Detecting COVID-19-infected persons in the surrounding areas using Armor Application

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Abstract-- **Our product is focused on COVID-19 safety Protocols. It is designed to ensure that people are adhering to social distancing guidelines. Ultimately, it can help make people and the community safer from the virus. This is a tracking app that uses a smartphone's GPS and Bluetooth features to track COVID-19 cases. Bluetooth technology enables users to assess their risk of being exposed to the COVID-19 virus if they have been within six feet of a confirmed case. It is also able to detect specific locations that are deemed 'infected areas through location data analysis, and crowdsourcing. this data so it is easily accessible for decision-making purposes. The idea behind the app was to make people aware of their risk and give them the tools to protect themselves from contracting the virus. We developed a product that would be a cost-effective measure for protecting profits and human life. The idea for our product is based on the idea of "control" to prevent COVID-19 from spreading. It would be an app that uses Bluetooth and GPS capabilities to track COVID-19 cases and would also provide alerts in case it detects COVID-19 in an area. This product was designed to be inexpensive, and effective, providing information necessary for the public's awareness of where the virus is being spread. We designed this app as an incentive to prevent someone from spreading the virus as they can see how close they are getting to people who have contacted it.**
Keywords: depression, machine learning, natural language processing, facial expression, early detection.

I. INTRODUCTION

In Wuhan, China, in December, the 2019 Coronavirus disease (COVID-19) was discovered. Following that, the virus spread rapidly around the world. As of March 2022, records show that COVID-19 had infected about 520 million people and that more than 4 million people had died because of the illness. The COVID-19 respiratory syndrome is an acute respiratory illness characterized by a persistent cough, a high-grade fever, and breathlessness. The rapid spread of COVID-19 caused the World Health Organization (WHO) to classify it as a pandemic. Numerous healthcare systems throughout the world have been affected by and put to the test because of the enormous number of cases that want for medical attention.

Overall, the COVID-19 pandemic has posed several difficulties for patients and healthcare institutions. Since it was found that the virus is more active in social settings, public authorities and governments implemented lockdowns and quarantines to stop the infection's spread among the populace. To stop the infection from spreading, the quarantine, stay-at-home, and social isolation policies were put into place. According to research, many healthcare systems were susceptible to such a pandemic because it exacerbated already-existing problems such staff shortages, a lack of personal protective equipment (PPE), the capacity of intensive care units (ICUs), and hospital bed shortages. The current healthcare systems face new challenges as a result of this unique circumstance.

According to health officials, human interaction is the primary factor contributing to the pandemic's spread. To prevent the spreading, it is therefore necessary to maintain the necessary spacing with some effort. In addition, implementing a Contact Tracing technique that is automated and protects privacy might be helpful to stop the spread.

Modern cell phones are not only used for communication; they can also detect movement, proximity, direction, and other environmental cues. At the same time, nowadays practically everybody uses a smartphone. Considering these realities, we suggest a method for leveraging smartphones to foster social estrangement. We propose a strategy for using smartphones to promote social alienation considering these facts.

Bluetooth Low Energy, more commonly known as BLE, is a technology created as an Android application that is used for proximity detection. It will trade Bluetooth Low Energy (BLE) beacons with neighboring devices, calculate the separation between them, and alert the user if the closeness is too close. Using a pre-trained deep neural network, the direct distance between two devices is calculated based on Radio Signal Strength Indication values. The users' devices retain the proximity data as transformed information that cannot be used to immediately re-identify the contacts.

Safety Protocols for COVID-19 are the focus of our product. It is intended to make sure that people follow the rules for social distancing. In the end, it may contribute to increased community and individual viral safety. This tracking application tracks the COVID-19 case using the GPS and

Bluetooth capabilities of a smartphone. Users can evaluate their risk of contracting the COVID-19 virus if they have been within six feet of a confirmed case thanks to Bluetooth technology.

Through crowdsourcing and the analysis of location data, it is also able to identify areas that are infected areas. This information is readily available for use in making decisions.

The purpose of the app was to inform users of their risk and equip them with the means of preventing virus exposure. We created a device that would serve as an economical safeguard for both financial gain and human lives. Our product's concept is centered on the notion of "control" to stop the spread of COVID-19. It would be an app that tracks COVID-19 instances using Bluetooth and GPS technology and sends warnings if it finds COVID-19 in a certain location. The purpose of this device was to tell the public about the locations where the virus is spreading while being affordable and efficient.

Social Distancing has increased in frequency during the past two years as a result of the Covid-19 pandemic outbreak. Interpersonal communication is the main factor driving the pandemic's spread, said worldwide health officials. It is therefore vital to maintain the required spacing with some effort in order to prevent the spreading. To further stop infection, creating an automated Contact Detection phase with privacy protection would be helpful. Smartphones of today are used for more than simply communication; they are also capable of detecting a wide range of environmental cues (such as movement, proximity, direction, etc.). Additionally, almost everyone uses a smartphone these days. Think about these details. A mobile app that may alert users when a person is approaching from a closer distance than is recommended solves the problem.

