MediSafe – Stay away and defeat diseases

2022 - 143

SLIIT

Discover Your Future

Our Team

Supervisor

Mr. Ravi Supunya

Co- Supervisor

Mr. Samantha Rajapaksha

External Supervisor

Dr. Shashika Liyanage

IT18077698

Thennakoon T.M.B.C.K

IT19015422

Perera B.A.A.W.S

IT19015040

Rasuni Wageesha H.A

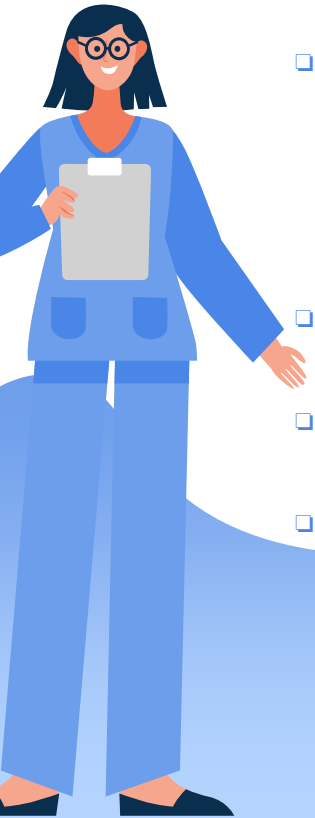
IT19011608

Senanayaka S.A.M.A.B.M

Introduction

- What is MediSafe ?
- Why are we doing this research?
- What is the purpose of our research?

Research problem



- There are some diseases that have arisen at present. (Heart attack, Pneumonia, Wheezing, Dengue, Covid'19)
- High cost for diagnosis.
- Informal lifestyle and busyness.
- Don't have enough idea about current situation of the country.

Background

Table 22. Leading Causes of Hospital Deaths, 2010 - 2019

Disease and ICD (10th Revision) Code		2019		2018		2017		2016		2015		2014		2013		2012		2011 [2]		2010 [2]	
		Rank	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%
Ischaemic heart disease	I20 - I25	1	15.1	1	15.0	1	14.2	1	14.1	1	14.2	1	14.8	1	14.7	1	14.4	1	13.4	1	12.8
Zoonotic and other bacterial diseases	A20 - A49	2	12.1	3	10.9	2	11.5	3	11.6	3	9.7	3	9.1	6	7.9	6	7.1	6	6.7	6	6.6
Neoplasms[1]	C00 - D48	3	11.7	2	11.7	3	10.5	2	12.0	2	11.0	2	11.7	2	11.2	2	11.6	2	11.8	2	11.1
Diseases of the respiratory system excluding diseases of upper respiratory tract, pneumonia and influenza	J20 - J22, J40 - J98	4	10.7	4	9.9	4	9.8	5	8.3	4	9.2	6	8.0	5	7.9	5	7.2	5	6.9	5	7.0
Pneumonia	J12 - J18	5	8.0	7	7.8	6	8.2	7	6.4	7	7.5	7	6.6	8	6.1	8	5.7	9	5.2	9	5.2
Pulmonary heart disease and diseases of the pulmonary circulation	I26 - I51	6	7.6	6	7.9	5	8.5	4	8.7	5	8.3	4	8.6	4	8.4	3	9.0	4	8.7	3	8.7
Cerebrovascular disease	I60 - I69	7	7.6	5	8.0	7	7.7	6	8.2	6	8.2	5	8.4	3	8.6	4	8.7	3	8.7	4	8.7
Diseases of the urinary system	N00 - N39	8	5.8	8	5.8	8	5.9	8	6.3	8	6.2	8	6.3	7	6.2	7	6.3	7	5.7	8	5.7
Diseases of the gastro-intestinal tract	K20 - K92	9	5.0	9	5.1	9	5.1	9	5.5	9	5.3	9	5.7	9	5.7	9	5.4	8	5.4	7	6.2
Traumatic injuries	S00 - T39, W54	10	3.6	10	3.9	10	3.8	10	3.9	10	3.8	10	3.5	11	3.3	11	3.7	11	3.6	11	3.7
Disease of the nervous system	G00 - G98	11	1.3	13	1.4	14	1.4	14	1.4	17	1.3	16	1.4	15	1.4	16	1.5	19	1.4	18	1.6
Symptoms, signs and abnormal clinical and labo	R00 - R99	12	1.3	11	1.5	12	1.5	12	1.6	13	2.3	11	3.2	10	4.8	10	4.5	10	4.1	10	5.0
Diabetes mellitus	E10 - E14	13	1.3	12	1.4	11	1.7	11	1.6	13	1.6	13	1.6	13	1.6	14	1.7	14	1.9	16	1.7

[1] Includes deaths reported from the Cancer Hospital (not analysed by site and type of neoplasm)

[2] Excludes Mullaitivu District

Source : Medical Statistics Unit

Source : Medical Statistics Unit Ministry of Health
http://www.health.gov.lk/moh_final/english/public/elfinder/files/publications/AHB/AHS%202019.pdf

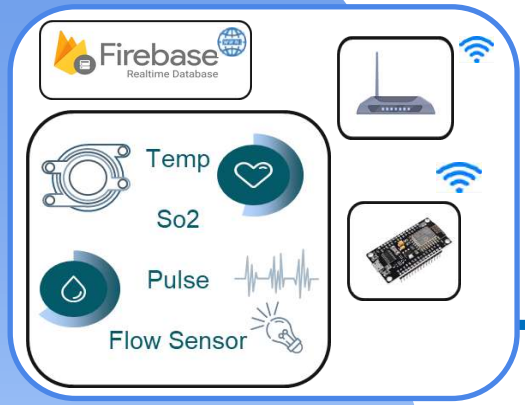
Overall solutions – 90%

- Developed an Arduino-based device that detects certain types of symptoms to diagnose certain heart and lung related diseases.
- Use some machine learning based techniques to identify diseases and clarify it.
- Show diseases spread rate to the user.
- Developing a web application to facilitate patient usage.

Research Objectives

- Implement a device to get parameters of the patient and identify Covid'19. (Possibility as a percentage)
- Disease level wise identification and provide suggestions/ recommendations to reduce the risk level.
- Identify the exact lung disease among other lung diseases.
- Identify the three major diseases spread rate in Sri Lanka.

System Diagram



01

Sensor captured data

04 Output

Covid analysis

Disease level identification

Image processing

Predicted current risk data

As recommendations

05

Web application

03

02

Values / Images

Collected data sets

Algorithm

Conventional Neural Network

K-nearest Neighbor algorithm

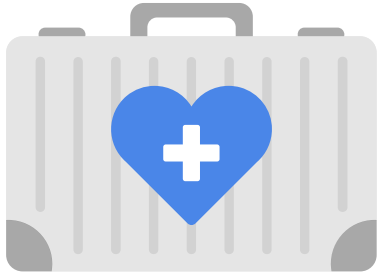
Regression model algorithm

Model training

Focusing areas

Hospital /Medical centers

Schools



Offices

Crowded areas

IT18077698

Thennakoon T.M.B.C.K

Specialization | Information Technology

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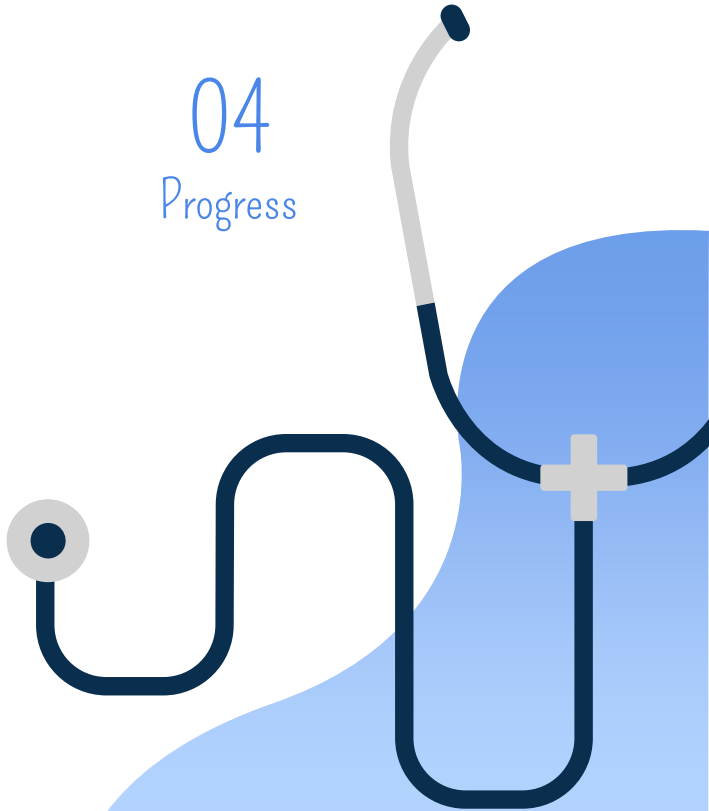
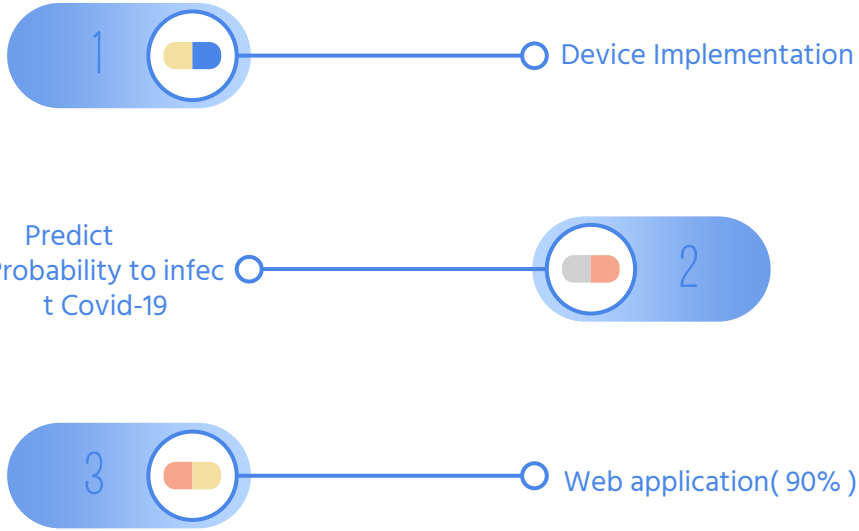


