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Major Project
20MCA41

On

"Covid Patient Tracing and Diagnosis System"

Submitted by
ISHITA SARKAR
USN: 1RV20MC028

Under the Guidance
Of

Internal Guide
Dr. Jasmine KS
Associate Professor
Department of MCA
RV College of Engineering®
Bengaluru – 560059

External Guide
Parag Jain
Reporting Analyst
EXL Services
Bengaluru – 560103

Submitted in partial fulfillment of the requirements for the award of degree of

MASTER OF COMPUTER APPLICATION

2021-2022

RV COLLEGE OF ENGINEERING ®

(Autonomous Institution Affiliated to Visvesvaraya Technological University, Belagavi)

DEPARTMENT OF

MASTER OF COMPUTER APPLICATIONS

Bengaluru– 560059

CERTIFICATE

Certified that the project work titled "**Contact Tracing using GPS Data and Machine Learning"** carried out by **ISHITA SARKAR, USN:1RV20MC028, a** bonafide student of **RV College** of **Engineering®, Bengaluru** submitted in partial fulfillment for the award of Master of Computer Applications of **RV College of Engineering®, Bengaluru affiliated to Visvesvaraya Technological University, Belagavi** during the year **2021-22.** It is certified that all corrections/suggestions indicated for criteria assessment have been incorporated in the report deposited in the departmental library. The project report has been approved as it *satisfies* the academic requirement in respect of project work prescribed for the said degree.

Dr. Jasmine KS
Associate Professor
Department of MCA
RV College of Engineering®
Benga1uru —59

Dr. Andhe Dharani
Professor and Director
Department of MCA
RV College of Engineering®
Benga1uru —59

Dr. KN Subramanya
Principal
RV College of Engineering®
Benga1uru—59

RV COLLEGE OF ENGINEERING ®

(Autonomous Institution Affiliated to Visvesvaraya Technological University, Belagavi)

DEPARTMENT OF

MASTER OF COMPUTER APPLICATIONS

Bengaluru– 560059

DECLARATION

I, **ISHITA SARKAR**, student of fourth semester MCA in the **Department of Master of Computer Applications,** RV College of Engineering®, Bengaluru declare that the project titled **"Contact Tracing using GPS Data and Machine Learning"** has been carried out by me. It has been submitted in partial fulfillment of the course requirements for the award of degree in **Master of Computer Applications of RV College of Engineering®, Bengaluru affiliated to Visvesvaraya Technological University, Belagavi** during the academic year **2021-22**. The matter embodied in this report has not been submitted to any other university or institution for the award of any other degree or diploma.

Date of Submission: **Signature of the Student**

Student Name: Ishita Sarkar
USN:1RV20MC028
Department of Master of Computer Applications
RV College of Engineering®
Bengaluru-560059

EXL

Private and Confidential

BY HAND/UNDER REGISTERED A. D. POST

Date: Jan 07th, 2022

To,
Ishita Sarkar,
Master of Computer Applications,
RV college of Engineering

Subject: Internship

Dear Ishita Sarkar,

You have been selected as an Intern in the Decision Analytics Team of Inductis (India) Private Limited for a period of 6 months starting from Jan 18, 2022 and unless otherwise terminated earlier pursuant to the terms & conditions mentioned here in after, automatically ending on Jul 18, 2022 without any notice or compensation to you.

We would like to take this forward and make you an offer on the following terms and conditions:

1. Scope of Internship/Project

You are expected to work as an intern during working hours/shifts of Inductis. You shall complete the project based on the inputs received from Inductis from time to time.

2. Duration

The engagement would be for a period of 6 months starting from Jan 18, 2022 and unless otherwise terminated earlier pursuant to the terms & conditions mentioned here in after, automatically ending on Jul 18, 2022 without any notice or compensation to you. However, depending upon the exigencies of project, the period of Internship may be varied at the sole discretion of Inductis.

3. Payment

Inductis shall, during the above said internship period, pay you a monthly stipend of INR 10, 000/- all incl. (Indian Rupees Ten Thousand only), which shall be subject to tax deduction at source.

4. Representations and Warranties by You/Trainee/Intern

4.1 You represent and warrant that you have all the requisite permissions, approvals, qualifications, skills and experience to undertake internship and project and that you are not engaged /working anywhere else, and that there are no contractual, judicial, administrative, regulatory, academic, professional and/or legal conditions, debars or restrictions including visa, FRRO and/or immigration restrictions, conditions, etc. which, or which may prevent, debar or prevent you from undertaking the internship and/or project under this offer/internship, and that you are duly allowed and permitted by the terms & conditions of your visa / immigration document, if any, to undertake the internship and project.

EXL

16. Governing Laws and Jurisdiction of Courts

This engagement/agreement shall be construed in accordance with the laws of India. The parties agree to the exclusive jurisdiction of the courts located in Delhi.

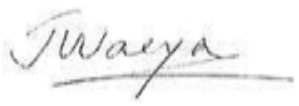
17. Waiver

No failure by either party to enforce any rights or remedies hereunder shall be construed as a waiver of such right(s) or remedy.

18. Acknowledgement and Acceptance

Please acknowledge receipt of this letter/agreement/document and your acceptance of this engagement/letter/agreement/document by signing a copy in the space provided and returning to us at the earliest.

Sincerely,
For Inductis (India) Private Limited



Jyotsna Warya
Vice President 2 – Human Resource

I, Ishita Sarkar, daughter/son of Amit Sarkar, resident of #29 Lakshmi Nagraj Nilaya, 13th cross, 6th Main, near Anika Family Restaurant MSR Nagar, Mathikere-560054 do hereby acknowledge and accept this document/letter/ agreement and do hereby unconditionally agree to all the contents and terms and conditions of this documents/ letter/ agreement with my free consent, and unconditionally agree to abide by all the terms and conditions if this documents/ letter/ agreement.

(Ishita Sarkar)
Date: 09-01-2022
Place: Bangalore

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ISHITA SARKAR
1RV20MC028
Department of MCA
RV College of Engineering®
Bengaluru-59

ABSTRACT

Tracking, screening, and forecasting existing and future infected cases, early detection and diagnosis of infection, medicine and vaccine research, and lowering the burden of healthcare professionals are all essential uses of artificial intelligence (AI) in the battle against the COVID-19 pandemic. COVID-19's propagation may potentially be handled as a data science problem. Non-traditional strategies for processing COVID-19 data, such as data collection and interpretation, modelling, prediction, and data visualization and communication, are required to manipulate COVID-19 infection dynamics.

If a person is diagnosed with Covid-19 and the diagnosis is confirmed, the next critical step is contact tracing to prevent the disease from spreading further. So how exactly can one achieve it, first of all, all the GPS data of the infected person is being collected. Next one need to choose an appropriate algorithm to render data such as Density-based Clustering, Hierarchal-based Clustering, Partitioning-based Clustering using the KNN technique etc. Further the data is passed through the chosen Machine Learning algorithm where its being processed and depict the rendered data in graphical format. Finally, test the trained algorithm with test data to check it's performance. The software technologies used for the above-mentioned steps are Python and Python libraries such as NumPy, Pandas and matplotlib; Machine Learning algorithms, and Jupyter notebook to compile our code/algorithm, and the hardware requirements are, Desktop or a laptop with minimum of 4-8 Gb RAM. The above steps are designed to collect individual personal data, which will be analyzed by ML and AI tools to track down someone vulnerable to the new virus due to their recent chain of contacts.

If used thoroughly, this idea can break the chain of transmission of the current novel coronavirus and suppress the epidemic by providing greater opportunities for adequate controls and helping to reduce the extent of the recent pandemic. The digital contact tracing process can be done virtually in real-time and much faster than the non-digital system which reduces manual effort and increases accuracy. The expected accuracy of the proposed system is about 80-90%.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

The Coronavirus-2 and its associated illness, coronavirus disease COVID which was first detected in China in late 2019, pose the most significant public health threat in the past 100 years. This sickness has swept the globe like wildfire. The worldwide reaction to the outbreak has been patchy. Some governments reacted quickly and efficiently, while others failed terribly. Strict lockdowns are one means of restricting viral propagation; however, this comes with a high economic cost due to company closures and job losses, and there is a chance that the spread will restart once the lockdowns are lifted.

1.2 Project Description

To combat COVID, most governments have focused on developing smart lockdown tactics that use a number of technological solutions. Overall, early disease prevention initiatives and a mix of high and low-tech solutions enabled several nations (such as China and South Korea) to limit disease spread. These countries rely on passengers being monitored and quarantined. Human movement was severely hampered in the early days of the outbreak. People began to withdraw within their houses. However, it resulted in the closure of the transportation industry. Individuals with minimal risk were also asked to adhere to quarantine, and their physical presence was either monitored by state operatives or tracked via cell tower location data. Identified patients were kept in covid wards for about a fortnight, determined by the availability of health care facilities.

Tracking, screening, and forecasting existing and future infected cases, early detection and diagnosis of infection, medicine and vaccine research, and lowering the burden of healthcare professionals are all essential uses of AI in the battle against the

covid pandemic. The propagation may potentially be handled as a data science problem. Non-traditional strategies for processing covid data, such as data collection and interpretation, modelling, prediction, and data visualization and communication, are required to manipulate covid infection dynamics.

If a person is diagnosed with Corona virus and the diagnosis is validated, the next crucial step is to trace the person's contacts in order to prevent the According to the World Health Organization, the virus is spread mostly by saliva, droplets, or nasal secretions. Contact tracing is an vital public health method for preventing the transmission of SARS-Cov-2. Contact tracing is a way of recognizing and monitoring people who have recently been in contact with a Covid patient in order to keep the spread of the virus further. In general, the method detects the ill person 14 days after the exposure.

If implemented completely, this approach has the potential to break the chain of transference of the present new coronavirus and suppress the epidemic by increasing options for effective controls and assisting in the reduction of the contemporary pandemic's scope. In this regard, a method of digital contact tracing with a mobile application is available in many affected countries, leveraging a variety of technologies such as GPS, Bluetooth, and smartphone tracking data. The digital contact tracing method is substantially faster than the non-digital technique and may be completed virtually in real time. All these digital apps are intended to capture an individual’s personal details, which will be processed by Machine Learning algorithms and techniques to identify people who are at risk to the new virus owing to their recent string of interactions.

1.3 Company Profile

Insurance, healthcare, banking and financial services, media, retail, and other industries are served by EXL Service, a worldwide analytics and digital solutions firm. The company's headquarters are situated in New York, and it employs over **30,000+** people across various countries and continents.

Vikram Talwar and Rohit Kapoor co-founded EXL in the year 1999. Vikram Talwar served the company as CEO as well as a vice-chairman after the company was founded in year 1999. Rohit Kapoor is the company's CEO as well as the vice-chairman of the company at the moment. Kapoor has previously held the post of president of the corporation. Conseco bought EXL in August 2001 and ran it as a completely owned subsidiary. Conseco sold the firm to Oak Hill Capital Partners and FTVentures in 2002. On October 20, 2006, the company's shares began trading on the NASDAQ market under the ticker EXLS.

With the purchase of peer business Inductis, EXL embarked along the route of expansion through acquisitions shortly before its NASDAQ debut. This acquisition was made to diversify EXL's income stream; previous to the acquisition, business process outsourcing (BPO) accounted for 90% of EXL's revenue; after the acquisition, BPO accounted for 70% of EXL's revenue, with the rest coming from research and analytics and advisory services. Through the acquisition of OPI in 2011, EXL increased their distribution reach in Eastern Europe and Southeast Asia. EXL was said to have planned a massive purchase spree in the US healthcare business in 2013, in response to the Affordable Care Act's inception and demand that all Americans have health insurance. The healthcare market accounted for around 10% of EXL's revenue at the time of this study in 2013.

EXL set foot in Latin America in 2014 by the way of a strategic joint venture with CT&S, which paired EXL's technical prowess with CT&S's local understanding and brand image. EXL's escalating client base for Spanish-language services was also amplified by this joint venture. EXL expanded its healthcare analytics capabilities by acquiring SCIOInspire Holdings in 2018.EXL purchased Clairvoyant in 2021, gaining scale in data, artificial intelligence, and cloud engineering.

1.4 Dissertation Organization

The remaining dissertation is arranged as follows:

Chapter 1: Introduction

In first chapter the part includes the description of the project i.e., what is the need of this project, what are the tools required to develop this project and what will be the outcome of this project. Second part includes brief introduction about the company and domain in which this project is based on. Third part includes the technical features of this project.

Chapter 2: Literature Survey

It consists of four segments where the first part discusses about any literature survey done with respect to content related to the project. The second part is about the existing & proposed systems. The tools & technologies used for project will be third and the requirements of hardware & software for running the project is the fourth segment

Chapter 3: Software Requirement Specification

In third chapter the first part includes the brief introduction of the project, abbreviations used while writing the document and overview of the project. The second part includes functional requirements i.e., the modules used in the project and what will be the input, processing and output of each module. It also includes non-functional requirements, design constraints i.e., hardware limitations and software compliance.

Chapter 4: System Design

Chapter 4 is all about system design i.e., a bigger view of the project on a large scale by explaining the problem and specifying the modules

Chapter 5: Detailed Design Fifth chapter includes the description of the detailed design. It includes object modelling which contain class diagram for the project, dynamic modelling which contains use case diagram, sequence diagram and activity diagram, functional modelling which contain data flow diagrams. These diagrams are included to describe the flow of the project.

