Approaching an Android Based Application of COVID-19 Tracker and User Case Analysis in Bangladesh

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Abstract - **In December 2019, a neighborhood episode of obscure infection at first was advised as pneumonia distinguished in Wuhan (Hubei, China), and was immediately resolved to be brought about by a novel COVID 2019, first namely severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). From December 2019 to January 2021 around 102,942,987 globally confirmed cases of COVID-19 and 2,232,233 deaths reported to WHO (World Health Organization). [3] To understand the exact coronavirus outbreak and the way it quickly surges worldwide, many countries are adopting non-therapeutic preventive measures, which include travel bans, remote work, complete country lockdown, regular updates of this pandemic, and most importantly social distancing. However, these measures face challenges in many countries including Bangladesh. This war-like situation, a lower-middle-income economy put Bangladesh and the government is a big challenge to implement the mitigation facilities. To moderate the effect of the Covid-19 pandemic the versatile sterilization, transitory isolate destinations, and medical care facilities could assist with spreading knowledge however to keep up this knowledge among the people, but we've come up with a digital solution in the form of an android application that uses the Haversine Algorithm to keep people informed. That can be easy to keep people updated all over the world in a moment, but initially we design it for Bangladesh. By using this, people can track who is near to them are positive COVID-19 patients. In this managerial work, we are advancing toward an application reliant on Covid-19 known as overall pandemic and to a mass this we utilize the Haversine algorithm, moreover, we take the customer case examination subject to Covid-19 situation.**

Index Terms - COVID-19, Novel Coronavirus, Coronavirus Application, Healthcare, Pandemic, COVID-19 in Bangladesh, Infection prevention and control, Design, Algorithm, COVID-19 awareness

INTRODUCTION

The outbreak of coronavirus has affected the quality of our daily lives. We can't go outside and not even able to go to the work freely like before. There is a kind of fear in the minds of all of us that who is affected by Corona around us. So, we need something through which we can see who is affected by covid-19. Like this way, we have attempted to fabricate a tracking application by which we can able to see who is really affected by Corona virus in our surrounding. So, what is a covid-19 tracker? In any scenario, a tracker is a method or device that can determine where someone or something is. As the novel coronavirus, also known as covid-19, became a global pandemic, it became essential to backtrack where and how one has come in contact with this virus. It is said that it is better to be safe than sorry therefore, we strategized to find a way to eliminate the element of surprise after contracting the virus. We brainstormed on how can take preventive measures against it. This carries us to examine our difficult space, where we broke down what the issues were, and utilizing our aggregate information and comprehension of our examinations, we executed an operational solution, which assembling an application that going to identify any Coronavirus contaminated patients between closest 5 miter distance zone and tell close-by clients on the off chance that they fall in the peril zone or are coming into any conceivable contact. Prior COVID-19 Symptom Tracker has been created by Zoe Global, Ltd is a joint effort with Dr. Timothy Spector, at King's College in London. The data are using are for non-commercial purposes to help fight the COVID-19 pandemic. The app is currently in use in the UK, but we tried to build something better, more beneficial. [5] But only the information can't make that much awareness among the people all over the world also with basic information of symptoms and its safety rules not enough for the people know who's got affected next to him/her. By visiting the WHO dashboard, people can easily get the information but the dashboard only provides information which is how many new covid-19 cases were found along with cured and death cases. The dashboard also provides the visitors with what way they can identify covid-19 symptoms and possible safety rules. So, overall, we want the best possible accuracy level on serving & UI graphics of our projects in the future thus it will be helpful not only in the country but also worldwide.

In the rest of the paper we are going to discuss about the background details, related works of this project, our motivation, about the algorithm we had used and our future work.

I.

