A

PROJECT FINAL REPORT ON

COVID-19 HOME CARE KIT

FOR

CS-580K

ADVANCED TOPICS IN CLOUD COMPUTING

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ABSTRACT

Novel Coronavirus (COVID-19) pandemic is an ongoing global pandemic which caused a lot of health issues and deaths in the entire world. Coronavirus is an infectious virus which spreads between humans. The pandemic is affecting different people in different ways. Nowadays, quarantining and social distancing are some common practices that are being followed in our day-to-day life. Because of these practices we cannot step outside our home frequently. Also, there are some people whose vitals require physical monitoring, but they cannot go to hospital due to the full acceptance of practices. It is very hard for doctors to monitor patient's health by visiting their houses.

The common symptoms of COVID-19 are fever, increased heart rate, fatigue, breathing difficulties and loss of smell and taste. Hence, there is a need to check the body temperature and pulse rate at least twice a week. But, as of now there are 52 million COVID cases in the entire world, and it is still increasing. So unfortunately, we cannot step outside our houses to get our pulse rate or body temperature checked. The people between the age group 50-80 years are affected badly.

To reduce the health risks and to prevent from exposure to COVID-19 we are proposing a system, which is "COVID-19 Home Care Kit". This kit will be helpful to read and store our health data into the system remotely. Moreover, it sends our personal health data to the hospitals and to the government so that doctors can monitor our daily data remotely.

With the proposed system, it is possible to track every person's health data in the world and if someone is sick or having some symptoms, hospitals and government can take appropriate actions by prescribing medicines remotely and prevent them from getting sick. We are implementing an advance system with use of sensors and cloud technology which will be useful to the humanity.

CONTENTS

1. INTRODUCTION

- As there is no vaccine available immediately or medicine to cure COVID-19, we still need to maintain social distance to prevent the spread.
- In this critical condition, it is very difficult to get health data from every person especially from remote areas.
- To overcome this problem, we are implementing a modern solution using IoT and Cloud Computing.
- By introducing this kit to every family, we can gather health information in very smart and convenient way.
- We can also use this kit in remote areas such as villages to get health data without any human contact.

1.1 Objective

- To take remote health measurements like pulse rate, body temperature and blood oxygen rate.
- Storing the data on database with unique user specifications.
- Sending the health data to the hospitals and to the Health department from anywhere with GPS coordinates of the user.
- Maintaining a website which can be accessed by hospital staffs as well as the patients.

2. LITERATURE SURVEY

- In December 2019, the COVID-19 got spread in Wuhan, China with respiratory syndrome coronavirus.
- COVID-19 got spread across the world by mid-March 2020
- The common symptoms of COVID-19 are fever, cough, fatigue, breathing difficulties and loss of smell and taste.
- The research suggests that the COVID-19 was transmitted through animals to humans in Huanan Seafood Market.
- COVID infection is seen most often in adult male patients with the median age of the patients was between 34 and 59 years but it can spread across any age group.
- Also, the highest death rate is commonly seen the patients above 60 years
- There is no vaccine or medicine readily available for masses for COVID-19 as of now.
- There is no remote health monitoring kit for individual person in the market.
- This was the main motivation for developing this kit.