Chapter 6: Implementation

This chapter provides code snippets related to the project & an explanation to implementation of the modules along with screenshots is given.

Chapter 7: Testing

Seventh chapter includes testing. It includes test cases for each module. This chapter include one failed test case.

Chapter 8: Conclusion

This chapter tells the whole summary of the project, comparison of existing system and proposed system and what all new things have been implemented.

Chapter 9: Future Enhancements

This chapter gives any future works/improvements that can be implemented in the future to improve and enhance the overall efficiency of the project.

CHAPTER 2

LITERATURE REVIEW

2.1 Literature Survey

Individuals' Rustam, F., Reshi, A., and Mehmood, "COVID-19 Future Forecasting Using Supervised Machine Learning Models", Machine learning (ML)-based forecasting techniques have demonstrated their use in predicting perioperative outcomes and improving decision-making about future actions. Many application fields that required the detection and prioritization of adverse aspects for a threat have long used machine learning models. The research shows that machine learning algorithms can predict the number of patients who would be afflicted by COVID-19, which is now regarded as a possible threat to humanity. Each of the models makes three types of predictions: the number of newly infected cases, the number of fatalities, and the number of recoveries the next ten days The study's findings show that using these strategies in the current COVID-19 pandemic scenario is a promising mechanism [1].

"Regression Analysis of COVID-19 Using Machine Learning Algorithms," with the guide of utilizing Ekta Gambhir, Ritika Jain, Alankrit Gupta, and Uma Tomer (2020). The original Coronavirus keeps on being an approaching danger to general wellbeing, and dropping down in records as one of the worldwide's most terrible pandemics is going. The expectation is to offer donors an additional a skill of the manner in which unique Machine Learning designs is most likely used in genuine worldwide situations. This concentrates moreover looks at the overarching design or test of Covid-19 transmission in India, further to the overall numbers. This analyze utilizes records from the Indian Ministry of H(health)F(Family)Welfare to give severa advancements and styles situated in different components of the worldwide. The records for this inspect become accumulated over a span of 154 days. The kind of dataset is the reason relapse assessment become chosen for the current day inconvenience proclamation. Since the dataset is relentless, relapse assessment is top of the line ideal for foreseeing a constant laid out factor from a fixed of fair-minded factors [2]. M. A. Sarwar, N. Kamal, W. Hamid, and M. A. Shah (2018, September). "In Healthcare, Prediction of Diabetes

Using Machine Learning Algorithms." In a variety of industries, machine learning techniques are utilised to do predictive analytics over massive data. Predictive analytics in healthcare is a difficult task, but it can ultimately assist practitioners in making timely decisions regarding a patient's health and treatment based on huge data. This study examines predictive analytics in healthcare, and it employs six different machine learning algorithms. A dataset of a patient's medical record is gathered for the experiment, and six different machine learning algorithms are applied to the dataset. The performance and accuracy of the algorithms used are compared and reviewed. The various machine learning approaches employed in this study are compared. A new study indicates which algorithm is superior for diabetes prediction. The goal is to use machine learning techniques to assist doctors and practitioners in the early detection of diabetes [3].

D. Dahiwade, G. Patle, and E. Meshram (2019, March). "Utilizing a Machine Learning Approach to Design a Disease Prediction Model." People are inclined to a whole parcel of infirmities due to their living way of behaving and the US of the climate. Thus, foreseeing contamination at an early recognition will turn into a fundamental errand. Nonetheless, logical clinical specialists figure out it hard to make specific expectations dependent generally upon side effects and side effects. The most troublesome undertaking is productively foreseeing contamination. To treatment this issue, measurements mining plays a fundamental component in disease forecast. Clinical innovative information produces a magnificent measure of insights every year. The appropriate appraisal of clinical insights has been profited from early impacted character care because of the sped up measure of insights development withinside the clinical and medical services fields. Information mining uncovers stowed away examples the use of sickness measurements. measurements covered in a heap of clinical measurements. Where the predominant sickness forecast dependent totally upon the impacted person's side effects and side effects. For compelling ailment expectation, hence the K-Nearest Neighbor (KNN) and Convolutional Neural Network (CNN) framework concentrating on calculations. An assortment of disease side effects and side effects is needed for sickness expectation. For an exact visualization, the person's dwelling conduct and exam measurements are viewed as in this exquisite ailment expectation. The CNN set of guidelines has an exactness of 84.5 percent in exquisite sickness forecast, this is higher than the KNN approach. Furthermore, KNN makes some

higher memories and memory need than CNN. Subsequent to anticipating exquisite disease, this instrument can compute the gamble of rich sickness, showing whether or presently as of now not the gamble is lower or higher [4].

S. Subudhi, A. Verma, A. B. Patel, C. C. Hardin, M. J. Khandekar, H. Lee, et al (2021). In COVID-19, researchers compared machine learning methods for predicting ICU admission and death. Machine learning methods could help clinicians identify high-risk individuals because forecasting COVID-19's course is difficult. The results of 18 machine learning algorithms for predicting ICU admission and mortality in COVID-19 patients are compared in this study. The generated and internally validated models using COVID-19 patient data from the Mass General Brigham (MGB) Healthcare database, and then further evaluated them using temporally diverse individuals who presented to the ED between May and August 2020 (n = 1711). Ensemble-based models outperform traditional models, according to our findings. COVID-19 predicts 5-day ICU admission and 28-day death better than other model types. CRP, LDH, and O2 saturation were important for ICU admission models, but the most relevant factors for predicting mortality were eGFR 60 ml/min/1.73 m2 and neutrophil and lymphocyte percentages. Such models could aid clinical decision-making in the event of future infectious disease epidemics, such as COVID-19 [5].

"A Survey of Mathematical, Machine Learning, and Deep Learning Models for COVID-19 Transmission and Diagnosis," by C. C. John, V. Ponnusamy, S. K. Chandrasekaran, and R. Nandakumar, 2021. COVID-19 is a life-threatening virus with worldwide ramifications. Drugs and vaccines have yet to be found because the disease is caused by a new coronavirus with unknown gene information. For the time being, illness spread analysis and prediction using a mathematical and data-driven model will be extremely useful in initiating prevention and control measures such as lockdown and quarantine. Various mathematical and machine-learning methods have been suggested for assessing and predicting the spread. For a given circumstance, each model has its own set of constraints and benefits. To provide greater insight, this paper covers state-of-the-art mathematical models for COVID-19, including compartment models, statistical models, and machine learning models, in order to find an acceptable model for disease spread analysis. Furthermore, a precise COVID-19 diagnosis is another critical step in identifying the infected person and preventing further dissemination.

Because the virus is spreading quickly, there is a need for an automated diagnosis system that can manage a huge population. Diagnostic mechanisms based on deep learning and machine learning will be more appropriate for this purpose [6].

R. Sujath, J. M. Chatterjee, and A. E. Hassanien (2020). "A COVID-19 pandemic estimating form the use of device acquiring information on in India." With realities examination and realities mining, records and report time helps withinside the dynamic system principally founded absolutely on notable realities. The amount of realities to be had is colossal, making gathering records and removing an intriguing example from it a hard endeavor. The cutting edge realities on affirmed, recuperated, and downfall in India throughout a drawn out time span supports foreseeing and estimating the near predetermination. The rendition's exactness will be progressed through incorporate additional abilities including numerous clinics, the impacted individual's resistant framework, the patient's age, orientation, and the endeavors taken to struggle the unfurl of the ailment of the infection, etc, so one can offer total records. Starting today, it is imperative that yards to hold be severe and cautious in nature so one can address this fundamental condition through friendly partition, lockdown, time limit, quarantine, and seclusion. One can likewise furthermore complete that the MLP strategy produces higher expectation results than the LR and VAR procedures using WEKA and Orange through looking through on the expected qualities and assessing them to models from John Hopkins UniversityFootnote11 realities. Thus one can utilize profound acquiring information on cycles to gauge time assortment realities withinside the predetermination to create higher forecasts [7].

Gupta, Rajan, Manan Bedi, Prashi Goyal, Srishti Wadhera, and Vaishnavi Verma are the people of the (2020). "Examination of COVID-19 Tracking Tool in India: Case Study of Aarogya Setu Mobile Application" Different states of their different countries are quickly developing COVID-19 checking stuff or contact-following applications. The Aarogya Setu instrument, progressed with the guide of utilizing the Indian specialists, is the worry of this analyze. It is a telephone programming progressed with the guide of involving the Ministry of Health as a piece of the E-Governance endeavor to tune and show Indian residents withinside the battle towards the unfurl of COVID-19. The look's at will probably learn about the apparatus' severa abilities and to give assorted measurements innovation ideas utilized withinside the product,

notwithstanding the device's value in taking care of the proceeding with pandemic. At the point when an individual is near a COVID-19 excited individual, the application utilizes Bluetooth and GPS period to tell them. To investigate COVID-19 unfurl in India, the product utilizes various Data Science ideas comprising of order, alliance rule mining, and bunching. The look at moreover shows possible moves up to the program, comprising of utilizing AI and PC creative and judicious to go over COVID-19 patients. Versatile period subject matter experts, measurements innovation experts, logical specialists, wellbeing related forefront representatives, public overseers, and specialists officials could all partake in the examination [8].

J. Berglund, J. Berglund, J. Berglund, J. Berglund "There's an App for That: COVID-19 Tracking" Vice President Mike Pence advised the snap in March 2020, sooner than COVID-19 laid proclaim to the United States, at the Covid pestilence, which on the time turned into a threat to travelers on board the Grand Princess journey convey secured off the bank of California [1]. Cases had ascended in Iran, Italy, and Spain on the time, but the disorder turned out to be regardless a spine chiller to most extreme Americans. At the point when mentioned roughly a possible episode in Washington, D.C., Vice President Mike Pence alluded the subject to Dr. Anthony Fauci, top of the National Institute for Allergy and Infectious Disease and an individual from America a Task Force. Fauci expressed that each and every individual who inspected great for the affliction could be exposed to contact following, which he characterized as "the overall population wellness weapon" for halting episodes. The World Health Organization proclaimed a global pandemic now at this point not extended later, and the infection began to unfurl all through the country [9].

C. Sandeepa, C. Moremada, N. Dissanayaka, T. Gamage, and M. Liyanage. Sandeepa, C., Moremada, C., Dissanayaka, N., Gamage, T., and Liyanage, M. (2020, September). "A System for Tracking Social Interactions and Predicting Potential COVID-19 Patients" Allowing for proper social distancing and isolation or confinement to identify possible patients is the greatest strategy to prevent the virus from spreading quickly. Because the virus has a 14-day incubation period, it's critical to track all social interactions during that time and place such potential patients in social isolation. For the time being, however, proper social interaction tracking systems and patient prediction algorithms based on this data are lacking. This study looks at how to track users' social

interactions and forecast infection risk based on such interactions. So in beginning a social contact tracking system based on BLE (Bluetooth Low Energy) and GPS was developed. Then, using the obtained data, an algorithm was created to estimate the likelihood of becoming infected with COVID-19. Finally, a system prototype with a mobile app and a web monitoring tool is implemented. In addition, then a graph-based model was to simulate the system and assess the behaviour of the proposed algorithm, which confirms that self-isolation is significant in slowing illness progression [10].

R. Mallik, D. Sing, and R. Bandyopadhyay (2020). "GPS Tracking App for Police to Track COVID-19 Patients for Safe Distancing." Traffic congestion is unavoidable in places with high population density, such as Bengaluru and Mumbai. According to the TomTom traffic index for 2019, Bengaluru is the world's most congested city, with Mumbai in fourth place. Transporting a COVID-19 patient between two locations quickly during a traffic jam could be difficult. The position information of an ambulance transporting COVID-19 patients may be valuable to traffic cops in isolating the ambulance from crowded areas and directing them to clear roads, allowing the patients to be relocated more quickly [11].

S. Saha, S. Maity, T. Bhattacharyya, T. Bhattacharyy (2021, February). "An Application Based on GPS Tracking and QR Code Scanner to Assist Health Workers and Ordinary Citizens During Covid-19" The pollution expense unleashed obliteration over the world, first influencing European global areas lastly the United States. Thus, on this work, so the suggestion was to develop a product program utility that gathers individual records to process the risk principally based absolutely at the merits of a re-did overview, provoking the individual to confirm assuming they might be encountering any medicinally settled side effects, after which sends it to the area civil center. Thus, the requirement for logical workers to move house to house on a customary premise, gambling with tainting, can be diminished. This product program comprises of GPS following, a danger stage forecast, a contamination diagram, and the ability to compute logical earnestness, among various things. Basically, our gadget is intended to direct consistently representatives and go to places in high-peril circumstances. This proposed period is utilized to confine capacity suggestive and asymptomatic clients from getting into public spots comprehensive of division shops and markets in area of interest zones. The product program will create a totally extraordinary QR code for each individual, for

you to show their all around certainly worth basically founded absolutely on a mandatory study to conclude whether or presently no longer they might be impacted [12].

2.2 Existing and Proposed System

2.2.1 Problem statement

The health sector is always in need of new technology, whether it's in the shape of gear or software that can do important jobs. When Covid struck, there was no means to fight the disease or even tell if someone was sick or not, which was a critical period for the health domain. During the Covid-19 epidemic, the number of persons infected worldwide increased dramatically, with the majority of those infected coming into touch with people who were already infected or showing symptoms.

