Attenuation of a Pandemic Disease Spread

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Abstract: *Healthcare is one of the most important industries in today's time. There has been significant development in the field of healthcare which has not only reduced the mortality rate but also contributed to a safe lifestyle for everyone. Indeed, there is a likelihood of pandemics to strike humanity at any point in time. Being prepared for such pandemics is the ideology behind our area of research where we employ technologies like Android Studio and Swift in assistance with Firebase Realtime Database. These fundamental variables will help us determine the cause of a pandemic and aid us in providing precautionary measures to reduce the psychological and physical damage to human life as much as possible.*

Keywords: Healthcare, pandemics, fundamental variables, psychological.

1. INTRODUCTION:

In today's heavy and compacted urban regions around the globe has led to increased chances of transmission of infectious disease from a contaminated person to a healthy person. Also, easily available low-cost Air Travel has further cranked up the problem because of which no country is out of harm's way. Though there are notable advancements in the areas of healthcare and technology, the elevation in the worldwide population has overshadowed the rise of glaring health and technological progress.

Global human population growth amounts to around 83 million annually or 1.1% every year thus decreasing the ratio of available doctors and facilities per patient.

Over the past few decades particularly in India, the formal tradition of healthcare practices involves taking an offline appointment with the doctor and getting treatment via offline measures and the issue of a handwritten prescription. This practice can cause a lack of transparency with the center and further can lead to a catastrophic scenario with an outbreak of new disease. Also, this can further complicate the problem if there is a need for contact tracing in the case of a new outbreak.

2. EXISTING METHODOLOGY:

The pre-existent technologies use traditional contact tracing methods in some nations whereas advanced digital tracing in some. This causes a delayed response in the deployment of resources that might minimize the further spread of a pandemic. The traditional contact tracing involves methodologies like manually trying to find all the people who have come in contact with an active case of the pandemic. However, some nations use advanced technologies that incorporate steps like using social media platforms to trace people or even Bluetooth technology. These methods might be successful in many cases but not all of them as there are many limitations attached to the use of advanced technology. Bluetooth technology has a limitation wherein contacts can only be traced within a 5-meter range whereas the use of social networking platforms has the limitation of people not getting found as there can be various possibilities of multiple people having the same names or their non-existence on any platform.

3. PROPOSED METHODOLOGY:

The system that we have developed will comprise the solutions for all the disadvantages of pre-existing technologies. Moreover, a systematic approach will not only make people's lives easier but also let the world be in readiness if any pandemic is further hit and prevent from causing a catastrophic scenario. As we are aiming to deploy systems for all countries, multilingual support is an important feature of our app. The following describes the approach in building our system.

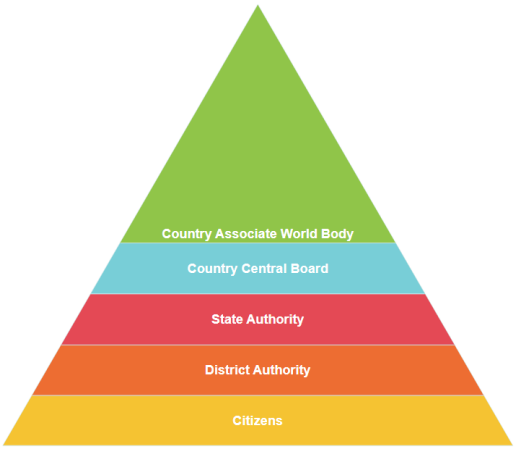

Fig. 1: The above illustration indicates the hierarchy of our suggested system.

3.1. Citizen/Doctor Registration

Citizens residing in any country have the respective primary identification of their nation, which alone is not sufficient to uniquely identify people at the global stage. Citizen Registration will comprise broadly 2 steps namely Registration and Verification which will commensurate with our required information. The citizens will be

required to enter their personal information including name, age, phone number, permanent address, and their unique identification number that is the primary identification source in their nation. Verification involves checking of entered data and authentication of the user by the Central government in order to activate their accounts. A similar process will be followed by the doctors to register themselves, an additional entry of UPRN (Unique Permanent Registration Number) will be recorded.