3. PROJECT ARCHITECTURE

3.1 OVERVIEW

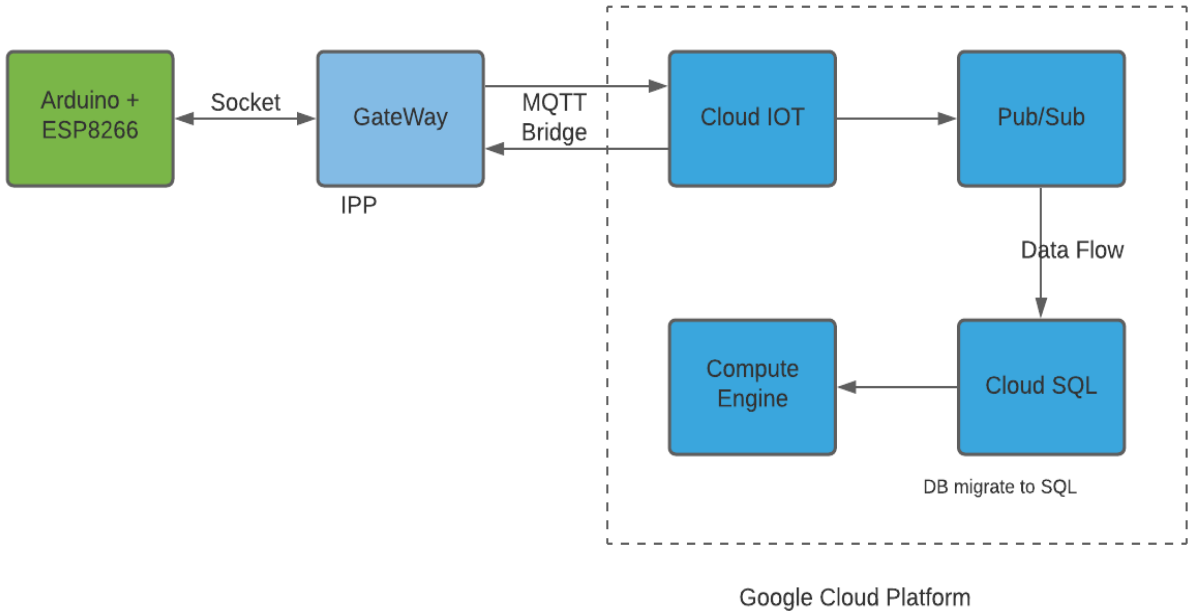


Fig. 1. Project Architecture

We are installing MQTT (Mosquitto) bridge on the Arduino microcontroller for establishing communication between IoT device and gcp cloud.

MQTT is responsible for data transfer between IoT device and gcp IoT core.

In gcp iot core, we first set up device registry, then set up pub/sub and subscription which is very flexible for streaming data and handling incoming messages.

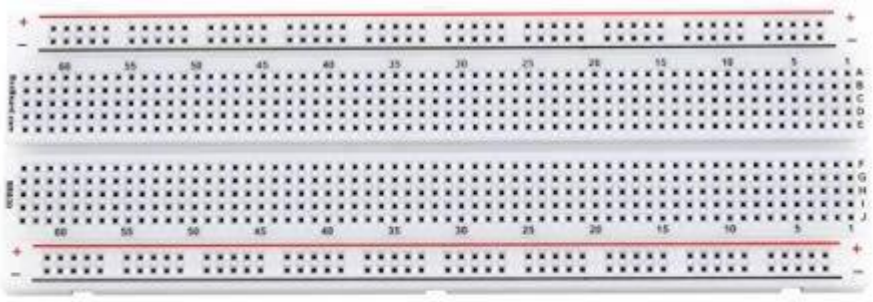
Then, we add device to the iot core registry.

Once, the connection is established, data received from device to the iot core pub/sub is migrated to the gcp cloud SQL server, which is then reflected on the web application hosted on the compute engine instance

3.2 HARDWARE SPECIFICATIONS:

- **Arduino Microcontroller – Uno**
  Arduino Is Atmega based microcontroller which we are using to interface Wi-Fi module, heartbeat sensor module, temperature sensor module and blood-oxygen module.

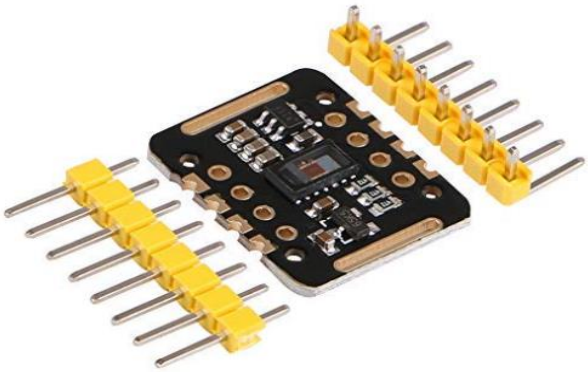
- **Breadboard**
  We are using beadboard to connect components easily. In future scope, we can mount them on PCB.



