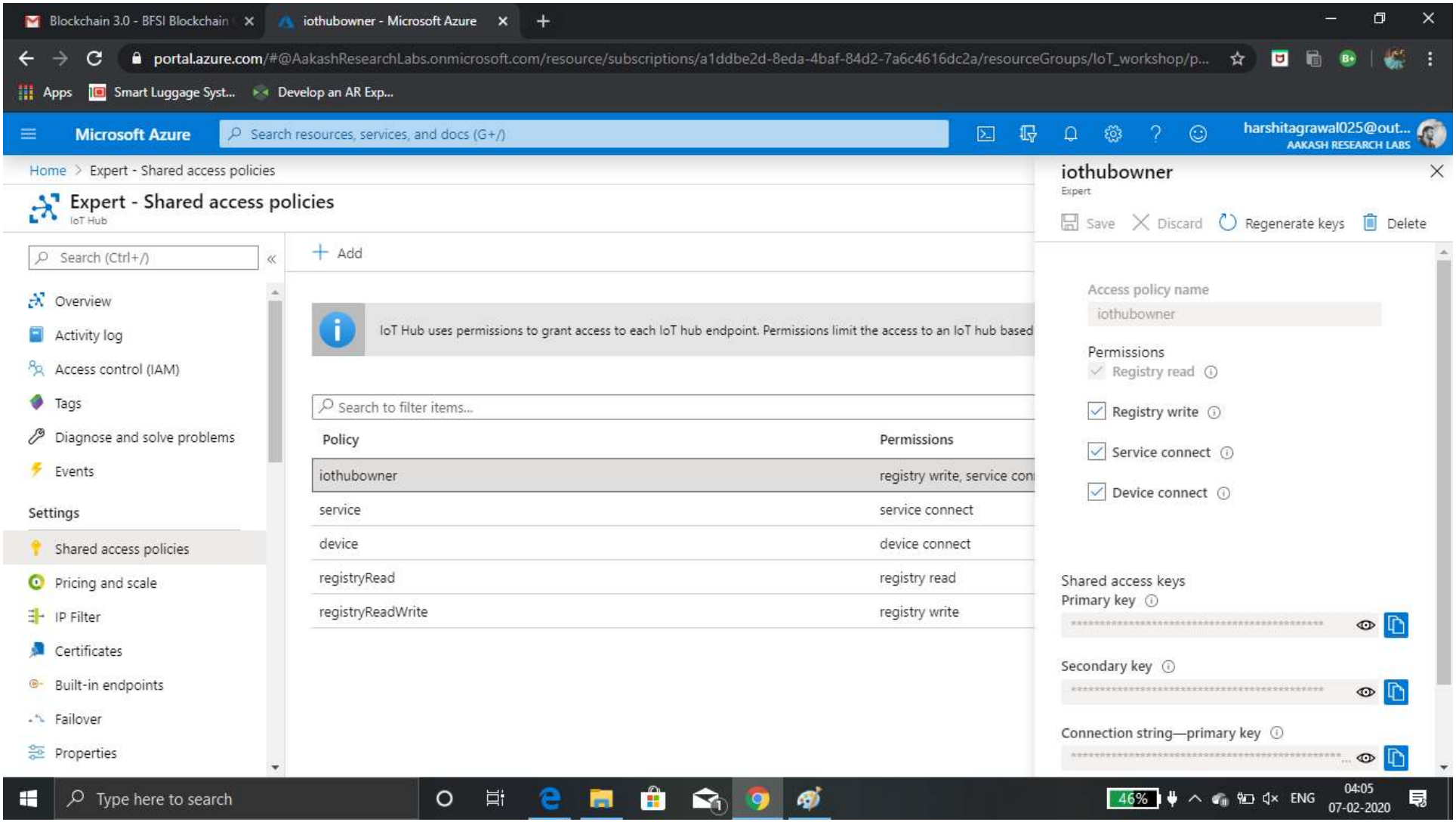
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device
device connect
registryRead
registry read
registryReadWrite
registry write
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Save
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Regenerate keys
Delete
Access policy name
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Permissions
Registry read
Registry write
Service connect
Device connect
Shared access keys
Primary key
Secondary key
Connection string—primary key
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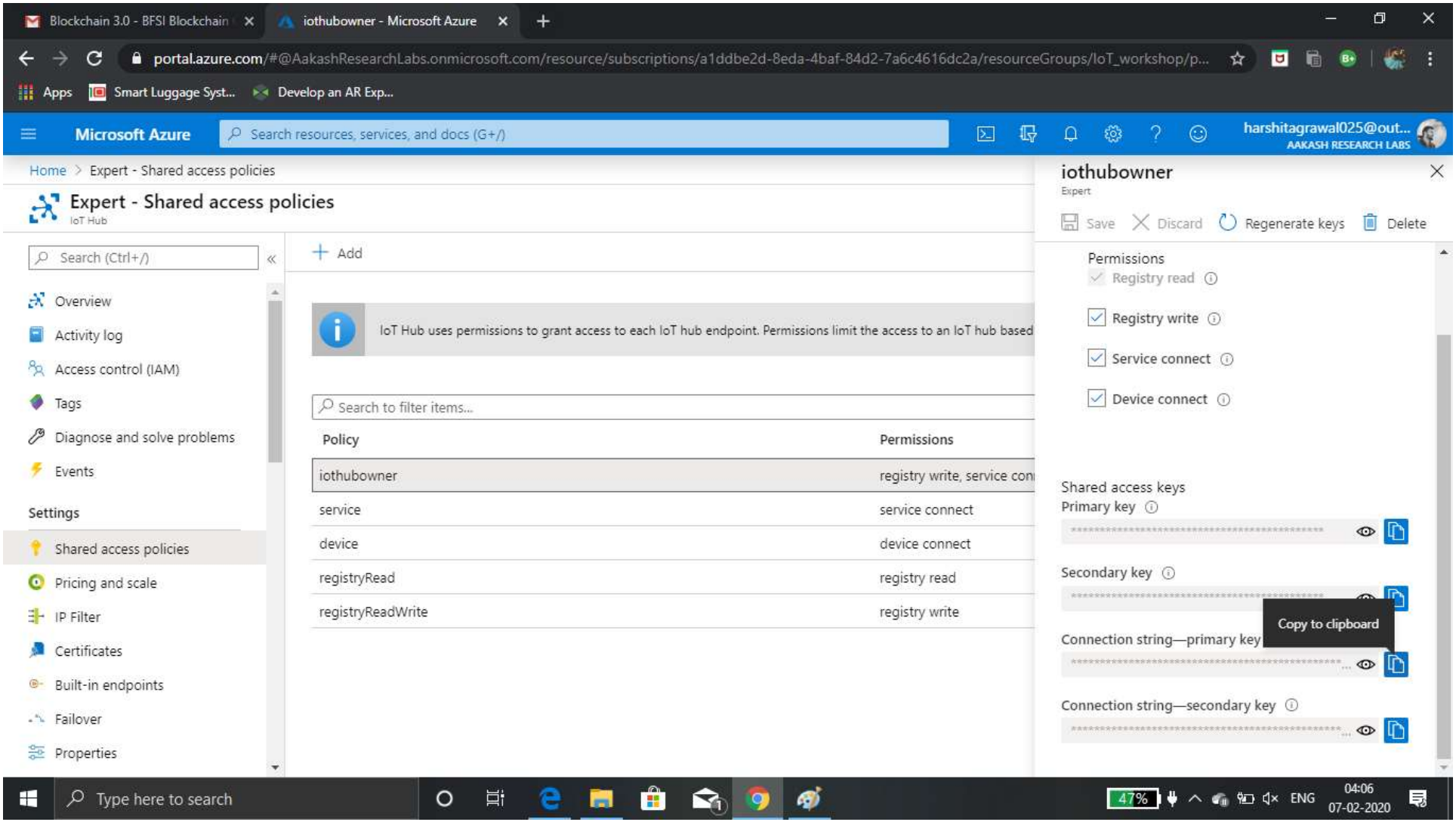
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Permissions
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Registry write
Service connect
Device connect
Shared access keys
Primary key
Secondary key
Copy to clipboard
Connection string—primary key
Connection string—secondary key
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Control access to IoT Hub

You can grant permissions in two ways: **Hub-level**, and **device level**

IoT hub-level shared access policies. Shared access policies can grant any combination of permissions. You can define policies in the Azure portal, programmatically by using the IoT Hub Resource REST APIs, or using the Azure IoT hub policy CLI. A newly created IoT hub has the following default policies:

A newly created IoT hub has the following default policies:

Shared Access Policy	Permissions
Iothubowner	All permission
Service	**ServiceConnect** Permissions
Device	**DeviceConnect** Permissions
registryRead	**RegistryRead** Permissions
registryReadWrite	**RegistryRead** & **RegistryWrite** Permissions

Control Access to IoT Hub-2

Per-Device Security Credentials. Each IoT Hub contains an identity registry For each device in this identity registry, you can configure security credentials that grant Device Connect permissions scoped to the corresponding device endpoints.

For example, in a typical IoT solution:

- The device management component uses the registry ReadWrite policy.
- The event processor component uses the service policy.
- The run-time device business logic component uses the service policy.
- Individual devices connect using credentials stored in the IoT hub's identity registry.

Authentication

- Azure IoT Hub grants access to endpoints by verifying a token against the shared access policies and identity registry security credentials.
- Security credentials, such as symmetric keys, are never sent over the wire.

Protocol Specifies

Each supported protocol, such as MQTT, AMQP, and HTTPS, transports tokens in different ways.

When using **MQTT**, the CONNECT packet has the deviceId as the ClientId, {iothubhostname}/{deviceId} in the Username field, and a SAS token in the Password field.

{iothubhostname} should be the full CName of the IoT hub (**for example, contoso.azuredevices.net**).

If you use **AMQP** claims-based-security, the standard specifies how to transmit these tokens.

For **SASL PLAIN**, the username can be: {policyName}@sas.root.{iothubName} if using IoT hub-level tokens.{deviceId}@sas.{iothubname} if using device-scoped tokens.

Special Considerations for SASL Plain

When using SASL PLAIN with AMQP, a client connecting to an IoT hub can use a single token for each TCP connection. When the token expires, the TCP connection disconnects from the service and triggers a reconnection

This behavior, while not problematic for a back-end app, is damaging for a device app for the following reasons:

- **Gateways usually connect on behalf of many devices. When using SASL PLAIN, they have to create a distinct TCP connection for each device connecting to an IoT hub. This scenario considerably increases the consumption of power and networking resources, and increases the latency of each device connection.**
- **Resource-constrained devices are adversely affected by the increased use of resources to reconnect after each token expiration.**

Security Token

- You use security tokens to grant time-bounded access to devices and services to specific functionality in IoT Hub.
- To get authorization to connect to IoT Hub, devices and services must send security tokens signed with either a shared access or symmetric key. These keys are stored with a device identity in the identity registry.
- A token signed with a shared access key grants access to all the functionality associated with the shared access policy permissions.
- A token signed with a device identity's symmetric key only grants the DeviceConnect permission for the associated device identity.