COVID-19 Background Details

During the COVID-19 pandemic situation, almost every country shared its every COVID case history with the WHO. Through the world health organization website (covid-19 dashboard) people can get every covid-19 information in details. People can easily get the information by visiting the website dashboard but the dashboard only provides

information which is how many new covid-19 cases were found along with cured and death cases. The dashboard also provides the visitors with how they can identify covid-19 symptoms and possible safety rules. Till the middle of 2020, everyone got updates regarding covid-19 based on the WHO web-based dashboard but after the middle of 2020 many of the software farms and entrepreneurs started to build applications based on covid-19. Some developers recently build applications based on this intensive situation and this application have their advantages and disadvantages as well, and this work highly motivated us to build a new digital application that will fulfill all the requirements. [4]

WHO: The world health organization's web-based dashboard is the first source of information that provides how many people were affected with a covid-19 virus during the initial period of 2019. [4] This website provides information on the people's symptoms regarding the covid-19 virus and its initial possible remedies. But only the information can't make that much awareness among the people all over the world also with basic information of symptoms and its safety rules not enough for the people know who's got affected next to him/her. So, it was the primary step of awareness among the people in the beginning but is it enough to take the precaution and get other people in the safety zone? [4] NO, so there should be another option which will help man to man information who are affected also if someone next to me is affected by covid-19 or not affected.

Coronavirus Contact Tracing Apps: Tracing is an android-based application that works to identify in-person single wise if he/she has come in contact with a coronavirus patient and this application helps to capture data and watch the movement of people to make the process useful and faster for all kinds of medical personalities. [14][15] Some could recognize individuals who may have been presented with the infection so they know to segregate themselves and watch for side effects. Tech leaders team up themselves in this coronavirus situation and use Bluetooth and a phone's operating system for contact tracing and they are Google and Apple. [9] Through an application programming interface (API) the information will be available only for health agencies cause instead of storing data on a central server that may be vulnerable to hackers, Google and Apple say their applications won't be able to read the raw data themselves. Some people are wary of an application that tracks where they go and whom they meet. [5] But is this all-sufficient? Cause the person who is roaming around the city, country, or else is affected or not is not confirmed and a huge amount of data and information working differently and we can use it so if anyone becomes positive covid-19 case will be stored and given a unique number through a mobile application so that it will help people around the globe to move safely.

COVID Plasma Finder: This application will help people to find covid-19 virus survival persons who can donate their plasma blood to the new covid-19 patient to get cured. But on the other side, it won't help people to take themselves to a safe zone. [11] This application is mainly built in Bangladesh by some new entrepreneurs and many similar applications are made regularly but no applications have such effective features to help the users effectively.

Canadian Covid-19 Alert: This application really helping its clients by telling them the Covid and every one of its conditions with obliging information close by following the closest Coronavirus patient who is now influenced [15] recently in 2021, Canada launched its application for its regional people. This application is not publicly launched all over the world but only for their own country. [6] So, the world needs a common application where they can find every helpful information which is helping them perfectly.

Leave home safe: The Government of Hong Kong dispatched the "Leave Home Safe" portable application on 16 November 2020 to furnish individuals from general society with a helpful advanced device for recording the hour of their visits to various scenes and taxi rides.[21] The versatile application will inform a client on the off chance that the person is subsequently recognized to have visited the very scene that an affirmed patient has visited at about the very time or taken the very taxi that an affirmed patient (either the driver or the traveler) has required around the same time. In the heartbreaking occasion of disease, the client's visit records put away in the application can help the Center for Health Protection ("CHP") in epidemiological examinations [21].

Motivation - During this pandemic, everything, outside the comfort of our own homes is unpredictable and this, in turn, has instilled fear within us especially when we are going out for necessities or if a relative comes over. The main motivation for this app was to overcome this state of uncertainty and be able to maintain some sense of security, awareness, and the severity of our current state of affairs. There is a solution but we want to give something a little better. Where we can able to see the statistics. But this app is an idea that trying to help people in better understanding and their surroundings as simply taking the basic, and usually easy, precautions of using a face mask and carrying sanitizers isn't enough. The number of individuals, infected or not, in the area also have to take into account the chances of getting infected; the number of known infected also affects how possible unknown infected there are too, being the case of designing this app. So, we want to create an app that will really help people in this very deep situation.