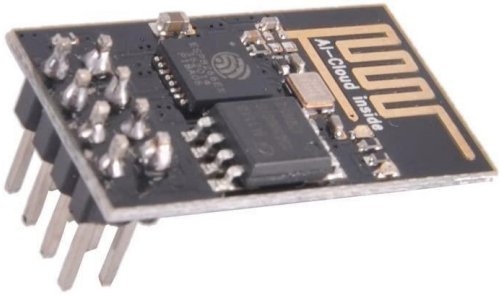
- **Heartbeat Sensor Module**
  - We are using heartbeat sensor module to measure the pulse rate.
  - We will be using MAX30102 module.

- **Temperature Sensor Module**
  - We are using temperature sensor module to measure the temperature.
  - We will be using MAX30102 module.

- **Blood Oxygen Sensor Module**
  - We are using blood oxygen sensor module to measure the blood oxygen rate.
  - We will use MAX30102 module.

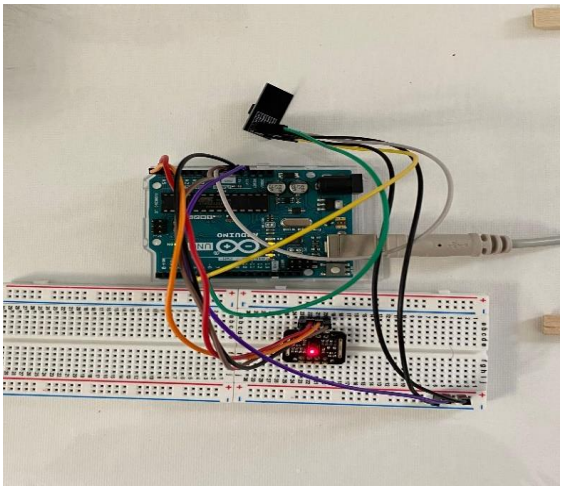


- **Wi-Fi Module**
  - We are using ESP8266 ESP-01S Wi-Fi Module which will allow the kit to connect to the internet



3.2.1 Hardware Implementation:

- We have interfaced MAX 30102 Sensor with Arduino Microcontroller which is series R3 Arduino Uno microcontroller board based on the ATmega328P
- We have integrated a Wi-Fi Module ESP8266 with Arduino Uno to establish a connection between Arduino and Google Cloud Platform IOT Core
- The MAX 30102 is an integrated pulse oximetry and heart-rate monitor module. It includes internal LEDs, photodetectors, optical elements, and low-noise electronics with ambient light rejection which gives oxygen level in the blood, heart rate data and temperature
- We must put our finger on the MAX 30102 Sensor in order to sense the data which includes body temperature, blood oxygen level and heart rate
- It will generate the data and we can also see that data on serial monitor of Arduino IDE
- There will be a python script which runs in background that will help sending the data to the GCP IOT core
- Then the Arduino microcontroller sends the received data to the database using Wi-Fi Module
- The Wi-Fi module establishes a connection with Google Cloud Platform IOT Core
- Hence, we get the data in the cloud database