Structure of Security Token

Format:

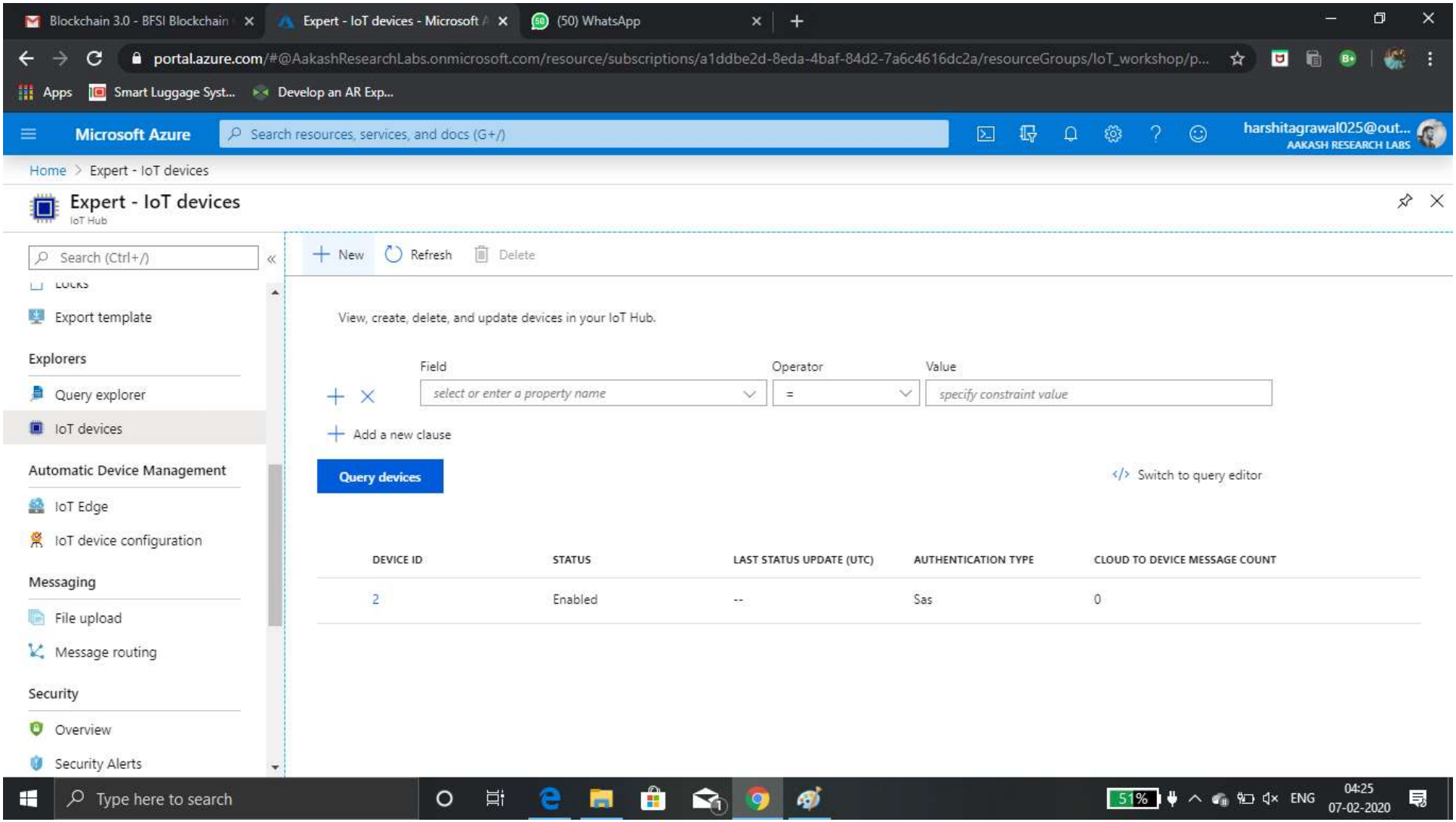
SharedAccessSignature

sig={signaturestring}&se={expiry}&skn={policyName}&sr={URL encodedresourceURI}

Register New Device in IoT Hub

- In this section, you create a device identity in the identity registry in your IoT hub. A device cannot connect to IoT hub unless it has an entry in the identity registry.
- In your IoT hub navigation menu, open IoT Devices, then click Add to register a new device in your IoT hub.
- The device or module ID stored in the identity registry is case-sensitive.

- At a high level, the identity registry is a REST-capable collection of device or module identity resources. When you add an entry in the identity registry, IoT Hub creates a set of per-device resources such as the queue that contains in-flight cloud-to-device messages.
- Use the identity registry when you need to:
  - Provision devices or modules that connect to your IoT hub.
  - Control per-device/per-module access to your hub's device or module-facing endpoints.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IoT Edge
IoT device configuration
Messaging
File upload
Message routing
Security
Overview
Security Alerts
New
Refresh
Delete
View, create, delete, and update devices in your IoT Hub.
Field
Operator
Value
select or enter a property name
=
specify constraint value
Add a new clause
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Switch to query editor
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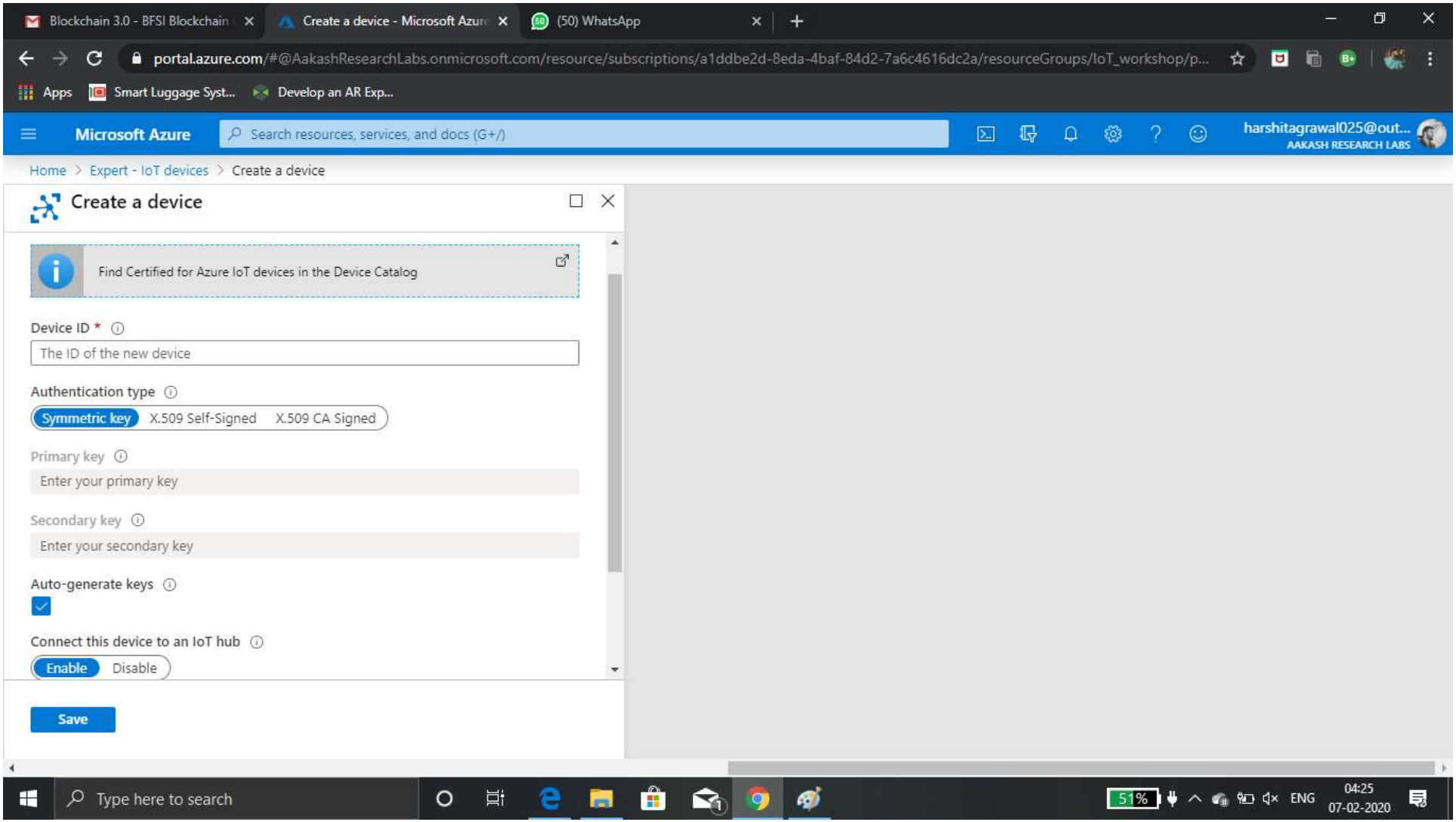
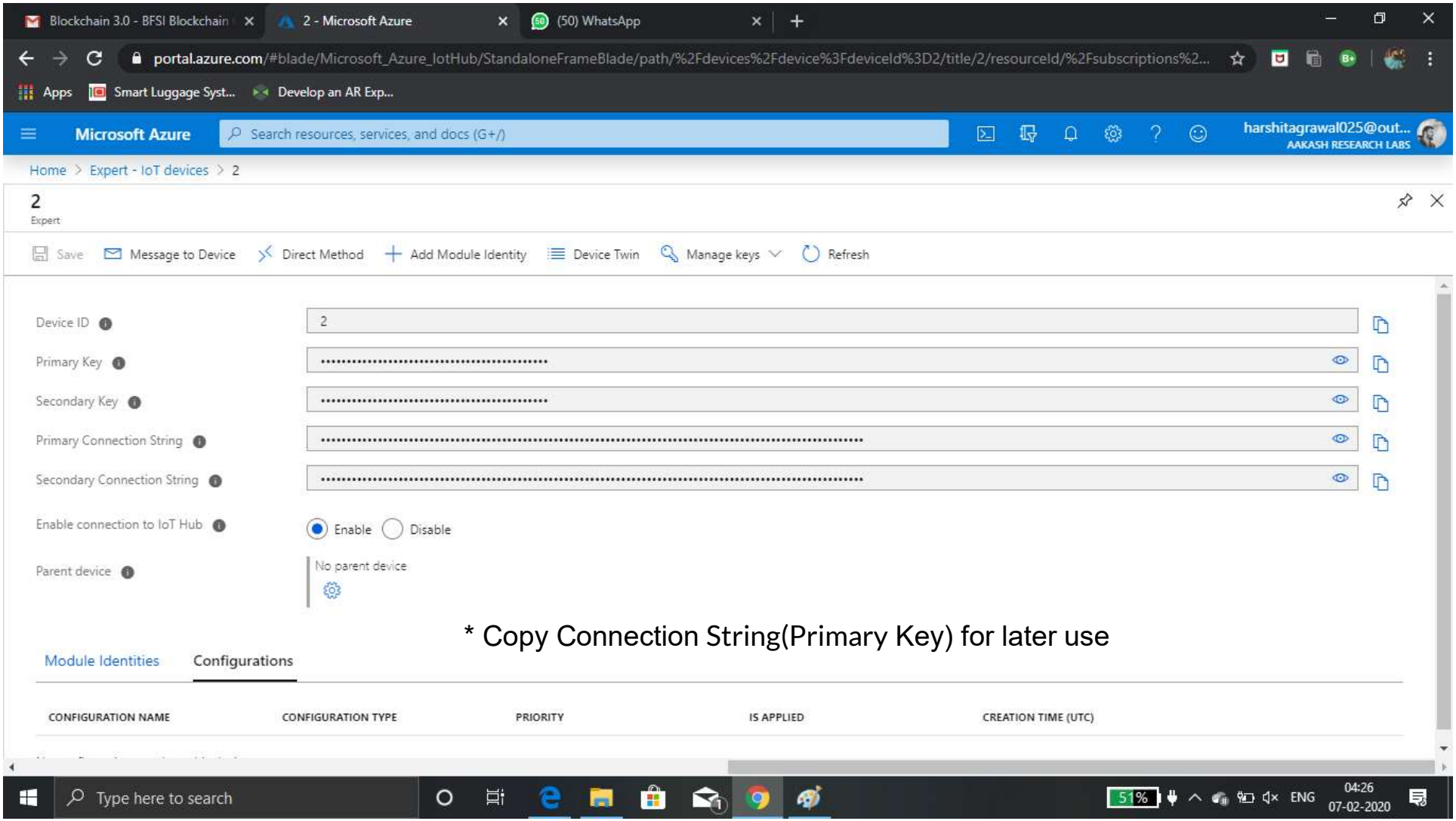