II. LITERATURE REVIEW

Bluetooth Low Energy is a standard designed by the Bluetooth Special Interest Group (Bluetooth SIG) for wireless personal area networks. It was designed with the aim of supporting Internet of Things (IoT) applications by using low-cost and low-power devices. BLE is used in many real-world applications nowadays. For example, AJ. Aljohani (2021) developed a model for identifying COVID-19 risks in university indoors and class environments. Similarly, M.J. Keeling provided a study on the Efficacy of contact tracing for the containment of the 2019 coronavirus.

The significant number of medical and personal mobile devices supporting this technology is making it possible for hospitals to better engage with their patients before, during, and after each visit. According to a 2013 eClinicalWorks Survey, 93% of healthcare professionals believe mobile apps can improve patient experience and outcomes.

Although, Bluetooth Low Energy (BLE) is the most used communication method in medical devices and sensors. Security and privacy are important, especially in healthcare technologies that can impact morbidity. There is an increasing need to evaluate the security and privacy of healthcare technology, especially with devices and sensors that use Bluetooth Low Energy due to the increasing prevalence and use of medical devices and sensors. Therefore, a more robust security analysis is needed to evaluate the security and privacy aspects of medical devices and sensors that use Bluetooth Low Energy.

III. PROJECT REQUIREMENTS

The objective of this project is to develop a mobile application called "Armor" that can scan for covid 19 infected persons in the surrounding area covered by Bluetooth. The app then Alerts the user if there is any risk in his/her surroundings.

1) Functional Requirements

The following are the functional requirements for the Armor app:

1. User Authentication: The app allows users to create an account log in with their credentials and store user data securely.
2. Services: The app uses BLE service and Cloud Fire Store to manage Bluetooth beacons and store users' data.
3. Mobile OS: The application supports both Android and iOS mobiles.
4. Users input: The app allows users to update their COVID-19-infected status in the app.
5. BLE service: The app Exchanges anonymous beacons (containing a unique key) and saves local anonymous data about people whom they encountered (contacts) and classifies the proximity of a nearby device using BLE RSSI values.
6. User Alerts: The app Alerts the user if any infected person is nearby. The application regularly downloads the database of infected users to check for matching keys in the local database.

2) Non-functional Requirements

The following are the non-functional requirements for the Armor app:

1. Performance: The app does not take more than 3 seconds to load the initial screen.
2. Efficiency: The app scans for COVID-19-infected persons in the nearby area and alerts the user.
3. Security: All the app data is secured and encrypted with minimum needs so that it is protected from the outside environment and from internal attacks.

4. Compatibility: The app is compatible with both Android and iOS devices running on the latest operating systems.
5. Scalability: The app can adapt itself to increased usage or be able to handle more data as time progresses.
6. Screen Adaption: The application can render its layout to different screen sizes. Along with automatic adjustment of Font size and image rendering.

3) Hardware Requirements

1. IOS or Android devices to run the application.
2. Any OS that runs the browsers.

4) Software Requirements

1. Visual Studio, Microsoft Excel, Microsoft Word, Google Chrome, Safari, Microsoft PowerPoint, Git Hub, and JIRA software.

5) Constraints

The following are the constraints for the Armor app:

1. Performance Constraints: The app works on any device without any bugs and crashes and at the same time consumes less memory and less battery.
2. Time Constraints: To reach the project deadline, the app must be created and tested within a predetermined timeframe.
3. Cost constraint: The cost of creation and maintenance should be kept to a minimum, and the app should be created within the constraints of the given budget.
4. Scope Constraints: To efficiently develop the app, the scope needs to be checked continuously and any changes to the scope should be documented properly.
5. Device Constraints: The app should be developed using a responsive design so that it can run smoothly on any device for all screen sizes and pixels.
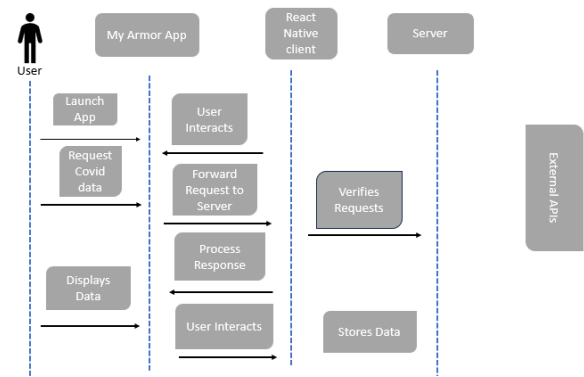
IV. SYSTEM DIAGRAM

Figure 4.1 Sequence Diagram

A sequence diagram is one which illustrates the interactions between the objects in a sequence in which they occur. Here it shows the interaction between the user and the armor app. The user interacts with the application by using the User Interface. The main service manages the flow of the application and coordinates with other services. BLE services manage beacon advertising and scans for nearby devices. Machine Learning Service classifies the proximity of nearby devices using RSSI signal strength.