Research question

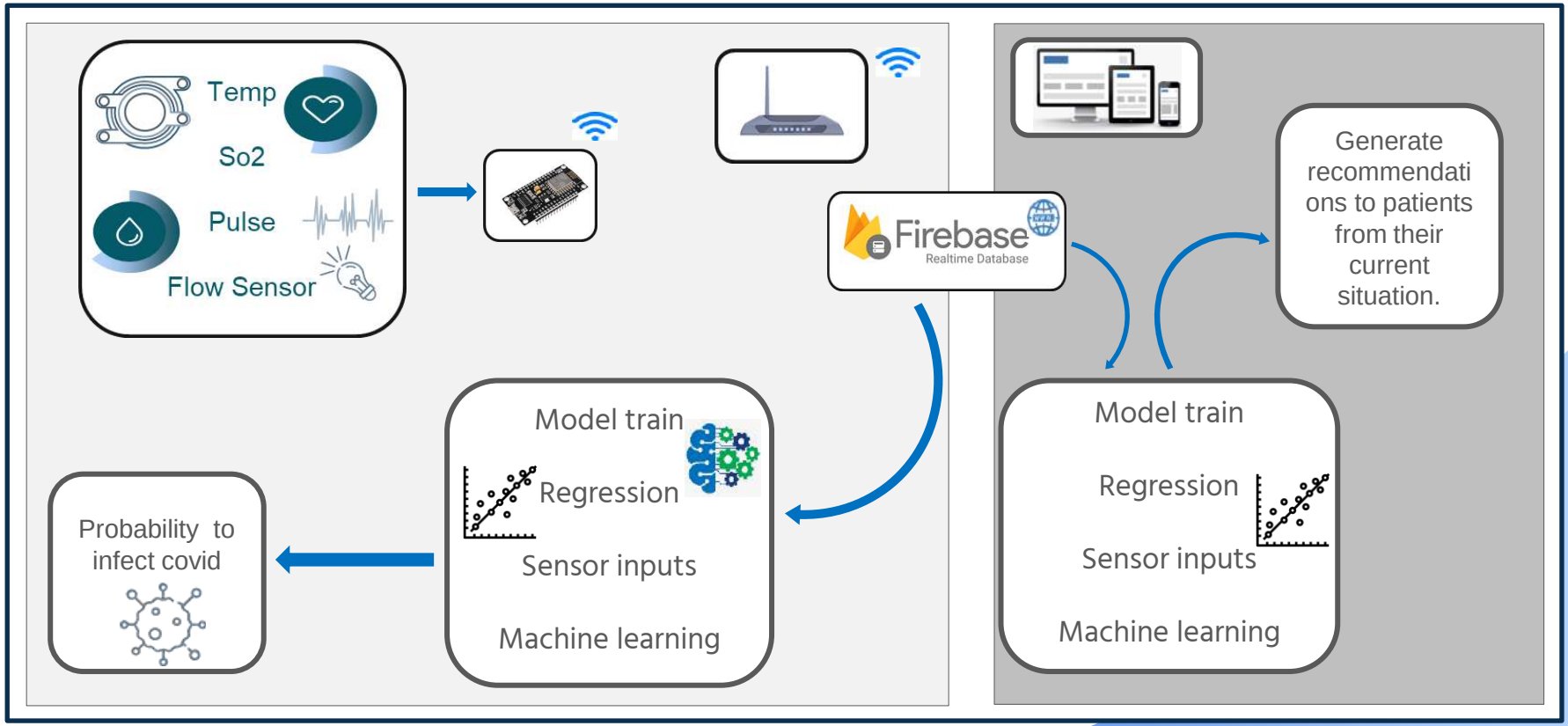
- Identify
  all measurements using single device with few minutes.
- Simple and user-friendly
  web application and mobile application.

- Provide probability to infect Covid 19 & Give what are the necessary actions need to get by patient.
- Get necessary inputs and Generate healthy recommendatio ns to day-to-day life.

Achieved – 90%


1
Device Implementation
Predict
Probability to infec
t Covid-19
2
3
Web application(90%)

System diagram



Progress

- Implement device (Medisafe).
- Upload data to firebase.
- Developing a model.
- Give probability of infect

Completed(50%)

90% Progress presentation

- Completed MediSafe device.
- Integrate member components together
- Generate recommendations to patients from their current situation.
- Completion of web application.

- Completed web application.
- Test all functions with patients and compare data.
- Host the web application

Final Presentation

Latest technologies in MediSafe

MediSafe device

ESP8266
Max30105sens
Flow meter
Firebase

Dataset collection and data training

Kaggle
Regression
Python / React

IDE

Jupiter Notebook
Arduino IDE
Visual studio code
Anaconda Prompt

Requirements

Functional

- Interoperability
- Accuracy
- Compliance

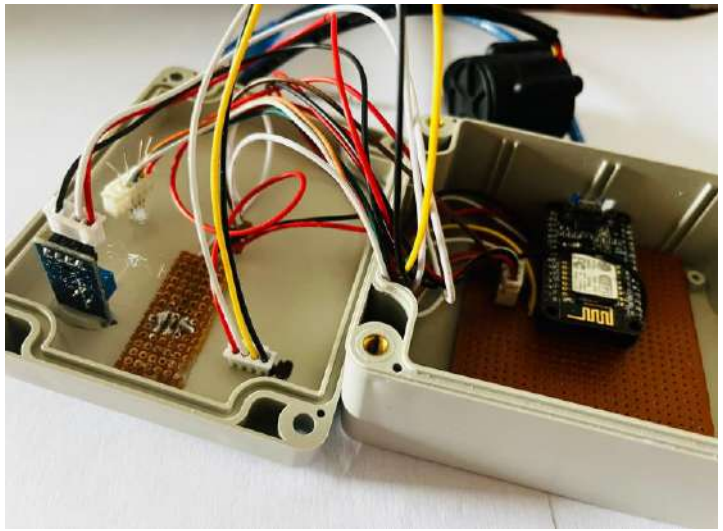
Non – functional

- Maintainability
- Manageability
- Usability
- Integrity

Risk mitigation

- This is related to medical industry research therefore the accuracy should be compulsory.
- Need to compare the actual output with a recommendation of a doctor
- Need to confirm that the output should provide the correct according to the currently available devices.

Completion of the project



Medisafe device

final2 | Arduino 1.8.19 (Windows Store 1.8.57.0)

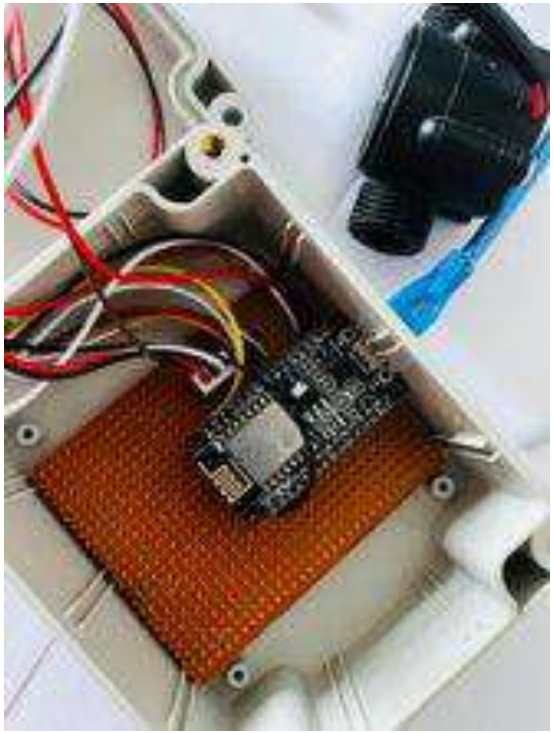
File Edit Sketch Tools Help

final2 § | Firebase | flow_meater | max30105 | so2 | temp

```
int count = 0;
int temp_bps;
//---------------------Firebase-----------

#include <ArduinoJson.h>
#include "FirebaseESP8266.h"
#include <ESP8266WiFi.h>
// Set these to run example.
#define FIREBASE_HOST "medisafe-research-default-rtdb.firebaseio.com/unit_1"
#define FIREBASE_AUTH "qjnABtFp7TrCzENApcxBGQSeI21kghAc1OPwrBB5"
#define WIFI_SSID "supun"
#define WIFI_PASSWORD "supun111191"
FirebaseData firebaseData;

#define SENSOR  D4
long currentMillis = 0;
long previousMillis = 0;
int interval = 1000;
//boolean ledState = LOW;
float calibrationFactor = 4.5;
volatile byte pulseCount;
byte pulse1Sec = 0;
float flowRate;
unsigned int flowMilliLitres;
unsigned long totalMilliLitres;
// ------------------led

#define REDLED  D5
```

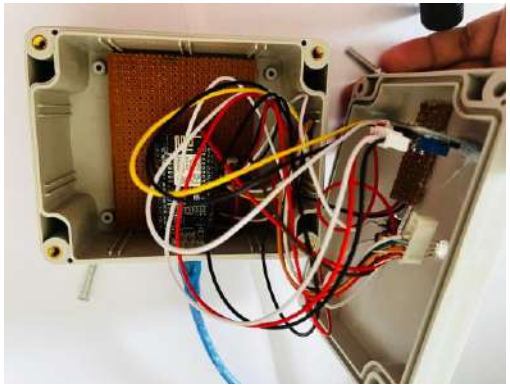
Arduino IDE

Completion of the project

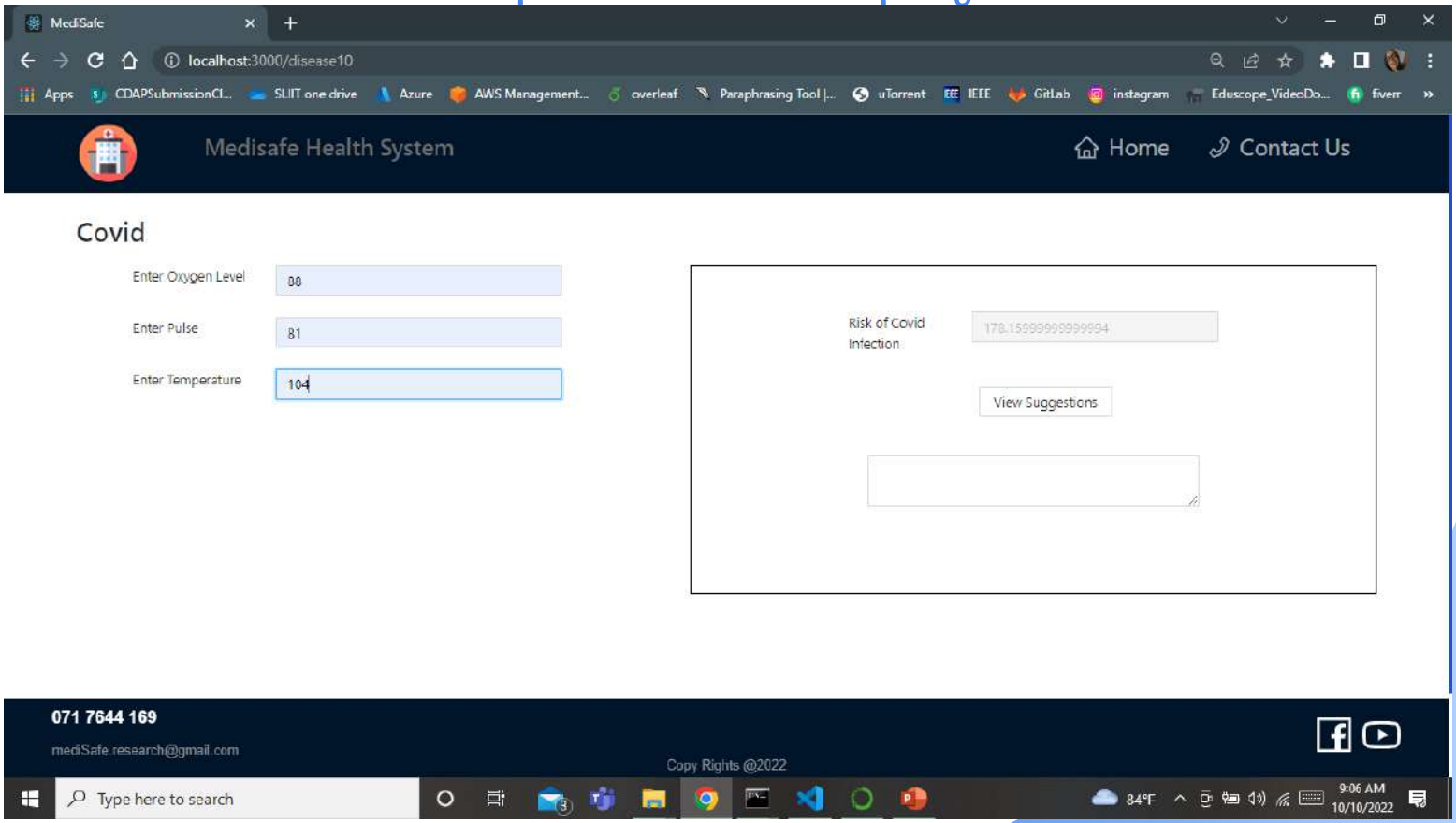


```
C:\WINDOWS\system32\cmd.exe

(covid) C:\Users\user>cd C:\Users\user\Desktop\24-04-2022\covid

(covid) C:\Users\user\Desktop\24-04-2022\covid>C:

(covid) C:\Users\user\Desktop\24-04-2022\covid>python Runcovid.py
type oxygen level : 90
type your pulse : 96
type your Temperature : 90
confidence : 100.0 %
The probability of having a covid infection is 35.360000000000004%
Traceback (most recent call last):
  File "Runcovid.py", line 1, in <module>
    from covid import predictc
ImportError: cannot import name 'predictc' from 'covid' (C:\Users\user\Desktop\24-04-2022\covid\covid.py)

(covid) C:\Users\user\Desktop\24-04-2022\covid>
```

