NATURE'S FURY

Will the city recover from the surge in cases??

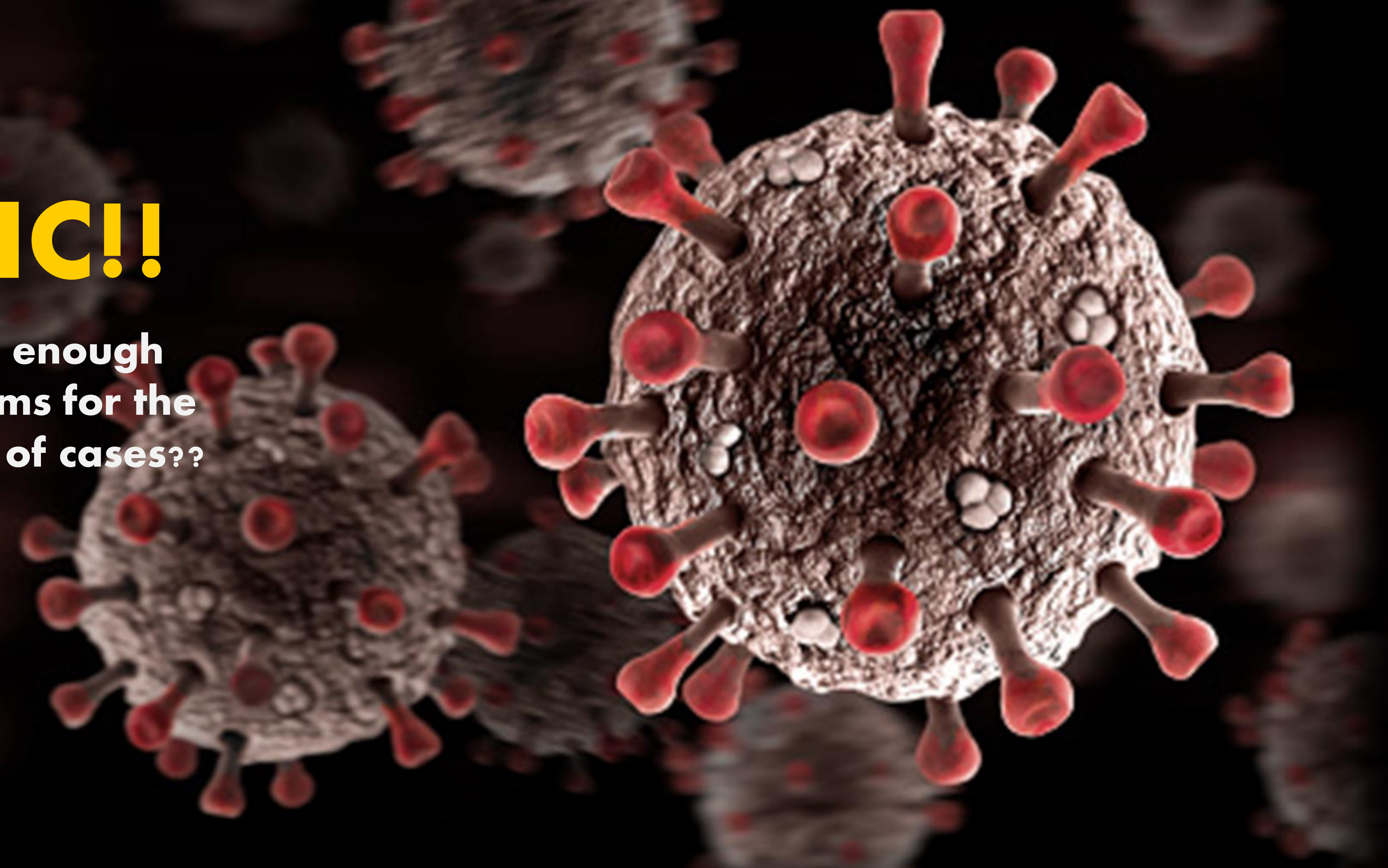
VACCINATIONS

How efficient will the vaccines be against the alien disease??