2.2.2 Scope of Project

Machine learning is a cutting-edge method with numerous applications in prediction. For the COVID pandemic, this technique must be used to detect high-risk patients, persons who have come into touch with positives, and other abnormalities. Rather than a standard overtly calculation-based method, it gives accurate and valuable features. Furthermore, this technique is useful in predicting the danger of COVID in healthcare during this crisis. Machine learning considers risk factors such as age, location, and climate.

2.3 Tools and Technologies

Python

Python's design philosophy stresses code readability, as seen by the extensive usage of whitespace.All programming paradigms are supported, including structured programming (particularly procedural), object-oriented programming, and functional programming.

Jupyter

Jupyter is actually and interaactive computing environment that enables users to edit and run code from the browser,create and use interactive javascript widgets,author narrative text using markup languauge . It is a web-based interface that allows for rapid prototyping and sharing of data-related projects. It works with many kernels (this is the name given to the code env that it can run), including but not limited to Pyhton and R (even though its more famous and suited for Python). In the old days, it used to be called IPython Notebook but has been renamed and moved to the Jupyter project. Jupyter is an open-source project aiming at creating a better work experience for (data) scientists. You can learn more and get a better definition by browsing their website. Basically ,it allows you to program in a web browser-its a mix of code, instructions and output and all of this information is displayed inline in one web page which makes it very useful for writing a code that tells a story,also it provides a self contained record of computation that can be converted into various formats and shared using email ,dropbox ,version control system like github**.** First you have to understand the purpose of notebooks or notebook documents. These are documents in which you bring together code and rich text elements (figures, links, equations, …). In the case of Jupyter Notebook, these notebook documents can be produced by the Jupyter Notebook App. The use cases in which you need to join your code and rich text elements in one document are quite varied: you might be working on a data science project, or building your data science portfolio, or you're making a dashboard or an ETL flow, … You might also use Jupyter Notebook for research purposes. On a bigger scales, data science teams can use Jupyter Notebooks to collaborate on projects. These use cases explain why you saw a link to the Jupyter project on a Pandas page. As a data manipulation and analysis

package for Python, Pandas can really be used in most
(if not all) use cases that are described above. Nevertheless, you can also see why

Pandas isn't the only package that can come in handy in a data science project or a dashboard. According to your use case, you might resort to, for example, the other typical Python data science libraries that are out there. I would consider all that I have said before the basic use of the Jupyter Notebooks. You can do much more, as Jupyter Notebook also allow you to run many other languages, such as R, Julia, Scala, SAS, you can easily make a notebook document that contains code that is another programming language than Python and you can interactively switch between languages in your notebook documents.

CSV

A CSV is a comma-separated values record, which lets in records to be stored in a tabular format. CSVs seem like a garden-range spreadsheet however with a .csv extension.CSV documents may be used with maximum any spreadsheet program, together with Microsoft Excel or Google Spreadsheets. They fluctuate from different spreadsheet record kinds due to the fact you may best have a unmarried sheet in a record, they cannot keep cell, column, or row. Also, you can't now no longer keep formulation on this format.

Pygal

Pygal is an open-supply information visualization library in Python. It is one of the exceptional python libraries to create distinctly interactive plots and charts for unique datasets. Also, it lets in you to down load your visualizations in SVG (Scalable Vector Graphics) or PNG (Portable Graphics Format) for more than one programs and personalize it accordingly.

DBSCAN

Grouping evaluation or unquestionably Clustering is essentially an Unsupervised perusing technique that partitions the measurements components into various one-of-a-kind clumps or associations, to such an extent that the measurements

components withinside similar associations have comparative homes and measurements components in unmistakable associations have particular homes in some sense. It comprises of numerous unmistakable techniques put together absolutely for the most part with respect to differential advancement. For example K-Means (distance among components), Affinity proliferation (chart distance), Mean-shift (distance among components), DBSCAN (distance among closest components), Gaussian blends (Mahalanobis distance to focuses), Spectral grouping (diagram distance) and so on. Essentially, all bunching procedures utilize a similar strategy for example first we compute similitudes and afterward we use it to group the insights components into associations or clusters. Here they equipped for cognizance on Density-based absolutely totally spatial grouping of utilizations with commotion (DBSCAN) bunching technique. Bunches are thick locales withinside the measurements space, isolated by means of districts of the lower thickness of components. The DBSCAN set of strategies is put together absolutely totally with respect to this natural idea of "bunches" and "commotion". The key thought is that for every component of a group, the organization of a given range needs to envelop basically a base measure of components.

Pandas

Pandas may be a software program library written for the Python programming language for statistics manipulation and evaluation. Particularly, it gives statistics systems and operations for manipulating numerical tables and statistic. It's unfastened software program launched below the three-clause BSD license. the decision is derived from the time period "panel statistics", a stochastics period of time for statistics units that consist of observations over more than one-time durations for the equal individuals. Its call may be a play at the phrase "Python statistics evaluation" itself. Wes McKinney began out constructing what might grow to be pandas at AQR Capital whilst he changed into a researcher there from 2007 to 2010. Pandas is especially used for statistics evaluation and related manipulation of tabular statistics in Dataframes. Pandas lets in uploading statistics from numerous report codecs which include CSV, JavaScript Object Notation, Parquet, SQL, and MS Excel. Pandas lets in numerous statistics manipulation operations which include merging, reshaping, selecting, in addition to statistics cleaning, and statistics wrangling functions. The improvement of pandas brought into

Python many similar functions of operating with Dataframes that have been installed withinside the R programming language. The

pandas library is made upon some other library named NumPy, that's orientated to effectively operating with arrays in preference to the functions of operating on Dataframes.

Numpy

NumPy can be a library for the Python programming language, as well as working with huge, multi-faceted clusters and grids, joined with an enormous arrangement of undeniable level numerical capacities to perform on such exhibits. . NumPy's connection, Numeric, was initially made with the assistance of Jim Hugunin's work with commitments from totally various engineers. In 2005, Travis Oliphant made NumPy utilizing the coordination of Numarray contender capacities into Numeric, with significant changes. NumPy is an open source programming framework program and has various benefactors. NumPy is an undertaking upheld by NumFOCUS in charge matters. NumPy is focused on Python's CPython reference execution, for example an enhanced bytecode translator. Math calculations composed for this Python model frequently run a horrendously related stack more slow than incorporated identical calculations because of absence of compiler enhancement. NumPy takes care of the issue of gradualness with the assistance of four-layered cluster mining, abilities and administrators that function admirably on exhibits; utilizing them joins code altering, predominantly inward circles, utilizing NumPy. Mining NumPy in Python gives MATLAB happiness for however long they are deciphered, permitting anybody to compose quick applications as long as most tasks are performed on exhibits or grids and not on aimless. By examination, MATLAB has a ton of extra toolboxs, including Simulink, while NumPy itself is coordinated with Python, a stylish and extensive extra programming language. Moreover, extra Python programs are accessible; SciPy can be a library with extra MATLAB-like capacities, and Matplotlib is a plotting bundle that gives MATLAB-like plotting abilities. Inside, each MATLAB and NumPy depends on BLAS and LAPACK for unpracticed arithmetical calculation. Python ties of the broadly utilized and required local scratch pad library OpenCV utilizes NumPy exhibits to store and perform measurements. Since pictures with more than one channel are in a real sense drawn as third-layered exhibits, ordering, falling, or overlaying completely

various clusters are seriously unpracticed ways to deal with creating extraordinary pixel consents for a photograph. NumPy outlines as day to day details in OpenCV for shots, mined execution scores, portion separating and more that
significantly improve on programming and troubleshooting processes.

2.4 Hardware and Software Requirements

2.4.1 Hardware requirements

- Processor: Intel® Core™ i3 processor, Ryzen 3 or above
- Hard Disk: 500 GB or above
- Memory (RAM): minimum 2GB
- Ethernet connection (LAN) or wireless adapter (WiFi)
- Graphical Processing Unit (GPU) 1050 Ti or above

2.4.2 Software requirements

- Operating System – Window 8-10, Linux 18.0
- Browser – Chrome v101.0.4951.54, Microsoft Edge
  v100.0.1185.39
- Programming languages – Python 3.6.0 or above
- Visualization tools – Seaborn 0.11.2, Matplotlib 0.11.0

CHAPTER 3

SOFTWARE REQUIREMENT SPECIFICATION

3.1 Introduction

A software program necessities specification is a documentation that includes an in depth description of the capability of the machine. The Software Requirement Specification (SRS) level of software program improvement is wherein the necessities of the machine beneath attention are documented with a purpose to lay the muse for the software program improvement activities. Consistency, completeness of all important necessities and their definitions, and correctness are all traits of a valid SRS document. This chapter gives an in-depth description of the proposed machine in addition to its predicted results. The machine's definitions, widespread product description and functions, person characteristics, purposeful and non-purposeful requirements, and machine hassle constraints are all protected in the specification.

3.1.1 Definitions, Acronyms and Abbreviations

np – Numpy

pd – Pandas

DBSCAN – Density Based Clustering

CSV – Comma Seperated Values

3.2 General Description

The work-flow of the system is presented in this section, which includes the product description, product functions, system user characteristics, general constraints, and assumptions.

3.2.1 Product Description

The product will be able to help medical professionals to find a particular covid patient and analyze the gravity of the situation by checking for other individuals who came in close contact with them, to further widen their search they will be able to check which one of them were already infected and who wasn't, thus in such cases they will be able to prevent the disease from spreading and also by taking the further necessary measures.

Let's check in-depth, the product will choose a random id of an infected individual particularly and plot it on a graph, further the id and date of the infected individual will be used to locate which cluster he/she belongs to which further helps to narrow down the search and one will get the list of people who came in close contact to them, which later will be used to check which of them were already infected and which ones aren't, lastly it will also predict the probability of them being infected after they directly or indirectly came in contact with the patient/patients.

3.2.2 Product Functions

Locating covid patients – How well can the developed system locate an individual.

Locate people who came in contact with the patient – The system should be able to locate the other people who came in contact with the patient within the given distance or radius.

Check if other people located were infected or not – To check for other patients among the clusters being formed.

Probability of person getting infected – To find the probability of the non-infected person of getting infected after coming in contact to the patient

3.2.3 User Characteristics

The system is used by the people who are medical professionals who provide medical and healthcare services. The user must be familiar with the patient details.

3.2.4 Assumptions and Dependencies

The user who will use this application should have the patient details with them along with an efficient device to smoothly rum ML algorithms.

3.3 Functional Requirements

3.3.1 Patient Tracking

Purpose: To locate the infected patient

Input: Latitude and Longitude

Function: Search for a particular patient

Output: Maps the searched patient's coordinates either in map or on the cluster

3.3.2 Infected Patient Diagnosis

Purpose: To locate people who possibly came in contact with the infected person and inform them

Input: 2 Latitudes and Longitudes

Function: Search through the mentioned coordinates and finds other people

Output: List of the people

3.3.3 Identification of probably infected patients

Purpose: To check whether the people located were infected themselves or not for further processing

Input: Person's name and id

Function: Checks whether the person is healthy or infected

Output: Gives details of the patient

3.3.4. Probability of people being infected

Purpose: To find the probability or percentage of the non-infected getting Covid

Input: Person's id

Function: Checks the level of the symptoms

Output: Gives a percentage value

3.4 Non-Functional Requirements

- **Performance**

Performance in terms of accuracy in finding/locating patients based on latitude and longitude.

- **Scalability**

Whether the system will be able to adapt to a different dataset with a different size. Should be able to handle 5000 sets of data up to 5000000 sets of data.

- **Accuracy**

The probability of the system being accurate is 96%.

3.5 Design Constraints

The system should have anaconda/python installed in it.

The system should have Jupyter notebook to run the ML code.

CHAPTER 4

SYSTEM DESIGN

System design provides an overview of the system's architecture, including how the system is connected internally, how work flows within the system, and the concept of complete system components.

4.1 Architectural design

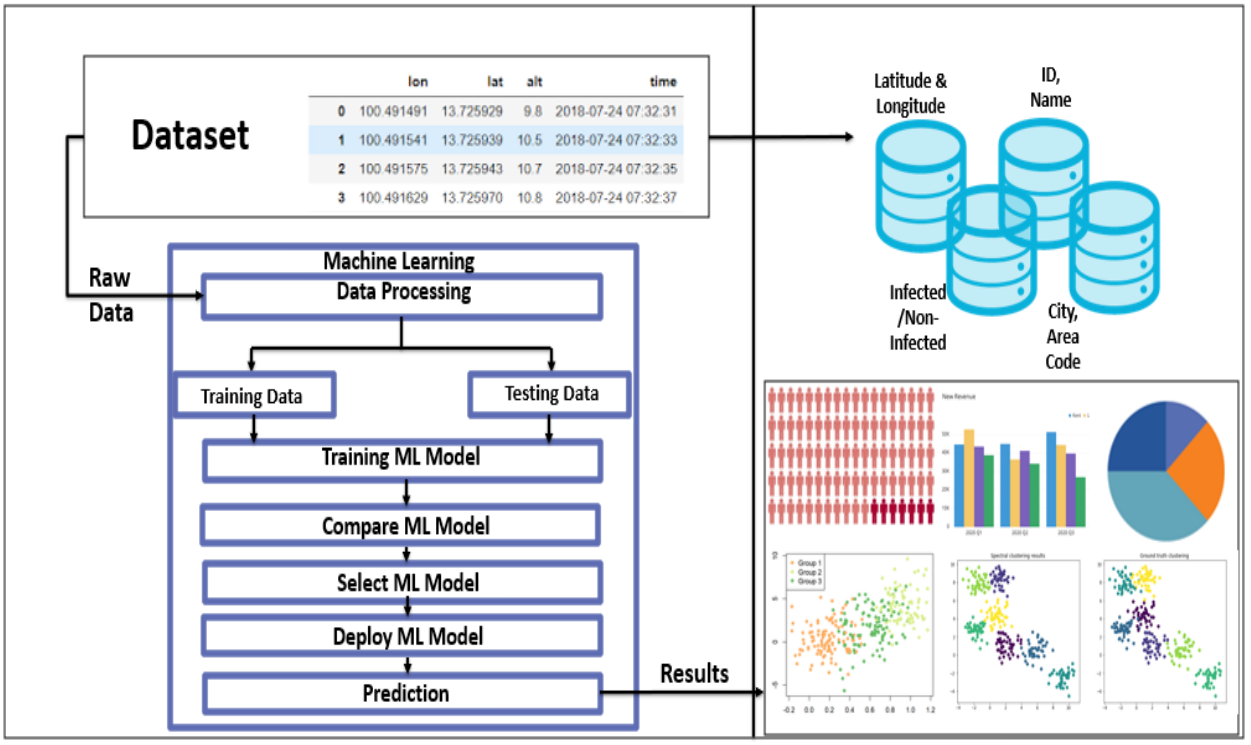


Fig 4.1 Architecture Diagram

Figure 4.1 shows the architecture of the proposed structure and how the system is going to be developed. It also shows the different components one to work with to completely built a Contact tracing model.