Output of prediction



Completion of the project



IT19015422

Perera B.A.A.W.S

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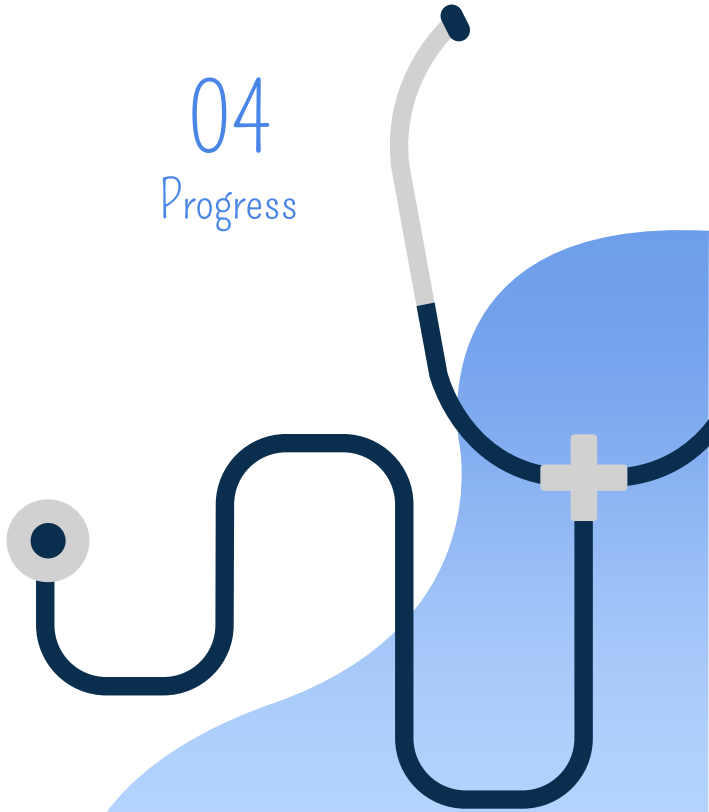
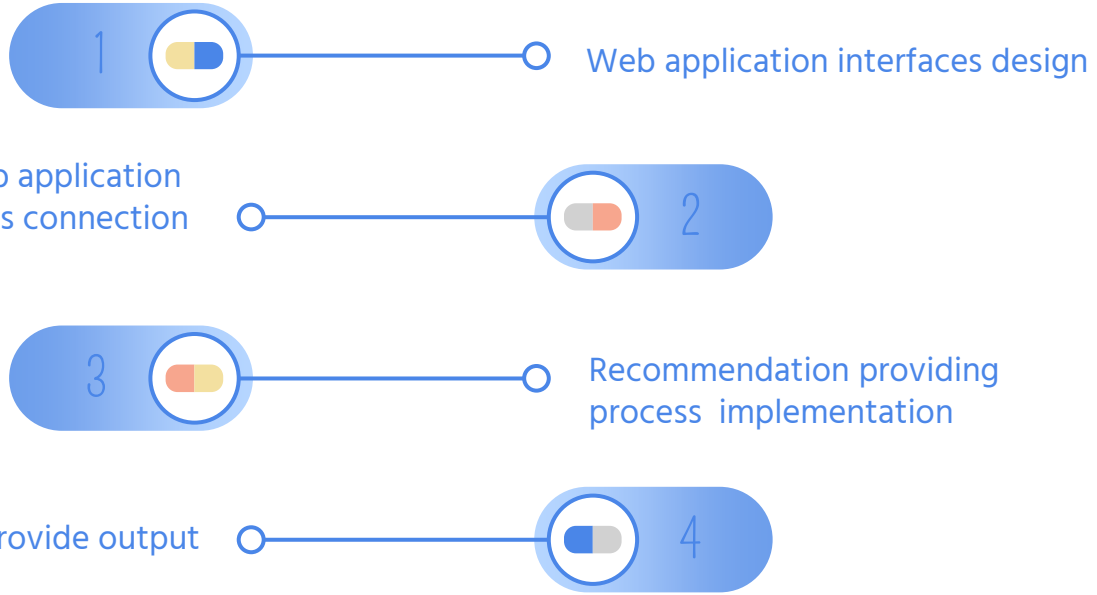


Research question

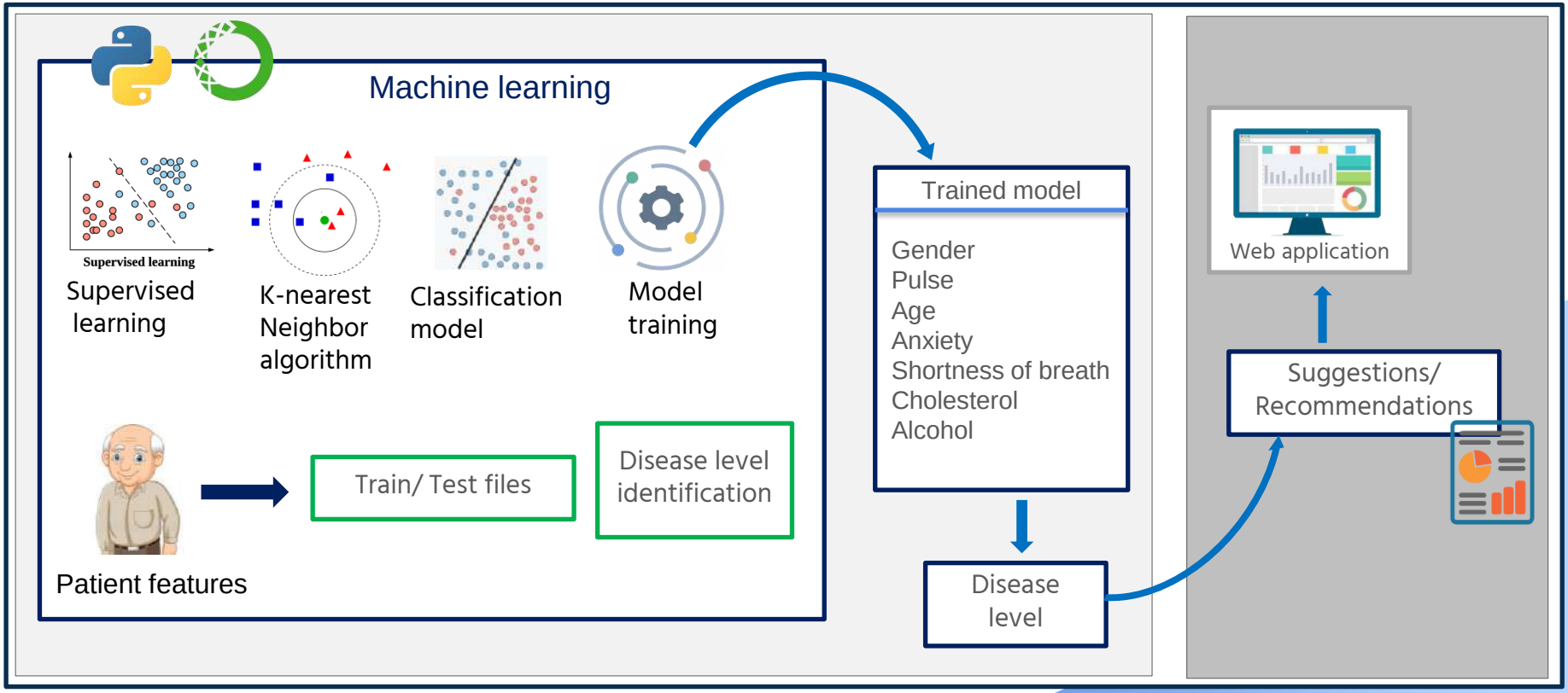
- How to identify the people who are suffering in such lung and heart diseases (level wise)
- How to check current situation in cost effectively

- How to provide easily recommendations via web application to the user
- What are the solutions we can give due to shortage of medicines

Achieved – 90%


1
Web application interfaces design
Enter user details via web application and backend analysis connection development
2
3
Recommendation providing process implementation
Provide output
4

System diagram



Progress

- Study the technology
- Data collecting
- Data analysis
- Find proper algorithm (K-nearest neighbors)
- Train the model
- Get the output as level wise related to the disease

Completed(50%)

90% Progress presentation

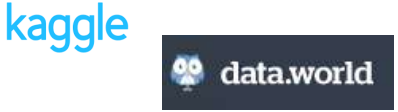
- Provide suggestions and recommendations to the user
- Web application implementation
- Integrate member components together

- Completion of web application
- Host the web application

Final Presentation

Latest technologies in MediSafe

DataSet collection



- https://data.world/informatics-edu/heart-disease-prediction
- https://www.kaggle.com/datasets/johnsmith88/heart-disease-dataset

Model training and Language

- K – nearest neighbor algorithm
- Libraries – pandas, sklearn, joblib, numpy …..
- Python / React

IDE

- Vs Code
- Jupyter notebook
- Anaconda prompt

Requirements

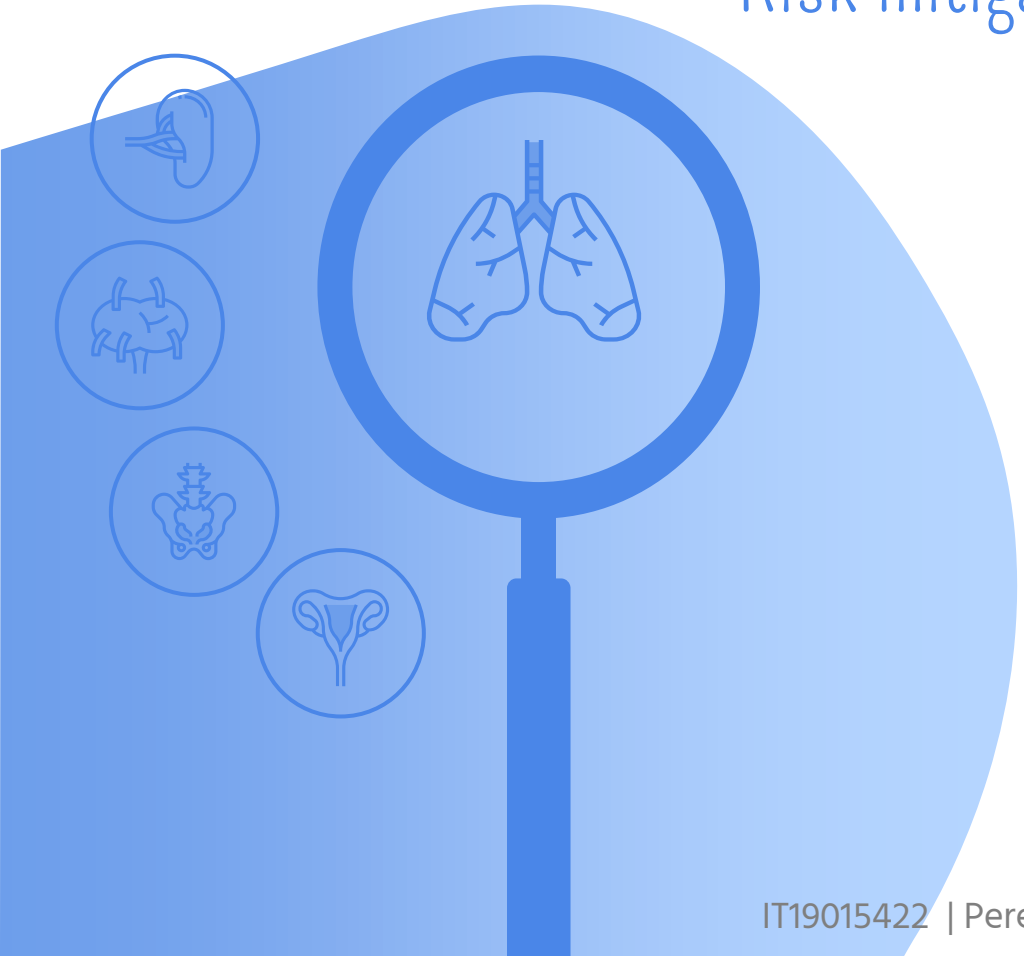
Functional

- Interoperability
- Authentication.
- Report generate
- User friendly

Non - functional

- Quality
- Durability
- Security
- Privacy

Risk mitigation



- ✓ Entering current situation features difficult to known by person . So that those features will get from the implemented device. (In future – 100%)
- ✓ Adults are not well fluent in new technologies.
- ✓ Validity of the disease level will depend on the user inputs.

