HospitAPP

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Abstract: Coronaviruses are a large family of viruses which may cause illness in animals or humans. In humans, several coronaviruses are known to cause respiratory infections ranging from the common cold to more severe diseases. The most recently discovered coronavirus is due to COVID-19. The number of new cases are increasing day by day around the world and has been declared a pandemic by the World Health Organisation (WHO). In light of this global health emergency, countries all over the world are facing unfamiliar situations and have little estimation of the no. of crucial medical resources (like hospital beds, medical equipment, etc) needed over the course of the next few weeks. In order to efficiently enforce measures and policies to control the spread of the virus, governments need to be dynamically updated about the severity of the said spread. Our aim is to build an app for the healthcare institutions and the government. The healthcare institutions will directly log cases (new/active/recovered cases and deaths), and our machine learning model will predict the cases for the coming week. Leveraging this information, they can keep stock of resources (Beds, PPEs and ventilators) beforehand. Secondly, they can distribute said resources on priority basis, and productively divide them among the institutions, with high exposure hospitals getting a fair share. The government will continuously monitor the information/projections and ensure the availability of resources to the healthcare institutions. They can also ensure the preparedness of the other hospitals (with maybe low exposure, and in less risk zones) in case of a high surge prediction.

Design Document

Objective

To build a crowdsourced app to swiftly identify high risk zones on a weekly basis and thereby efficiently allocate medical resources (Beds, PPEs and ventilators) to the hospitals/healthcare institutions in those zones accordingly.

Goals

- To help healthcare institutions directly log cases and keep track of weekly projections to avoid congestion.
- To facilitate the government in keeping track of high and medium risk zones, both on a daily basis and a weekly basis.
    - Allocate essential medical resources in advance to handle future rise in cases.
    - Redirect medical resources to handle present cases.
    - Promptly take measures in projected high/medium risk zones.
- Directly notify (pop up alert) the government when resources are running low, current high zones and projected high risk zones.
- Zone wise availability of information on cases, down to individual hospitals/healthcare institutions.
- Zone wise availability of information on the capacity of hospitals, down to the number of medical resources (Beds, PPEs and ventilators) in each hospital.

Target Users: Healthcare Institutions, Government

Scope

This app is currently limited to hospitals in Hyderabad and the Telangana government.
It can easily be scaled to incorporate other cities as well.

Assumptions

People will go to a nearby hospital (not necessarily the nearest one) , i.e, a hospital in the same zone as where they live. The zones will be marked as high, medium or low risk depending on the number of active cases, current rise in cases and/or projected rise/fall in cases reported by the hospitals in those zones.

Functionality

- Build an app for healthcare institutions to directly log on a daily basis
    - New cases, Active cases, recovered cases and deaths.

    - Present capacity, i.e, no of hospital beds, ventilators and PPEs (personal protective equipment).
- Use this data to make weekly projections of rise/fall in cases and mark zones within the city as high, medium or low risk based on this data for the government to:
    - Promptly seal off a high risk zone and impose precautionary measures for inhabitants of that zone.
    - Prepare in advance by either
        - redirecting essential medical resources from hospitals in low risk zones to the hospitals in the most affected zones, or
        - order additional equipment and allocate resources depending on the capacity of each hospital to avoid shortage of resources and equipment, and congestion.

App Interface

Since the app targets both the healthcare institutions as well as the government, the interface for the two will have slight variations:-

- Healthcare Institutions/Hospitals
    - Homepage and login will be common
    - Users will be redirected to the hospital information entry page.
    - Once done, users can then log data, see weekly projections, individual hospital data, zonal data, receive alerts and so on.

- The Government
    - Homepage and login will be common
    - Users will be redirected to the predictions page.
    - After login, users can see weekly projections, individual hospital data, zonal data, receive alerts and send alerts to the inhabitants of a high risk/projected high risk zone.
    - The government cannot update or log data.

Features

- Home page:-
    - **Description:** First page that the user will see on opening the app.
    - **Purpose:** For the user to login/sign-up to the app.

- Login:-
    - **Description:** Unique username and password

    - **Purpose:** To ensure that only authentic users can access/input the valid information.

- Page after login:-
    - *Government*
        - **Description:** Government users after login will be redirected to the statistics and heatmaps page.

    - *Hospitals*
        - **Description:** Hospital users after login will be redirected to the hospital information entry page.

- Hospital Information:-
    - **Description:** Capture basic information of hospitals, capacity and location (zone).
    - **Purpose:** To segregate hospitals into various zones.

- Logging in Data:-
    - *Cases*
        - **Description:** Record new, active, recovered cases and deaths daily.
        - **Purpose:** To update the government on a daily basis and to use for weekly projections of cases.

    - *Medical resources and equipment*
        - **Description:** Record total number of beds/ventilators/PPEs along with how many currently in use and how many available on a daily basis.
        - **Purpose:** To immediately alert the government to allocate resources (according to hospital capacity) based on our weekly projections and direct resources on a daily basis if a hospital is running out of essential equipment despite having the capacity to treat more patients.

- Statistics:-
    - **Description:** No. of active/new/recovered cases and deaths in each zone on a daily basis as well as weekly predictions.
    - **Purpose:** To be aware of the situation on a daily basis and prepare in advance based on the weekly predictions.

- Heat Maps: -
    - **Description:** Zone wise heatmaps to show which zones currently have the most (and least) cases/deaths and classify them as high (red), medium (yellow) or low risk (green) along with projections in a week's time.
    - **Purpose:** Giving the government information to take necessary precautionary measures.

- Pop up Notification:-
    - *Cases*
        - **Description:** Pop up alert on both the government and hospital pages when a particular zone/zones are projected to be high risk or are currently high risk.
        - **Purpose:** Instant alerts for the government and hospitals in that zone to take immediate action.

    - *Medical equipment*
        - **Description:** Pop up alert on the government and hospital pages when a hospital (depending on the capacity) within a zone or all the hospitals in a zone need more medical equipment for current and projected cases.
        - **Purpose:** Instant alerts for the government and the hospitals in that zone (or a nearby zone if all the hospitals in that zone have reached their limit or if that zone has very few hospitals) in advance to share the load if some hospitals have already reached their limit, and direct essential medical care accordingly.

    - *General Public (if time permits)*
        - **Description:** Send sms to the inhabitants of a high risk/projected high risk zone from the government's end.

Dataset

- We aim to use a dummy dataset for the demo. The app will collect real data once deployed.
- As mentioned above, the dataset (updated daily) will contain
    - basic info of hospitals, location (zone), capacity (how many beds/ventilators it can hold)
    - Number of active/new/recovered cases and deaths per hospital
    - Current number of beds/ventilators and PPEs it holds

Method

- Using the above data from hospitals to make a predictive model for weekly projections of cases along with medical equipment needed.
- Data will be directly sourced from the hospitals.
- Weekly projections per zone (and hospital also) based on the dataset
- The city will be divided into a fixed number of zones based on the city's division of areas.
- Zones will be classified as high/medium/low risk based on the number of hospitals, no. of current cases/projected rise or fall in cases and deaths.