4.1.1 Problem Statement

The health sector is always in need of new technology, whether it's in the shape of gear or software that can do important jobs. When Covid struck, there was no means to fight the disease or even tell if someone was sick or not, which was a critical period for the health domain. During the Covid-19 epidemic, the number of persons infected worldwide increased dramatically, with the majority of those infected coming into touch with people who were already infected or showing symptoms.

4.1.2 Block Diagram

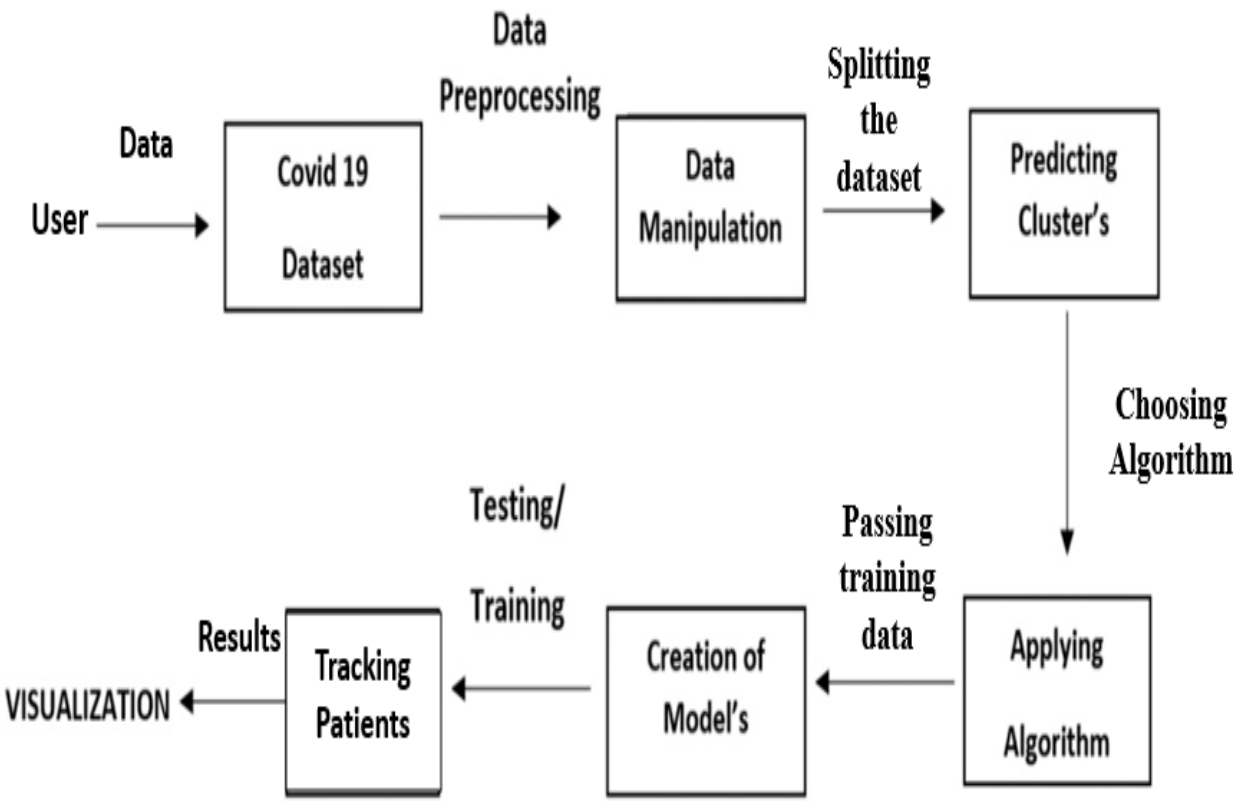


Fig 4.2 Block Diagram

Fig 4.2 shows the flow of the request from a user to the providing of patient details. When the service is requested by the user, it is accepted through the model built and the task is further performed to search who is nearest to the location of the patient.

4.1.3 Module Specification

Patient Tracking

Tracking Patient

Tracking Patient's whereabouts

Location patients using latitude and longitude

Infected Patient Diagnosis

Sorting individuals who came in contact with patient

Matching dates with that of patient

Checking whether other people are from the same cluster only

Identification of probably infected patients

List of patients who are infected

List of patients not infected

Probability of the non-infected patient of getting infected

Probability of person getting infected

Percentage value of the non-infected getting infected

The percentage value should be calculated depending on:

- Whether came in contact with patient or not
- The range of symptoms

4.2 Context Diagram

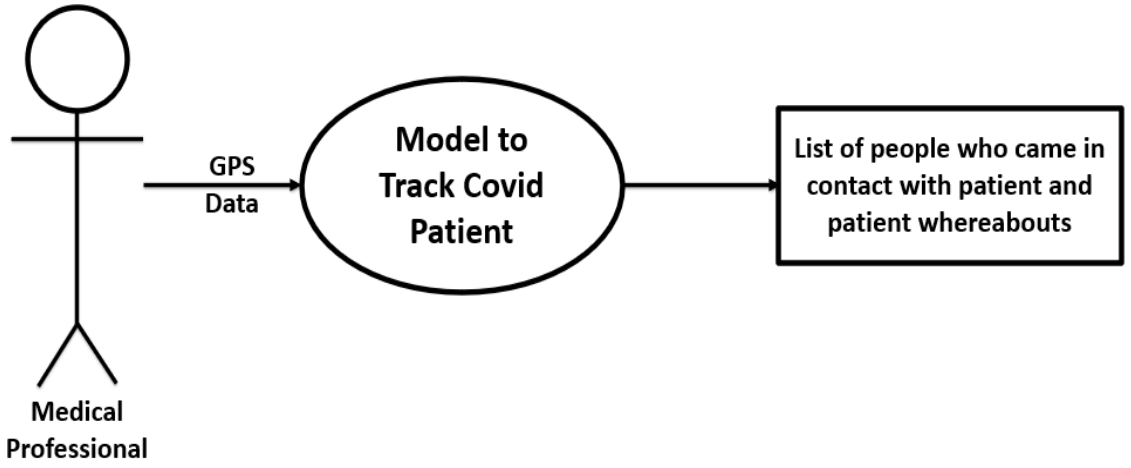


Fig 4.3 Context Diagram

Fig 4.3 shows the flow between the components of the system. This is a high-level diagram that shows the internal process that takes place when a user requests a service. The model provides service based on the GPS data passed. Once the data is available the clusters are formed and the model searches for the patient and other individuals.

CHAPTER 5

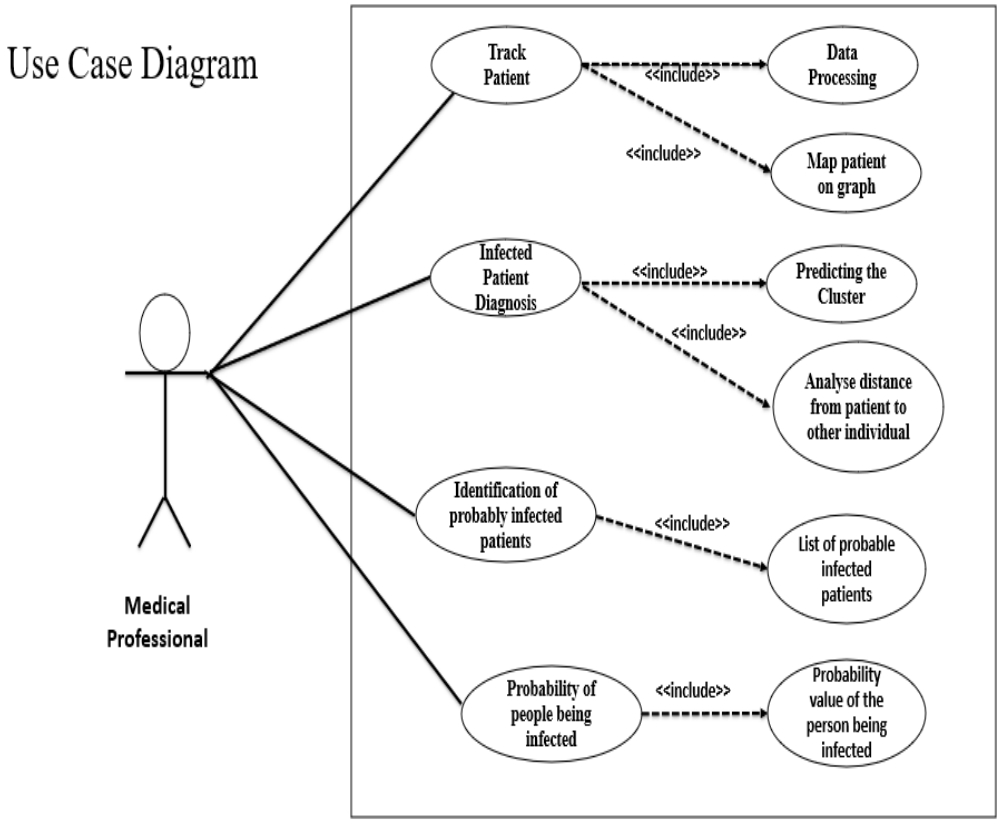
DETAILED DESIGNS

5.1 System Design

System design administer a sketch and analysis of the system's architecture, including how the system is connected internally, how work flows within the system, and the concept of complete system components.

5.1.2 Dynamic Modelling

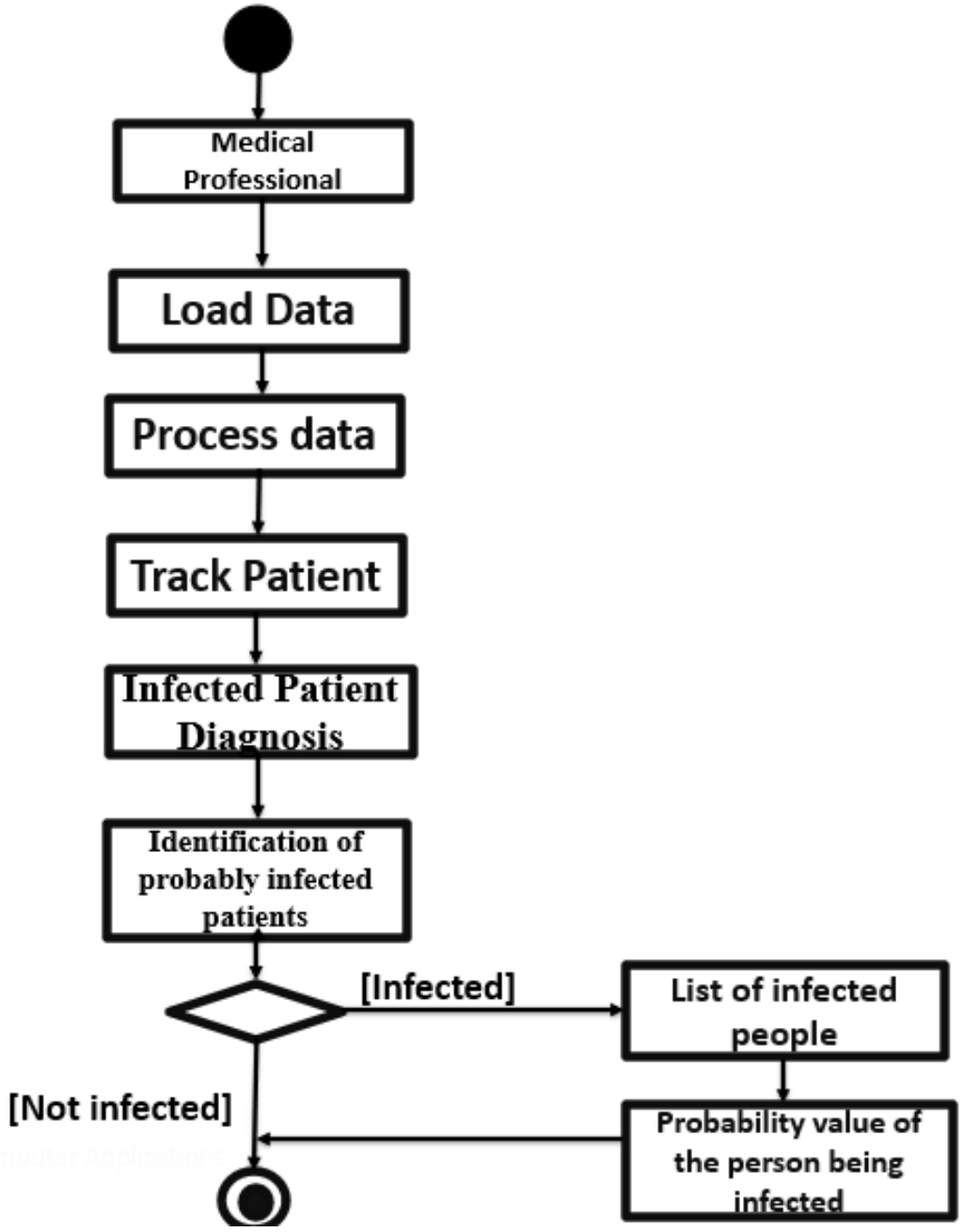
5.1.2.1 Use Case Diagram



5.1 Use-case Diagram

Fig 5.1 shows the actor, User, present in the system. The actor has specific functions to perform. The user tracks patients using the GPS data. They further diagnose the infected patient to check for people who came in contact with them. After which it checks among the other individuals who are infected and who aren't.