Completion of the project

Frontend

1

```
<LayoutHeader />
{loading && <$Spin />}
<$Row style={{ marginTop: "100px", marginLeft: "5%" }}>
  <h1>Pneumonia</h1>
</$Row>
<$Row style={{ marginRight: "5%" }}>
  <$Col xl={12} sm={12}>
    <$Row className="jus-con-cen row-items">
      <$Col xl={5} sm={12}>
        <p>Enter Age</p>
      </$Col>
      <$Col xl={10}>
        <$Input
          name="age"
          handleChange={this.onHandleChange}
          value={form.age}
        />
      </$Col>
    </$Row>
    <$Row className="jus-con-cen row-items">
      <$Col xl={5} sm={12}>
        <p>Enter Gender</p>
      </$Col>
      <$Col xl={10}>
        <Radio.Group
          value={form.Gender}
          onChange={(e) => {
            this.onHandleChange("Gender", e.target.value);
          }}
        >
```

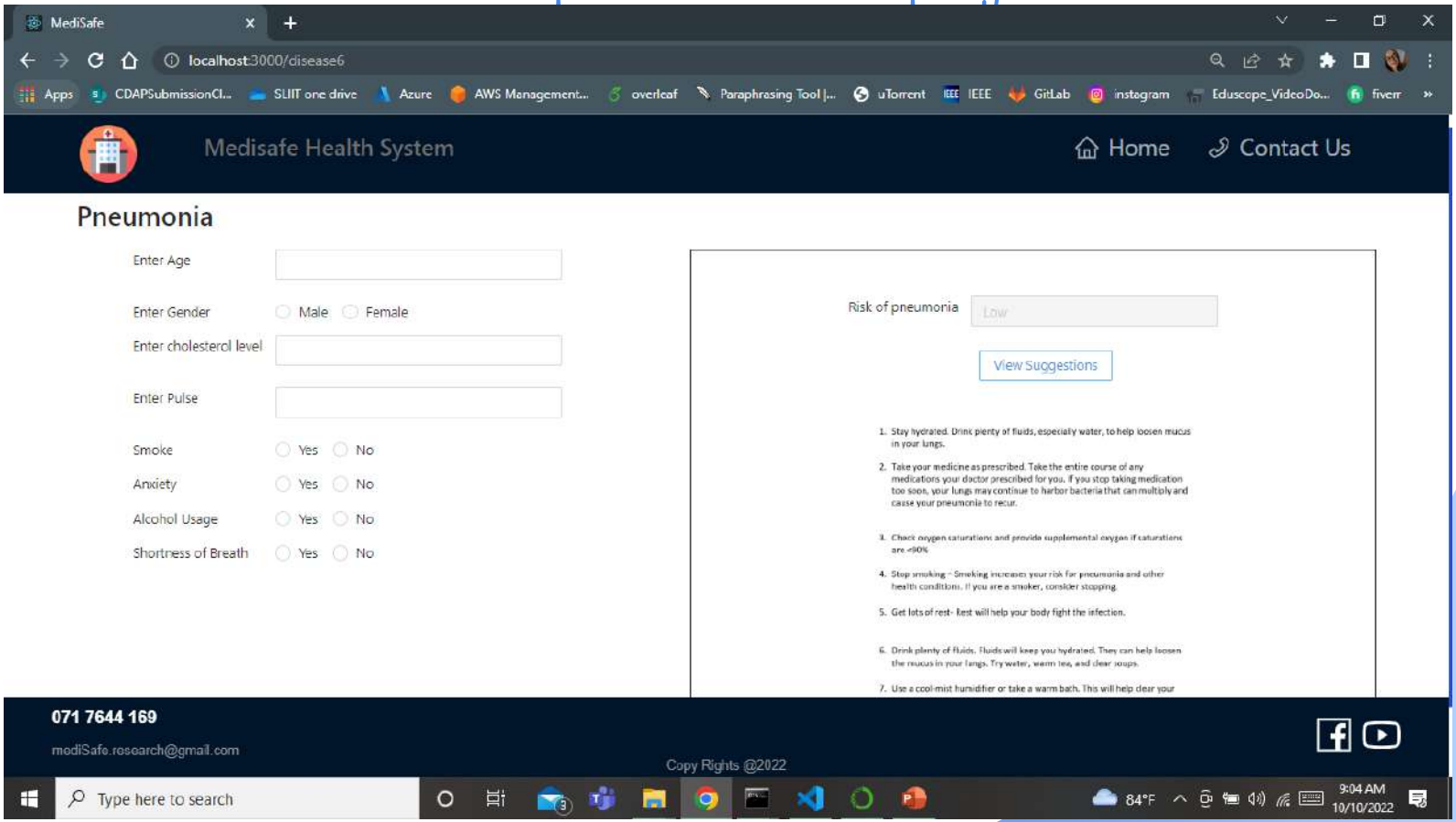
Completion of the project

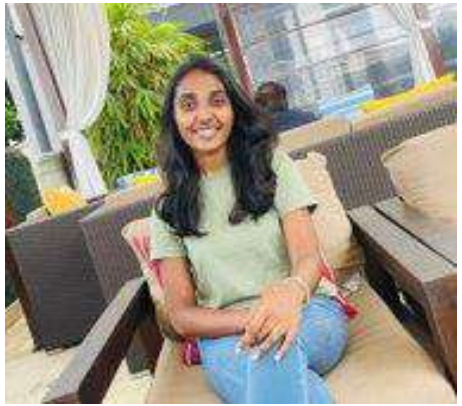
API controller implementation

1

```python
@app.route('/risk', methods=['GET', 'POST'])
def predictR():
    data = {}
    post_data = request.json

    age = str(post_data['age'])
    Gender = str(post_data['Gender'])
    Cholesterol = str(post_data['Cholesterol'])
    Pulse = str(post_data['Pulse'])
    Smoke = str(post_data['Smoke'])
    Alcohol = str(post_data['Alcohol'])
    Shortness_of_breath = str(post_data['Shortness_of_breath'])
    Anxiety = str(post_data['Anxiety'])

    y_predictH, y_predictP, y_predictW = get_risk_level(
        age, Gender, Cholesterol, Pulse, Smoke, Alcohol, Shortness_of_breath, Anxiety)

    data['prediction_heart'] = y_predictH[0]
    data['prediction_wheeze'] = y_predictP[0]
    data['prediction_pneumonia'] = y_predictW[0]

    return jsonify(data)
```

Completion of the project





IT19015040

Rasuni Wageesha H.A

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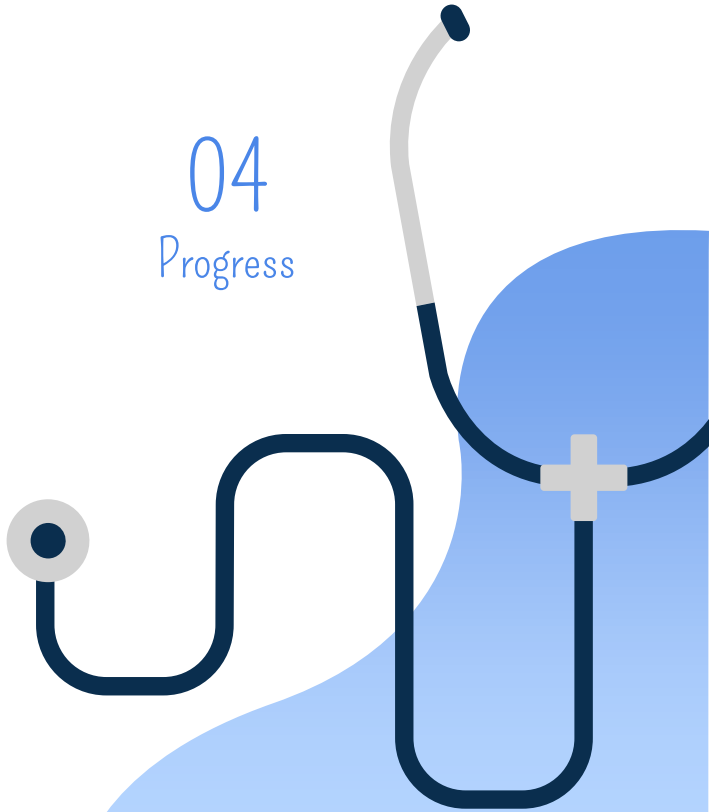


Research question

There are many different types of lung diseases and diagnosing one might be difficult.