Existing Solution – During this pandemic situation, every country is trying its best to give the people an exact solution. UN organizations trying to produce the vaccine for this virus also are trying to spread awareness for COVID-19. So many countries all around the world share their exact COVID-19 data with UN organizations. So, this is going to help the UN to know the virus and how it operates in the human body. In terms of the solution, there is no hard solution worldwide like android based GPS tracking (COVID case information). The only way that people have they can only get updates of cases through a web-based dashboard. There are numerous like Domo Stay in the web regarding significant (COVID-19) information summed up by affirmed cases, topography, testing and treatment, projections, and monetary effect. [12][13] In Bangladesh, there is an application by the public authority of Bangladesh which encourages the cross-country individuals to realize how to play it safe and what sorts of drugs can help them and the hospitals details that are dealing with COVID-19 cases and provide the patients treatment. Yet at the same time, in Bangladesh, there aren't any such

applications that will assist individuals with advising the nearest COVID-19 case. The dashboard also provides the visitors with what way they can identify covid-19 symptoms and possible safety rules. Till the middle of 2020, everyone got updates regarding covid-19 based on the WHO web-based dashboard but after the middle of 2020 many of the software farms and entrepreneurs started to build applications based on covid-19. Here some of the details of the covid-19 application are given with their advantages and disadvantages which also help us and give our project group a great motivation to build an application based on this highly demanded topic. [4] Appropriately, they are a huge load of utilizations that are dispatched during this pandemic at any rate none of them are left any strong impact which individuals need and those applications are WHO Dashboard, Coronavirus Contact Tracing Apps, COVID-19 Plasma Finder, and Canadian COVID-19 Alert Regional Application [16]. In Hong Kong they dispatched the "LeaveHomeSafe" portable application on 16 November 2020 to furnish individuals from general society with a helpful advanced device for recording the hour of their visits to various scenes and taxi rides and so on [21].

Proposed Solution – In our application which is named COVID-19 tracker, this Bangladesh application dependent on android, which will help for the most part individuals with checking whether anybody around him/her is ruined with the crown and the specific location of that person with the distance. This application also urges the country's administration to get precise data of COVID-19 particularly, and moreover can send them the proper treatment and support. [17] In our application, the user can simply signup by his number and set up some basic information about the user. Tolerating the application client endeavored COVID-19 negative, by then, it will empower his status, and besides, if some other client close to that individual is being endeavored COVID-19 that there is someone who is tested positive and the distance with the location. Generally, this application's main focus is to spread awareness among all the people about their nearest position. In this pandemic, everything outside the comfort of our own homes is unpredictable and this, in turn has instilled fear within us especially when we are going out for necessities or if a relative comes over. The main proposed solution in this situation was to overcome this state of uncertainty and be able to maintain some sense of security, awareness, and the severity of our current state of affairs. This app is an idea in trying to help people in better understanding their surroundings as simply taking the basic, and usually easy, precautions of using a face mask and carrying sanitizers isn't enough. The number of individuals, infected or not, in the area also have to take into account the chances of getting infected; the number of known infected also affects how possible unknown infected there are too, being the case of designing this app.

Solution work and key features – Keeping our goal in mind, we researched what steps to follow and how to progress with building this application. We analyzed our requirements and over the study of eight months to worked towards achieving those key features. We made a list of features that would be user-friendly and informative at the same time. One of the major requirements for our application was its efficiency. Hence, we modeled a draft design for our outlook and developed on implementing those on the user and server

interface. Below is the list of features we developed and the model design we created in our mission to attain it.

Splash Screen
Sign Up/Log in
Mobile Phone Verification OTP (Using Firebase)
Location Tracking/ Map view
Dashboard UI
Navigation Drawer
Personal Data Retrieve
Total COVID patient detection on given range
Send notification if any COVID-19 patient within a 5-meter range of users.

Solution Assessment – In spite of the fact that numerous nations are attempting to produce more solutions for this pandemic circumstance still there is no such application that will assist individuals with getting told of the closest data about these COVID-19 cases. The few existing solutions are only based on how to take precautions and the worldwide details. So, in terms of this our application hopefully will be more helpful for every user all around the globe. If we look at the software or applications hub there are no such applications with this kind of feature, where user can get notified through the application that there is someone in his/her surroundings by the covid-19 positive case or negative case. It's an open COVID-19 case navigation system where the user gets every update based on COVID-19 and also can easily navigate the patient or identify in what distance someone is positive if it is really.
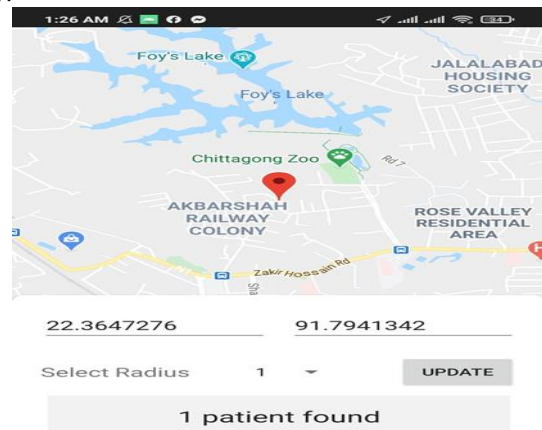