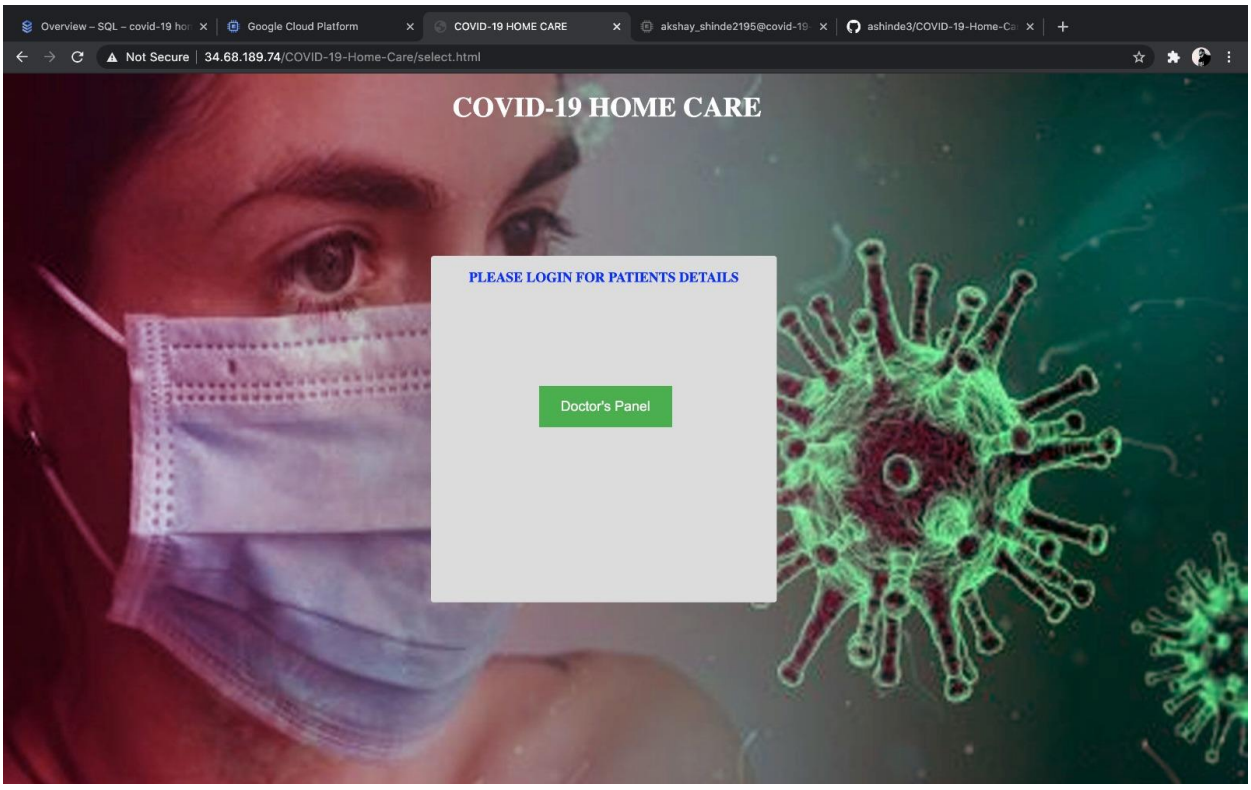
3.3 SOFTWARE SPECIFICATIONS:

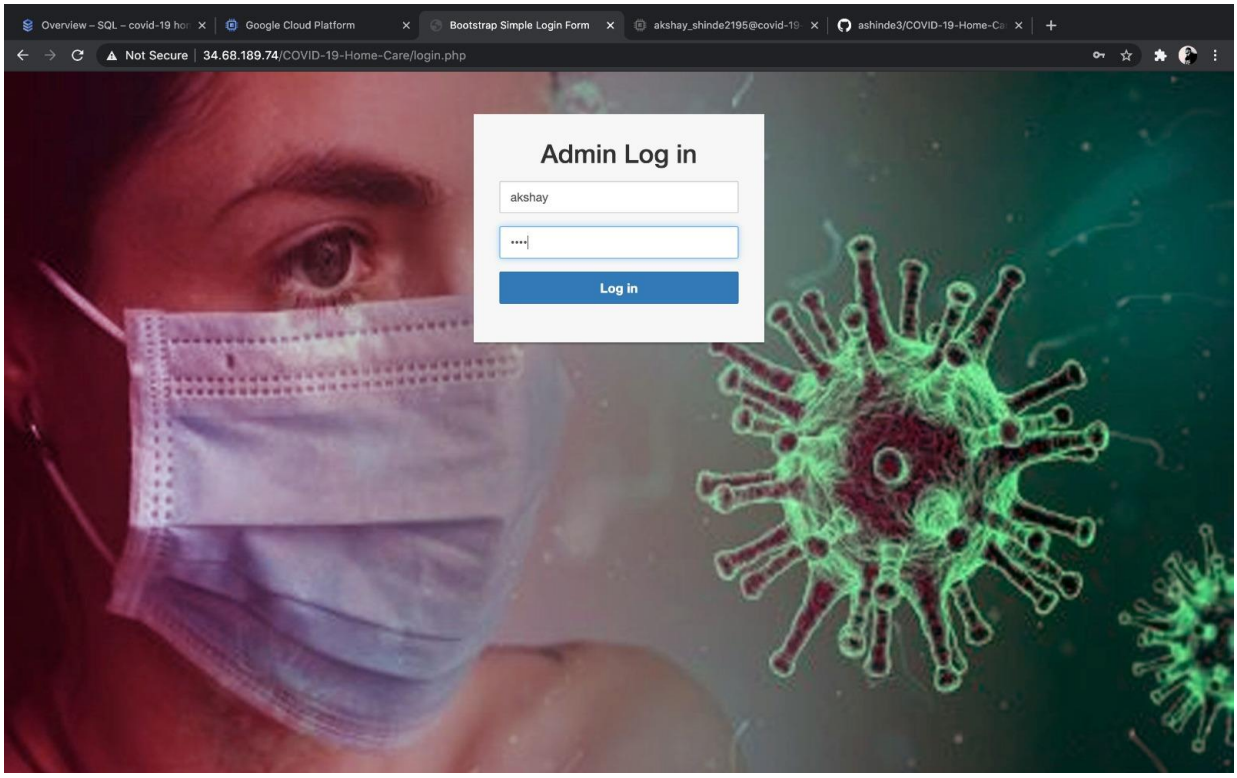
3.3.1 Webpage

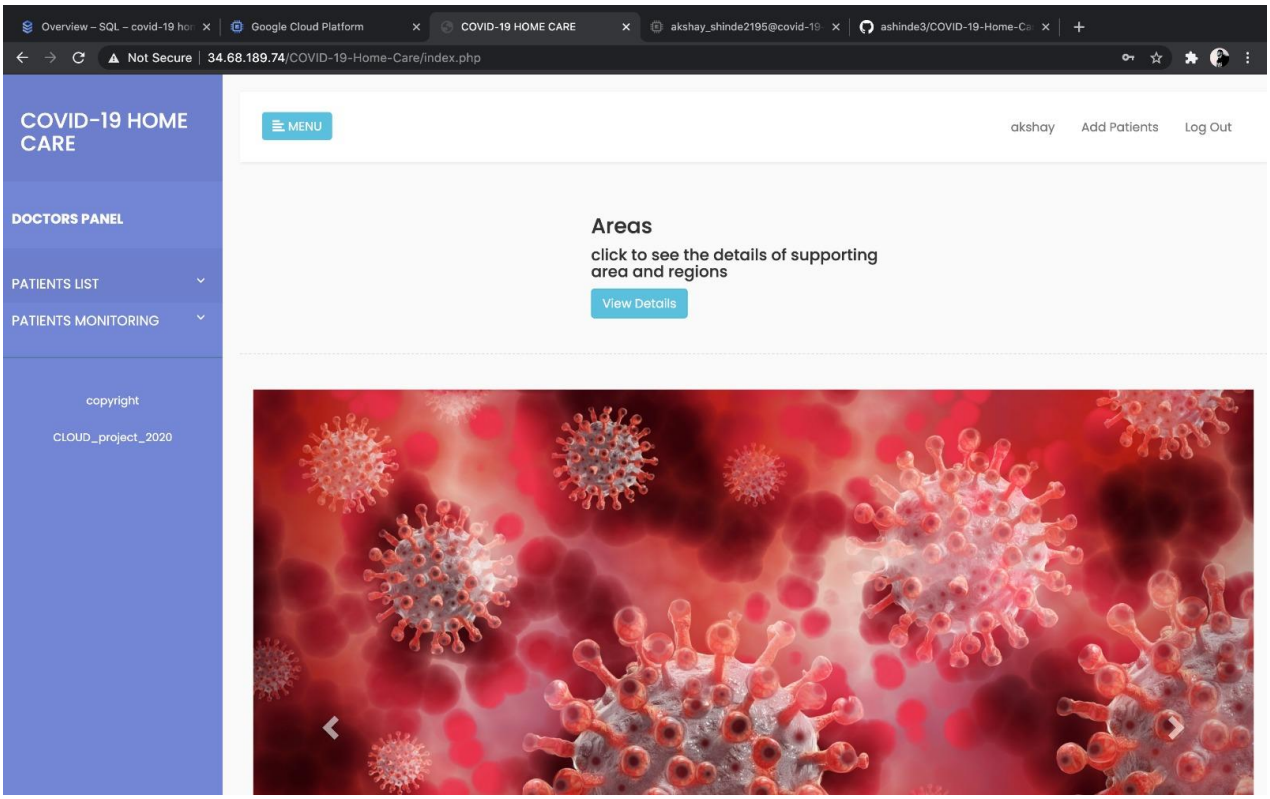
We have created a user interface for the health department (i.e., the doctors) to add check the list of patients that are on the database. The doctor can sign in with user-id and password which gives them the access to patient's name, age, location as well their vitals such as heartbeat rate, blood oxygen rate as well their temperature. The patients with these three vitals in abnormal range are listed under the patients which need to be monitored. The doctors can also add patients according to the geographical location of the patients on the map and the list will be updated with the respective names.
The technologies used are as follows:

- We have used php-MySQL as a server-side scripting language.
- We have used html CSS and bootstrap for designing an interactive webpage.
- We have used JavaScript for importing google maps API service.

Screenshots:




Overview – SQL – covid-19 hor
Google Cloud Platform
Bootstrap Simple Login Form
akshay_shinde2195@covid-19
ashinde3/COVID-19-Home-Ca
Not Secure
34.68.189.74/COVID-19-Home-Care/login.php
Admin Log in
akshay
Log in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COVID-19 HOME CARE
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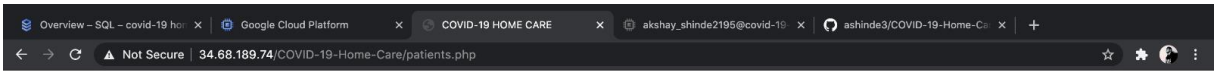
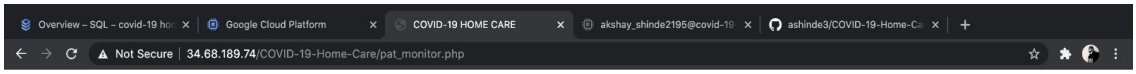
ashinde3/COVID-19-Home-Ca
Not Secure
34.68.189.74/COVID-19-Home-Care/index.php
COVID-19 HOME CARE
DOCTORS PANEL
PATIENTS LIST
PATIENTS MONITORING
copyright
CLOUD_project_2020
MENU
akshay
Add Patients
Log Out
Areas
click to see the details of supporting area and regions
View Details