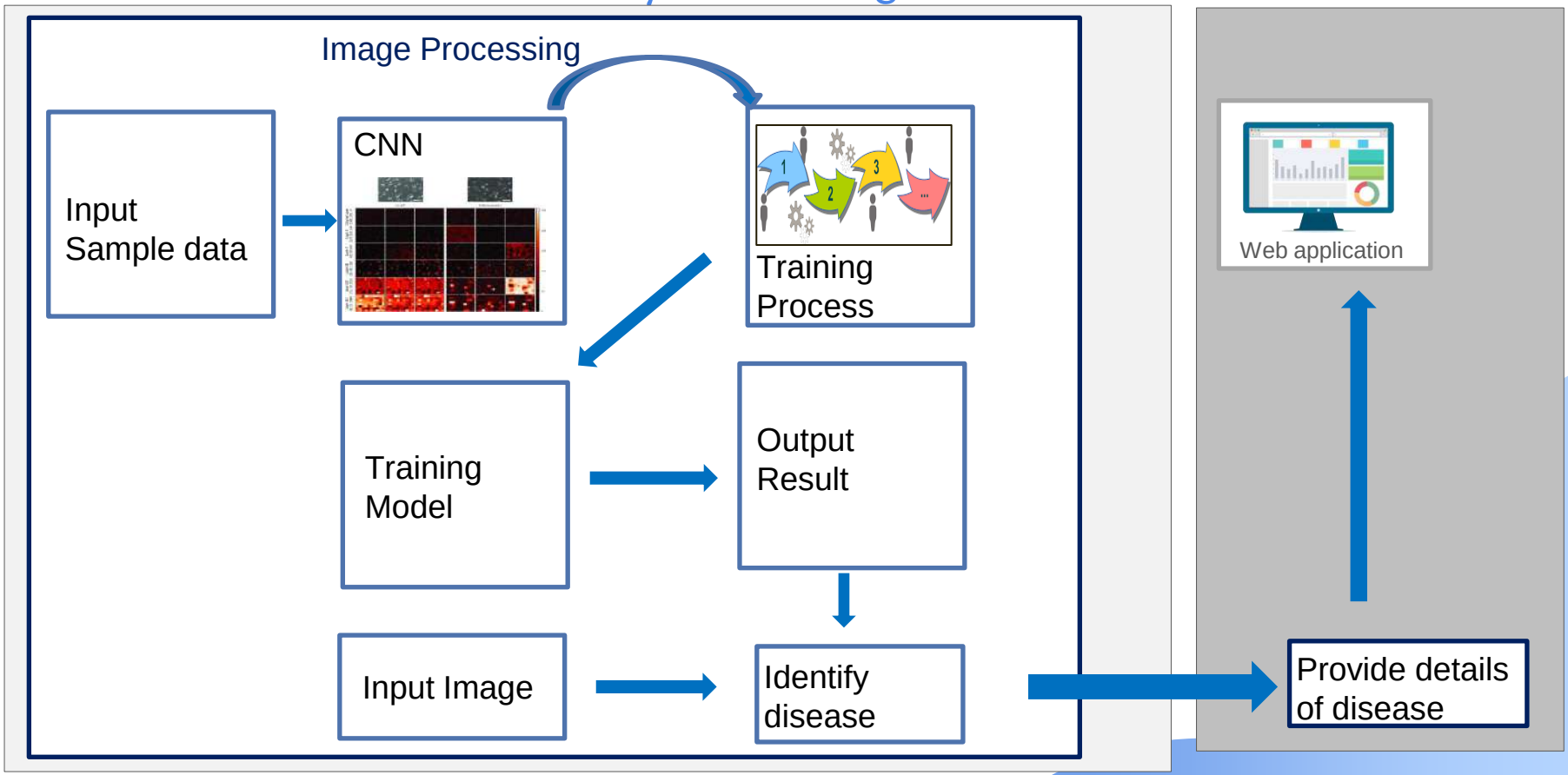
Achieved -90%

1 Web application interfaces design

Enter X Ray images via web application and display confidence level

3 Provide Output

System diagram



Progress

- Collecting diseases images.
- Identify how to develop the system.
- Trained images and generated a model using CNN.
- Got the output using trained module for test data.

Completed(50%)

90% Progress presentation

- Provide details of the disease.
- Web application implementation.
- Integrate member components together.

- Completion of web application.
- Generate suggestion.
- Host the web application

Final Presentation

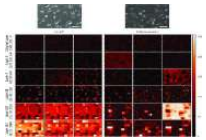
Technologies in MediSafe

Collected data

kaggle

https://www.kaggle.com/datasets/mdsafayet/multiclass-disease-classification

Algorithem



TensorFlow

Convolutional Neural Network

Python / React

Tesor flow

IDE

Visual Studio

Requirements

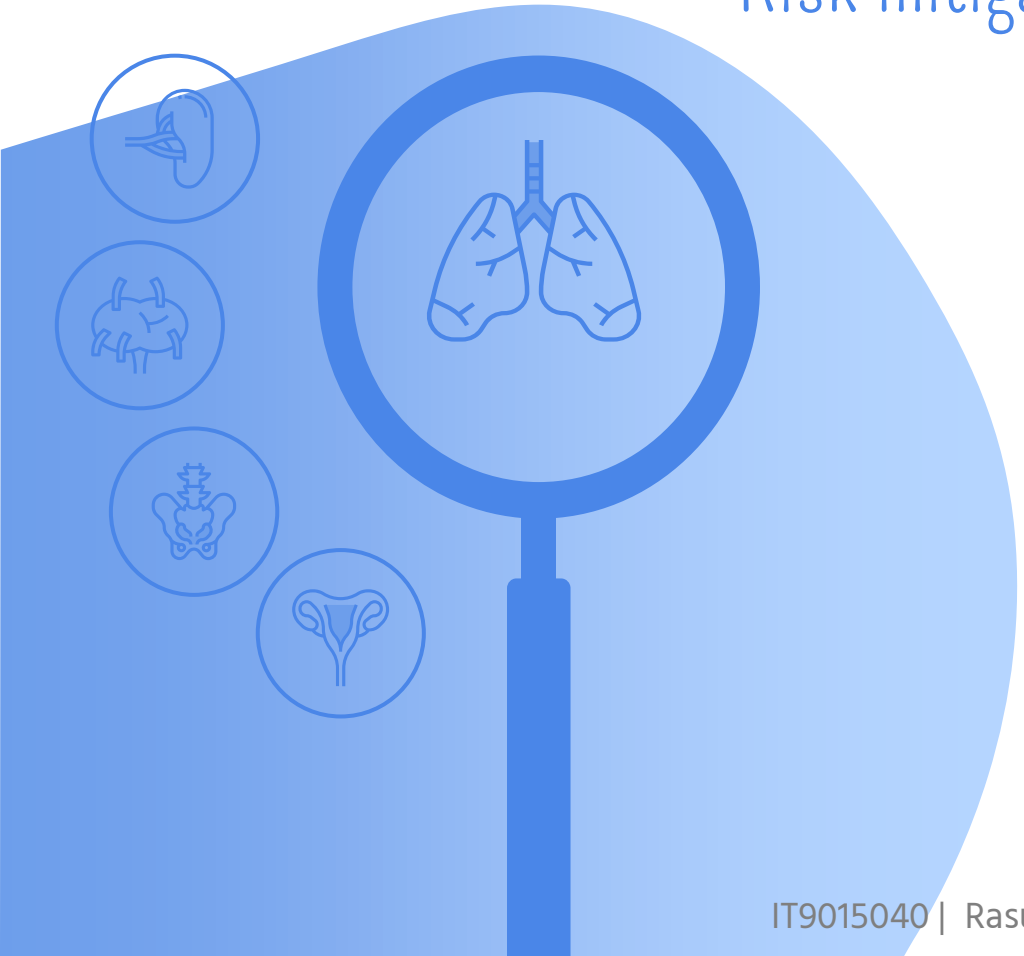
Functional

- Upload the lung image to the system.

Non – functional

- Performance
- Availability
- Reliability

Risk mitigation



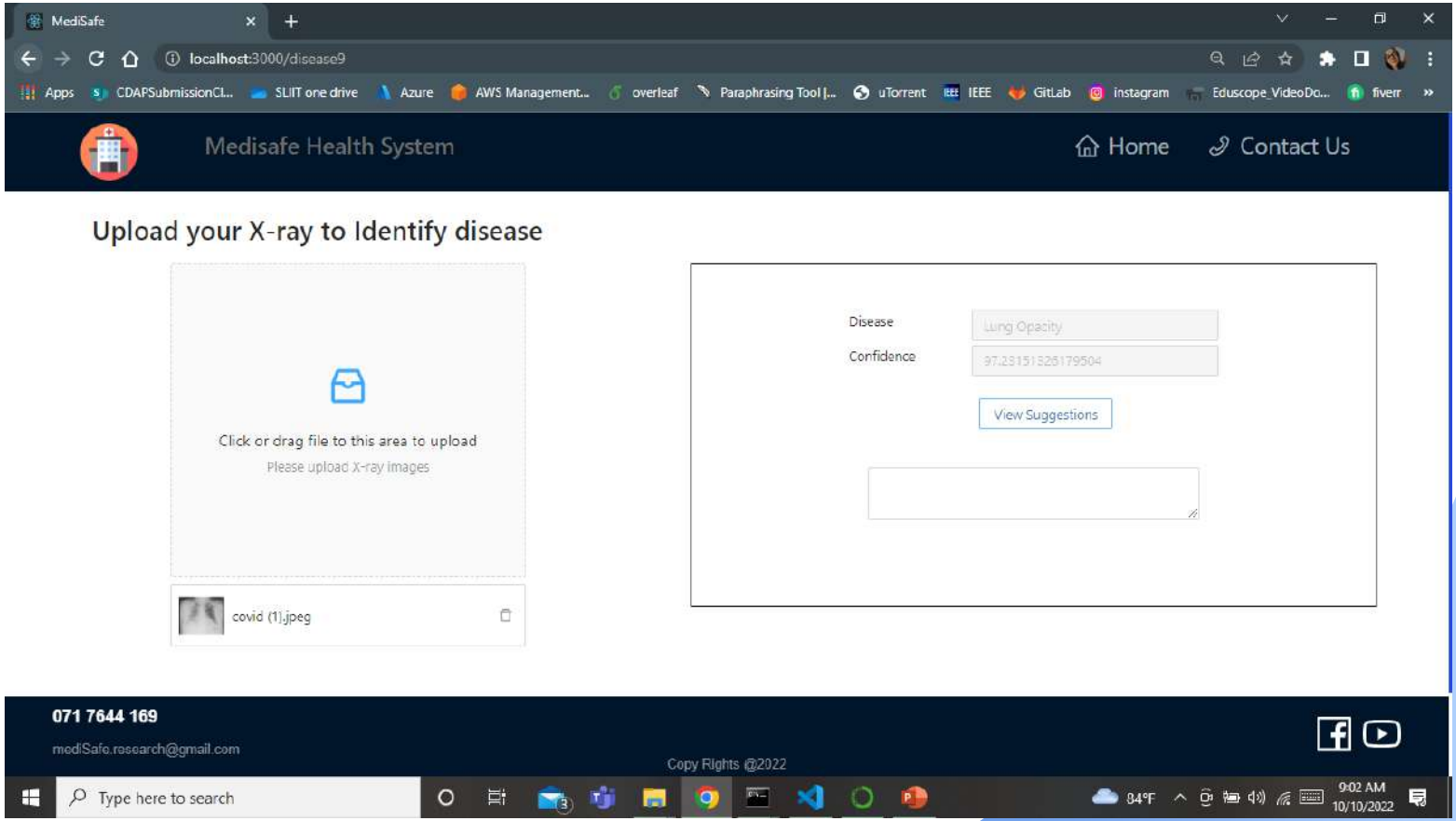
Validity of the clear images.