Fig 1.01: User Navigating Some Patients

Design Alternative – If we get govt. support like having coronavirus test result data then we are planning to take user coronavirus status update control to us. If any patient is a coronavirus victim according to GOVT test data and if he/she doesn't install the application, they will get an alert message on their device to install. When a Covid-19 victim install the application, he/she doesn't have to control their Covid-19 status, for this there will be consequently refreshed synchronizing with the data set all along, the Bluetooth and GPS will start work automatically until the user recovers from the coronavirus. He/she (coronavirus patient) also can't uninstall/logout unless he/she recovered or again logged in with the same number on another device. Because by one mobile number you can register on only one device at a time. The new logged-in device will work like the earlier one until you recover. If users recover but the system shows them positive yet then they can send a system verification request of their coronavirus status by giving their test result id. Then

the system administrator will work following on this objection.

According to the Bangladesh environment, people are not willing to mark them coronavirus infected. Because our government initially faced so much travel to make people understand about the benefit of masks. So same to our app, but our young generation shared their positive review with us. So, our young generation and GOVT should come up together and cooperate with others, thus we could accomplish our target and reactivate the whole nation.
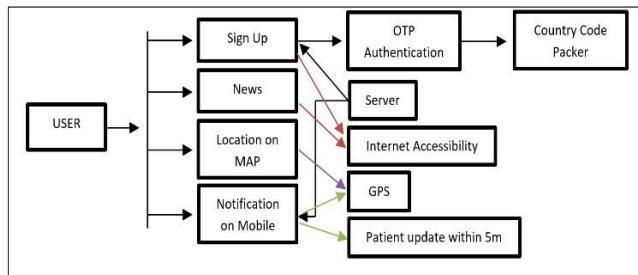

Fig 1.02: Technical Model & Use Case Diagram

Here we have our two active performer user and system server. After users signing up for the system there, they would face a mobile phone OTP verification. After a successful verification completion user's given data will be stored on the database and the dashboard UI will open to them. Dashboard UI is full of components like searching for anything getting all kinds of COVID-19 related updates and news. Users can get their location by google Maps and can see the total numbers of affected patients nearer to them. If any patients come nearer to them within 5 meters, then the user will get an alarming notification on mobile. For this location tracking and notification system, the user must have GPS enabled. The whole system also required internet accessibility.
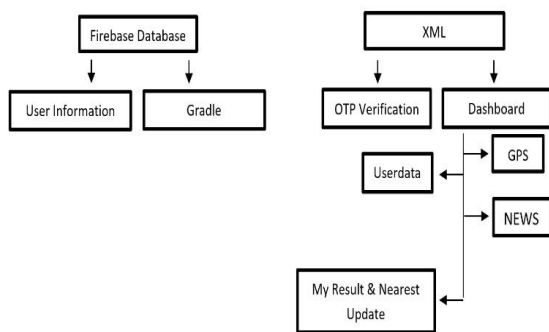
Technical Design – System Level

Fig 1.03: Technical Design of System Level

II. *Algorithms*

Haversine formula: The haversine recipe decides the extraordinary circle distance between two focuses on a circle given their longitudes and scopes. It results in an error of up to 0.5%. The Haversine formula method is used to determine the distance between two users' locations on android. Haversine formula. Distanced is a function of two latitude and longitude coordinates (fi1,y1) and (fi2,y2). Where earth radius is r. For example, haversine(θ) = $\sin^2(\theta/2)$. The haversine formula is a very accurate way of computing distances

between two points on the surface of a sphere using the latitude and longitude of the two points.[7]

$$d(\varphi_1 y_1 y_2) = 2r \cdot \arcsin\left(\sqrt{\sin^2\left(\frac{\varphi_2 - \varphi_1}{2}\right) + \cos(\varphi_1)\cos(\varphi_2)\sin^2\left(\frac{y_2 - y_1}{2}\right)}\right)$$