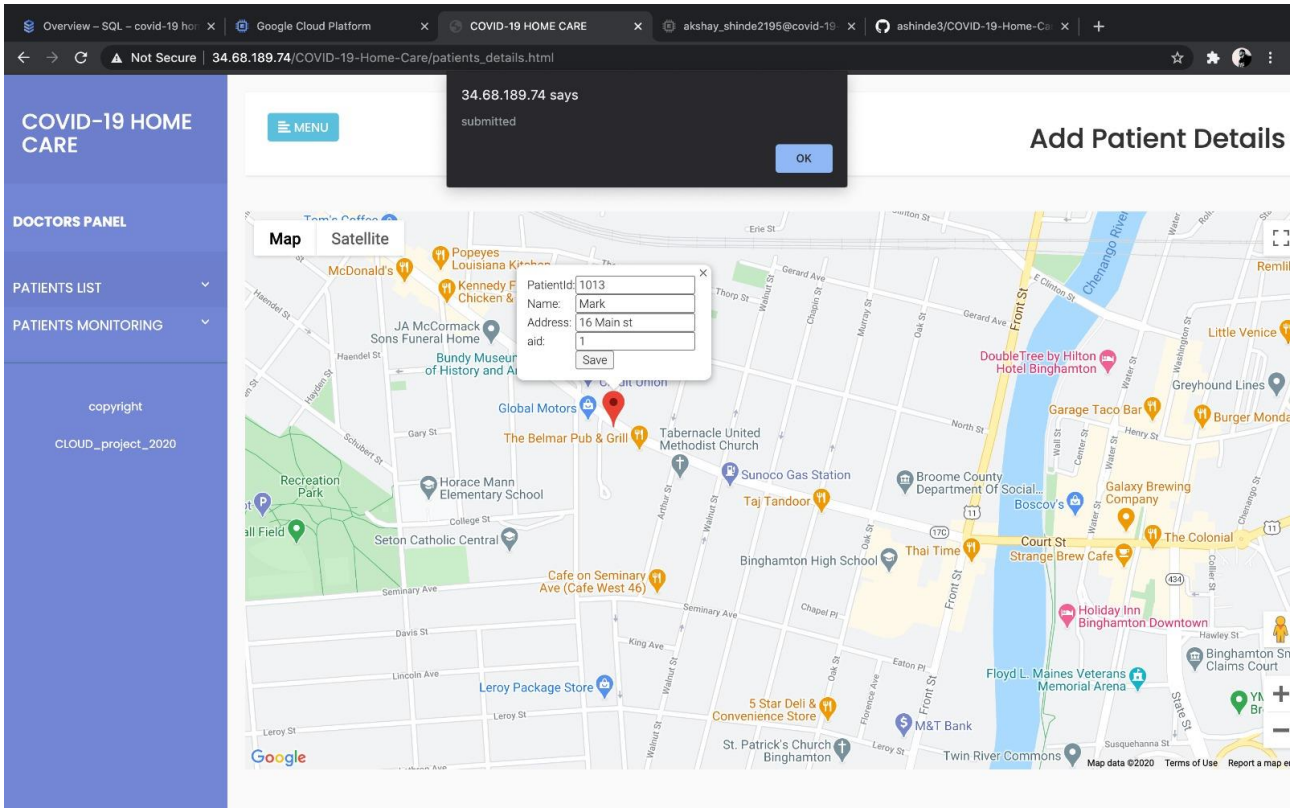
Patients Details

#	patients_id	name	patients_add	lat	lng	temp(Farenheit)	avg bpm	blood oxygen	date-time
1	1010	Akshay	Main Street	42.1049	-75.9361	95.35	83	99	2020-12-07 15:11:05
2	1011	charuhas	Dunkin	42.105	-75.934	98.31	87	100	2020-12-07 15:17:22
3	1012	parneet	Johnson City	42.1158	-75.9598	102	95	97	2020-12-07 17:30:45



Patients Details

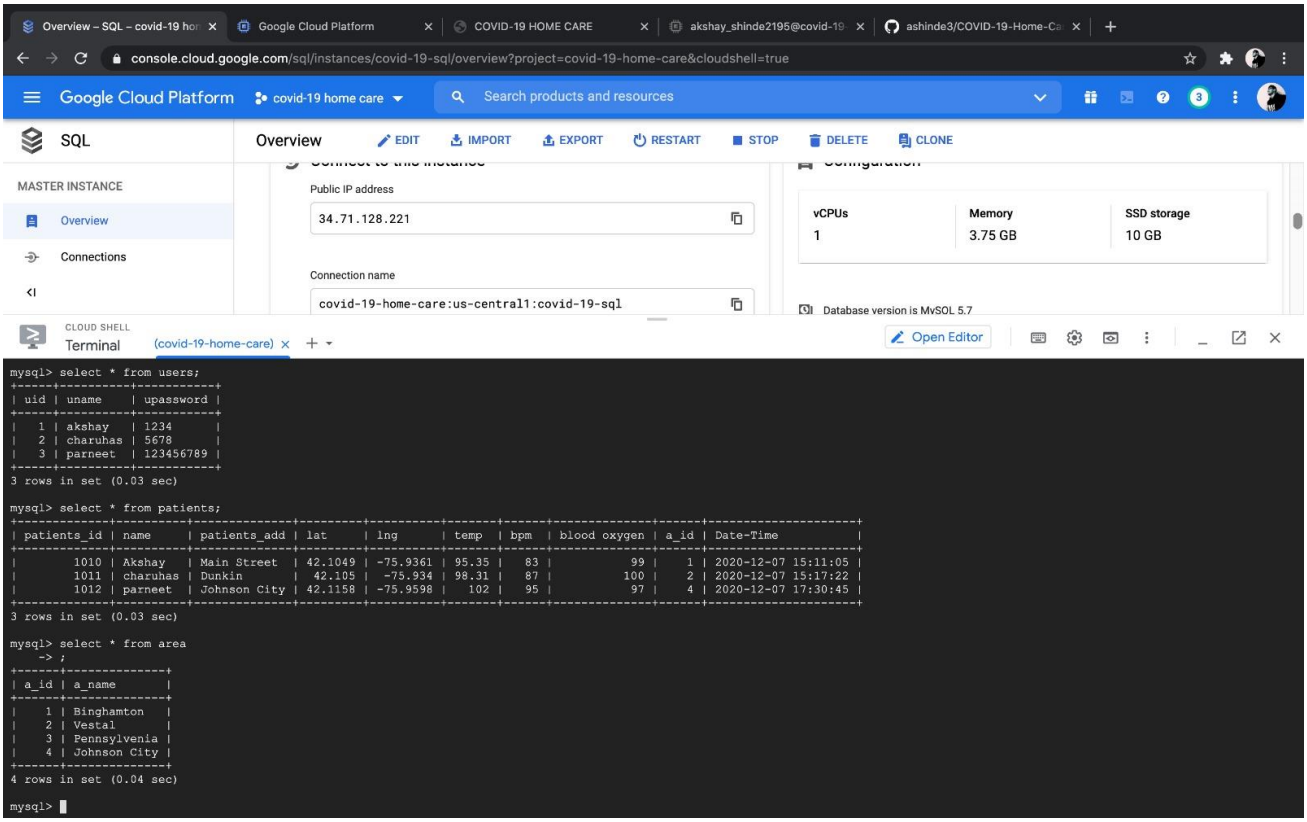
#	patients_id	name	patients_add	lat	lng	temp(Farenheit)	avg bpm	blood oxygen	date-time
1	1012	parneet	Johnson City	42.1158	-75.9598	102	95	97	2020-12-07 17:30:45