WIN
SEMESTER
MAY 2023

PANIC!!

Do we have enough support systems for the rising number of cases??



THE OUTBREAK AND ITS RISING

BCSE102L PROJECT

AAKAASH (22BAI1113) AND SRIKANTH (22BAI1117)

THE ECHOES OF THE PAST HAUNT THE PRESENT, FORGING THE BLOODLINES OF THOSE WHO FIGHT TO LIVE

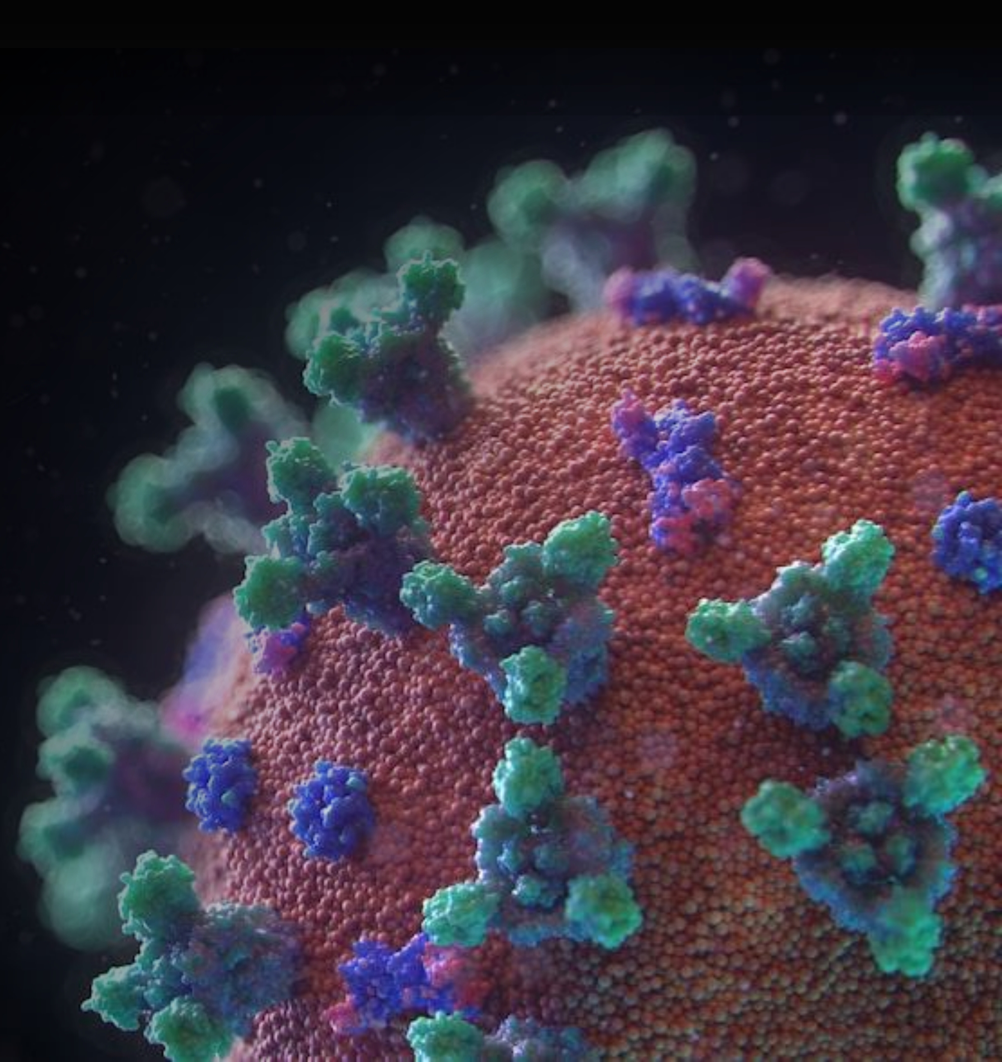
AN INTERACTIVE CODE TO MATHEMATICALLY MODEL THE RISING CASES OF THE DISEASE WHICH HAS BEEN HAUNTING THE ENTIRE CITY