Distance Formula:
$\Delta\psi = \ln(\tan(\pi/4 + \varphi_2/2) / \tan(\pi/4 + \varphi_1/2))$ ('projected' latitude difference)\
$q = \Delta\varphi/\Delta\psi$ (or $\cos\varphi$ for E-W line)
$d = \sqrt{(\Delta\varphi^2 + q^2 \cdot \Delta\lambda^2)} \cdot R$ (Pythagoras)

where φ is latitude, λ is longitude, $\Delta\lambda$ is taking the shortest route (<180°), R is the earth's radius, ln is the natural log.

Code Method:
```
/**
* The desired interval for location updates. Inexact. Updates
may be more or less frequent.
*/
private static final long UPDATE_INTERVAL_IN_MILLISECONDS = 5000;
/**
* The fastest rate for active location updates. Updates will
never be more frequent
* than this value.
*/
private static final long FASTEST_UPDATE_INTERVAL_IN_MILLISECONDS = UPDATE_INTERVAL_IN_MILLISECONDS / 2;
```
After Location updating on database system frequently search for nearer patient within 5m range as for 5000m we have taken 5 so for 5m meter the value would be .25 that's what we used for our logical operation:

Code:
```
public void notify(LatLng currentLocation){
    FirestoreUtil.getInstance().getDocumentRef().collection("users")
        .whereEqualTo("status", true)
        .get()
        .addOnCompleteListener(task -> {
            List<DocumentSnapshot> documents = task.getResult().getDocuments();
            int count = 0;
            for (DocumentSnapshot snapshot : documents){
                Double latitude = (Double) snapshot.get("lat");
                Double longitude = (Double) snapshot.get("lon");
                if (latitude != null && longitude != null){
                    LatLng latLng = new LatLng(latitude, longitude);
                    float distance = LocationUtil.getInstance().findDistance(currentLocation, latLng);
                    if (distance <= 0.25){
                        count ++;
                        Log.d(TAG, "notify: " + distance);
                    }
                }
            }
```

```
        // if count > 0 that means COVID-19 positive patient
found
        // then a notification will be showing for notify the
user
        if (count > 0){
            mNotificationManager.notify(NOTIFICATION_I
D,
                getNotification(String.format("Alert!    %s
COVID positive patient detect near you", count)));
        }
    });
source: LoctionUpdatesService.java
```

We have used some functionalities for a time duration, database updating, shared preference & navigation drawer also. If any information is needed you can check the datasheet segment of the report. [8]

III. *Required Tools, Skills and Components*

In this research project, the required skill we used are Java Programming Language, Android Studio, XML Studio, Firebase account management to configure the Firebase Authentication, Firebase Database, Cloud Fire store, Country Code picker, SDK, Gradle. These are the required skills and knowledge which will help to finish the project on time. Moreover, required tools and components are Generating GOOGLE API key, Tracking Tools, Haversine Method, GPS, Channel ID, Action Broadcast, I binder, Notification channel creation, location map, map marker, haversine method, fused location operation, I binder, for the coder, hash map<>, GPS enable status, listing, JSON file operating, SHA1 key generating, Distance between two-point method, Cloud fire store operating, GitHub, on Verification Completed() etc are use as tools and components.