Completion of the project

API

```python
@app.route('/lung', methods=['GET', 'POST'])
def predict():
    data = {}

    filestr = request.files['file'].read()
    img = imgread(filestr)

    prediction_inst = []
    prediction_conf = []
    list_Of_cf = []

    outputs = model_process_img(img)
    for item in outputs['predictions']:
        list_Of_cf.append(item['confidence'])

    for item in outputs['predictions']:
        if item['confidence'] == max(list_Of_cf):
            print(item['label'], max(list_Of_cf) * 100)
            conf = max(list_Of_cf) * 100
            prediction_inst.append(item['label'])
            prediction_conf.append(conf)

    temp_val = prediction_inst[0]
    temp_conf = prediction_conf[0]
    print(temp_val)

    prediction_inst.clear()
    prediction_conf.clear()
    list_Of_cf.clear()
    data['detection'] = temp_val
    data['detectionScore'] = temp_conf

    return jsonify(data)
```

Completion of the project



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Senanayaka S.A.M.A.B.M

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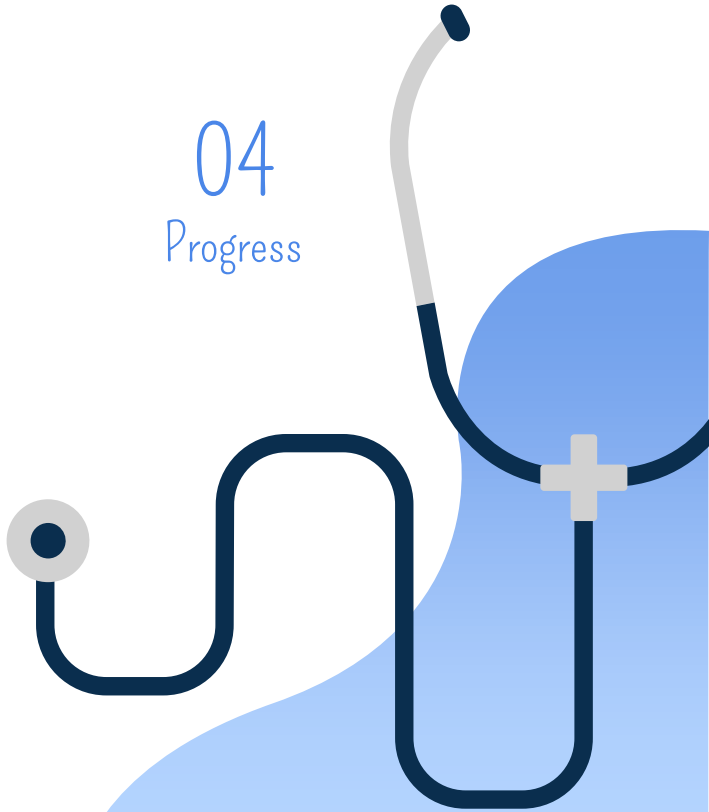
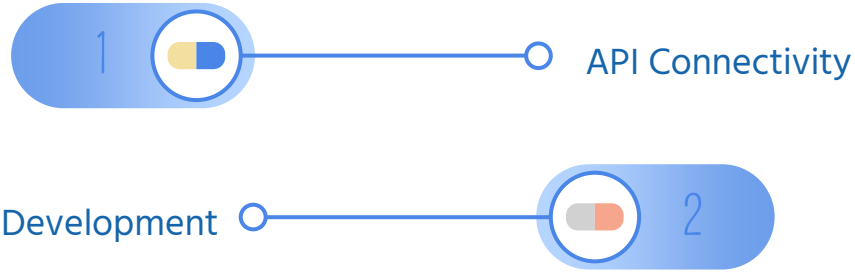


Research question

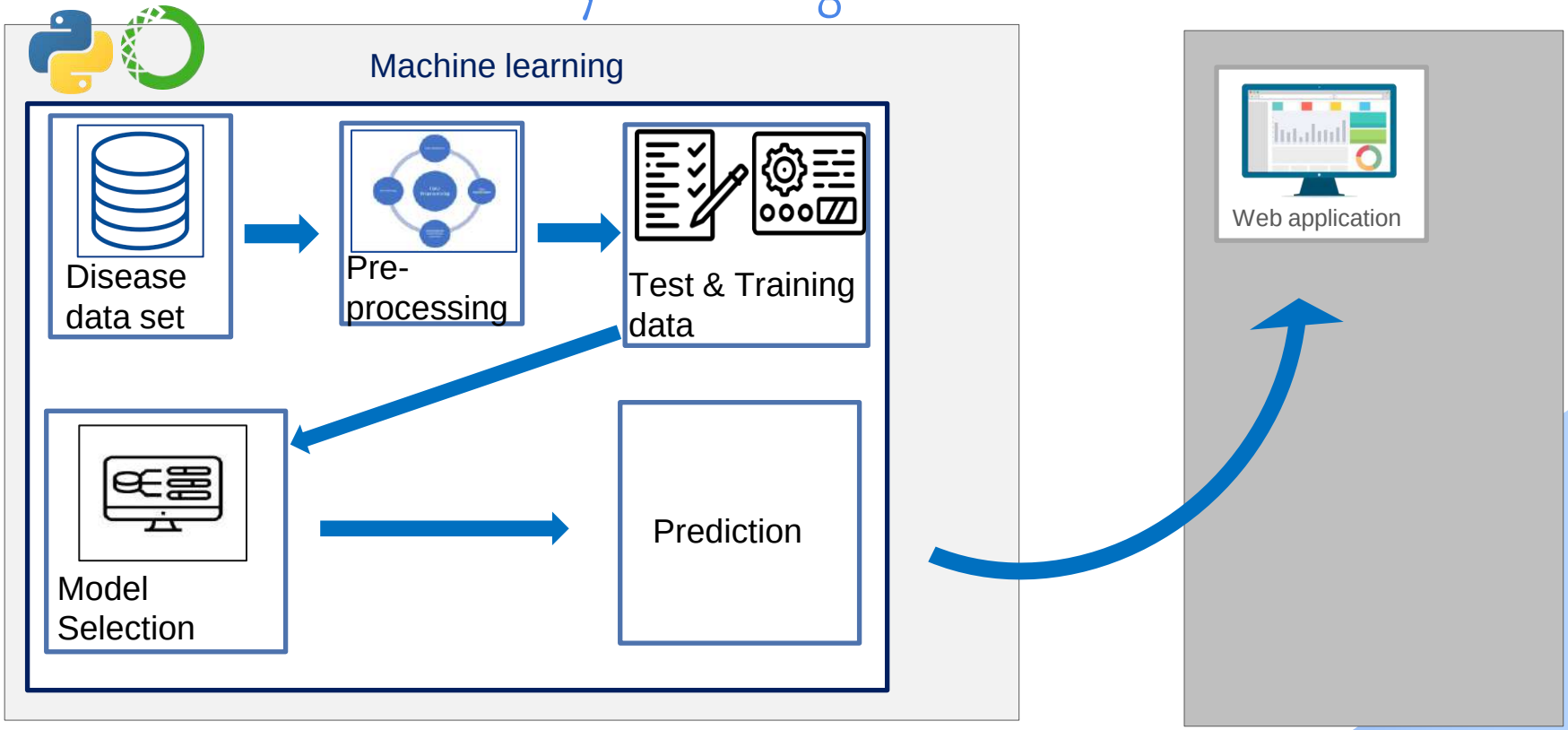
Identify the disease count on the Sri Lanka.

Target Domain

Achieved – 90%



System diagram



Progress

- Study the technology
- Data collecting
- Data analysis
- Find proper algorithm
- Train the model
- identify the spread rate count

Completed(50%)

90% Progress presentation

- Create API connection
- Web application implementation
- Integrate member components together

- Completion of web application
- Host the web application

Final Presentation

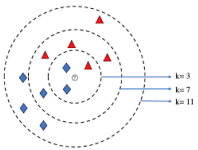
Technologies in MediSafe

Collected data

kaggle

1) https://www.healthdata.org/sri-lanka
2) https://www.kaggle.com/

Algorithem



Long short term-memory algorithms

Python / React

Ide

jupyter

Jupiter notebook and vs code

Requirements

Functional

- Identify the spread rate count
- Display the data healthcare dashboard

Non – functional

- Accuracy
- Availability

Risk mitigation

Find relevant and accurate data.

Completion of the project

API

```python
@app.route('/spread', methods=['GET', 'POST'])
def predictS():
    data = {}
    post_data = request.json

    sickness = str(post_data['sickness'])
    city = str(post_data['city'])
    Date = post_data['Date']

    print(sickness, city, Date)

    responseArray = []
    for x in Date:
        response = get_prediction(sickness, city, str(x).split('T')[0])
        responseArray.append(response)

    data['details'] = responseArray
    return jsonify(data)
```

Completion of the project

Frontend-submit detail

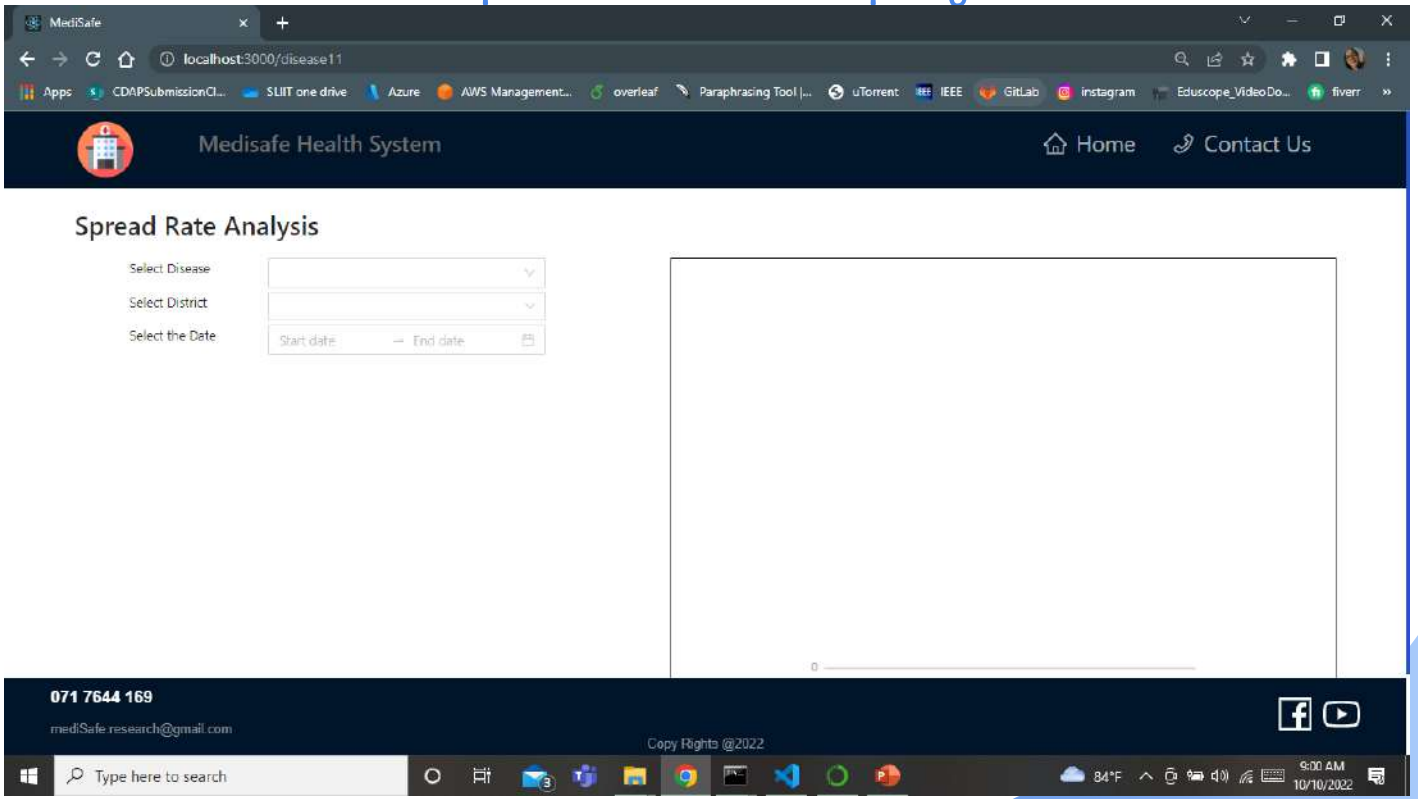
```
submit = async () => {
    const form = { ...this.state.form };
    const sickness = form.sickness;
    const city = form.city;
    let getDaysArray = this.getDaysArray(
      moment(form.Date[0]).format("YYYY-MM-DD"),
      moment(form.Date[1]).format("YYYY-MM-DD")
    );

    console.log(getDaysArray, "getDaysArray");

    const data = {
      sickness: sickness,
      city: city,
      Date: getDaysArray,
    };
    this.setState({ loading: true, getDaysArray: getDaysArray });
    try {
      await fetch("/spread", {
        method: "POST",
        headers: {
          "Content-Type": "application/json",
        },
        body: JSON.stringify(data),
      })
        .then((response) => response.json())
        .then((response) => {
          var spread = response["details"];
          this.setState({
            spread: spread,
          });
        });
      this.setState({ loading: false });
      let graph = this.getGraph(this.state.spread, this.state.getDaysArray);
      this.setState({
        graph: graph,
      });
    } catch (error) {
      this.setState({ loading: false });
    }
    this.setState({ loading: false });
  };
```

Completion of the project

Frontend-graph

```
{graph && (
                    <Line
                      data={graph}
                      xField="Date"
                      yField="scales"
                      autoFit={false}
                      xAxis={{ range: [0, 1], tickCount: 5 }}
                      point={{ size: 5, shape: "diamond" }}
                      label={{
                        style: {
                          fill: "#aaa",
                        },
                      }}
                    />
                  )}
```

Completion of the project



Commercialization

01

We discussed with some surgeons, and they allow us to test that implemented system (100%) in their premises. (Dispensary, Hospitals)

02

After completing (100%) our project we are hoping to introduce this to some clinical centers.