5.1.2.2 Activity Diagram



5.2 Activity Diagram

Fig 5.2 describes the activities that take place in the system. The activity starts when the User loads the data. After which they form clusters using ML algorithm, once the clusters are formed a random id is chosen and further used for processing.

5.1.2 Functional Modelling

5.1.2.1 Data Flow Diagram

Zero Level DFD

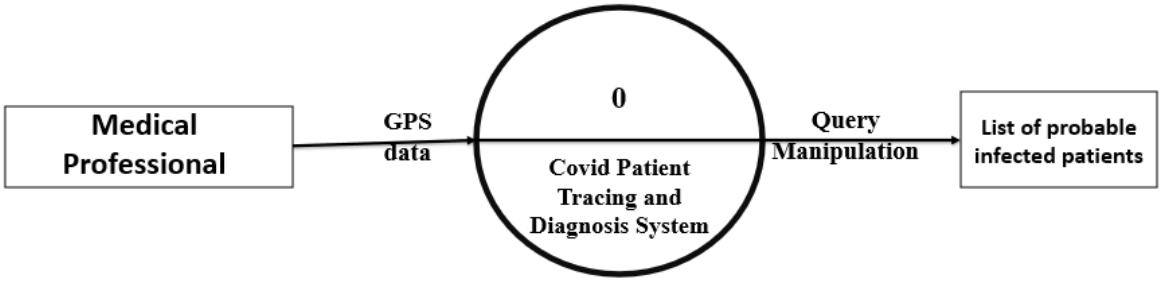


Fig 5.3 DFD Level-0

The fig. 5.3 shows the highest level of the DFD. The process involved when a user requests a patient to be tracked is shown.

First Level DFD

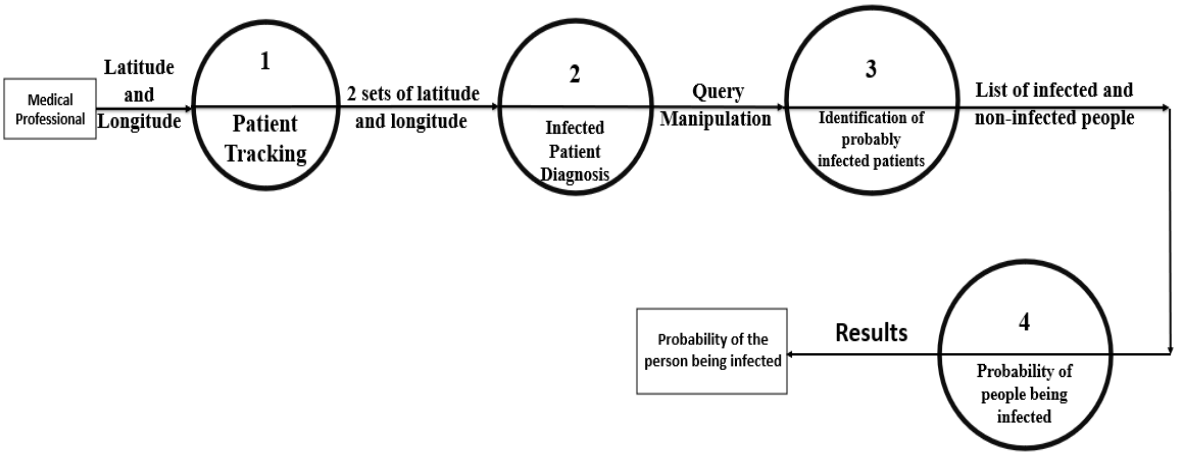


Fig 5.4 DFD Level-1

The fig. 5.4 shows the data flow between user, track patient, infected patient diagnosis and identification of probable infected patient. When the data is loaded by the user, the details of the patient is taken and the location is tracked. The patient information is transferred to the infected patient diagnosis. Once the patients are recognized the details are sent to the user.

Second Level DFD

Module Name: Patient Tracking

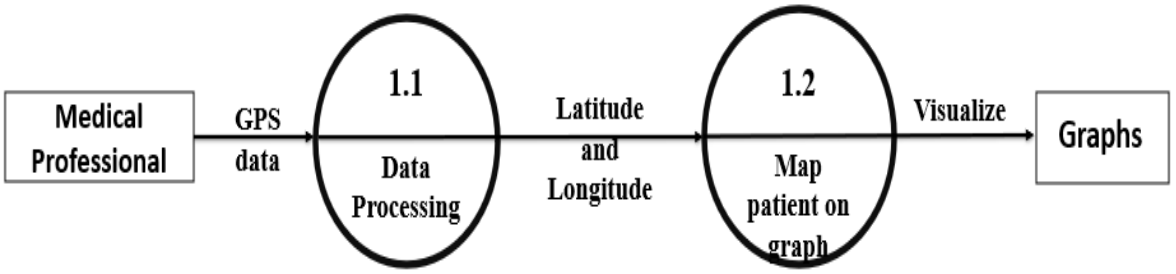


Fig 5.5 DFD Level-2 Patient Tracking

Module Name: Infected Patient Diagnosis

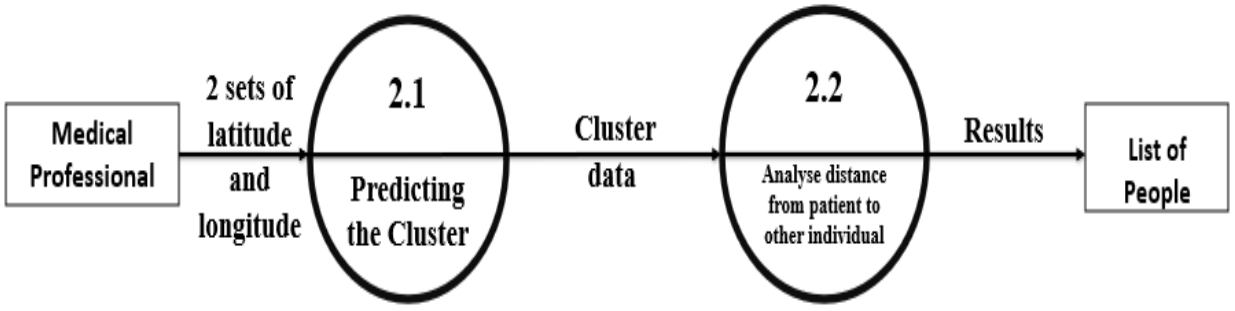


Fig 5.6 DFD Level-2 Infected Patient Diagnosis

Final Level DFD

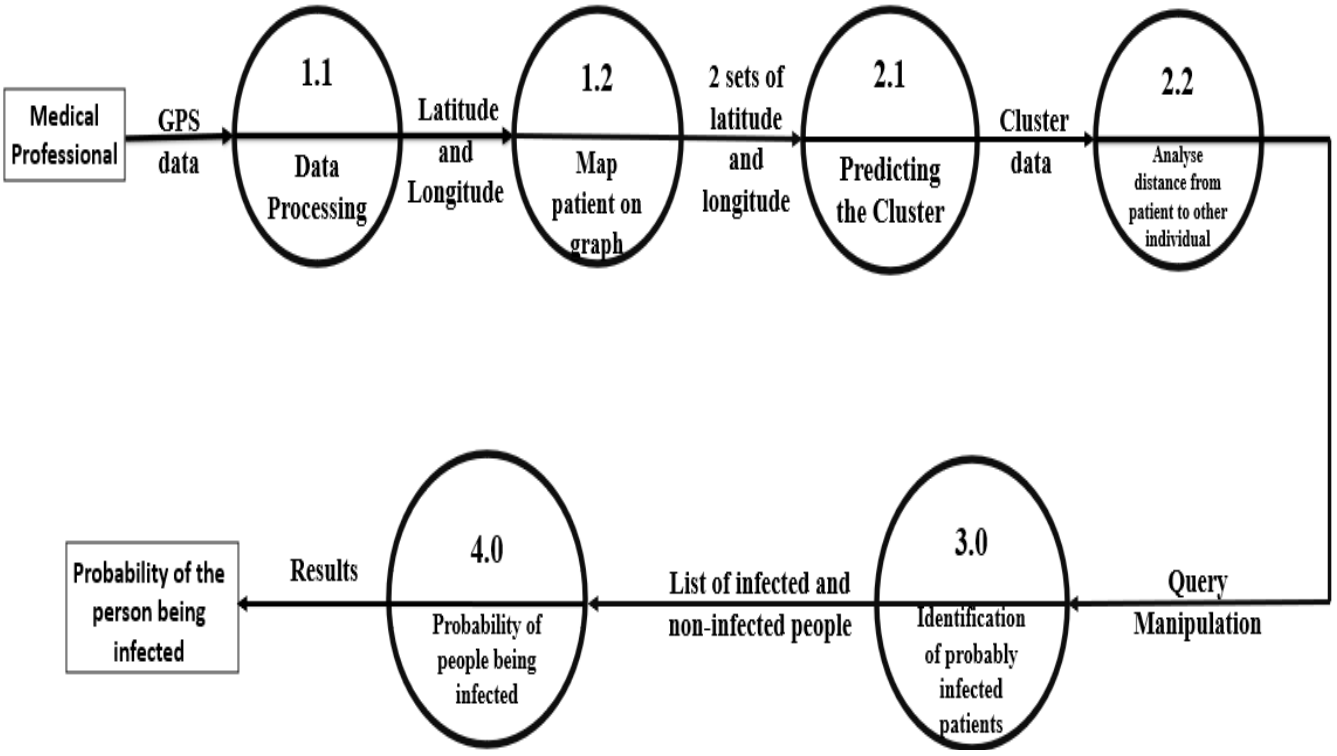


Fig 5.5 Final DFD

Fig 5.5 shows the next level of DFD that is the in-depth flow of data that takes place. The data that is flown from the user to the model, from the model to the patient diagnosis, from patient diagnosis to the identifying probable patients.

5.1.2.2 Sequence Diagram

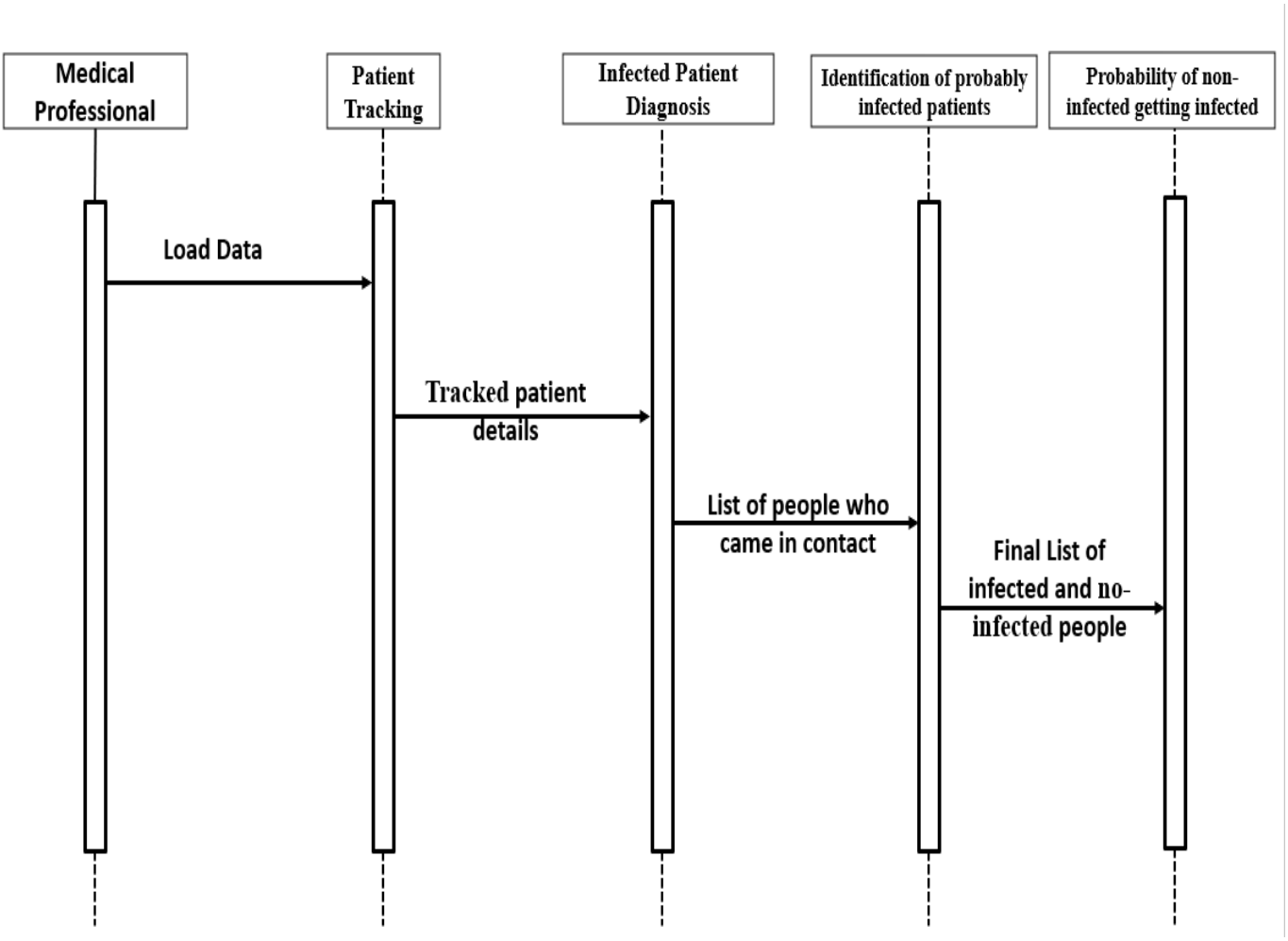


Fig 5.6 Sequence Diagram

Fig 5.6 gives a clear description of the data flow inside the Contact Tracing Mode