Blockchain 3.0 - BFSI Blockchain
Create a device - Microsoft Azure
(50) WhatsApp
portal.azure.com/#@AakashResearchLabs.onmicrosoft.com/resource/subscriptions/a1ddbe2d-8eda-4baf-84d2-7a6c4616dc2a/resourceGroups/IoT_workshop/p...
Apps
Smart Luggage Syst...
Develop an AR Exp...
Microsoft Azure
Search resources, services, and docs (G+/)
harshitagrawal025@out...
AAKASH RESEARCH LABS
Home > Expert - IoT devices > Create a device
Create a device
Find Certified for Azure IoT devices in the Device Catalog
Device ID *
The ID of the new device
Authentication type
Symmetric key
X.509 Self-Signed
X.509 CA Signed
Primary key
Enter your primary key
Secondary key
Enter your secondary key
Auto-generate keys
Connect this device to an IoT hub
Enable
Disable
Save
Type here to search
51%
ENG
04:25
07-02-2020



* Copy Connection String(Primary Key) for later use

Start the online simulator

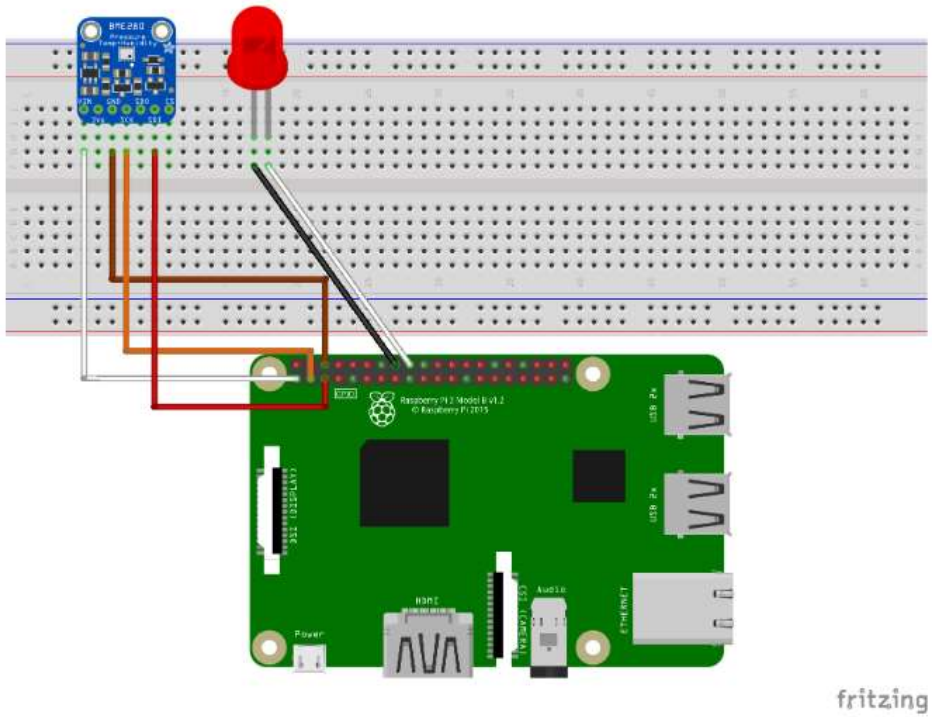
https://azure-samples.github.io/raspberry-pi-web-simulator/#GetStarted

Blockchain 3.0 - BFSI Blockchain | Expert - IoT devices - Microsoft | (50) WhatsApp | Raspberry Pi Azure IoT Web Sim

azure-samples.github.io/raspberry-pi-web-simulator/#GetStarted

Apps | Smart Luggage Syst... | Develop an AR Exp...

Raspberry Pi Azure IoT Online Simulator — Help — English




```
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 function getMessage(cb) {
24   messageId++;
25   sensor.readSensorData()
26     .then(function (data) {
27       cb(JSON.stringify({
28         messageId: messageId,
29         deviceId: 'Raspberry Pi Web Client',
30         temperature: data.temperature_C,
31         humidity: data.humidity
32       }), data.temperature_C > 30);
33     })
34     .catch(function (err) {
35       console.error('Failed to read out sensor data: ' + err);
36     });
37 }
38
39
```

Run Reset

Replace the placeholder in Line 15 with the Azure IoT hub device connection string.

Type here to search

54% ENG 04:31 07-02-2020

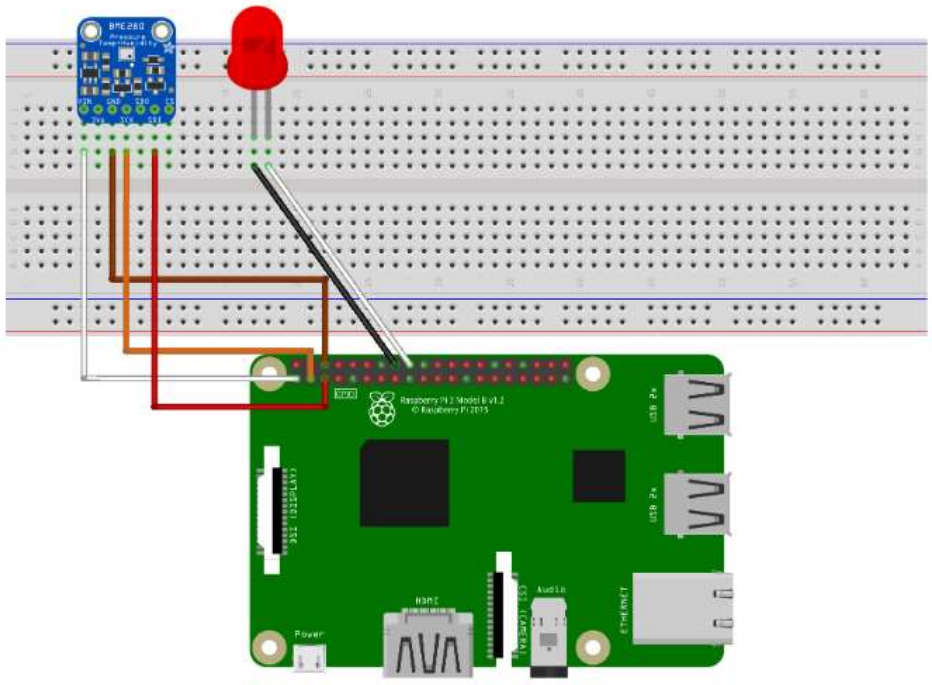
Blockchain 3.0 - BFSI Blockchain | Expert - IoT devices - Microsoft | (50) WhatsApp | Raspberry Pi Azure IoT Web Sim

azure-samples.github.io/raspberry-pi-web-simulator/#GetStarted

Apps | Smart Luggage Syst... | Develop an AR Exp...

Raspberry Pi Azure IoT Online Simulator

Help | English




```
/*
 * IoT Hub Raspberry Pi NodeJS - Microsoft Sample Code - Copyright (c) 2017 - Licensed MIT
 */
const wpi = require('wiring-pi');
const Client = require('azure-iot-device').Client;
const Message = require('azure-iot-device').Message;
const Protocol = require('azure-iot-device-mqtt').Mqtt;
const BME280 = require('bme280-sensor');

const BME280_OPTION = {
  i2cBusNo: 1, // defaults to 1
  i2cAddress: BME280.BME280_DEFAULT_I2C_ADDRESS() // defaults to 0x77
};

const connectionString = 'HostName=Expert.azure-devices.net;DeviceId=2;SharedAccessKey=49e
const LEDPin = 4;

var sendingMessage = false;
var messageId = 0;
var client, sensor;
var blinkLEDTimeout = null;
```

Run | Reset

```
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.
>
```

Type here to search

54% ENG 04:31 07-02-2020

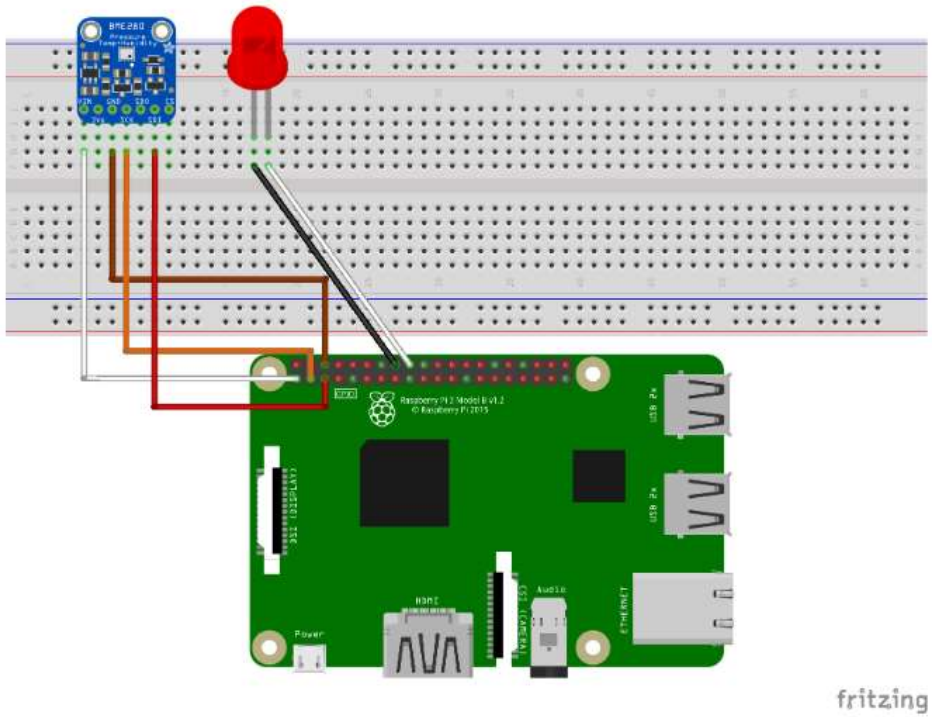
Blockchain 3.0 - BFSI Blockcha | Expert - IoT devices - Microsof | (50) WhatsApp | Raspberry Pi Azure IoT Web Si | (12) Full Song: Tujhe Kitna

azure-samples.github.io/raspberry-pi-web-simulator/#GetStarted

Apps | Smart Luggage Syst... | Develop an AR Exp...