03

Advertise our mediSafe product via social media with its benefits.

Banner

MEDISAFE
Stay away and defeat diseases

(1) Introduction

Currently in our country all the people re in busy schedule herefore they don't have enough time to think about their health situation (Non – communicable diseases). From this research we are hoping to introduce a better solution for those matters and reduce the possibility that the diseases being affect and help them to prevent from diseases.

(2) Background and Literature Reviews

Non-communicable diseases (NCD- Heart Attack, Pneumonia, Wheezing, Lung cancer, kidney diseases) are a major factor in the number of reported premature deaths each year. Tobacco, inactivity, alcohol use, and following an unhealthy diet all raise the risk of dying from an NCD.

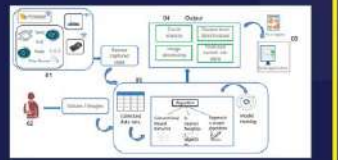
(3) Research Problem

- There are some diseases that have arisen at present. (Heart attack, Pneumonia, Wheezing, Dengue, Covid'19)
- High cost for diagnosis.
- Informal lifestyle and busyness.
- Don't have enough idea about current situation of the country.

(4) Objectives

- Implement a device to get parameters of the patient an identify Covid'19. (Possibility as a percentage)
- Disease level wise identification and provide suggestions/ recommendations to reduce the risk level
- Identify the exact lung disease among other lung diseases.
- Identify the three major diseases spread rate in Sri Lanka.

(5) System Diagram



(6) Provided Solution

- Developed an Arduino-based device that detects certain types of symptoms to diagnose certain heart and lung related diseases.
- Use some machine learning based techniques to identify diseases and clarify it.
- Show diseases spread rate to the user.
- Developing a web application to facilitate patient# usage.

(7) Results and Discussion

- Implement a device that device identifies diseases parameters to analysis.
- Image processing-based lung diseases identification.
- Spread rate analysis using machine learning based algorithms.
- Risk level wise identification using machine learning based algorithms.

(8) Necessary References

- D. K. Ravish, K. J. Shanthi, N. R. Shenoy and S. Nisargh, "Heart function monitoring, prediction and prevention of Heart Attacks: Using Artificial Neural Networks," 2014 International Conference on Contemporary Computing and Informatics (IC3I), 2014, pp. 1-6, doi: 10.1109/IC3I.2014.7019580.

- D. Ashourlon, A. A. Matkan, A. Huete, H. Aghighi and M. R. Mobasheri, "Developing an Index for Detection and Identification of Disease Stages," in IEEE Geoscience and Remote Sensing Letters, vol. 13, no. 6, pp. 851-855, June 2016, doi: 10.1109/LGRS.2016.2550529.

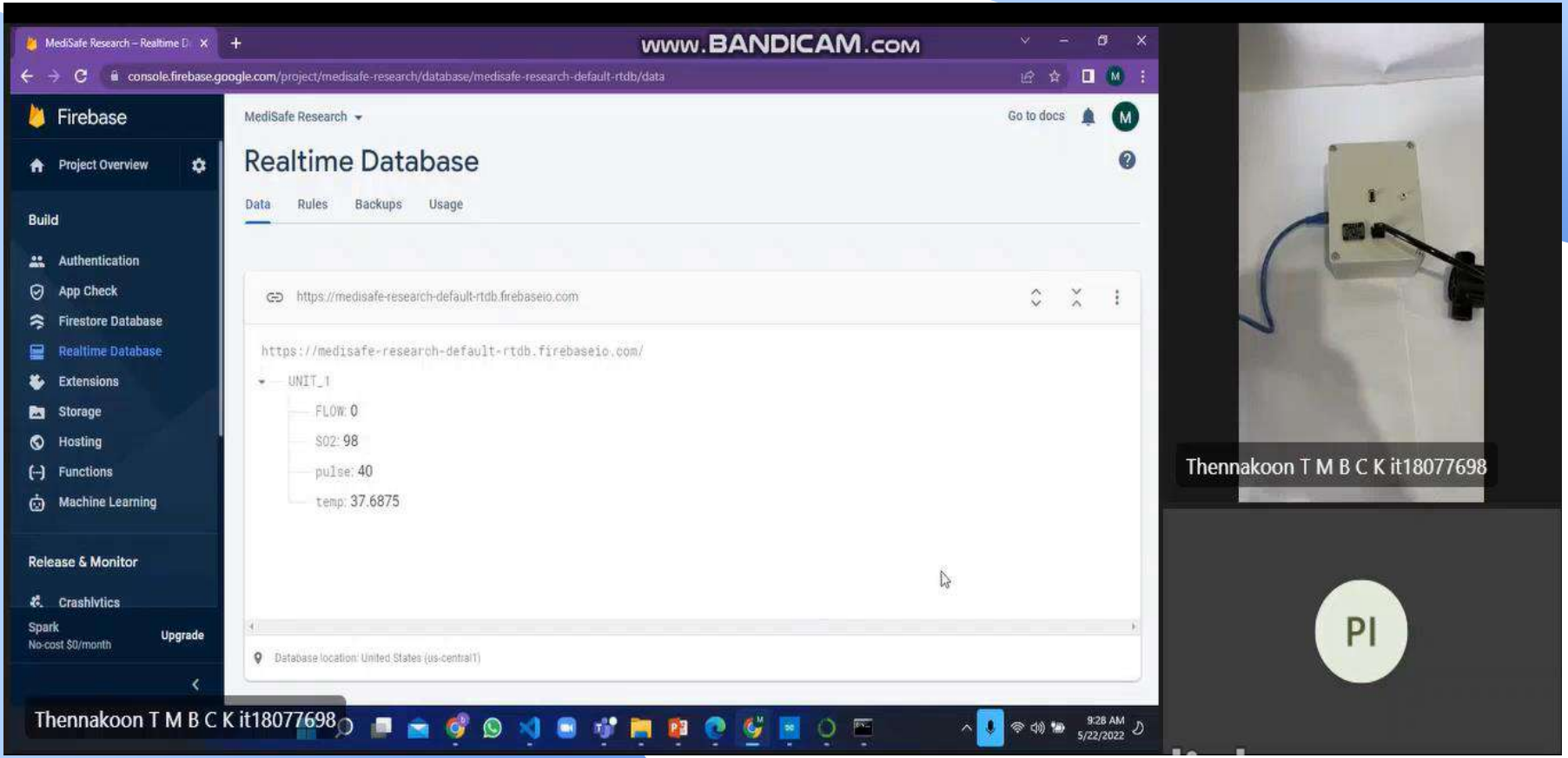
(9) Acknowledgments

The instructions from our co-supervisor and supervisor are much appreciated. Dr. Shashika Liyanage (Ph.D.) was a tremendous assistance to us in medical matters. We would especially like to thank our parents and the SLIIT students for their generosity.

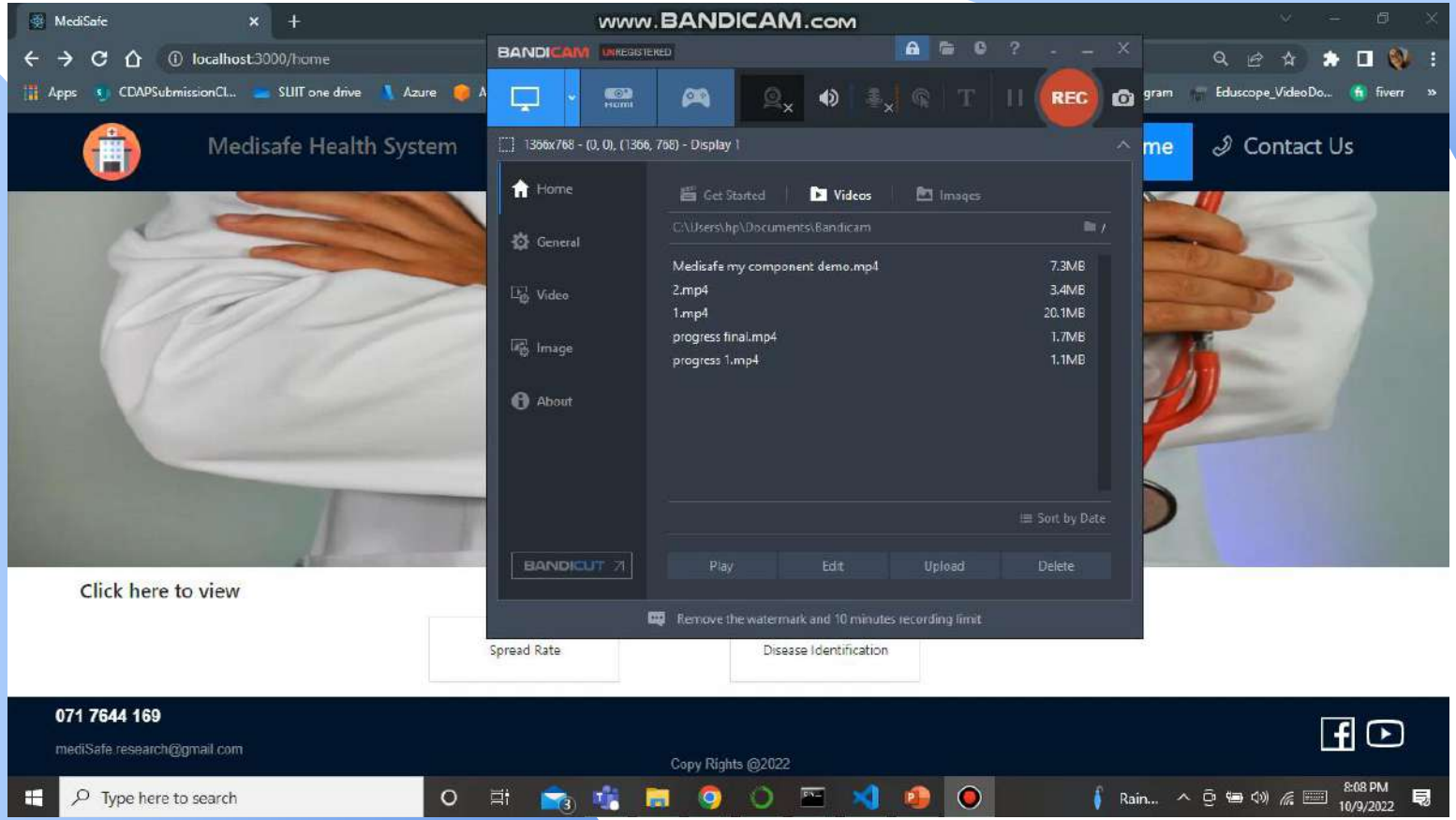
Project ID : 2022-143
Supervisor : Mr.Ravi Supunya
Co-Supervisor : Mr.Samantha Rajapaksha

