MSc. Computer Science

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Cloud Computing

1. Introduction

With the growing population of the world and the attention of people to their health and wellbeing. The proportion of medical bills around the world has increased. There has been a continuous medical development and research to help improve health and medical challenge. This has driven big data and technology in managing these resources. In the process of continuous informatization in the medical field, to solve the challenge of massive medical data, especially the security storage problem, major companies have launched some targeted solutions for safe storage. Therefore, it is of practical significance to carry out the research on the security storage of medical data in a cloud computing environment.

With the continuous improvement of the national medical system, health monitoring combined with cloud computing and the Internet of Things has become a concern. This study mainly discusses the medical health monitoring IoT system based on cloud computing. From the user to the health service provider, there are three devices: sensor terminal, gateway terminal, and service platform. The sensor terminal is used to measure physiological indicators, such as blood pressure, electrocardiogram, blood oxygen saturation, heart rate, and other physiological indicators; the gateway terminal is used to link the sensor terminal to receive physiological indicators and forward them to the business platform; the gateway is also used to receive health information and other instructions issued by the server. In the community service mode, users can be divided into groups according to the community and region, and the corresponding service doctors and agent-customer service personnel (nurses) can be assigned. Users can collect personal physiological indicators at home or outside through the medical terminal. These indicators and information are transmitted to the background health platform system through the mobile GSM-TD communication network. Users can also view their own historical health records and opinions of health consultants through the web/WAP website. Through the integration ability of health cloud platform, relying on the interconnection, we jointly operate special value-added services, such as appointment registration, maternal and child healthcare, and medical communication (doctor-patient interaction), so that users can enjoy the remote service and guidance of professional medical institutions by subscribing to health value-added services. During the whole test process, the indicators are stable, and there are no restarts, crash, and other phenomena, so the system performance meets the design requirements.

1.1. Cloud Computing Platform

The use of the chronic disease big data secure storage system in the cloud computing environment can greatly reduce the storage cost of chronic disease data, borrow the powerful computing power of cloud computing to access the stored data and enable the designed audit strategy to be completed quickly, and then improve storage security (Li, Wang and Liu, 2020). The designed access control rules can limit the user's authority and then reduce unnecessary operation errors and malicious attacks; through the audit technology, the stored chronic disease

data is checked for security, so as to achieve the purpose of chronic disease data privacy protection (Mishra et al., 2019). The spatial range that the perception layer

1.2. Internet of Things

The rapid growth of the IoT causes has invariably caused a sharp growth of data. Large amounts of networking sensor devices are continuously collecting and transmitting data to be stored and processed in the cloud. Such data can be environmental data, geographical data, astronomical data, logistic data, and so on. Internet of Things medical care includes core functions such as medical and health data collection, identification, positioning, tracking management, etc. It uses intelligent network and communication technology to connect individuals, medical staff, and various sensors, and the application space is very broad. It will introduce the IoT technology of sensor nodes based on short-range communication technology and home wireless IoT technology (Chen, Lin and Liu, 2018). The perfect combination of the Internet of Things and remote health monitoring technology allows people to monitor their physical condition and exercise status at any time. First of all, it is beneficial to patients to obtain the best disease prevention and treatment results and the country's reforms to improve medical and health public services and security capabilities