BY THE STUDENTS OF
VIT CHENNAI

INTRODUCTION

In today's interconnected world, understanding the spread of infectious diseases has become a paramount challenge. Accurate predictions about the propagation of diseases can help authorities and healthcare professionals make informed decisions to prevent and control outbreaks. This project report delves into the fascinating realm of mathematical modeling and its application in predicting the outspread of diseases. Inspired by the recent global pandemic, COVID-19, we explore the development and application of mathematical models to forecast disease transmission dynamics, evaluate intervention strategies, and contribute to public health preparedness.

And thereby, to aid people and medical professionals in modelling and predicting the outspread of a epidemic, we have developed this application. We believe that measures could be taken swiftly by analysing the data here and thus this could be a gamechanger in the medical field



SOURCE OF INSPIRATION:

CORONA
VIRUS

The COVID-19 pandemic, which emerged in late 2019, has had a profound impact on societies worldwide. It emphasized the need for efficient disease spread prediction models to inform public health decisions and resource allocation. Mathematical modeling plays a crucial role in understanding the dynamics of infectious diseases and predicting their future trajectories.

The primary objective of this project is to develop a software application that utilizes mathematical modeling to predict the spread of diseases. The program should provide insights into various aspects, such as the population of the infected region, the number of infected individuals, recovery rates, and potential interventions to control the outbreak such as the utilization of vaccines etc.

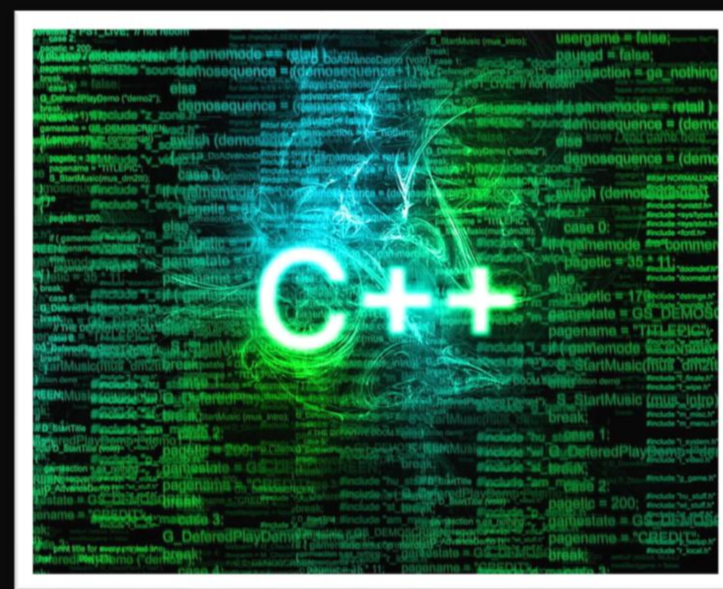
METHODOLOGY

Mathematical modeling using exponential functions is a powerful tool for predicting the outbreak and spread of a disease. Exponential functions describe the rapid growth or decay of a quantity over time, and they can effectively capture the dynamics of infectious diseases.

When it comes to diseases, the number of infected individuals often increases exponentially at the early stages of an outbreak. This exponential growth is due to the fact that each infected person can transmit the disease to multiple others, creating a compounding effect. By quantifying this growth using mathematical models, we can estimate how quickly the disease will spread and predict its future trajectory.

To develop a mathematical model for disease spread, various factors need to be taken into account. These factors include the initial number of infected individuals, the rate at which the disease spreads from person to person and the duration of the infectious period. Exponential functions allow us to represent these factors and simulate the spread of the disease over time.

SOFTWARE DESIGN & IMPLEMENTATION



The software design and implementation for predicting the outspread of a disease through mathematical modeling was carried out using the C++ programming language. C++ was chosen for its robustness and flexibility, allowing for the creation of a sophisticated program capable of accurately simulating the dynamics of disease transmission.