Demonstration

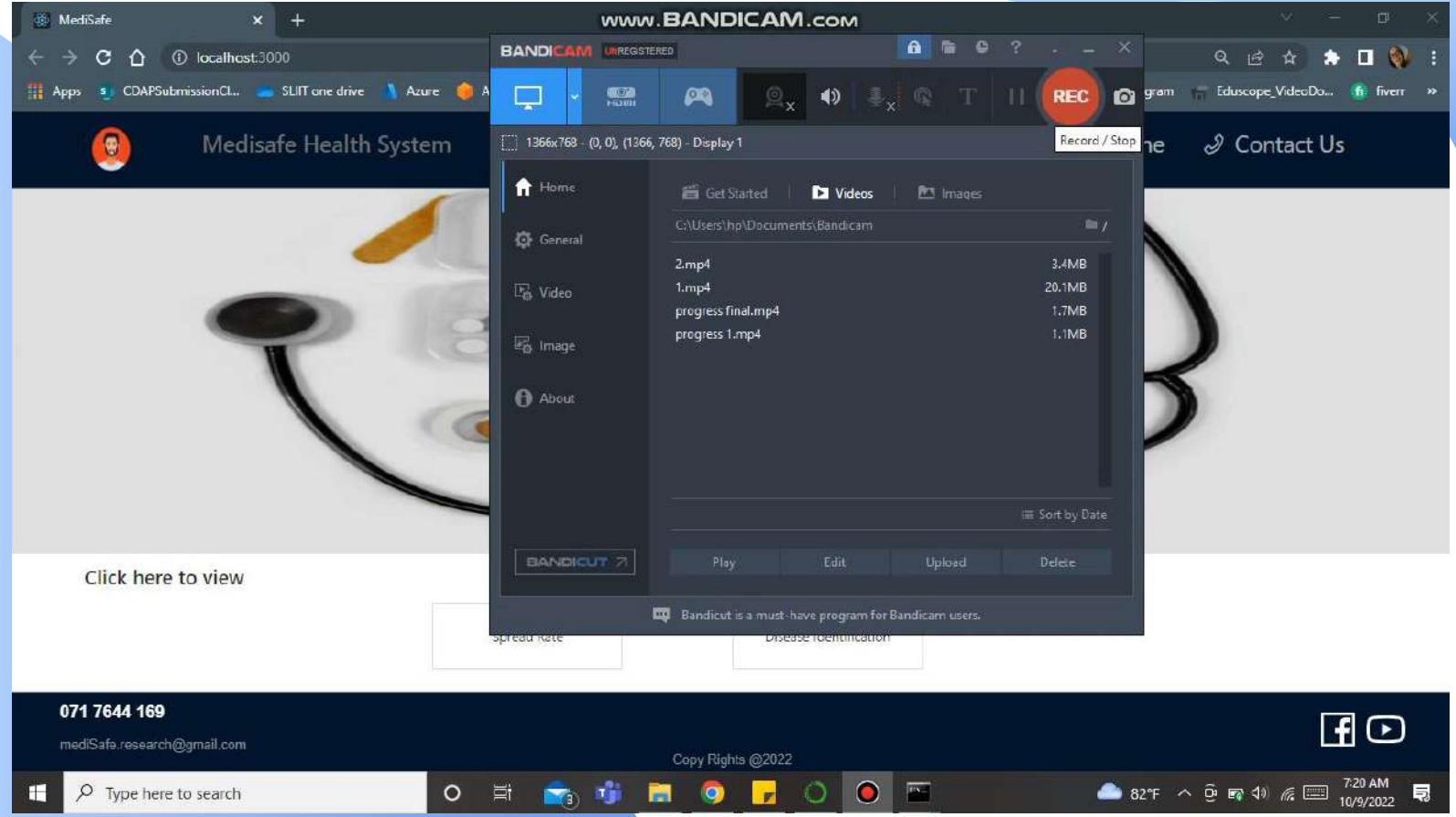
Arduino based device implementation



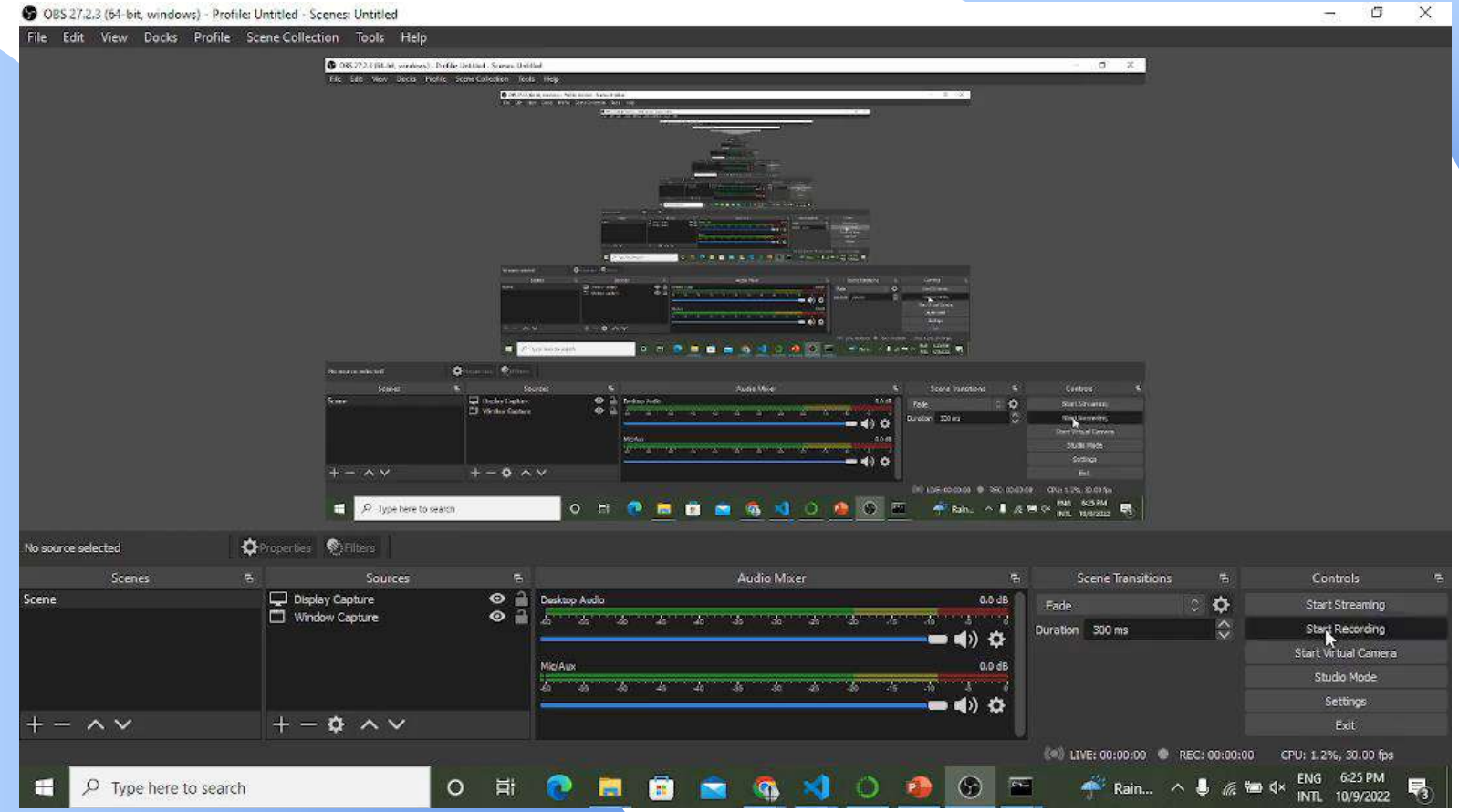
Covid 19 analysis



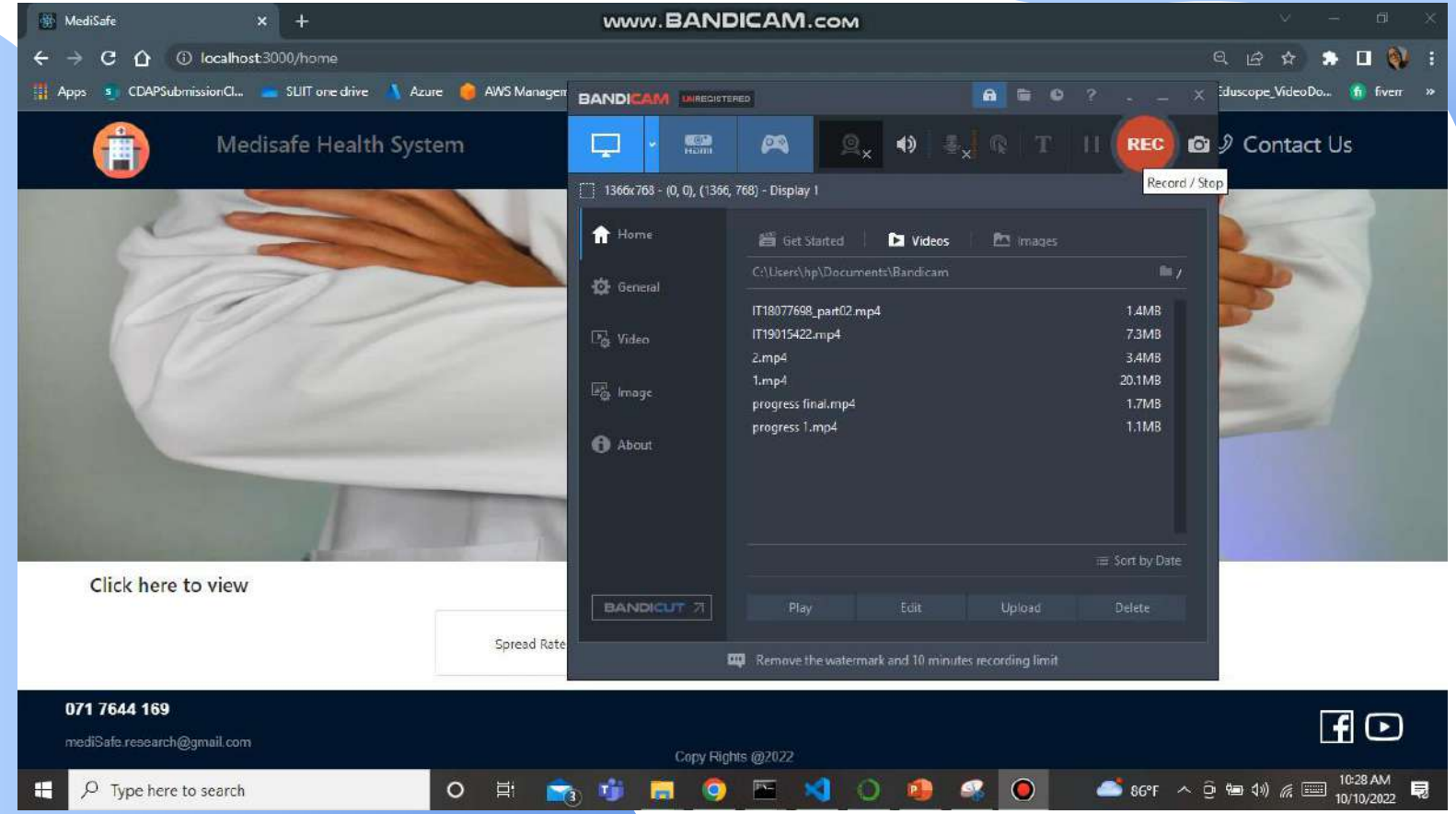
Disease level wise identification and provide suggestions



Identify exact lung disease among other lung diseases



Identify the three major diseases spread rate in Sri Lanka



Thank You

Do you have any questions?