Test Requirements – The test requirement of this research project is completely important. So, we set up some important requirements and these requirements are –
Android Emulator - After the work to follow work progress in Android.
Mobile Phone(s) - Testing of the built application on physical devices.
Logcat - Logcat is an order line device that shows a log of framework messages, including stack, follows when the gadget tosses a mistake and messages that you have composed from your application. One can likewise see log messages from the Logcat window in Android Studio. [19]
Build - It gathers application assets and source code, and bundles them into APKs that you can test, send, sign, and convey. [18]

IV. *User Case Analysis*

After spending a lot of time building such an application, we choose to take a user case survey and besides this, we also do the same survey among random people. This survey is completely done through social media and Google forms support. From the beginning of the pandemic and the massive cause that occurs for this then from till now people are still scared. In our analysis, we ask people 5 different questions and they give us their valuable answers which work to set our information datasheet. At the first question, we got 70.3%

badly need a covid-19 application which can detect covid-19 easily on the other hand 17.7% feel less important and 12% reapplied that they don't this one will put an impact on this situation additionally in the second question 59.1% thinks that covid-19 application can be useful and rest of the 40.9% thought that it won't be useful for them. In the third question, we ask people they should government avail their covid-19 data among the people and 76% agreed with it where 24% don't think in that way so they give their negative reply. So, we continue our survey and run for the fourth question answer which is regarding the lock-down and it is important, then basically 31% people think it's more important, 27.4% think too much important, 36.3% thinks that less important and along with the 10.6% of people don't agree with the lock-down. Now we come to the end of our survey and we decided on the last question which is our fifth one and that was an application that can make people aware and, in that part, 77.9% agreed with it and 22.1% still with the negative answer and they want it simple.

Future Development – We have already worked on a dashboard which will be a term to view the user's current location on the map, COVID-19 related news, and can see nearby COVID-19 patient locations with a limited range. Users can easily update their information and statement. Consideration for the removal of the logout button for a patient who is COVID-19 positive. Assuming an individual is contaminated with crown, as indicated by the GOVT test in the event that they don't have the application introduced, they will get an alarm to introduce it. In the event that any quiet is a COVID-19 mishap as shown by GOVT test information and on the off chance that he/she doesn't present the application, they will get an alert message on their device to present. When a COVID-19 casualty introduced the application he/she doesn't have to control their COVID-19 status there will be consequently refreshed synchronizing with the information base all along, the Bluetooth and GPS will start work automatically until the user recovers from COVID-19. He/she (COVID-19 patient) also can't do uninstall/logout unless he/she recovered or again logged in with the same number on another device. Because by one mobile number you can register on only one device at a time. The new logged-in device will work like the earlier one until you recover. If users recover but the system shows them positive yet then they can send a system verification request of their COVID-19 status by giving their test result id. Then the system administrator will work following on this objection. So, overall, we want the best possible accuracy level on serving & UI graphics of our projects in the future thus it will be helpful not only in the country but also worldwide. We have also thought that we will try to add a COVID-19 test prediction portal where someone can check their probability of their COVID-19 percentage by which he/she can go to the hospital after seeing the probability of having the chance. By which we can able to save a lot of COVID-19 test kits.

RESULT AND DISCUSSION

As our project is a COVID-19 patient tracking system, the user must be registered and should mark themselves as COVID-19 positive or negative statements for the time being. If the app can be connected to the government database for the patient status, the users would not need to do a self-report. So, we built our project from scratch, worked on a sign-up,

splash screen dashboard, and logout system. The users can register themselves through phone verification and the users can see their current location status.
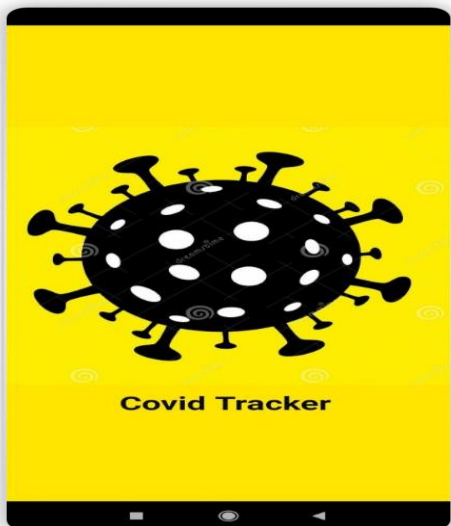