Raspberry Pi Azure IoT Online Simulator

Help English




```
2  * IoT Hub Raspberry Pi NodeJS - Microsoft Sample Code - Copyright (c) 2017 - Licensed MIT
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9
10 const BME280_OPTION = {
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12   i2cAddress: BME280.BME280_DEFAULT_I2C_ADDRESS() // defaults to 0x77
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16 const LEDPin = 4;
17
18 var sendingMessage = false;
19 var messageId = 0;
20 var client, sensor;
21 var blinkLEDTimeout = null;
22
23
```

Run Reset

```
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.
> npm start
```

Use npm start to start your application.
Do not use any proxy or VPN

Type here to search

57% ENG 04:36 07-02-2020

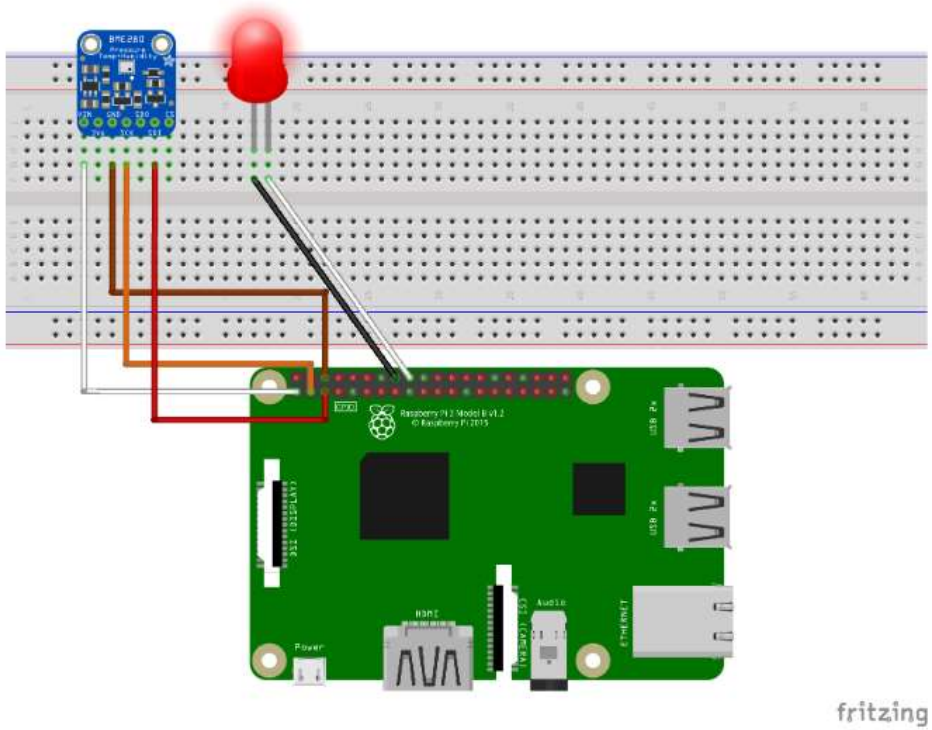
Blockchain 3.0 - BFSI Blockcha | Expert - IoT devices - Microsof | (50) WhatsApp | Raspberry Pi Azure IoT Web Si | (12) Full Song: Tujhe Kitna

azure-samples.github.io/raspberry-pi-web-simulator/#GetStarted

Apps | Smart Luggage Syst... | Develop an AR Exp...

Raspberry Pi Azure IoT Online Simulator

Help | English




```
 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;
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 7  const Protocol = require('azure-iot-device-mqtt').Mqtt;
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11    i2cBusNo: 1, // defaults to 1
12    i2cAddress: BME280.BME280_DEFAULT_I2C_ADDRESS() // defaults to 0x77
13  };
14
15  const connectionString = 'HostName=Expert.azure-devices.net;DeviceId=2;SharedAccessKey=49e
16  const LEDPin = 4;
17
18  var sendingMessage = false;
19  var messageId = 0;
20  var client, sensor;
21  var blinkLEDTimeout = null;
22
23
```

Stop Reset

```
>
Message sent to Azure IoT Hub
>
Sending message: {"messageId":2,"deviceId":"Raspberry Pi Web Client","temperature":25.189191642844
>
Message sent to Azure IoT Hub
>
Sending message: {"messageId":3,"deviceId":"Raspberry Pi Web Client","temperature":31.145668681667
>
Message sent to Azure IoT Hub
>
```

Type here to search

57% ENG 04:37 07-02-2020

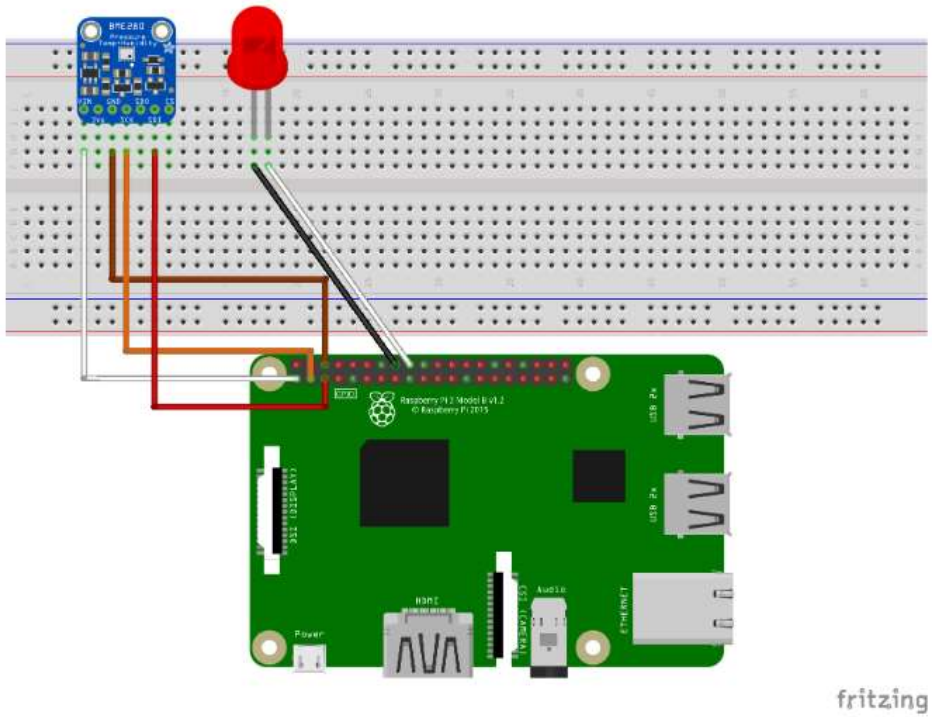
Blockchain 3.0 - BFSI Blockcha | Expert - IoT devices - Microsof | (50) WhatsApp | Raspberry Pi Azure IoT Web Si | (12) Full Song: Tujhe Kitna

azure-samples.github.io/raspberry-pi-web-simulator/#GetStarted

Apps | Smart Luggage Syst... | Develop an AR Exp...

Raspberry Pi Azure IoT Online Simulator

Help | English




```
2  * IoT Hub Raspberry Pi NodeJS - Microsoft Sample Code - Copyright (c) 2017 - Licensed MIT
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7  const Protocol = require('azure-iot-device-mqtt').Mqtt;
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9
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11   i2cBusNo: 1, // defaults to 1
12   i2cAddress: BME280.BME280_DEFAULT_I2C_ADDRESS() // defaults to 0x77
13 };
14
15 const connectionString = 'HostName=Expert.azure-devices.net;DeviceId=2;SharedAccessKey=49e
16 const LEDPin = 4;
17
18 var sendingMessage = false;
19 var messageId = 0;
20 var client, sensor;
21 var blinkLEDTimeout = null;
22
23
```

Run | Reset

```
>
Sending message: {"messageId":16,"deviceId":"Raspberry Pi Web Client","temperature":25.2471834260
>
Message sent to Azure IoT Hub
>
Sending message: {"messageId":17,"deviceId":"Raspberry Pi Web Client","temperature":20.6793282591
>
Message sent to Azure IoT Hub
>
Sample stopped.
>
```

Type here to search | 58% | ENG | 04:37 | 07-02-2020

Next Step :

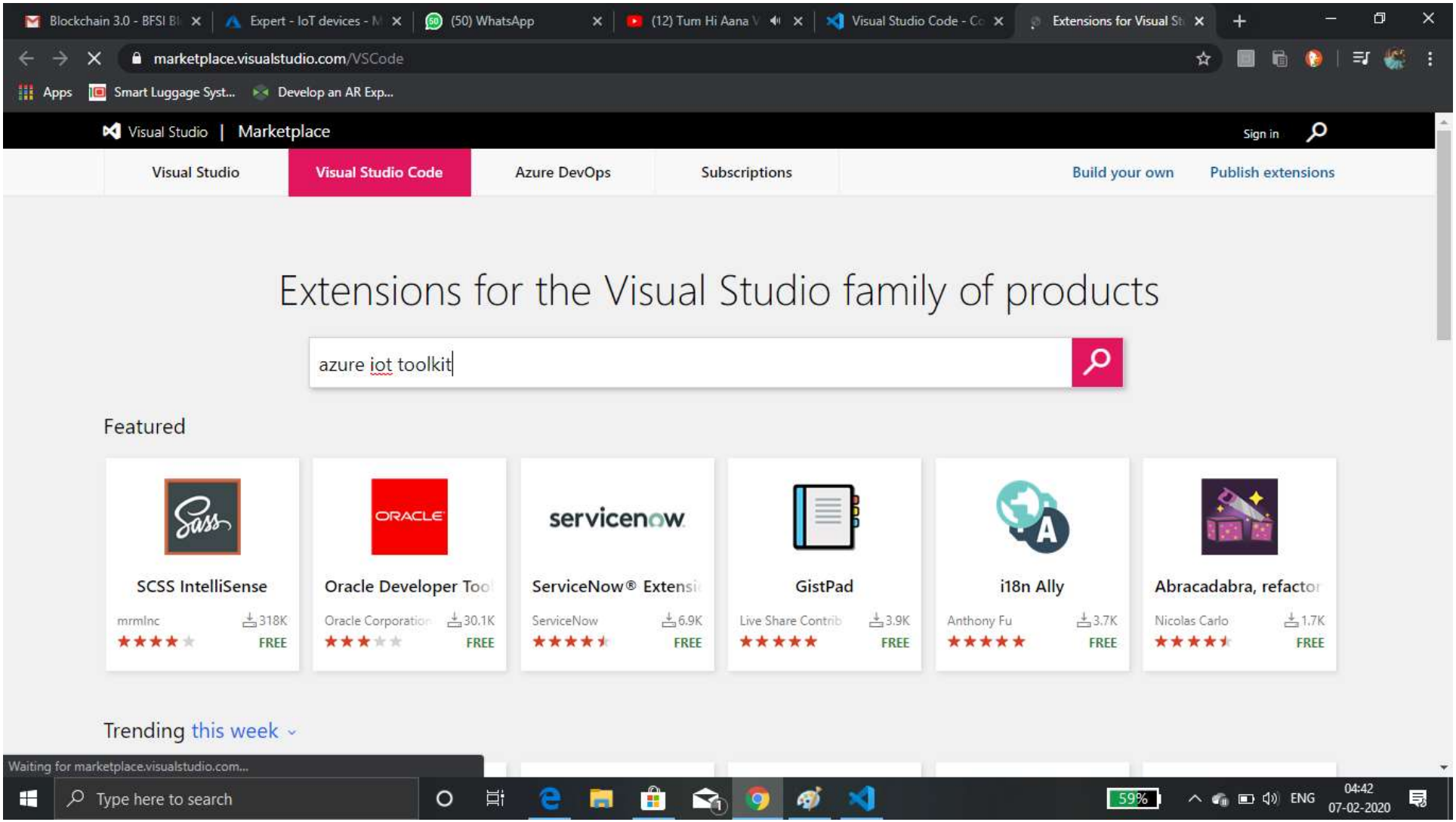
Install Visual Studio Code.

(Download from : https://code.visualstudio.com/Download)

Visual Studio Code > Programming Languages > Azure IoT Toolkit > Select IoT Hub

Select IoT Hub, and then select the subscription, followed by the IoT Hub created in previous steps.

Now, we can observe the device we had earlier added!