CHAPTER 6

IMPLEMENTATION

6.1 Code Snippets

DBSCAN

```
safedistance = (0.0018288/6371)
ls=[]
for date in data.Dates.unique():
    data1=data[data.Dates==date]
    print("Data shape : ",data1.shape[0])
    model = dbscan(eps=safedistance, min-samples=2, algorithm='ball-tree',
metric='haversine').fit(np.radians(data1[['lat', 'long']]))
    core-samples_mask = np.zeros_like(model.labels_, dtype=bool)
    core-samples-mask[model.core-sample-indices_] = True
    labels = model.labels_
    data1['Cluster'] = model.labels_.tolist()
    ls.append(data1)
data_final=pd.concat(ls,axis=0)
print("Final data shape : ", data_final.shape)
print (model.labels_)
```

Patient Tracking

```
# randomly find a number
import random

# random_id=random.randint(data_final1.id.min(),data_final1.id.max())
# random_id=random.choice(data_final1.id.tolist())
```

```
random_id=random.choice(data_final1.loc[data_final1.infected==True,'id'].tolist())

#find the cluster where he/she falls

random_id_cluster=data_final1[(data_final1.id==random_id)]
print(f"The random id is : {random_id} and belongs to cluster
{random_id_cluster['Cluster'].tolist()[0]}. Name :
{random_id_cluster['first_name'].tolist()[0]}. He was present on date
{random_id_cluster['Dates'].tolist()[0]}")
```

Infected Patient Diagnosis

```
cluster_req=data_final.loc[data_final.id==random_id,'Cluster'].tolist()[0]

infected_ids=data_final[(data_final.Dates==random_id_cluster['Dates'].tolist()[0]) &
(data_final.Cluster==cluster_req)]
infected_ids

disp-dict={}
lst=[]
for index, row in infected_ids.iterrows():
    if row['id'] !=random_id:
        lst.append((row['latitude'], row['longitude']))



xy-chart = pygal.XY(stroke=False)#,style=dark-lighten-style)

xy_chart.add(str(random_id_cluster['first_name'].tolist()[0]),
[(random_id_cluster['latitude'].tolist()[0], random_id_cluster['longitude'].tolist()[0])])
#other person
xy_chart.add("Infected",lst_infected)
```

```
xy_chart.add("Not Infected",lst_not_infected)
displays(HTML(base-html.format(rendered-chart=xy-chart.render(is-unicode=True)
)))
```

Identification of probably infected patients

```
infected_ids=data_final1[(data_final1.Dates==random_id_cluster['Dates'].tolist()[0])
& (data_final1.Cluster==random_id_cluster['Cluster'].tolist()[0])]
infected_ids
```

```
infected_ids=data_final1[(data_final1.Dates==random_id_cluster['Dates'].tolist()[0]) &
(data_final1.Cluster==random_id_cluster['Cluster'].tolist()[0]) &
(data_final1.infected==False) &  (data_final1.id!=random_id)]
infected_ids
```

```
infected_ids=data_final1[(data_final1.Dates==random_id_cluster['Dates'].tolist()[0]) &
(data_final1.Cluster==random_id_cluster['Cluster'].tolist()[0]) & (data_final1.infected==True)
&  (data_final1.id!=random_id)]
infected_ids
```

Probability of patient getting infected

```
cough=int(input("Cough Range : [Enter value between 1 and 5 , 1 being the
lowest and 5 being the highest] :"))

fever=int(input("Fever Range : [Enter value between 1 and 5 , 1 being the
lowest and 5 being the highest] :"))

breathe=int(input("Breathing Range : [Enter value between 1 and 5 , 1 being the
```

```
lowest and 5 being the highest] :"))
infected=input("In contact with infected? (y/n) :")
if infected.lower()=='y':
    infected=1
elif infected.lower()=='n':
    infected=0
else:
    print("Incorrect value entered. Please start again")

if infected==0 or infected==1:
    value=(cough+fever+breathe)/3*5
elif infected==1:
    value=((cough*2+fever2+breathe2)/(3*5)2)*0.5
print("The severity % is :",value)
[5:57 pm, 09/06/2022] Amar Chokher Bali: cough=int(input("Cough Range :
[Enter value between 1 and 5 , 1 being the lowest and 5 being the highest] :"))

fever=int(input("Fever Range : [Enter value between 1 and 5 , 1 being the lowest
and 5 being the highest] :"))

breathe=int(input("Breathing Range : [Enter value between 1 and 5 , 1 being the
lowest and 5 being the highest] :"))

infected=input("In contact with infected? (y/n) :")
if infected.lower()=='y':
    infected=1
elif infected.lower()=='n':
    infected=0
else:
```

```
    print("Incorrect value entered. Please start again")

if infected==0 or infected==1:
    value=(cough+fever+breathe)/3*5
elif infected==1:
    value=((cough * * 2+fever *  * 2+breathe * * 2)/(3 * 5 ) * * 2) * * 0.5
print("The severity % is :",value)
```

6.2 Implementation

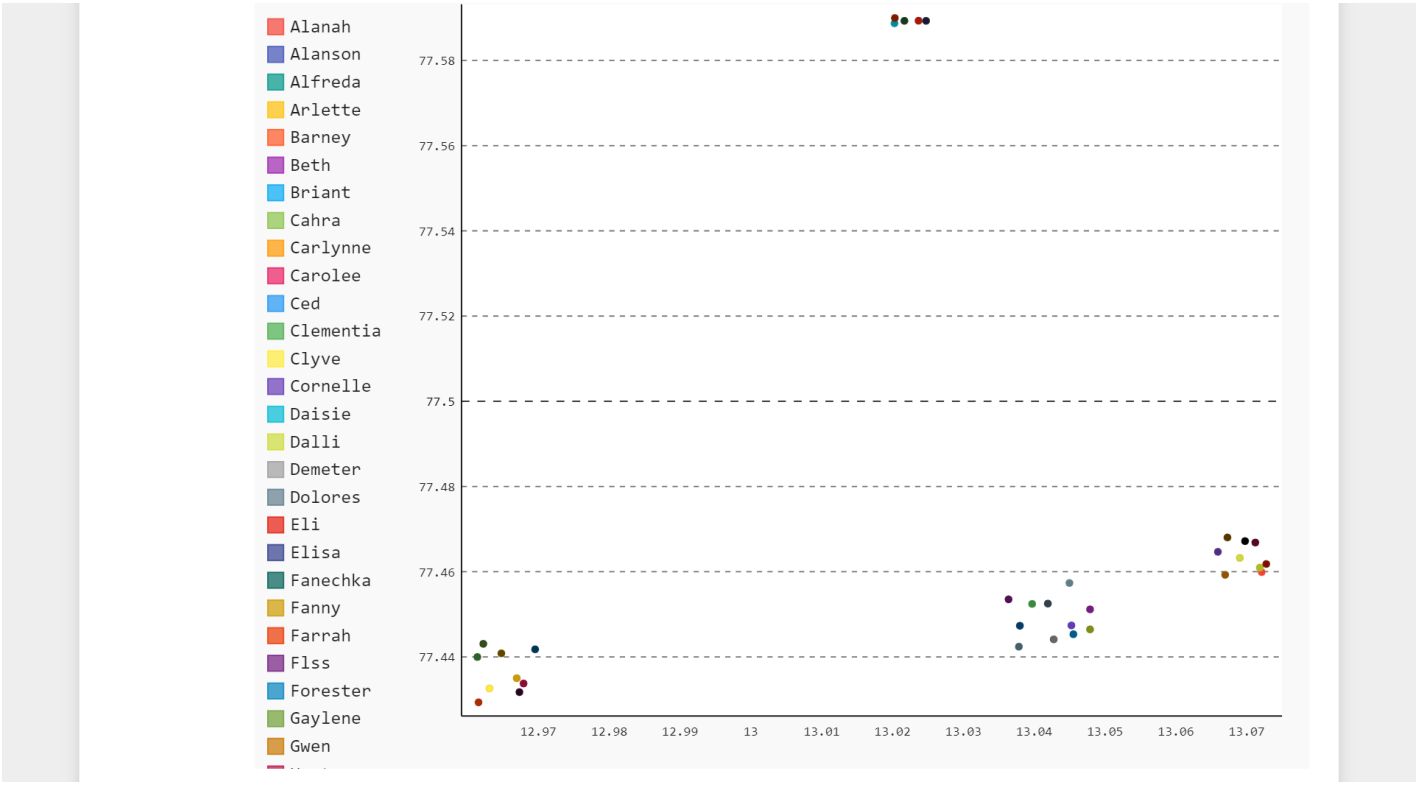


Fig 6.1 Clusters

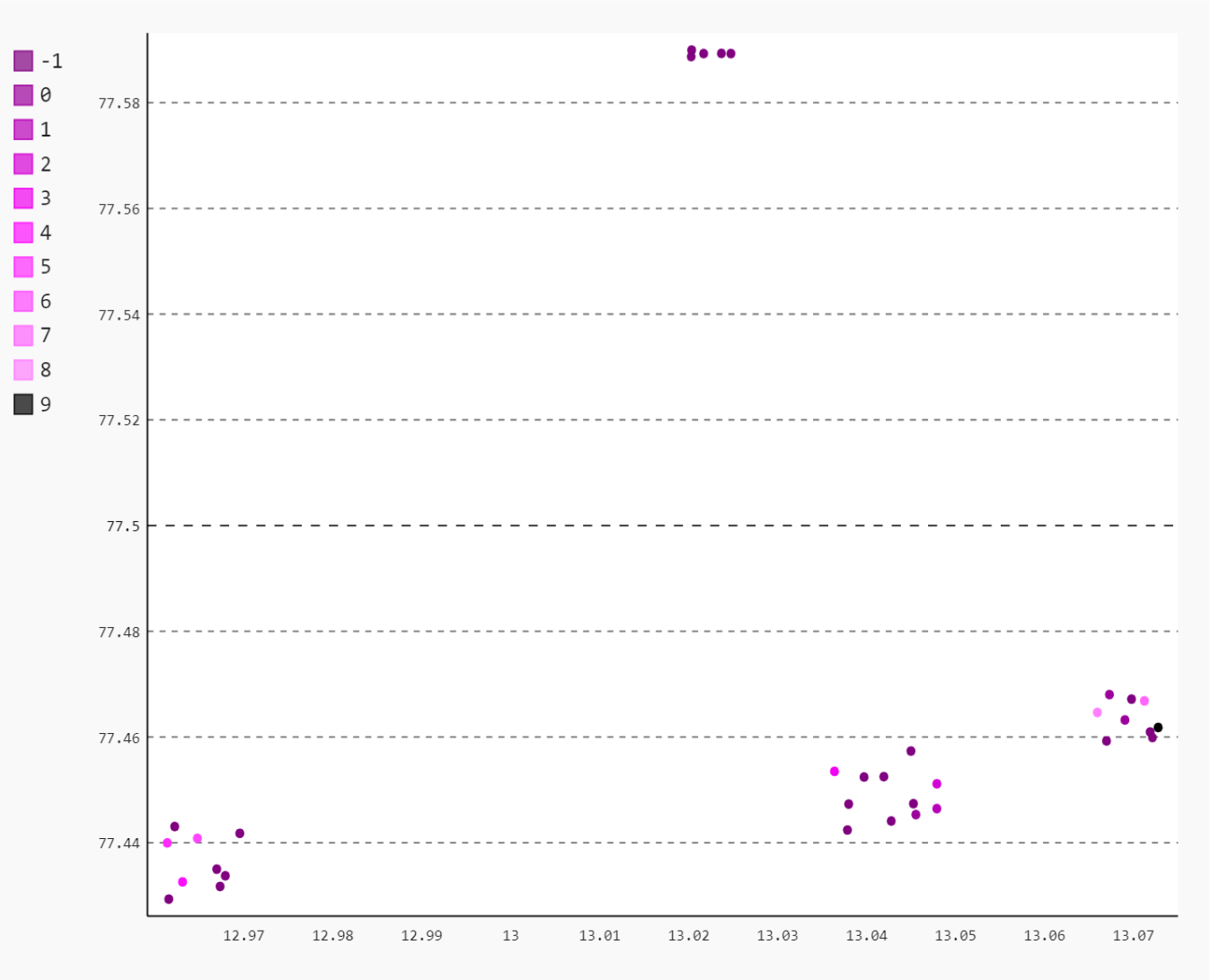


Fig 6.2 Clusters with noise

Fig 6.2 shows the clusters with a -1 cluster too which represents the outliers in the dataset and are needed to be removed, the numbers from 0 to 9 represents the clusters one actually need to work with the contact tracing.