The software design followed an object-oriented approach, utilizing classes to represent key components of the disease modeling system. The design consisted of the following classes:

1. Population Class: This class represented the population being simulated. It included attributes such as the total population size, birth rate of the region, death rate, population growth rate, contact rate of the people (averaged), etc.
2. Disease class: This involved the variables of the disease such as the transmission rate, recovery rat,e, initially infected people, incubation period, days before isolation etc.

3. Vaccination class: Involves the variables on the vaccine such as its efficiency, rate of vaccination, number of days since the outbreak after which the vaccine was invented etc.

Steps followed:

- The classes defined during the design phase were implemented as C++ classes, with appropriate member variables and member functions to encapsulate the desired behaviors and data.
- The program included mechanisms for user input to define simulation parameters and displayed relevant outputs, such as the number of infected individuals over time and statistical summaries. For this, we made use of control structures, including loops and conditional statements
- These inputs were typecasted and checked for values and were stored into variables upon verification. Special functions were defined for this purpose
- Functions were defined to manipulate the existing data. Overloading these functions had made it possible to pass multiple forms of data instead of declaring different functions to return the same output

The object-oriented approach facilitated the modeling of complex interactions within the population, making it a powerful tool for predicting disease dynamics and aiding in decision-making processes

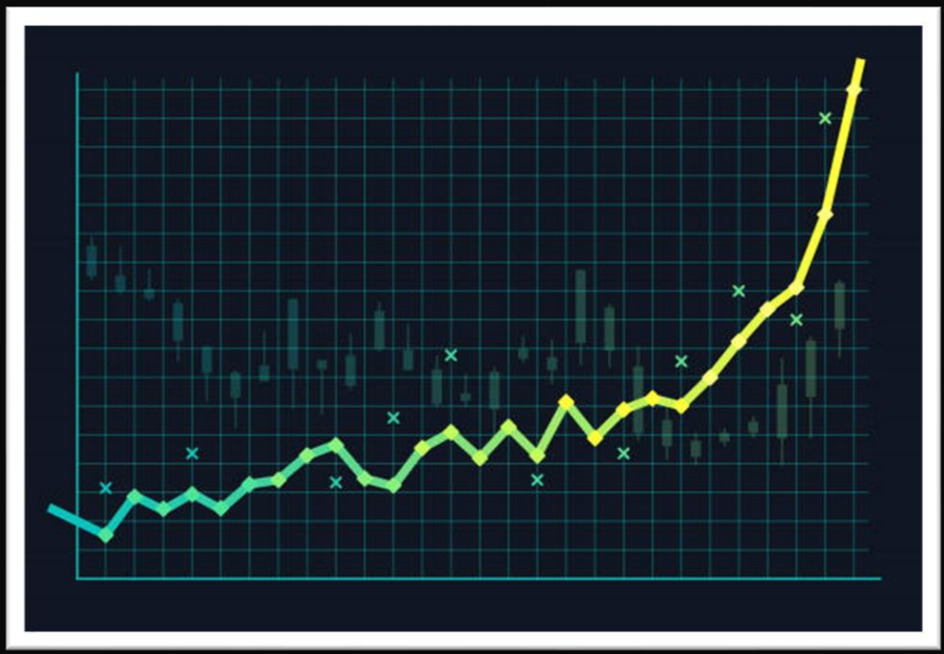
DATA ACQUISITION AND PROCESSING

To develop and train our model, we required a dataset containing relevant information about past disease outbreaks. We collected epidemiological data from various reliable sources, such as the World Health Organization (WHO), national health agencies, and research publications. The dataset consisted of information on the number of reported cases, demographic factors, geographical locations, and other relevant parameters.

For the demographic data, we took the help of reliable sources including

- Medinfo
- India online pages
- Aspiring Youths
- Wikipedia
- Statista
- World population organization
- National Health Centre, UK ministry
- Centre for Disease Control and Prevention
- European Centre for Disease Prevention and Control
- Worldometer
- Our World in Data

MATHEMATICAL COMPUTATION



Our program employs mathematical computations to simulate and predict the outspread of a disease. By utilizing existing data, such as historical infection rates or known parameters about the disease, the program performs calculations based on mathematical models.