COVID-19 HOME CARE
DOCTORS PANEL
PATIENTS LIST
PATIENTS MONITORING
copyright
CLOUD_project_2020
MENU
34.68.189.74 says
submitted
OK
Add Patient Details
Map
Satellite
PatientId: 1013
Name: Mark
Address: 16 Main st
aid: 1
Save
Global Motors
The Belmar Pub & Grill
Tabernacle United Methodist Church
Sunoco Gas Station
Taj Tandoor
Broome County Department Of Social...
Boscov's
Galaxy Brewing Company
The Colonial
Strange Brew Cafe
Court St
Thai Time
Binghamton High School
Cafe on Seminary Ave (Cafe West 46)
Holiday Inn Binghamton Downtown
Floyd L. Maines Veterans Memorial Arena
Leroy Package Store
5 Star Deli & Convenience Store
M&T Bank
St. Patrick's Church Binghamton
Twin River Commons
Seton Catholic Central
Horace Mann Elementary School
Recreation Park
JA McCormack Sons Funeral Home
DoubleTree by Hilton Hotel Binghamton
Garage Taco Bar
Greyhound Lines
Little Venice
Google

3.3.2 Cloud technologies

- **Compute Engine**
  We have created GCP compute engine instance to host our web application.
  Steps:
  - Install Apache on the cloud instance.
  - Install PHP on the cloud instance.
  - Install Apache2 library of PHP.
  - Then to integrate the database install MySQL.

- **CloudSQL**
  We have created MySQL server instance on GCP cloud SQL service for storing database and establishing its connection with compute engine instance.
  To integrate the database, we followed the following steps:
  - Create a MySQL instance on GCP.
  - Then in the connection option you can add the network and then give the IP address of compute engine instance.



- Cloud IOT core
  We have used GCP IoT core service for establishing communication with our IOT devices.
  Steps included to set IoT core were:
    - installing MQTT bridge components in Arduino.
    - setup device registry.
    - set up pub/sub and subscription.
    - add device to the core registry.
    - migrating the data to cloud SQL and then to compute engine.

4 CONCLUSION, FUTURE SCOPE AND PROJECT OUTCOME

4.1 Conclusion

This technology is another step towards remote medical services which is beneficial to the young, old, and the far located. It will help track the COVID patients around the globe leading to monitoring and controlling the spread of this pandemic.

4.2 Future Scope

- Increase the count and quality of sensors.
- Make another portal for patients to login and track their data.
- Currently one device can record and update data for a single patient. This can be improved such that a single family can use a kit.

4.3 Project Outcome

GitHub was used as a code hosting platform for version control and collaboration
https://github.com/ashinde3/COVID-19-Home-Care

5 REFERENCES

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