Fig 1.04 Display of the splash screen

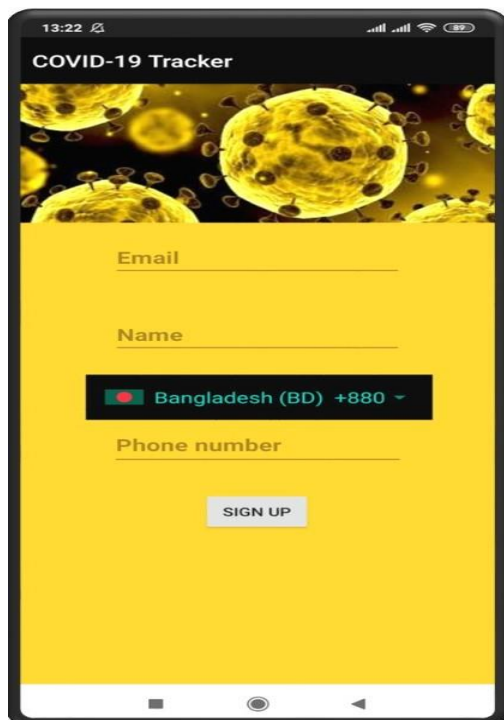After installing the app the user will able to see this splash screen for 5 sec.

Fig 1.05: Sign up page for the user in the system

After the display of the splash screen the user of the application come to sign up page to use the application there is also phone verfication feature included in the application. That will auto code fetching on same device mobile, make saving on Firebase &after verifying code goes into dashboard.
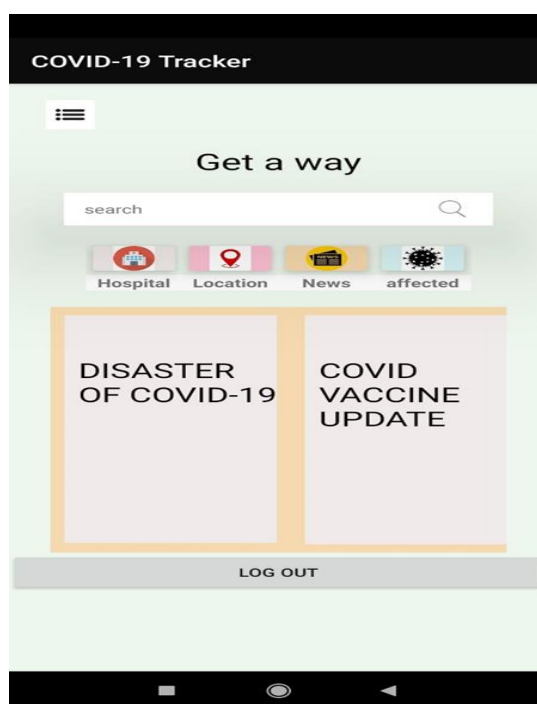

Fig 1.06 OTP verification feature of the application.

Fig 1.07 The landing dashboard of the application

After sign into the application the user will able to see the dashboard of the application. Where menu icon opens the navigation bar. The search bar to bring COVID related news in one place. And search for hospital details, infected in the user's current location, COVID related news, total affected rate over the world.
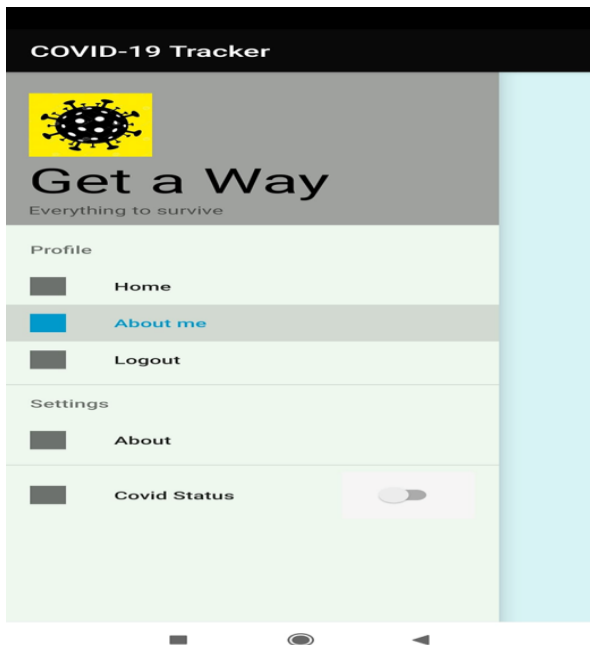
Fig 1.08: The landing page of navigation drawer