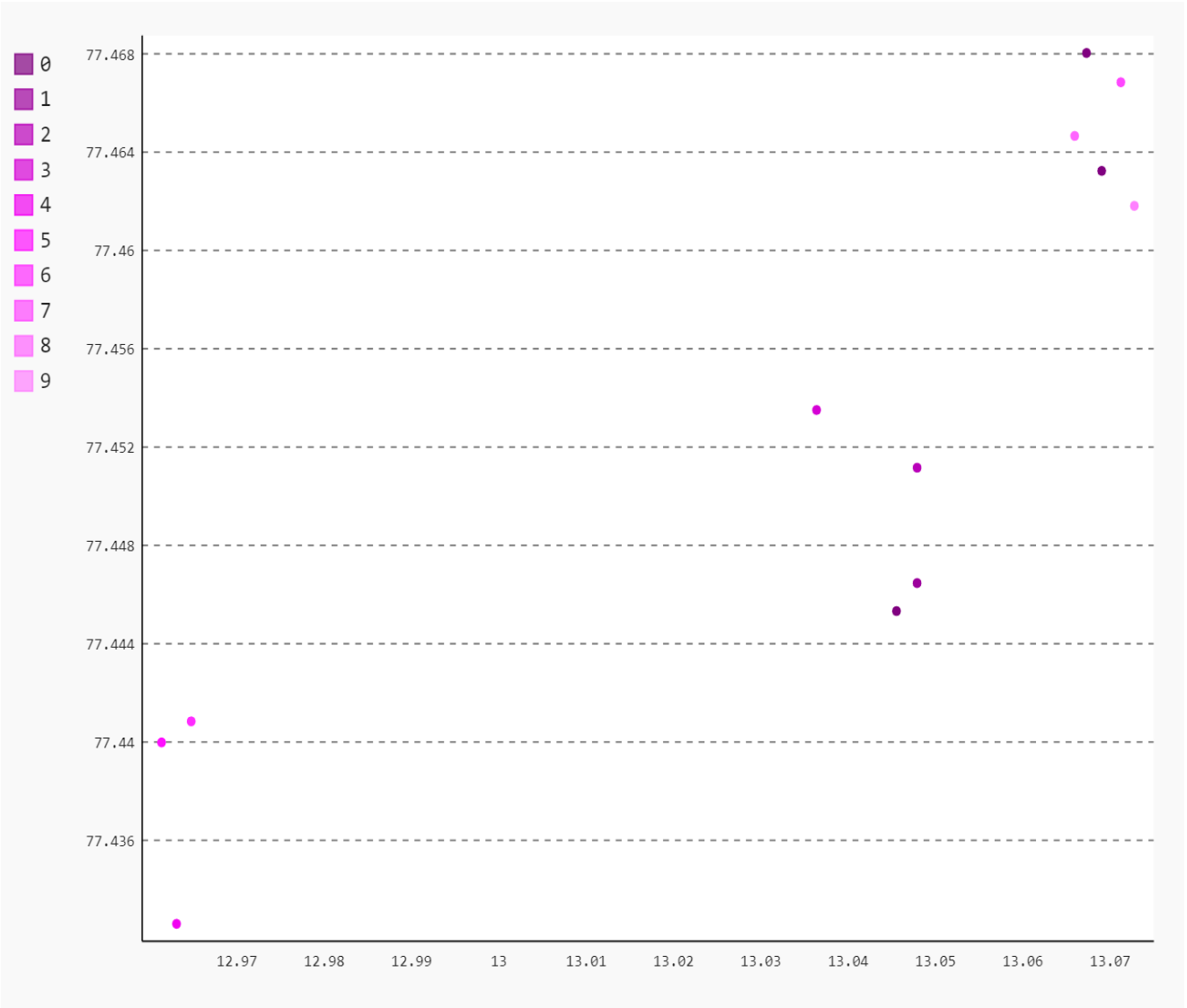


Fig 6.3 Clusters without noise

Fig 6.3. shows the final data and clusters without the outliers, thus after removing the -1 cluster the final cluster value is 10.

randomly find an id of the infected person

In [15]:
```
# randomly find a number
import random
# random_id=random.randint(data_final1.id.min(),data_final1.id.max())
# random_id=random.choice(data_final1.id.tolist())
random_id=random.choice(data_final1.loc[data_final1.infected==True,'id'].tolist())
#find the cluster where he/she falls
random_id_cluster=data_final1[(data_final1.id==random_id)]
print(f"The random id is : {random_id} and belongs to cluster {random_id_cluster['Cluster'].tolist()[0]}. Name : {random_id_c
```

```
The random id is : 364 and belongs to cluster 7. Name : Lexie. He was present on date 25-04-2022
```

Fig. 6.4 Choose Random id

Fig. 6.5 Plotting single Patient

Fig 6.5 shows the process of choosing a random patient and plotting that random patient on a graph using latitude and longitude.

```
In [111]: infected_ids=data_final[(data_final.Dates==random_id_cluster['Dates'].tolist()[0]) & (data_final.Cluster==cluster_req)]
          infected_ids
```

Out[111]:

	id	first_name	last_name	gender	Area	latitude	longitude	Dates	infected	full name	Cluster
21	213	Mordy	Wherrit	Male	Kadaranahalli	13.047887	77.446465	25-04-2022	True	Mordy Wherrit	0
22	214	Randa	Kynsey	Female	Kadaranahalli	13.047887	77.446465	25-04-2022	True	Randa Kynsey	0

Fig. 6.6 List of people who came in contact

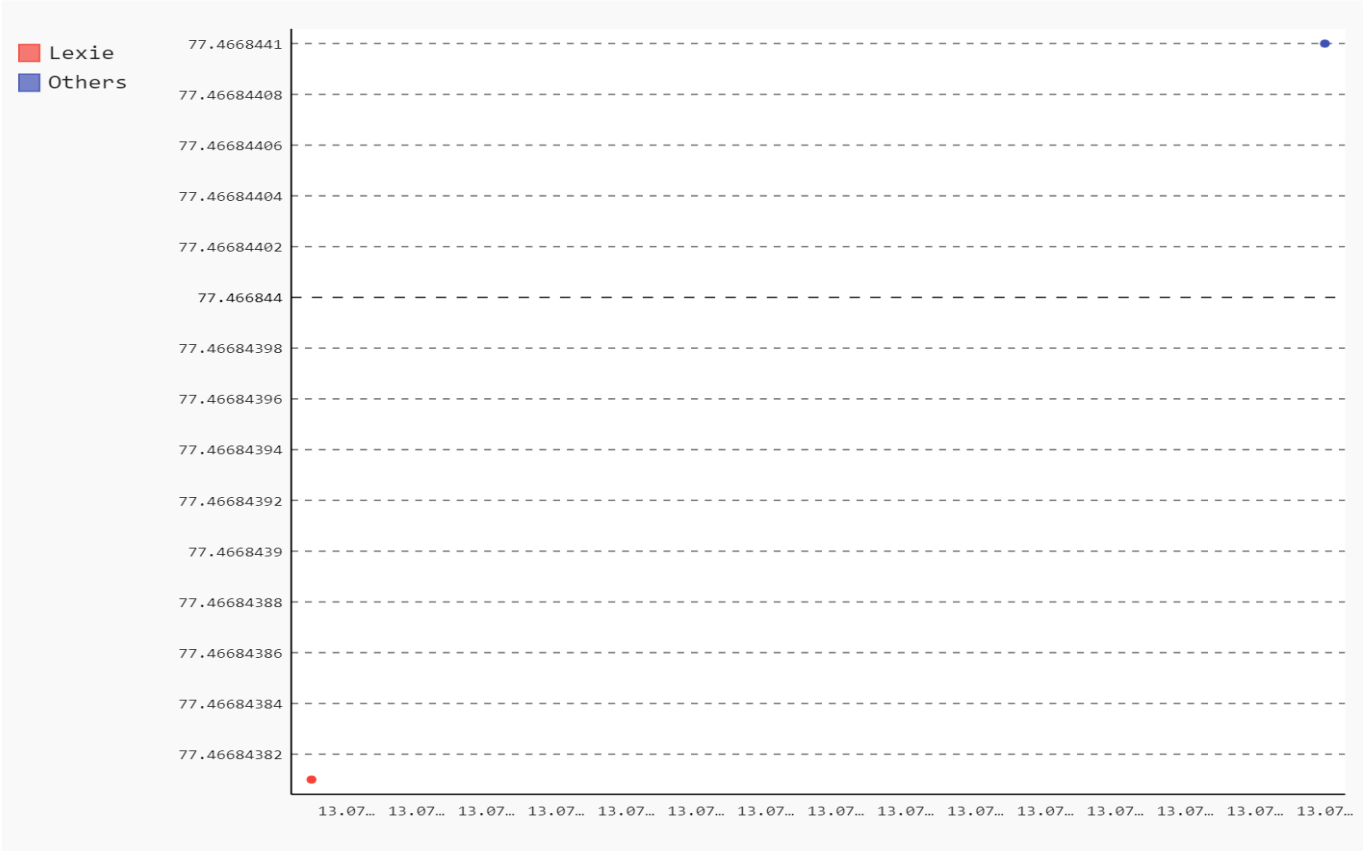


Fig. 6.7 Plotting newly identified individuals

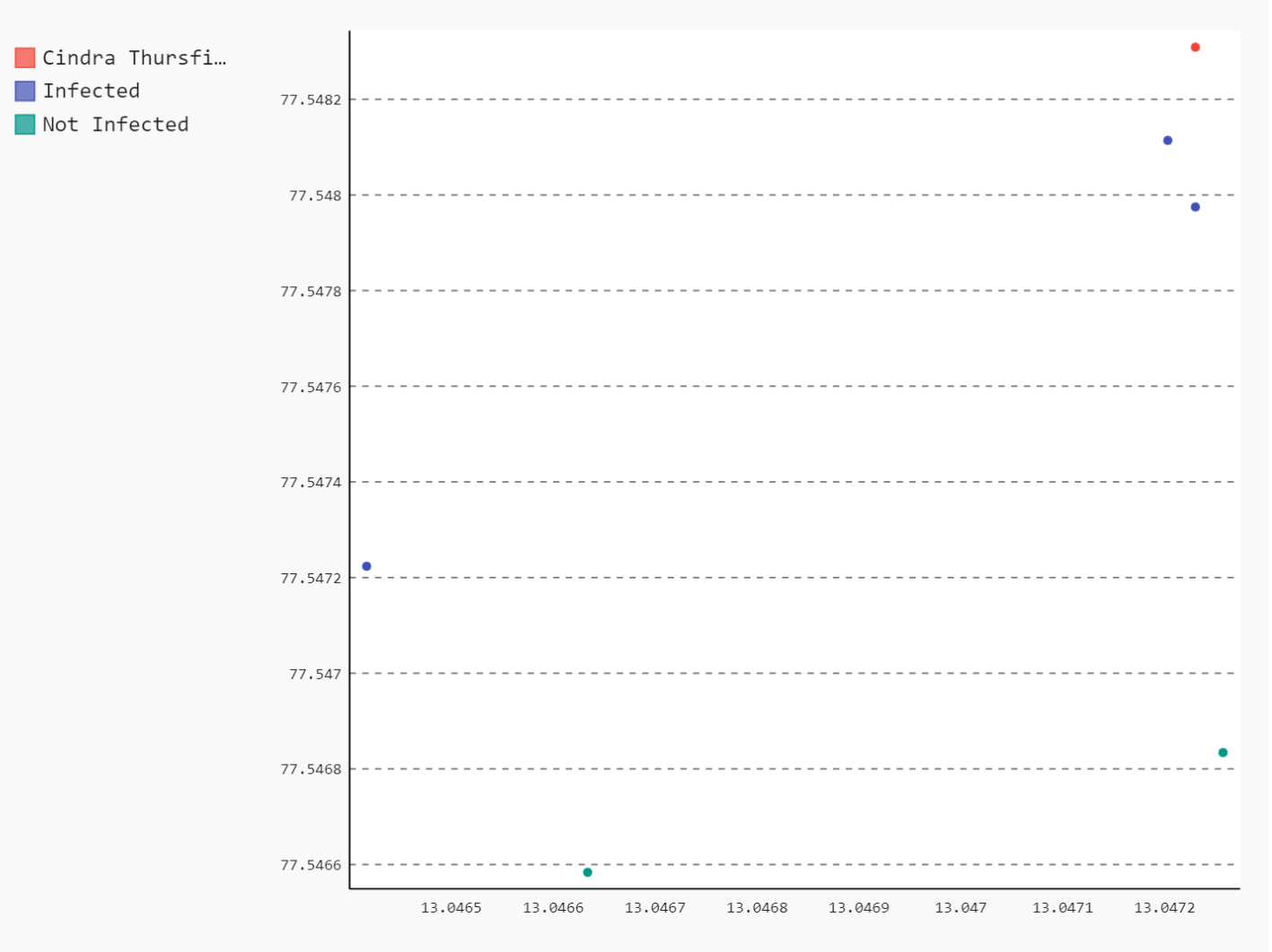


Fig. 6.8 Plotting infected and non-infected people

```
cough=int(input("Cough Range : [Enter value between 1 and 5 , 1 being the lowest and 5 being the highest] :"))

fever=int(input("Fever Range : [Enter value between 1 and 5 , 1 being the lowest and 5 being the highest] :"))

breathe=int(input("Breathing Range : [Enter value between 1 and 5 , 1 being the lowest and 5 being the highest] :"))

infected=input("In contact with infected? (y/n) :")
if infected.lower()=='y':
    infected=1
elif infected.lower()=='n':
    infected=0
else:
    print("Incorrect value entered. Please start again")


if infected==0 or infected==1:
    value=((cough+fever+breathe+infected)*100)/16
elif infected==1:
    value=((cough +fever +breathe+infected )*100 )/16
print("The severity % is :",value)
```

```
Cough Range : [Enter value between 1 and 5 , 1 being the lowest and 5 being the highest] :3
Fever Range : [Enter value between 1 and 5 , 1 being the lowest and 5 being the highest] :2
Breathing Range : [Enter value between 1 and 5 , 1 being the lowest and 5 being the highest] :2
In contact with infected? (y/n) :y
The severity % is : 50.0
```