The mathematical computations involve formulating equations or algorithms that describe the disease dynamics, incorporating relevant factors such as transmission rates, incubation periods, and other disease-specific parameters.

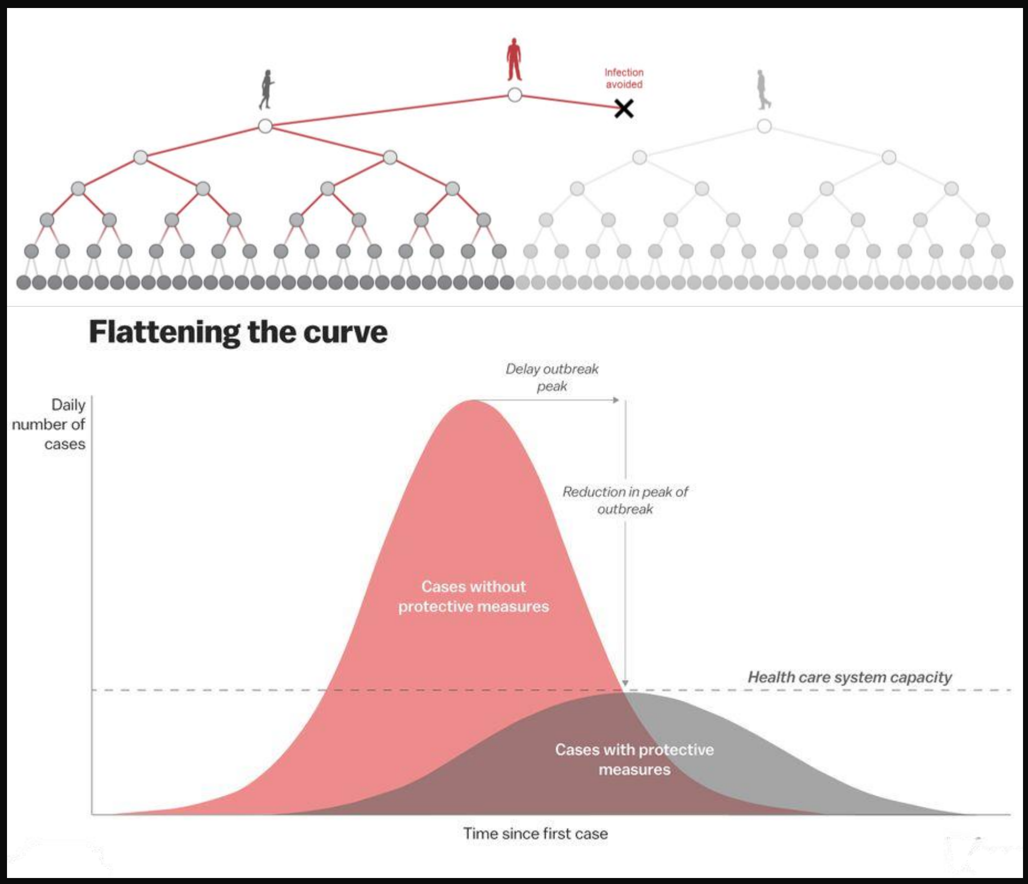
By using mathematical computations, the program predicts the progression of the disease over time. It can estimate the number of infectious, and recovered individuals at different time points, providing valuable insights into the potential outspread of the disease within a population.

RESULT & ANALYSIS

Once the mathematical computations are performed, the program generates results that can be analyzed to gain a deeper understanding of the disease outspread. These results can be presented in various forms, such as numerical data, graphical visualizations, or other suitable representations.

The generated results can be analyzed to identify patterns and trends in the disease transmission, estimate the impact of control measures or interventions, and assess the effectiveness of different scenarios. By comparing the predicted outspread with known data or historical records, the program's accuracy and reliability can be evaluated and the uncertainties can also be figured out in this manner.