2 Cloud Architecture

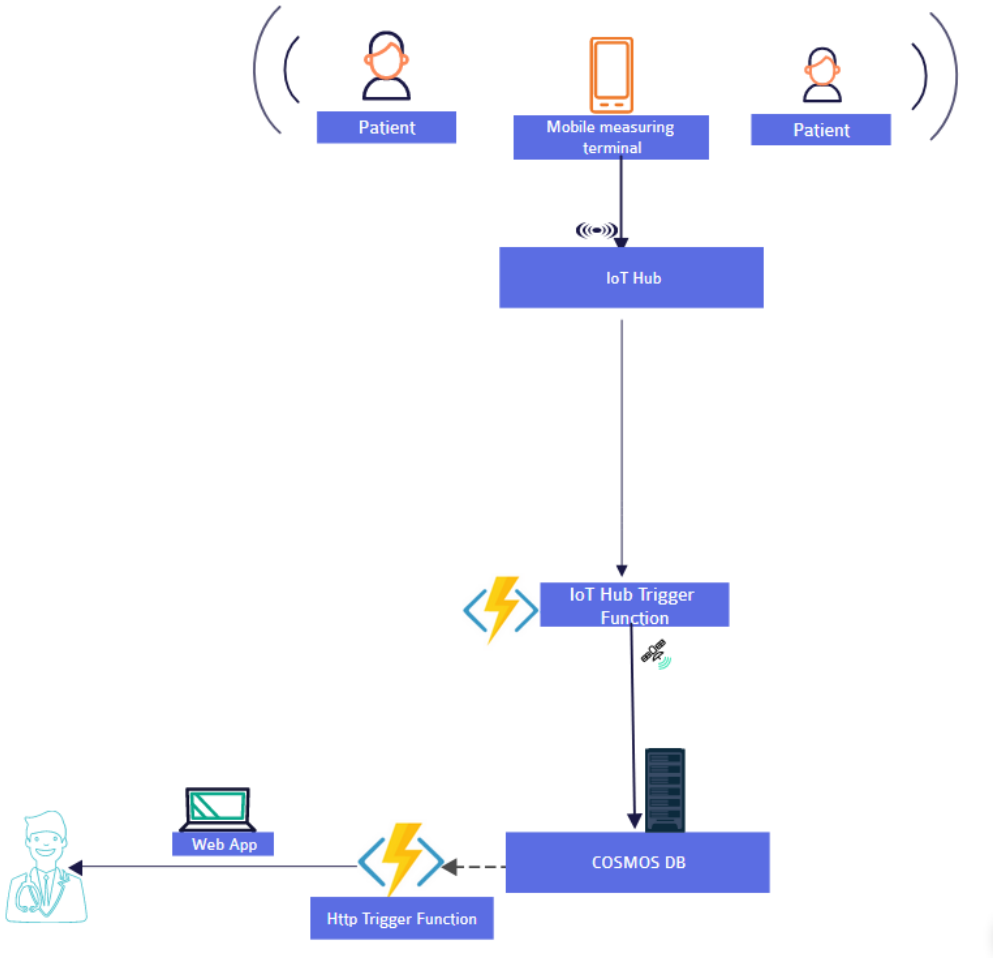

Fig 1.0 Cloud Architecture Diagram

Mobile measuring terminal (Simulated Device): This is used to send and measure and send data to the IOT HUB. This device has the capacity to send enormous data through a secured connection string that is shared from the cloud to the device. It forms the base in which data are generated.

IoT Hub: The IoT Hub is receives data from the simulated device. It shared its primary connection string with the simulated device. The IoT Hub that acts as a central message hub for bi-directional communication between an IoT application and the devices it manages.

IoT Hub trigger: This processes any data sent from the IoT Hub to the cosmos DB. When IoT Hub receives data it triggers and save the data to the database

Cosmos database: The Cosmos stores all data coming from the simulated device. Its also send data to the web browser**.**

The User Interface: This helps to retrieve data stored on the database. The interface gives an aesthetic view on what the user hopes to see. This could be a web browser or an application (windows, IOS or android)

1. Development:

The idea around this development is divided into the below.

1. Checking one's health status is paramount for healthy living. Some patient live in remote areas where doctors and nurses cannot accesso as to check their health status. This location differences can be handles using a medical device that checks the health status of the patient and upload to the cloud
2. Data from medical researches needs to be properly stored, protected and retrieve when needed.

1. Initial setup

The development involves various steps. The steps are listed below.

- Installation of Dotnet 6.
- Installation of visual studio code
- Create an azure account
- Installation of azure dependencies on visual studio

2. Creation of Azure IoT Hub

The below steps will be performed on azure portal

- Sign Into azure
- Created a resource group an filed the relevant details
    - Put the group description(Telemedicine)
    - Put the IOT description
    - Put the region (Uk south)
    - Review and save

- Create an azure Iot Hub
    - Added my resource group
    - Region
    - IotHub Name(teleMedicineSensorV1)
    - Pricing and scaler tier
    - Review and save

- Create Iot device
- Copy the primary connection string and pasted on my notepad

3. **Creation of an azure function**

   The below steps will be performed on visual studio code IDE

   - Sign Into azure
   - Created a function
   - Specify C#
   - Specify .NET6
   - I provided function name
   - Name space
   - Run my code
   - Finally deploy to azure

4. **Create and azure DB**
   - Specify a database name
   - Specify the container
   - Specify the
   - Ran my application
   - Ran my simulated device
   - Validate the data is coming to my datable
5. **Serverless Functions to fetch data from DB**

The below core function is to be imported. On the HttpTriger code

```
using Microsoft.Azure.WebJobs.Extensions.Http;
using Microsoft.AspNetCore.Mvc;
using Microsoft.AspNetCore.Http;
using System.Collections.Generic;
```

A function which fetches value from the data was also introduced. SQL statement is contained within the function to fetch value from DB