Fig. 6.8 Probability of a person getting infected

CHAPTER 7

SOFTWARE TESTING

Every business enterprise need to provide number one cognizance to checking out whilst constructing any project. Testing is an crucial part of improvement , specially to make certain quality. Many smaller and mid- sized corporations don't provide checking out lots interest albeit it's important for handing over a strong product. Just like it's crucial to own checks present, it additionally topics how the company run those checks. Every business enterprise growing a product need to have checks present. Testing is an crucial part of improvement , specially to make certain quality. Many smaller and mid- sized corporations don't provide checking out lots interest albeit it's important for handing over a strong product. Just like it's crucial to own checks withinside the specific situation, it additionally topics how the company run those checks. Some corporations prefer to do guide checking out, even though that's now no longer the handiest approach. The subsequent logical step is automating your checking out technique the business enterprise have checks present. Manual checking out need to be minimized in any respect costs. And take a look at automation will increase average software program improvement performance and lets in for extra strong equipment to be built.The following are examples of the types of testing carried out as part of this project.

Unit Testing

Testcases are prepared for each and every feature and the entire flow is tested in such a manner that each and every testcase is passed in each of the cycle so that there is no bugs remaining due to code changes after each cycle,which enables to have a very bug free product after the end of the unit testing.

Load Testing

Load testing emphasizes testing of the behaviour of system during the course of load being put on it or computing device can handle high loads given a high demand of end-users.

7.1 Test Cases

The testing phase of the project consists of unit test cases. Since the modules are independent of each other completely as intermediary outputs are being fed for the next module as input, there is no connection or integration done at a later point of time

.

7.1: Unit test cases for Extraction of data

Test Case ID/No.	Test Case Description	Input/Inputs	Expected Outputs	Actual Outputs	Results
T01	Format of dataset dumped by client	"C:\Users\ ISHITA \Desktop\ Major project\testdata01.csv"	{1, Parry Rodolf, Male, Ganganagar, 13.024737, 77.589290, 23-04-2022, True}; {2, Thatch Woolatt, Male, Ganganagar, 13.024737, 77.589290, 23-04-2022, True}	{1, Parry Rodolf, Male, Ganganagar, 13.024737, 77.589290, 23-04-2022, True}; {2, Thatch Woolatt, Male, Ganganagar, 13.024737, 77.589290, 23-04-2022, True}	Pass
				Dataset in .flv format	Fail
TO2	Validation of date format	“23-04-2022”	True/Valid	True/Valid	Pass
				Any other output	Fail

TO3	Check if any row is empty	If(row.i==” ”)	Delete the row	Delete the row	Pass
				Any other output	Fail

The test cases talk about validating the format of the data sets and location of file which is fetched in notebook. The average number of patient details is generated using Mockroo website where user has to enter the number of required columns and add the parameters as needed then it generates the number of rows with particular dummy data which can used. This results in generating huge data in hundreds of files based on the time period for which the model was getting tested.

Validation of dates is a common scenario where the model can find out the number of individuals who came in proximity with positive patient on the same day. Normalizing them would help the model recognize the data from all the time periods simultaneously that reduces time of execution.

7.2: Unit test cases for Locating covid patients

Test Case ID/No.	Test Case Description	Input/Inputs	Expected Outputs	Actual Outputs	Results
T01	Find Infected People using ID	Person ID= 213	213,Mordy Wherrit, Male, Kadaranahalli, 13.047887, 77.446465, 25-04-2022, True,0	213,Mordy Wherrit, Male, Kadaranahalli, 13.047887, 77.446465, 25-04-2022, True,0	Pass
				Any other output	Fail

TO2	Find Infected People using Name	"Randa"	214, Randa Kynsey, Female, Kadaranahalli, 13.047887, 77.446465, 25-04-2022, True, 0	214, Randa Kynsey, Female, Kadaranahalli, 13.047887, 77.446465, 25-04-2022, True, 0	Pass
				Any other output	Fail
T03	Find Infected People using Date	"4-9-2021"	{213, Mordy Wherrit, Male, Kadaranahalli, 13.047887, 77.446465, 25-04-2022, True, 0};{ 214, Randa Kynse, Female, Kadaranahalli, 13.047887, 77.446465, 25-04-2022,True, 0}	{213, Mordy Wherrit, Male, Kadaranahalli, 13.047887, 77.446465, 25-04-2022, True, 0};{ 214, Randa Kynse, Female, Kadaranahalli, 13.047887, 77.446465, 25-04-2022,True, 0}	Pass
				Any other output	Fail

The Unit test cases for Locating covid patients talk about tracing the particular individual positive patient with inserting few unique values as patient id or name as a input. The details of covid positive patient will be displayed with location as in dataset it has mentioned about the coordinates

with place name also dataset contains the dates of the particular patient on which date he was present on which location, which gives us clear picture to figure out the covid infected and non-infected people.

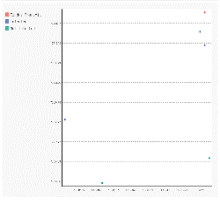
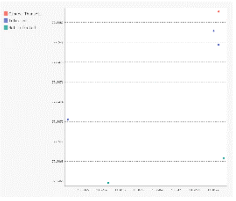
7.3: Unit test cases for Locate people who came in contact with the infected patient

Test Case ID/No.	Test Case Description	Input/ Inputs	Expected Outputs	Actual Outputs	Remarks
T01	checking People in radius with infected person	"4-6-2022"	"Danish, male, infected; Akanksha, female, non-infected; Alok, male, non-infected"	"Danish, male, infected; Akanksha, female, non-infected; Alok, male, non-infected"	Pass
				Any other output	Fail
T02	Checking People in same clusters with infected person	Cluster=2	"Vimal, male,2;Tanisha,female,2"	"Vimal, male,2;Tanisha,female,2"	Pass
				Any other output	Fail
T03	Finding People in same city	"Bengaluru"	{"Lalith,male,23, Bengaluru"; "Arav,male,34, Bengaluru"}	{"Lalith,male,23, Bengaluru"; "Arav,male,34, Bengaluru"}	Pass
				Any other output	Fail

The Unit test cases for Locate people who came in contact with the infected patient talk about tracing the particular individual people who has been in contact with positive patient within the given radius mentioned (**i.e., 0.0001876**) in eps value in algorithm where it defines the neighborhood around the single data point i.e. so if the distance between 2 points is less than or equal to 'eps' then they are considered as neighbors and **MinPts which counts** the **Minimum number of neighbors (data points) within the eps radius/range. Larger the dataset, the larger value of MinPts must be chosen by the user.** The cluster is formed based on the DBSCAN algorithm where it basically focus on Density-based clustering along with noise clustering method, also to find number of

infected through clusters are one of the technique. Dataset contains the name of the cities through which one can detect the number of infected or non-infected people around the city.

Table 7.4: Unit test cases for check if other people located were covid infected or not

Test Case ID/No.	Test Case Description	Input/Inputs	Expected Outputs	Actual Outputs	Results
T01	Find infected people in contact	0, 25-4-2022”	214, Randa Kynsey, Female, Kadaranahalli, 13.047887, 77.446465, 25-04-2022, True, 0	214, Randa Kynsey, Female, Kadaranahalli, 13.047887, 77.446465, 25-04-2022, True, 0	Pass
				Any other output	Fail
T02	Find non-infected people in contact	1, Ganganagar	3,Lazare Moryson, Male, Ganganagar, 13.023669, 77.589321,23-04-2022, False, 1	3,Lazare Moryson, Male, Ganganagar, 13.023669, 77.589321,23-04-2022, False, 1	Pass
				Any other output	Fail
T03	Graph the identified people	{214, Randa Kynsey, Female, Kadaranahalli, 13.047887, 77.446465, 25-04-2022, True, 0};{3,Lazare Moryson, Male, Ganganagar, 13.023669, 77.589321,23-04-2022, False, 1}			Pass
				Any other output	Fail

The Unit test cases for check if other people located were covid infected or not and its results, tracing the particular individual people who has infected or not followed by count of infected people and count of non-infected people based on the certain parameters. It can be based on city where the input will be city name and the list of people infected or non-infected will be displayed and second method is based on dates which can find out the infected or non-infected person with respective to city. The other method followed will be through clusters where the count of infected and non-infected in same clusters can be displayed or respective other clusters based on safe distance mentioned, if the person is in under mentioned distance will be counted as infected vise-versa.

Table 7.5: Unit test cases to check if the probability value predicted is correct

Test Case ID/No.	Test Case Description	Input/Inputs	Expected Outputs	Actual Outputs	Results
T01	Find probability	35	50%	50%	Pass
				Any other output	Fail
T02	Check if infected value taken is correct or not	'y'	Proceed further	Proceed further	Pass
				Any other output	Fail
	Check symptom range is	Cough		Proceed further	Pass

T03	within expected limit	Range : 3	Proceed further	Any other output	Fail

The Unit test cases for check if the probability value predicted is correct and it's results. One can observe that if the values of person came in contact is anything else than 'n' or 'y' the model won't be able to predict the values correctly and will predict some incorrect value. Not only that the patient id should also be entered correctly otherwise the percentage value will not be correct.

CHAPTER 8

CONCLUSION

The COVID-19 epidemic continues to have an impact on everyone's way of living. Contact tracing is anticipated to be crucial in aiding health officials in promptly spotting those who may have been exposed to the virus. COVID-19 has made a terrible impact on human existence around the world, it has severely impacted the management of educational institutions and workplaces, as well as many other areas of daily life as one knows it.

Thus, from the preceding sections that a clustering technique like DBSCAN can cluster data points from the dataset without having previous knowledge of number of clusters being formed. Thus, DBSCAN is effective in finding non-linearly separable clusters, on the other hand clustering algorithms like k-means are insufficient for this kind of dataset. The DBSCAN function is implemented in this project has three objectives where it finds the infected person, the people who came in contact with infected patient followed with the list of infected people and non-infected people based on the same dates and clusters they fall into. Thus, giving us an effective way of tracking down potentially infected individuals. Both digital contact tracing and manual approaches have their own limitations. However, employing machine learning to perform effective contact tracing can help us save on an array of human and financial resources and errors. Finally, one can conclude that the developed system was able to achieve an accuracy of 80-90% while detecting the probability of the non-infected people.

CHAPTER 9

FUTURE ENHANCEMENTS

The current COVID-19 outbreak has sparked a widespread adoption of a virus tracking app. If these models and technologies had been in existence and extensively tested before to the commencement of the Covid-19 pandemic, one could have been better prepared for a pandemic of this magnitude.

1) Improvement in proximity accuracy:

In previous exchanges, the current issues with contiguity accuracy were discussed. The Bluetooth technology was not created with location or proximity determination as a primary consideration. During the development phase of new "Bluetooth-like" protocols, a focus on location/proximity services should be prioritized. This approach should include antenna design, which allows for not only distance precision but also direction-finding. The Bluetooth 5.1 protocol does include direction-finding, albeit with limited precision. At the time of writing, no Covid-19 tracing program has such direction capabilities built into their contiguity analysis.

2) A fully decentralized architecture for infection tracing:

One of the "takeaways" from the COVID19 disaster is that the privacy concerns should be superscribe in order for the public to use the technology more widely. None of the apps that is been discussed so far have a fully disseminated design; they all rely on a central server to some extent, usually under the direction of a governing dominion. It is necessary to conduct research on a fully disseminated system that uses some type of peer-to-peer network to permit privacy-preserving information sharing among user-devices.

3) Quantum communications:

At least in terms of deployment, the most newfangled of all the new quantum

applications. Commercial quantum communications services are currently available, and prototype deployment in space has already taken place. The newfangled communications security and intensified privacy protections offered by this technology will most likely have the greatest impact on tracing applications. In theory, if properly implemented, future virus-tracking programs will have unrestricted security and privacy, making hacking and unaccredited access to virus-tracking data outdated.

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