Blockchain 3.0 - BFSI Bl
Expert - IoT devices - M
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Visual Studio Code - Co
Extensions for Visual St
marketplace.visualstudio.com/VSCode
Apps
Smart Luggage Syst...
Develop an AR Exp...
Visual Studio | Marketplace
Sign in
Visual Studio
Visual Studio Code
Azure DevOps
Subscriptions
Build your own
Publish extensions
Extensions for the Visual Studio family of products
azure iot toolkit
Featured
SCSS IntelliSense
mrmlnc
318K
FREE
Oracle Developer Too
Oracle Corporation
30.1K
FREE
ServiceNow® Extensi
ServiceNow
6.9K
FREE
GistPad
Live Share Contrib
3.9K
FREE
i18n Ally
Anthony Fu
3.7K
FREE
Abracadabra, refactor
Nicolas Carlo
1.7K
FREE
Trending this week
Waiting for marketplace.visualstudio.com...
Type here to search
59%
ENG
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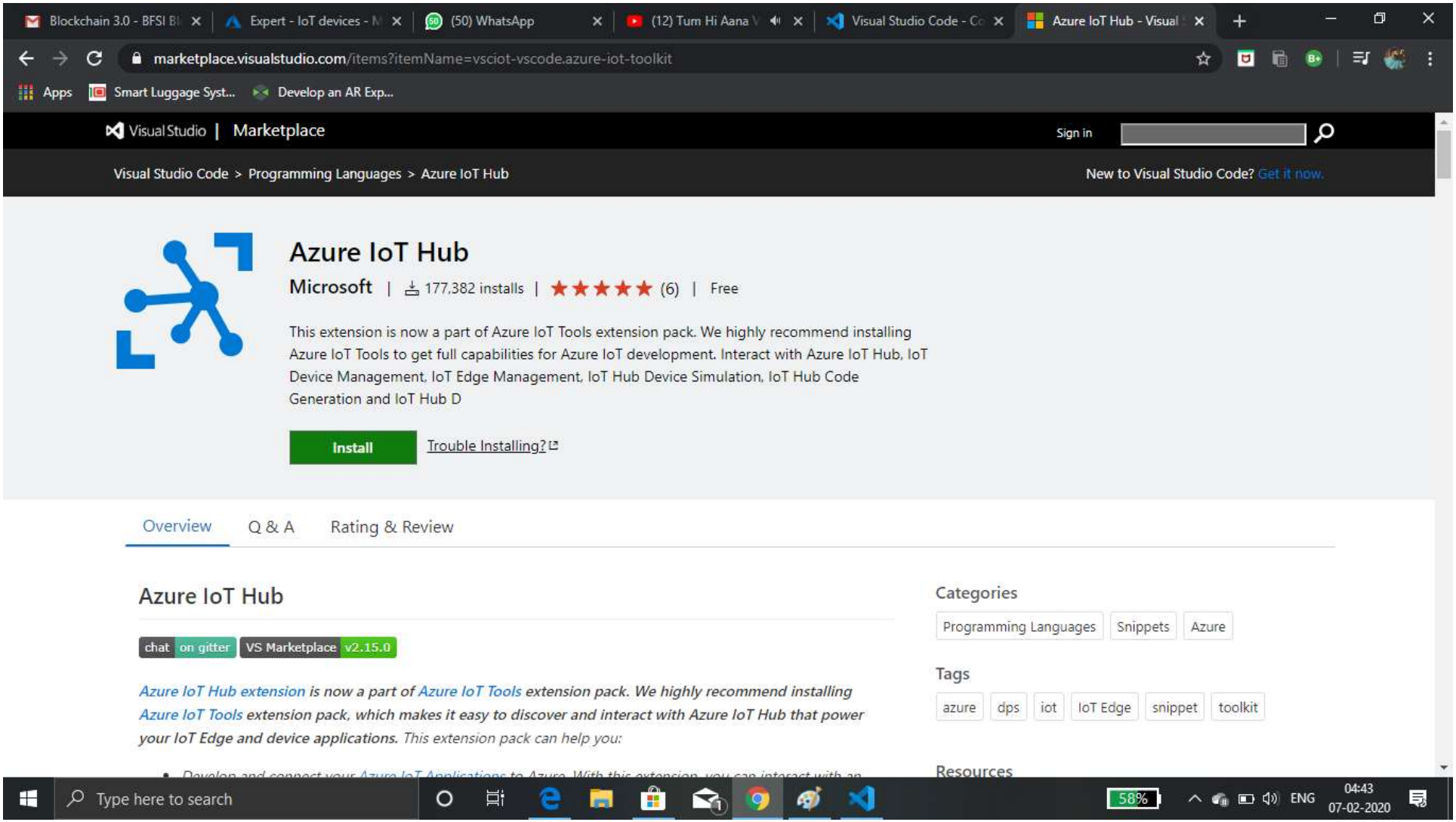
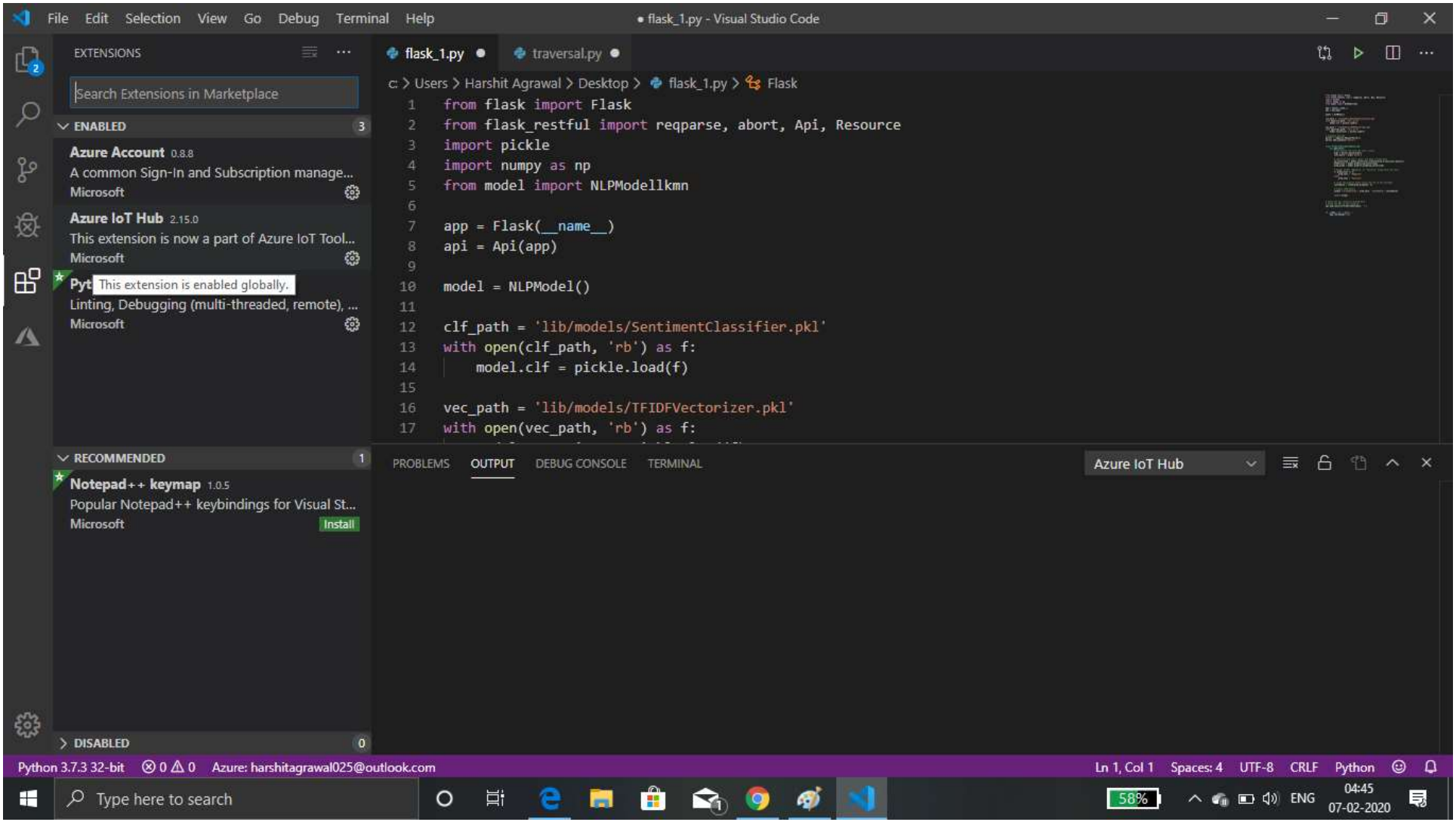
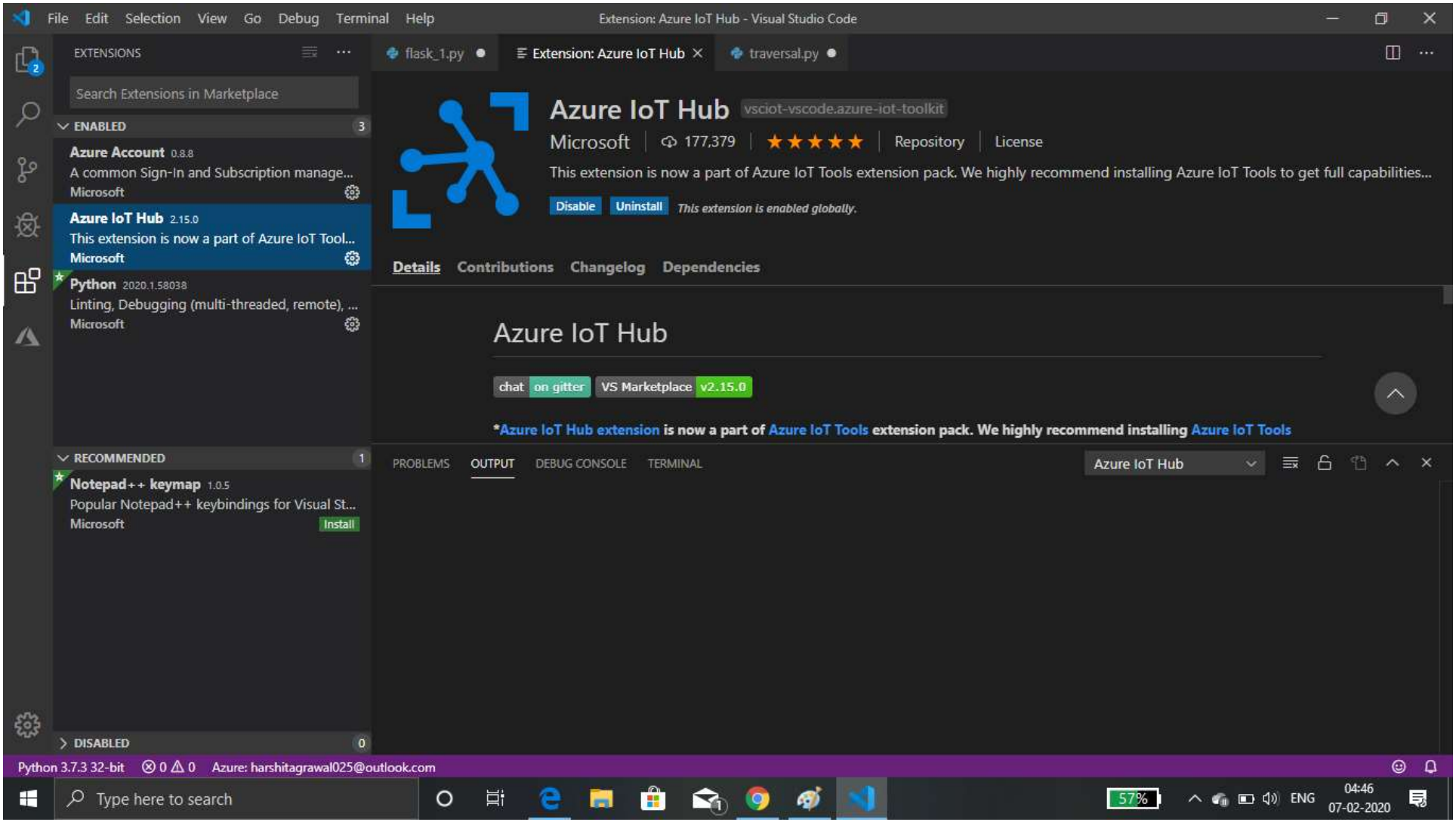
07-02-2020