In the navigation drawer Home – Redirect to Dashboard. About me - Retrieve user information form server. Logout – Logout from server and redirect to signup page. About – Overview of the Application. COVID Status – Users can mark them COVID positive/Negative.
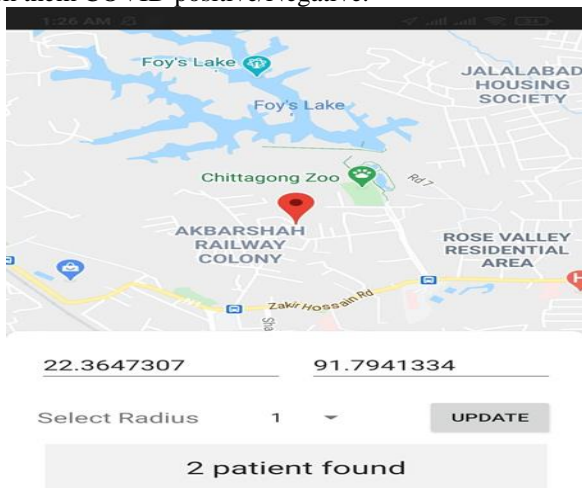

Fig 1.09: Location of the affected patients around the user.

At the final stage, they will be notified by the application who is next to the user a covid-19 positive patient or negative patients.
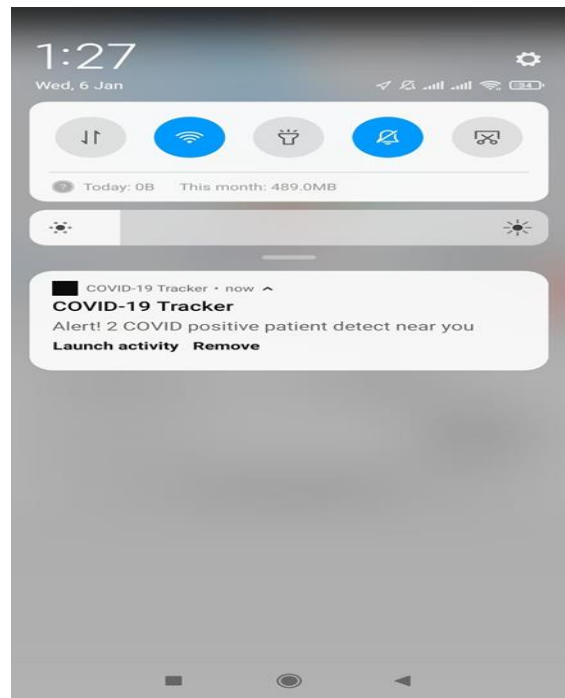

Fig 1.10: Alert from the application to the user

This application gives 90% accuracy on identification like Bluetooth however as per the Bangladesh climate individuals are not able to check them Covid-19 contaminated. Our application there is ease of access for the user, more transparent Data record, self-awareness and protection & swifter response when vaccine is available. Our government initially faced so much trouble to make people understand about the benefit of masks. So same to our app, but our young generation shared their positive review with us. So, our young generation and GOVT should come up together and cooperate with others, thus we could accomplish our target and reactivate the whole nation [20].

CONCLUSION

We were able to get started with making an app that does the basic things needed for the final state of our goals but there are still ways to make the app with more functionality. We added some important functionality in this project where the user gets a notification if anyone roaming around is tested COVID-19 positive. So finally, we became successful and made the application with its every initial important feature from scratch and all the functions are working in its appropriate manner but also, we need the government support because only Bangladesh govt. organization IEDCR has a huge number of COVID-19 patient data resources. So, if the govt. shares their resources like the Canadian government. Then we can work it to the next level but apart from this our project can work manually with the same facilities. Not exceptionally various functionalities were added to the application to make an effort not to swell the application from the essential goal of showing the customer the amount of COVID-19 positive patients to allow users to make better-informed decisions on if they would like to continue to venture into an area where several infected are present. Further, with a higher number of COVID-19 positive patients, the chances of there being unidentified COVID-19 infected would be exponentially higher. And the people of Bangladesh should use it because our application there is ease of access

for the user, more transparent Data record, self-awareness and protection & swifter response when vaccine is available.

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