6. **Integrating my cosmos DB data with my UI**
   - I installed azure tools
   - Referenced my URL on my html file
   - Call the local server and I was able to see the data on the browser

7. **Testing.**

A total of 5 end points was exposed for this development as shown below

```
[2022-05-18T14:57:07.791Z] Found C:\Users\USER\Documents\My document\School\cloud2\cloud2.csproj. Using for user secrets file con
figuration.

Functions:

        GetClinicalAllData: [GET] http://localhost:7071/allsensor

        GetClinicaldataFemaleGender: [GET] http://localhost:7071/clinical/Female

        GetClinicaldataMaleGender: [GET] http://localhost:7071/clinical/Male

        getHighgBp: [GET] http://localhost:7071/high/bp

        getsugarLevel: [GET] http://localhost:7071/sugarLevel

        Verifier: [GET] http://localhost:7071/loaderio-049218ebf4779518eaf209cfc09fc11b

        myIoTHubTrigger: eventHubTrigger
```

Fig. 2 endpoint generated for testing

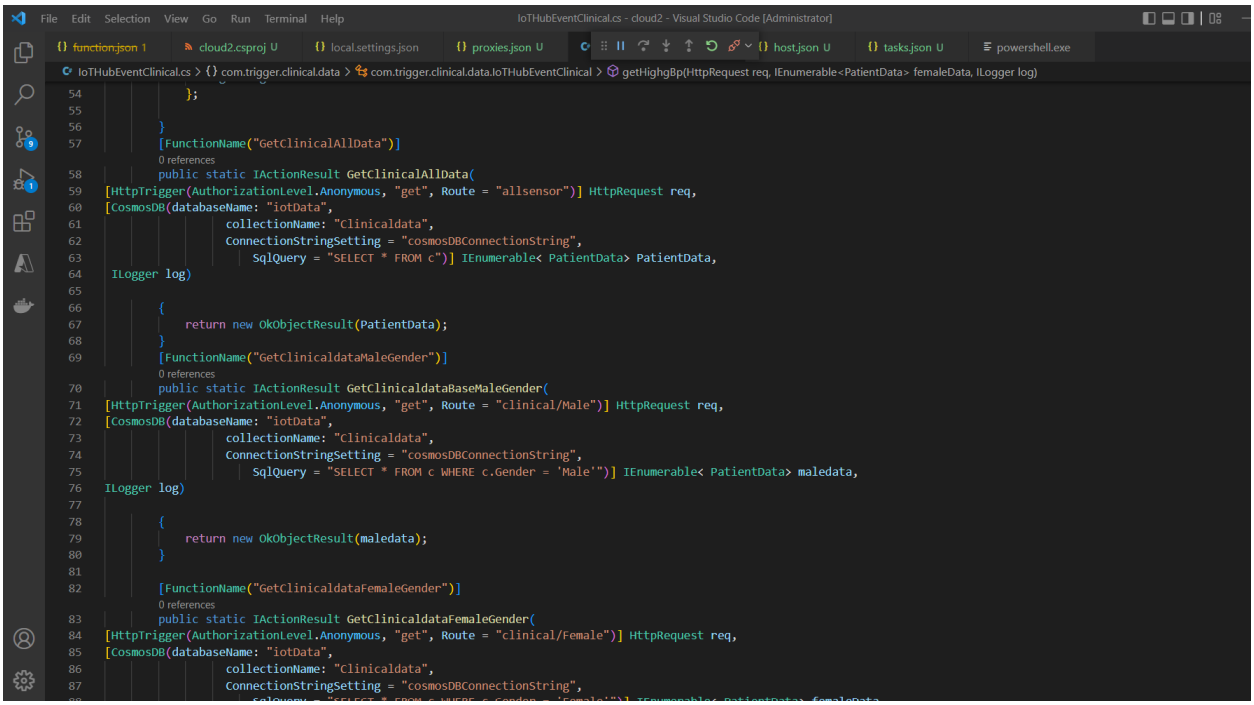

Fig. 3 view of my work (Workshop 6)