Blockchain 3.0 - BFSI Bl
Expert - IoT devices - M
(50) WhatsApp
(12) Tum Hi Aana V
Visual Studio Code - Co
Azure IoT Hub - Visual
marketplace.visualstudio.com/items?itemName=vsciot-vscode.azure-iot-toolkit
Apps
Smart Luggage Syst...
Develop an AR Exp...
Visual Studio | Marketplace
Sign in
Visual Studio Code > Programming Languages > Azure IoT Hub
New to Visual Studio Code? Get it now.
Azure IoT Hub
Microsoft | 177,382 installs | (6) | Free
This extension is now a part of Azure IoT Tools extension pack. We highly recommend installing Azure IoT Tools to get full capabilities for Azure IoT development. Interact with Azure IoT Hub, IoT Device Management, IoT Edge Management, IoT Hub Device Simulation, IoT Hub Code Generation and IoT Hub D
Install
Trouble Installing?
Overview
Q & A
Rating & Review
Azure IoT Hub
chat on gitter
VS Marketplace v2.15.0
Azure IoT Hub extension is now a part of Azure IoT Tools extension pack. We highly recommend installing Azure IoT Tools extension pack, which makes it easy to discover and interact with Azure IoT Hub that power your IoT Edge and device applications. This extension pack can help you:
Categories
Programming Languages
Snippets
Azure
Tags
azure
dps
iot
IoT Edge
snippet
toolkit
Resources
Type here to search
58%
ENG
04:43
07-02-2020


File Edit Selection View Go Debug Terminal Help
• flask_1.py - Visual Studio Code
EXTENSIONS
Search Extensions in Marketplace
ENABLED 3
Azure Account 0.8.8
A common Sign-In and Subscription manage...
Microsoft
Azure IoT Hub 2.15.0
This extension is now a part of Azure IoT Tool...
Microsoft
Pyt This extension is enabled globally.
Linting, Debugging (multi-threaded, remote), ...
Microsoft
RECOMMENDED 1
Notepad++ keymap 1.0.5
Popular Notepad++ keybindings for Visual St...
Microsoft Install
DISABLED 0
flask_1.py
traversal.py
c: > Users > Harshit Agrawal > Desktop > flask_1.py > Flask
1 from flask import Flask
2 from flask_restful import reqparse, abort, Api, Resource
3 import pickle
4 import numpy as np
5 from model import NLPModellkmn
6
7 app = Flask(__name__)
8 api = Api(app)
9
10 model = NLPModel()
11
12 clf_path = 'lib/models/SentimentClassifier.pkl'
13 with open(clf_path, 'rb') as f:
14 model.clf = pickle.load(f)
15
16 vec_path = 'lib/models/TFIDFVectorizer.pkl'
17 with open(vec_path, 'rb') as f:
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
Azure IoT Hub
Python 3.7.3 32-bit ⊗ 0 ⚠ 0 Azure: harshitagrawal025@outlook.com
Ln 1, Col 1 Spaces: 4 UTF-8 CRLF Python
Type here to search
58%
ENG
04:45
07-02-2020


File Edit Selection View Go Debug Terminal Help
Extension: Azure IoT Hub - Visual Studio Code
EXTENSIONS
Search Extensions in Marketplace
ENABLED 3
Azure Account 0.8.8
A common Sign-In and Subscription manage...
Microsoft
Azure IoT Hub 2.15.0
This extension is now a part of Azure IoT Tool...
Microsoft
Python 2020.1.58038
Linting, Debugging (multi-threaded, remote), ...
Microsoft
RECOMMENDED 1
Notepad++ keymap 1.0.5
Popular Notepad++ keybindings for Visual St...
Microsoft
Install
DISABLED 0
flask_1.py
Extension: Azure IoT Hub
traversal.py
Azure IoT Hub
vsciot-vscode.azure-iot-toolkit
Microsoft
177,379
Repository
License
This extension is now a part of Azure IoT Tools extension pack. We highly recommend installing Azure IoT Tools to get full capabilities...
Disable
Uninstall
This extension is enabled globally.
Details
Contributions
Changelog
Dependencies
Azure IoT Hub
chat on gitter
VS Marketplace v2.15.0
*Azure IoT Hub extension is now a part of Azure IoT Tools extension pack. We highly recommend installing Azure IoT Tools
PROBLEMS
OUTPUT
DEBUG CONSOLE
TERMINAL
Azure IoT Hub
Python 3.7.3 32-bit
0 0
Azure: harshitagrawal025@outlook.com
Type here to search
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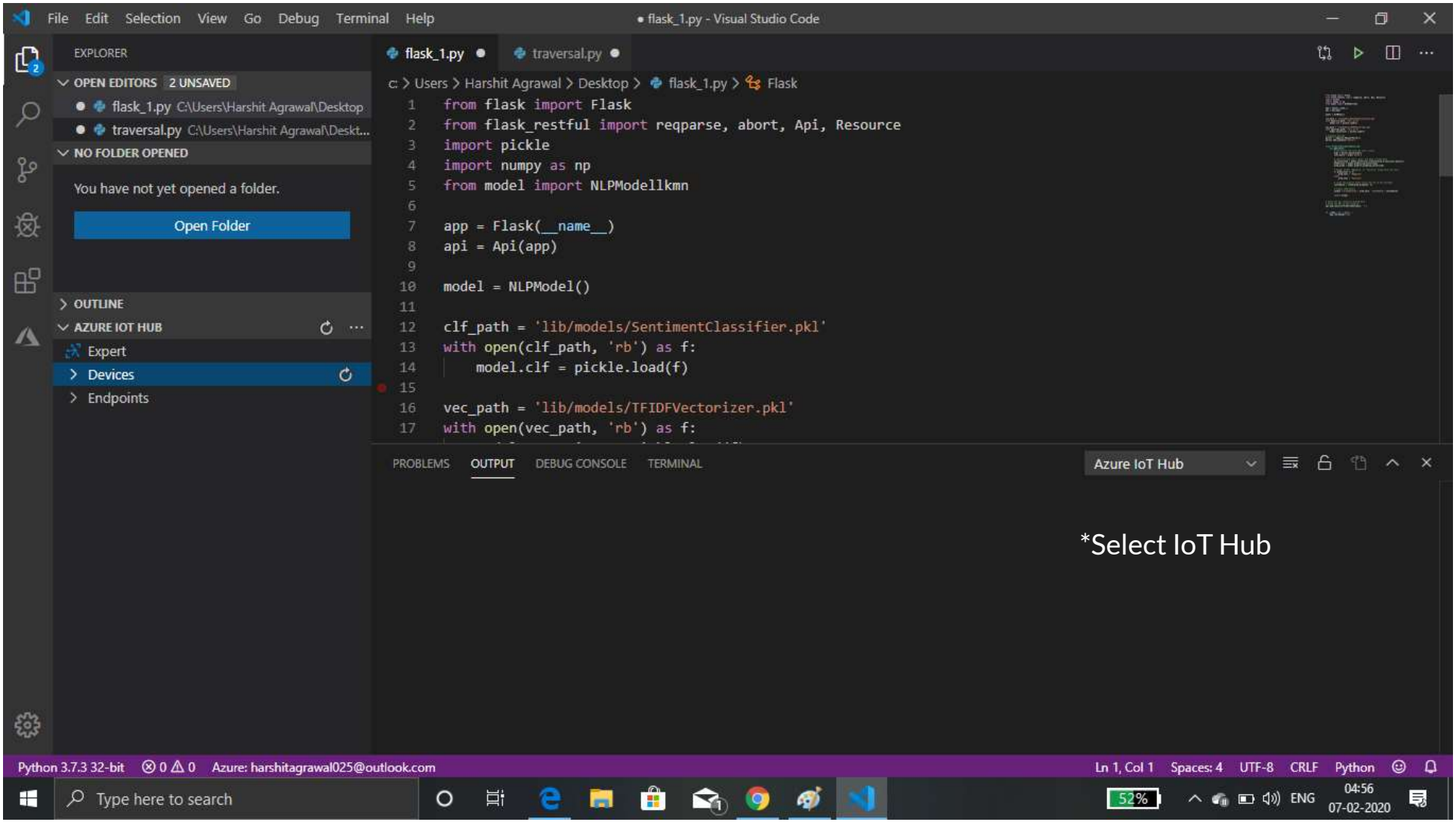
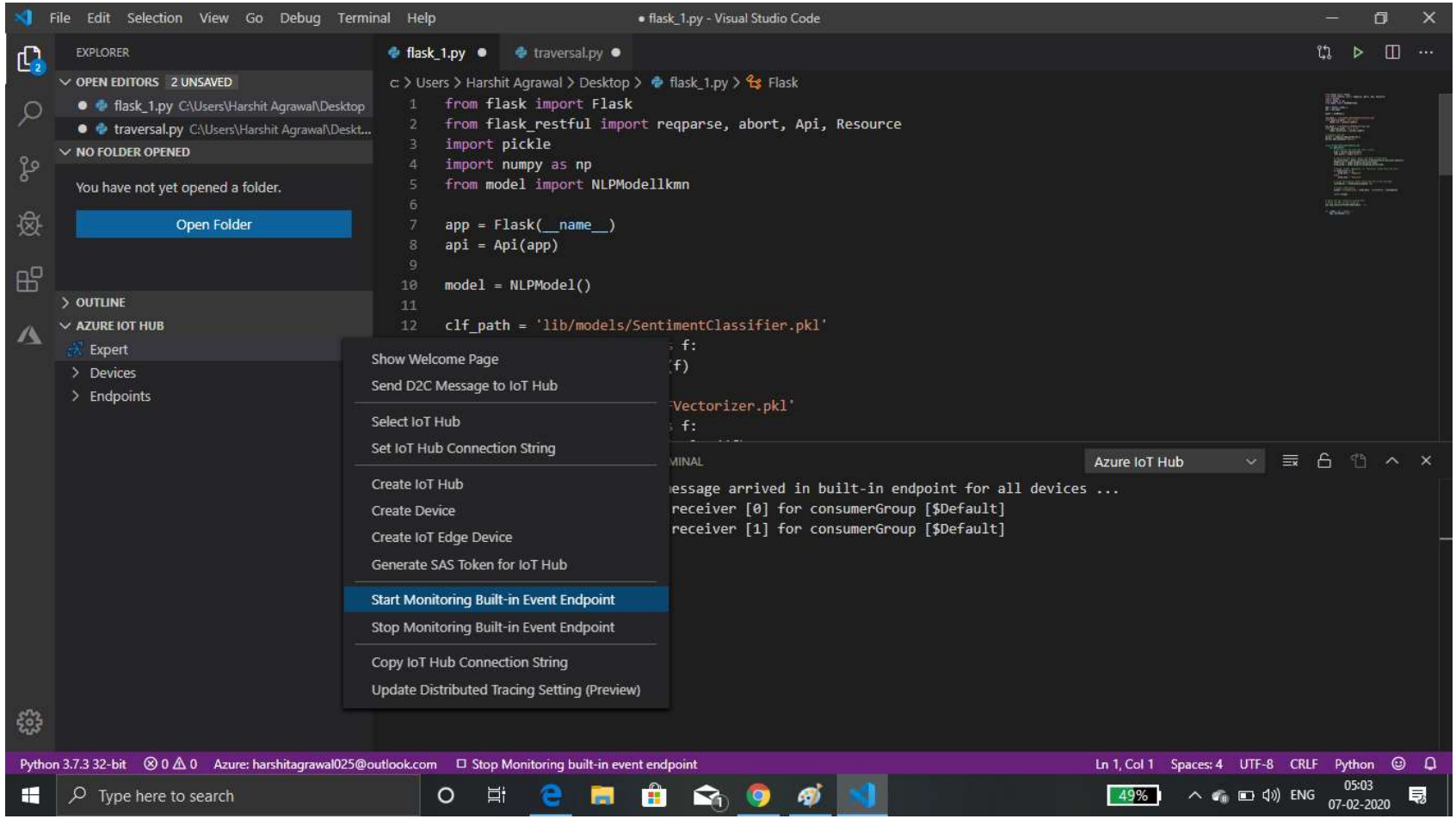
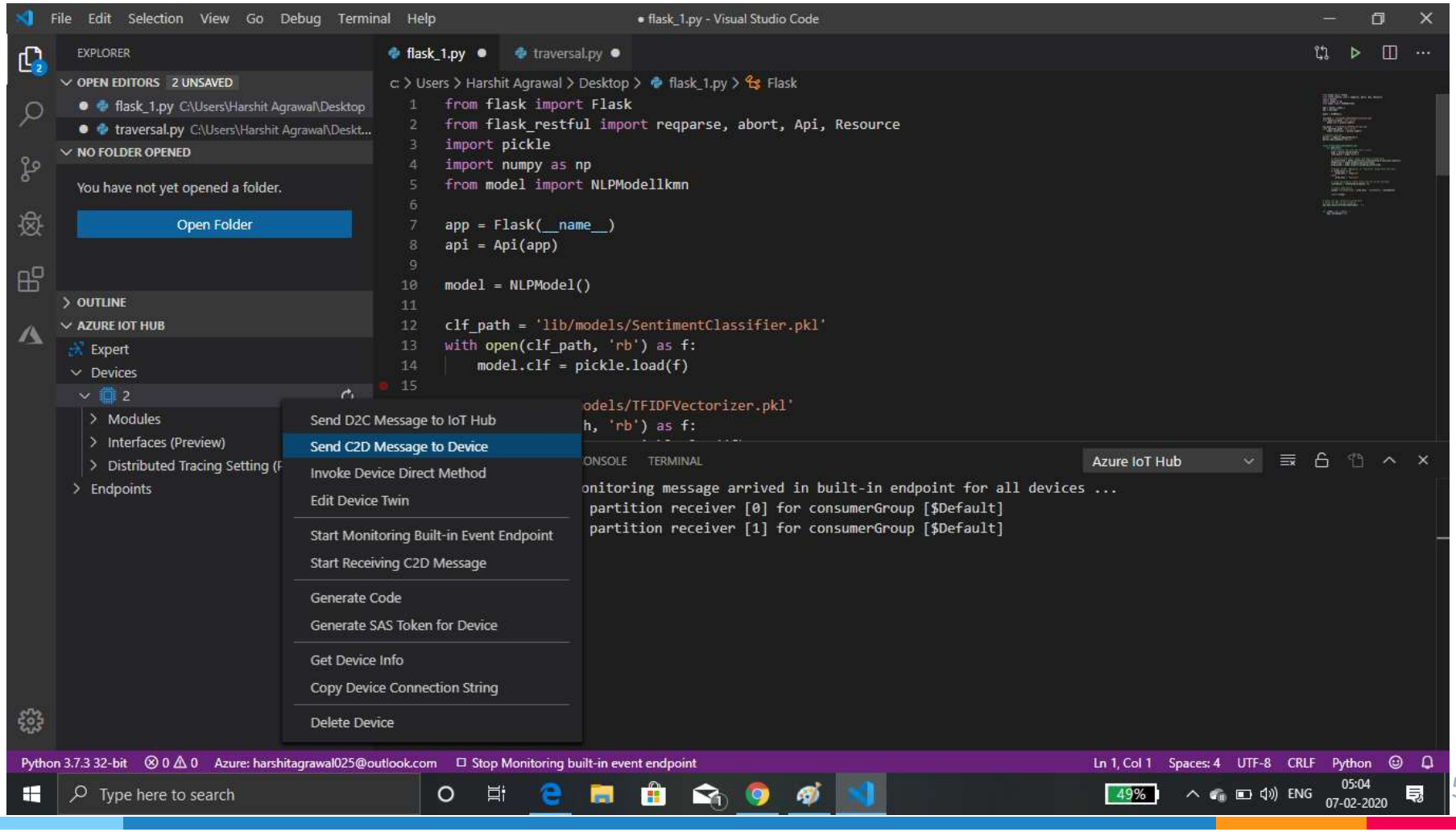
ENG
04:46
07-02-2020