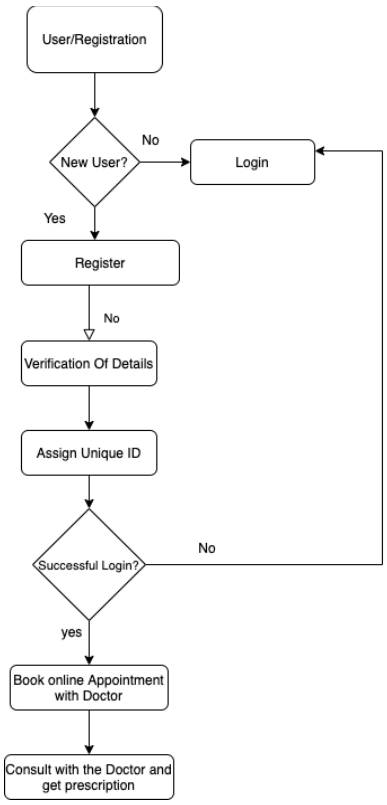

Fig. 2: The above illustration indicates the flow diagram of our system's registration procedure.

3.2. Global Unique ID (GUID) Assignment

Once a citizen or doctor has been successfully verified and is authenticated successfully, the system will allocate a unique ID to every verified member which will uniquely identify anyone. GUID is assigned using the following method-

1. The first three characters of the GUID indicates the country the person belongs to.
2. The next three characters will contain the document name one has entered.
3. Following these six characters will contain the ID number of the particular document.

Example: An Indian resident registering via Aadhar Card with Aadhar Number of 234966336666 will be allocated a GUID "INDADR234966336666". The above-generated GUID and a 12-character password will be sent on their phone number as Login Credentials for the app. The Password can be changed by the user after their First login in the app via the Phone-Authentication process.

Fig. 3: The above illustration indicates user credentials with their unique ID.

3.3. Citizens Module (Normal Situation)

1. Booking of Doctor appointment

   Citizens can compare various doctors by the in-app rating of his/her patients and decide which doctor would be the best suitable for their treatment. People can easily book an appointment with any doctor by selecting the available time slot in their nearby visiting clinic that best suits the user.

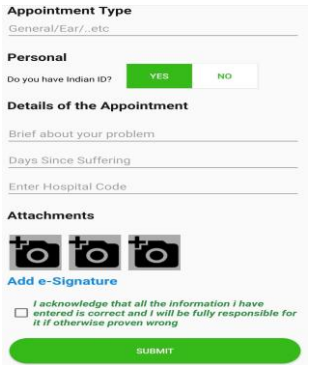

Fig. 4: The above illustration indicates the user interface for booking an appointment

2. Receiving Prescription

   After visiting the doctor, the assigned medical will be sent to the patient in the app in an Encrypted QR-Code which can only be scanned at the

pharmacist to avoid prescription less buying of medicals.

3. Availing Health Insurance facilities

   Also, people can buy health insurance policies through the app without any intermediate costs. We do have a recommendation system that recommends people with health policy they might be interested in buying and which best suits their budget and their family.

4. Filtered News

   News Page in App which displays filtered news. For the above-stated purpose we have developed a classification algorithm that takes Age, gender, location, doctors visited as input features and outputs a label on each news post as to which might be appropriate for them or not.

3.4. Doctors Module (Normal Situation)

1. Accepting Patient Request

   Doctors can manually select days of their visits at different hospitals or can set up a weekly timetable which will be followed unless they do not suggest any change. Once the scheduling is done, the system can automatically allocate user booking without the doctor having to manually do the same. Secondly, when the booking is accepted, detailed information about patients' past treatments and symptoms will be shared with the doctor which will help them to understand the case much better.