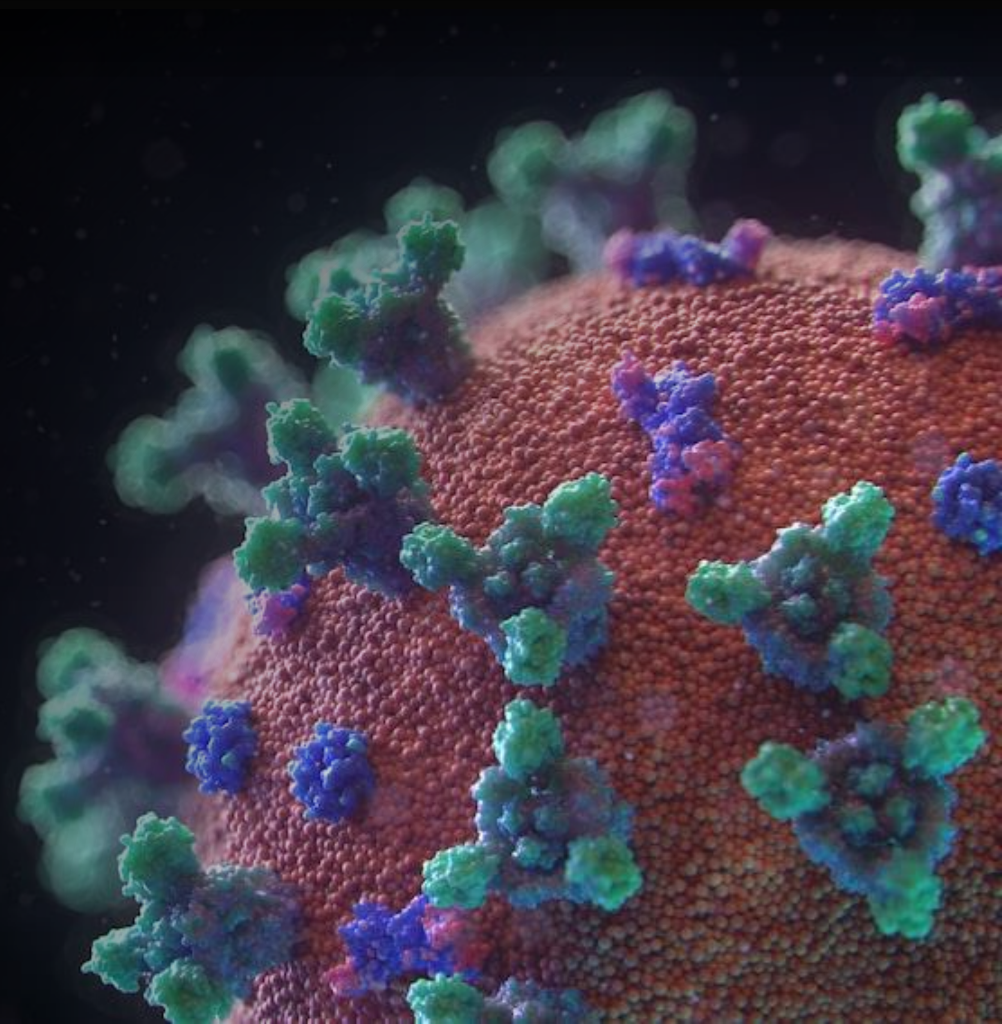
Overall, the results and analysis obtained from the computations provide valuable information for understanding and predicting the outspread of the disease, aiding in decision-making processes and proactive measures.



CONCLUSION

In conclusion, our project aimed to develop a program-based app that utilizes mathematical modeling to predict the outspread of diseases. Inspired by the COVID-19 pandemic, we implemented a mathematical model based on simple mathematical compounding. The results and analysis demonstrated the efficacy of our model in forecasting disease transmission patterns.

By leveraging mathematical modeling techniques, our program provides a valuable tool for understanding and predicting the outspread of diseases. The insights gained from our project can contribute to proactive measures in disease prevention, early detection, and effective response planning.



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