4 DevOps

1. **Development**
2. **Deployment on azure server**
   Deployment is done by using the deploy to azure function button on the VS studio.

```
3:58:51 PM MyAzureDeployment: Starting deployment...
3:58:59 PM MyAzureDeployment: Creating zip package...
3:59:01 PM MyAzureDeployment: Zip package size: 4.05 MB
3:59:01 PM MyAzureDeployment: Updating submodules.
3:59:01 PM MyAzureDeployment: Preparing deployment for commit id '1a0a91e3fb'.
3:59:02 PM MyAzureDeployment: Skipping build. Project type: Run-From-Zip
3:59:03 PM MyAzureDeployment: Skipping post build. Project type: Run-From-Zip
3:59:03 PM MyAzureDeployment: Triggering recycle (preview mode disabled).
3:59:03 PM MyAzureDeployment: Deployment successful.
3:59:23 PM MyAzureDeployment: Syncing triggers...
3:59:34 PM MyAzureDeployment: Querying triggers...
3:59:35 PM MyAzureDeployment: HTTP Trigger Urls:
 GetClinicalAllData: https://myazuredeployment.azurewebsites.net/allsensor
 GetClinicaldataFemaleGender: https://myazuredeployment.azurewebsites.net/clinical/female
 GetClinicaldataMaleGender: https://myazuredeployment.azurewebsites.net/clinical/male
 getHighgBp: https://myazuredeployment.azurewebsites.net/high/bp
 getsugarLevel: https://myazuredeployment.azurewebsites.net/sugarlevel
 Verifier: https://myazuredeployment.azurewebsites.net/loaderio-049218ebf4779518eaf209cfc09fc11b
```

Fig. 4 List of endpoints deployed

3. Load Testing.

Load testing was carried out on each API. A diagram is shown below

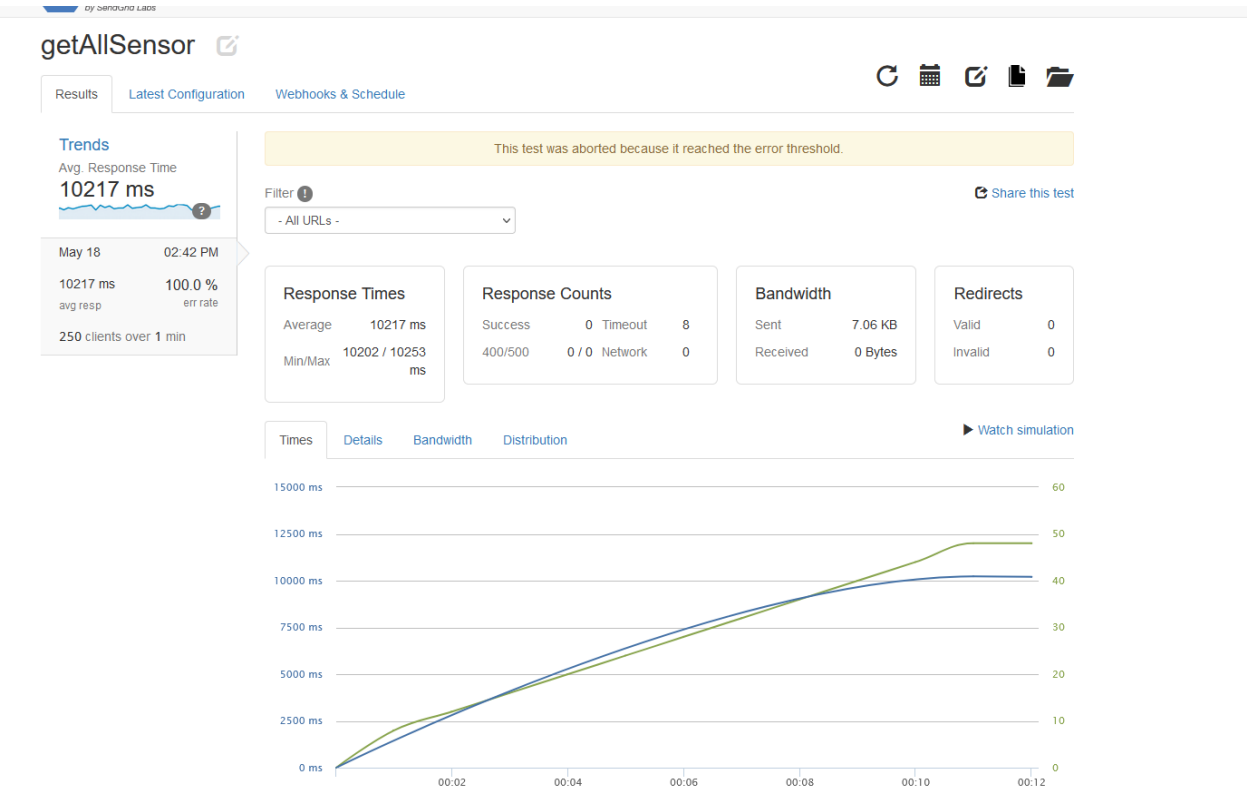

Fig . 5 List of end point deployed

Reference

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