2. Assigning Medics

   After the patient visits the doctor has to simply type the name of the medicine to be prescribed which will be encoded and converted to QR-Code Format and sent to the patient.

3. Writing Articles about common preventive measures of general diseases

   Doctors can write posts about various preventive measures of general diseases and aware the citizens to protect themselves

3.5. Pandemic Situation

1. Identification of Spread

   If more than 20% of the population of a particular district is seen to be suffering from common symptoms or if any disease or symptom is termed as a novel by the doctors of that area, then will be termed as a “perilous area”

2. Notifying the Residents

   Once the spread is identified, the residents of that area will be notified about the spread and its symptoms. In case of any spread in any particular area, or a lot of people suffering from similar kinds of symptoms or similar diseases our further modules will be triggered.

3. Capturing all phone locations in that area.

   When a particular area has been found to be “perilous” then our system will start recording the phone location of all the individuals in the area around the affected area. Hence this practice will make people aware of the places that are more likely to be contagious and avoid such locations

4. Contact tracing

   In the case of a pandemic, it is necessary to trace back the steps of the active cases in order to reduce the further spread of the disease. We provide an interface wherein a user will be notified whether he/she has come in contact with an active case. This would not only help in the immediate treatment of a person suspected to have contracted the disease but also help in controlling the spread.

5. Location Tracing

   This feature works in unison with contact tracing. In this case, the route of an active case and the respective contacts traced is noted with the help of HyperTrack console and area-wide notification is sent to the fellow travelers. The notification is an alert that suggests the travelers avoid that route as there might be some particulate matter which might cause the disease to spread more. That respective area can be taken into consideration and sanitized in order to prevent the spread of disease. The area will also be Geo-Fenced hence preventing any individual entering into that area by frequent notifying via the app

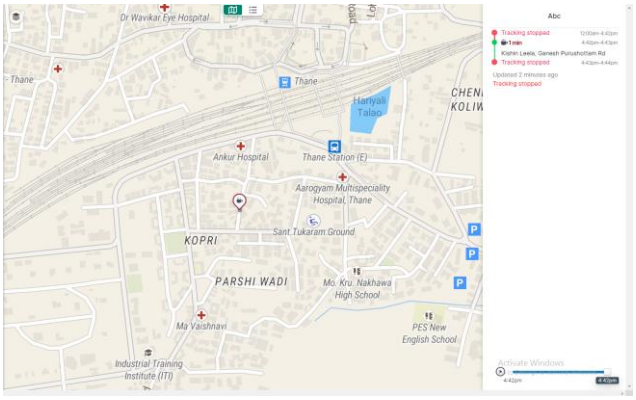

Fig. 5: The above figure suggests a brief look at the Location Tracking interface

6. Geo-Fencing

   Locations, where many people with positive symptoms visited, will be stored as a string of longitude and latitude thereby forming a fence around the area. Hence this practice will make people aware of the places that are more likely to be contagious and avoid such locations

7. Avoiding mass gathering

   In case if the disease is found to be air-borne or spreading from person to person, in such scenarios avoiding close contact with people is essential to prevent the spread of disease. If such a scenario occurs and the government switches on the alert feature, then if four or more mobile devices come in close proximity with each other all of the phones will start ringing until there is sufficient distance between the individuals. The sensitivity of Location is about 4 meters(the Maximum that we can achieve using Firebase Database) and the system refresh rate is about 3 seconds, so we can say that if four or more people are in a circular area of a radius of 4 meters the ringer will come in the picture.

   This technique will further leverage the work of the police and officials to manually avoid gatherings of people.

8. Categorizing of Areas

   Areas can be classified based on the significance of their safety

Table 1: Categorization table

Groups	Description
Group A	The disease is spread on a wide scale and we are unable to trace the spread
Group B	The disease is spread on a wide scale but we are able to trace the spread and find the origin
Group C	The disease is not widespread
Group D	The area is Safe, no new cases for the past 20 days

Different strategies will be followed in different regions to fight the situation with minimal damage.