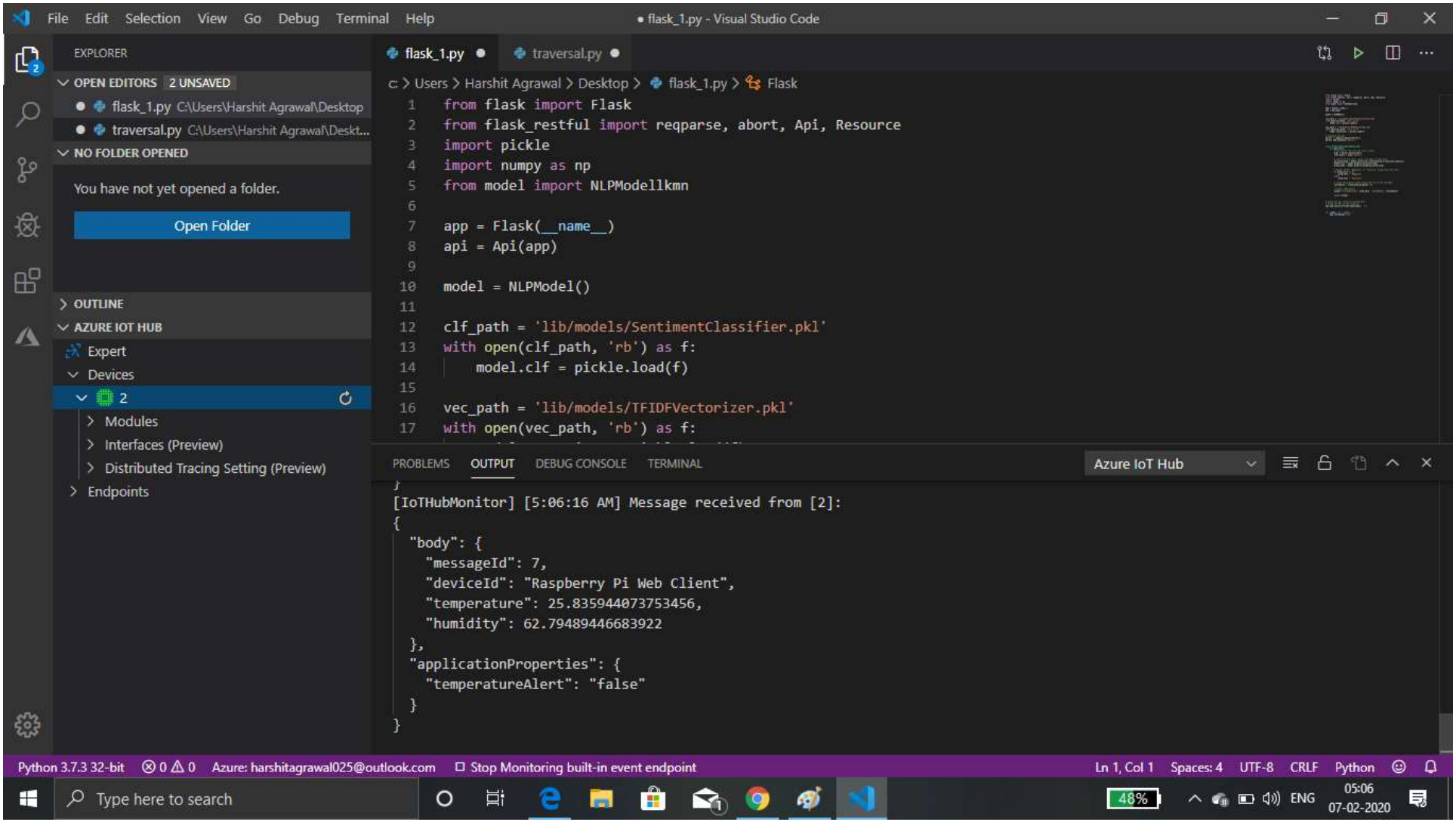

File Edit Selection View Go Debug Terminal Help
• flask_1.py - Visual Studio Code
EXPLORER
OPEN EDITORS 2 UNSAVED
flask_1.py C:\Users\Harshit Agrawal\Desktop
traversal.py C:\Users\Harshit Agrawal\Deskt...
NO FOLDER OPENED
You have not yet opened a folder.
Open Folder
OUTLINE
AZURE IOT HUB
Expert
Devices
Endpoints
flask_1.py
traversal.py
c: > Users > Harshit Agrawal > Desktop > flask_1.py > Flask
1 from flask import Flask
2 from flask_restful import reqparse, abort, Api, Resource
3 import pickle
4 import numpy as np
5 from model import NLPModellkmn
6
7 app = Flask(__name__)
8 api = Api(app)
9
10 model = NLPModel()
11
12 clf_path = 'lib/models/SentimentClassifier.pkl'
13 with open(clf_path, 'rb') as f:
14 model.clf = pickle.load(f)
15
16 vec_path = 'lib/models/TFIDFVectorizer.pkl'
17 with open(vec_path, 'rb') as f:
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
Azure IoT Hub
*Select IoT Hub
Python 3.7.3 32-bit ⊗ 0 ⚠ 0 Azure: harshitagrawal025@outlook.com
Ln 1, Col 1 Spaces: 4 UTF-8 CRLF Python
Type here to search
52%
ENG
04:56
07-02-2020

Start Monitoring :



Send Cloud to Device Message:




File Edit Selection View Go Debug Terminal Help
• flask_1.py - Visual Studio Code
EXPLORER
OPEN EDITORS 2 UNSAVED
flask_1.py C:\Users\Harshit Agrawal\Desktop
traversal.py C:\Users\Harshit Agrawal\Deskt...
NO FOLDER OPENED
You have not yet opened a folder.
Open Folder
OUTLINE
AZURE IOT HUB
Expert
Devices
2
Modules
Interfaces (Preview)
Distributed Tracing Setting (Preview)
Endpoints
flask_1.py
traversal.py
c: > Users > Harshit Agrawal > Desktop > flask_1.py > Flask
1 from flask import Flask
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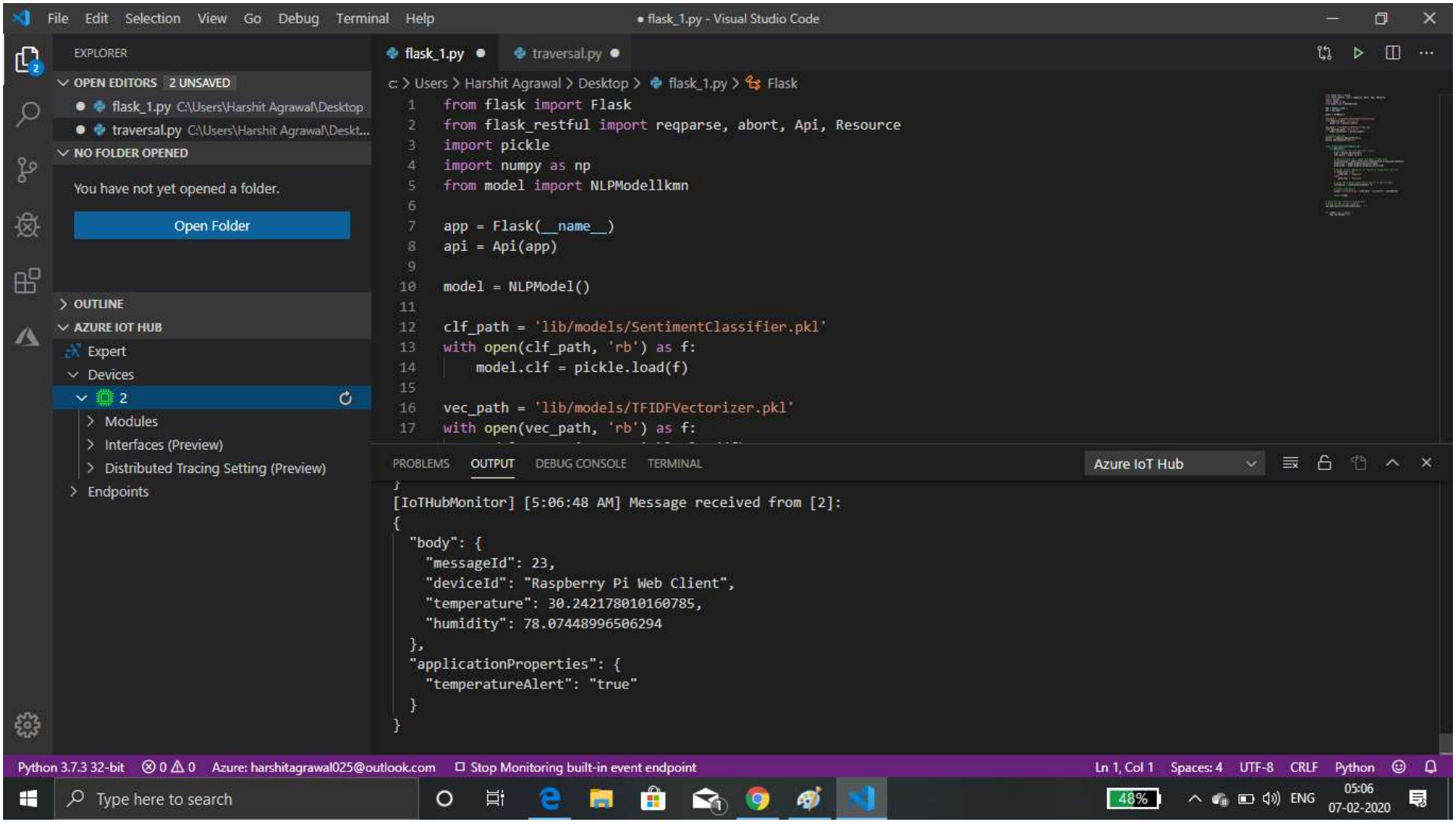
13 with open(clf_path, 'rb') as f:
14 model.clf = pickle.load(f)
15
16 vec_path = 'lib/models/TFIDFVectorizer.pkl'
17 with open(vec_path, 'rb') as f:
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
Azure IoT Hub
[IoTHubMonitor] [5:06:16 AM] Message received from [2]:
{
"body": {
"messageId": 7,
"deviceId": "Raspberry Pi Web Client",
"temperature": 25.835944073753456,
"humidity": 62.79489446683922
},
"applicationProperties": {
"temperatureAlert": "false"
}
}
Python 3.7.3 32-bit
Azure: harshitagrawal025@outlook.com
Stop Monitoring built-in event endpoint
Ln 1, Col 1
Spaces: 4
UTF-8
CRLF
Python
Type here to search
48%
ENG
05:06
07-02-2020


File Edit Selection View Go Debug Terminal Help
• flask_1.py - Visual Studio Code
EXPLORER
OPEN EDITORS 2 UNSAVED
flask_1.py C:\Users\Harshit Agrawal\Desktop
traversal.py C:\Users\Harshit Agrawal\Deskt...
NO FOLDER OPENED
You have not yet opened a folder.
Open Folder
OUTLINE
AZURE IOT HUB
Expert
Devices
2
Modules
Interfaces (Preview)
Distributed Tracing Setting (Preview)
Endpoints
flask_1.py
traversal.py
c: > Users > Harshit Agrawal > Desktop > flask_1.py > Flask
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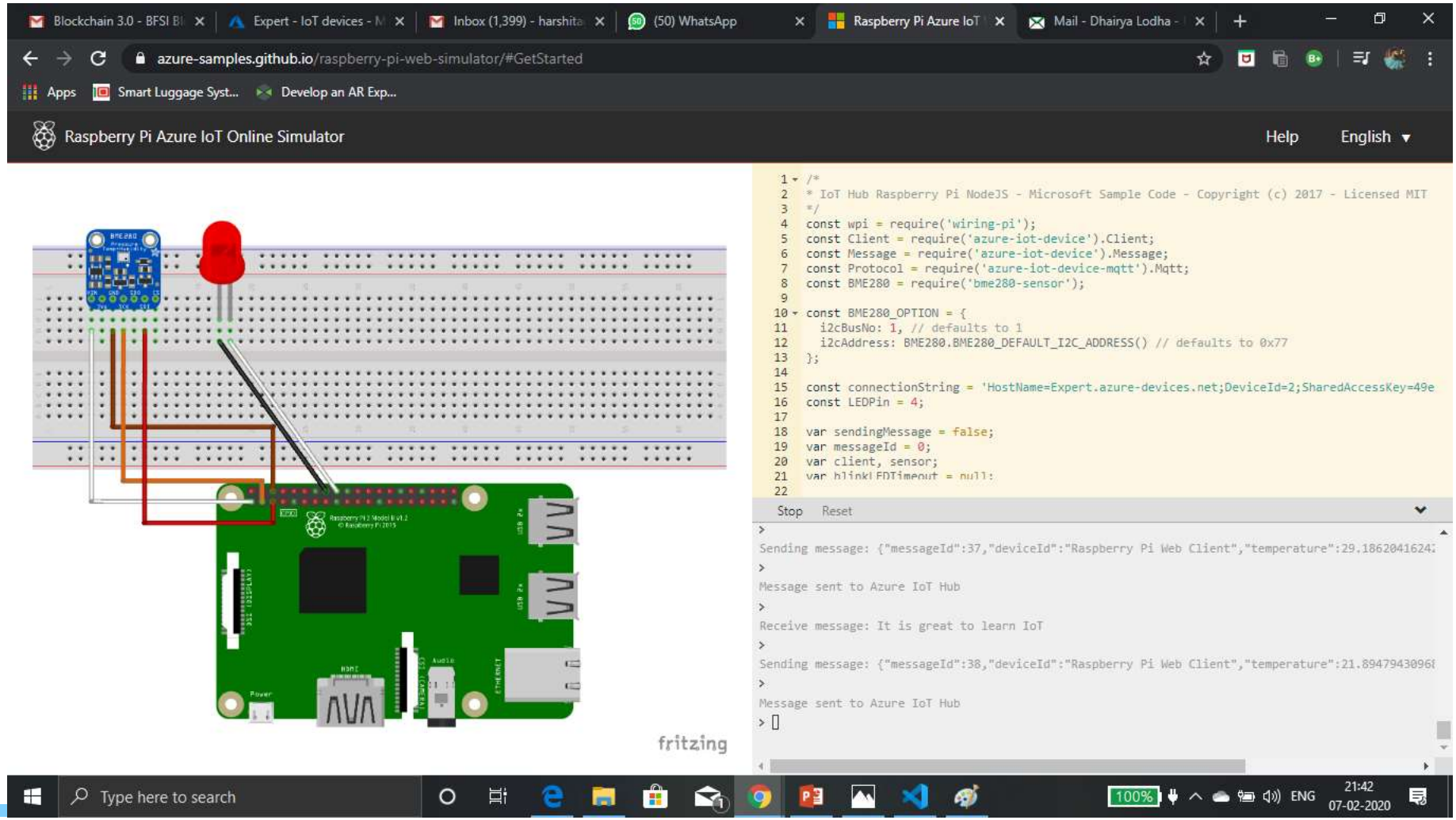
model = NLPModel()
clf_path = 'lib/models/SentimentClassifier.pkl'
with open(clf_path, 'rb') as f:
model.clf = pickle.load(f)
vec_path = 'lib/models/TFIDFVectorizer.pkl'
with open(vec_path, 'rb') as f:
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
Azure IoT Hub
[IoTHubMonitor] [5:06:48 AM] Message received from [2]:
{
"body": {
"messageId": 23,
"deviceId": "Raspberry Pi Web Client",
"temperature": 30.242178010160785,
"humidity": 78.07448996506294
},
"applicationProperties": {
"temperatureAlert": "true"
}
}
Python 3.7.3 32-bit
Azure: harshitagrawal025@outlook.com
Stop Monitoring built-in event endpoint
Ln 1, Col 1 Spaces: 4 UTF-8 CRLF Python
Type here to search
48%
ENG
05:06
07-02-2020

Send Device to Cloud:



In short, this happened

Sensor <--> Device <--> Azure IoT Hub

Visualize Real-Time Sensor data

Sensor <--> Device <--> Azure IoT Hub <--> Stream Analytics <--> Power BI

Add a consumer group to your IoT hub

Consumer groups are used by applications to pull data from Azure IoT Hub

In the left pane of IoT Hub, click Built-in Endpoints, under Events on the top pane, enter a name under Consumer groups, and then click Save.

Create, configure, and run a Stream Analytics job

Let's start by creating a Stream Analytics job. After you create the job, you define the inputs, outputs, and the query used to retrieve the data.

Enter the following information for the job.

- **Job name:** The name of the job. The name must be globally unique.
- **Resource group:** Use the same resource group that your IoT hub uses.
- **Location:** Use the same location as your resource group.
- **Pin to dashboard:** Check this option for easy access to your IoT hub from the dashboard

Add an input to the Stream Analytics job

- Open the Stream Analytics job.
- Under Job Topology, click Inputs.
- In the Inputs pane, click Add Stream Input, and then select IoT Hub, with additional details:
  - Input alias: The unique alias for the input.
  - Source: Select IoT hub.
  - Consumer group: Select the consumer group you just created.
- Click Create.

Add an output to the Stream Analytics job

- Under Job Topology, click Outputs.
- In the Outputs pane, click Add, select Power BI, and then enter the following information:
  - **Output alias:** The unique alias for the output.
  - Click Authorize, and then sign into your Power BI account.
- Once authorized, enter the following information:
  - **Group Workspace**: Select your target group workspace.
  - **Dataset Name:** Enter a dataset name.
  - **Table Name:** Enter a table name.
- Click Create.

Elliptic Curve Cryptography

- FLECC_IN_C is a Flexible Elliptic Curve Cryptography library written IN C code.
- Supports 8/16/32/64-bit architectures.
- Supports multiple elliptic curves at run-time.
- Optimized for a low memory footprint.
- Supports multiple elliptic curve standards (e.g., NIST).
- Supports SHA-1, SHA-224, and SHA-256
- Supports ECDSA signatures as standardized in FIPS 186-3
- Supports EC-DH key exchanges
- For more information, visit **https://github.com/IAIK/flecc_in_c**

Routing of Low Power Lossy Networks

RPL is divided into 2 parts

- Distance Vector
  - Source Routing Protocol
  - Distance-vector protocols are based on calculating the Direction and Distance to any link in a network. – “Direction" usually means the next hop address and the exit interface. – "Distance" is a measure of the cost to reach a certain node.
- The term distance vector refers to the fact that the protocol manipulates vectors (arrays) of distances to other nodes in the network.

RPL

- Intra-domain routing protocol
- Requires that a router inform its neighbors of topology changes periodically
- Have less computational complexity and message overhead
- The least cost route between any two nodes is the route with minimum distance.
- Each node maintains a vector (table) of minimum distance to every node.
- The cost of reaching a destination is calculated using various route metrics.

Project Approach

- Identify the problem statement
- Key Components
  - Network Architecture
  - Devices and Sensors
  - Data Stream and logs
  - Analysis of stream and logs
  - Taking action on analytics
- Design the use case with sample data
- Focus on Analytics- what charts and graphs are generated?
- Use cases can be for an individual or group of people, government, or industrial

Thanks!

Any questions?

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