9. Symptom Checker

   Doctors in discussion with each other will release a set of questions and their positive answers that can help to identify who is currently suffering from the disease or who are most likely to get affected. The questionnaire can be easily converted into a symptom checker deployed in the app which will help people to stay informed and take preventive measures before it gets late

10. Issuing permits to individuals for movement

    In pandemics to prevent disease spread the general strategy followed so far is implementing a lockdown which causes a lot of economic damage to the country and in turn, reduces the country's GDP and further puts pressure on the government in such a catastrophic scenario. So, if in this scenario the government is able to issue permits to the people who are safe and can go out and work would release the pressure, keeping that in mind we have developed an approach that allows the government to do so with great ease. As seen from above Table 1, areas in Group C and Group D are the ones which can be eased restrictions and allowed to go out for work. But necessary precautions need to be taken in order to stop the spread in the areas, as people may go out for work. We also suggest deploying a symptom checker for anyone willing to go out for any reason. Might while stepping out they can take a simple symptom check. Only if they pass the symptom check they can get a travel pass which can last for 24 hours

11. Spread Prediction

    Using a Deep Learning model we can easily predict the cases per day or growth of the spread in any particular area by taking appropriate features into account like area's population, population density, present-day number of cases, current growth rate (Ro), number of hospitals, Total beds in hospitals, available beds, history of all days number of cases till today

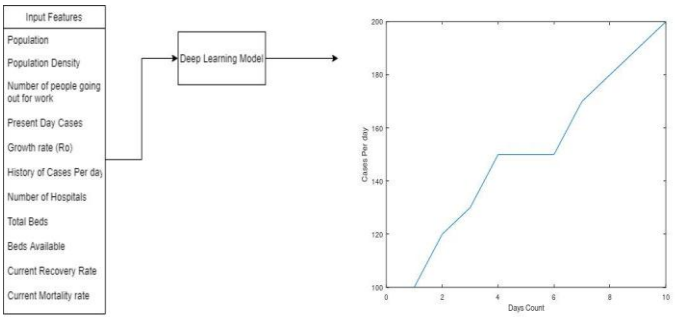

Fig. 6: The above illustration indicates the prediction of the cases in a particular area using concepts of deep learning

12. Violation of the Rules:

    The violation of any rule will lead to the cancellation of the movement allowance of that individual except for any emergency activities.

4. CONCLUSION:

As traditional contact tracing involves methodologies like manually trying to find all the people who have come in contact with an active case of the pandemic. Therefore, this technology might not be sufficient, and this methodology is time-consuming. By using this we cannot find all the people who have symptoms of the pandemic. In Our methodology all the citizens and doctors will register themselves on this portal and in turn they will get a unique ID. By using this, users can take online consultation with the doctor. And by using contact tracing and location tracing features, the government can keep track of all active cases. If some area has more active cases then the government can lock that area so it will prevent a pandemic from spreading further without any disruption of any service. By using our methodology, it will get easier for them to keep track of the active cases. So that they can easily manage the situation. And it will prevent the spread of the pandemic.

5. FUTURE SCOPE:

If the user doesn't have a phone, then he can register himself with the unique patient ID which will be provided by a doctor. So, in the future, we can contact him using this ID. But the user has to remember this ID No. For such patients, it is imperative to consult with the doctor after a specific interval of time so that the doctor can update his data in a database. And it will be easy for the doctor to keep track of his health-related issues. Our app will provide an online consultation system with doctors. During this pandemic situation, patients are unable to visit the doctor. Therefore, if a patient is affected by mental or physical illness then he can take an online consultation with the doctor, and according to his health-related issues doctor will provide him with a prescription. In terms of security design for the future, the app may implement login authentication. This function may bring more confidence about the privacy features of our app. This helps us to prolong the confidentiality and integrity of the system.

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