Notification service is designed to send out alerts or notifications to users or administrators, and the type of notification sent depends on specific events or occurrences within the system. For example, if there is an error, a new message, or an important update, the notification service will generate and deliver the appropriate alert to the relevant recipients. Database service is responsible for collecting and storing data that is generated or sent by devices when they connect to the system. Here the data is stored anonymously. Anonymizing the data helps protect user privacy and security. Background tasks, which are operations that run in the background of your application without requiring user interaction, are managed using Firebase Work Manager. Firebase Work Manager is a tool or service provided by Google that helps schedule and execute these background tasks efficiently. These tasks can include things like data synchronization, updates, or other automated processes that don't need to be in the foreground.
When certain events or occurrences impact users, their anonymized data is stored in Firebase Cloud Storage. Firebase Cloud Storage is a cloud-based storage service provided by Google. It's commonly used to store various types of data, such as user-generated content or application data. The term "anonymized data" implies that any data stored here has been stripped of information that could identify individual users, ensuring their privacy while still allowing for analysis or other purposes.
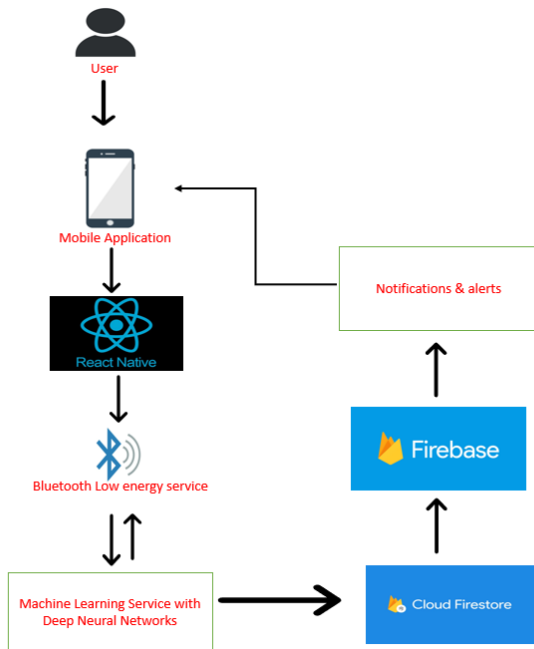
Figure 4.2 Conceptual Architecture Diagram

The high-level conceptual design of a system or software application is represented by the Conceptual Architecture Diagram above. It gives a general overview of the main parts of the system and shows how they work together to accomplish the required functionality.

Users install the Armor mobile application, which is being built using the React native framework. We are using Bluetooth Low energy service (BLE) which helps to scan the nearby devices which have unique keys. It scans the devices that will be in the range. These keys are exchanged between the BLE and the Machine Learning Service with Deep Neural Networks which are further processed and stored in the database.

Whole data, like who is infected with the virus, and the people the user met, is stored in the Cloud Fire store and the Firebase is the local database from which the system frequently retrieves data. According to the situation, all the notifications and alerts will be sent to the mobile application and the user can follow the steps accordingly.

V. Sequential Architecture Diagram

VI. Product Results

The application's crucial Bluetooth technology, which is a crucial component of its functioning, has so far seen tremendous improvement. Creating an account on the app and signing up is also made easy as the app lets the user sign up using an Email address. All the details of a user are subject to privacy. Additionally, user feedback functionality has been included to improve the application's user-friendliness. The Bluetooth function is now able to be controlled by users within the application, allowing them to quickly enable or disable it as needed. Users now have access to timely information because of the effective integration of notifications for COVID-19 alerts and updates. To increase privacy and control over their gadgets, users can also choose to make them invisible to other devices. As for the user interface to date, Figures 5.1 and 5.2 show the developed front end of Armor application.
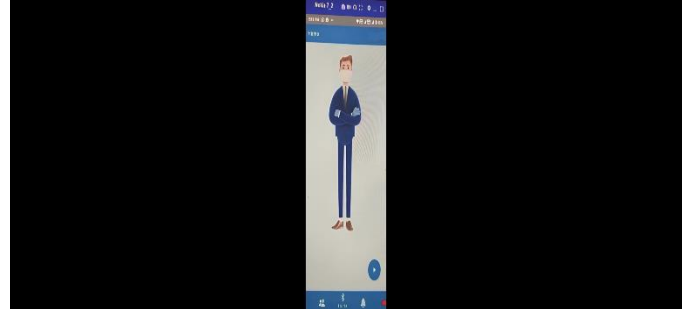

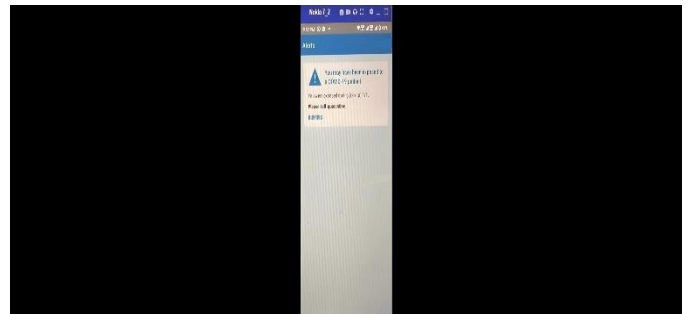Fig 5.1 Home page of the Armor application

Fig 5.2 Notification page of Armor application

VII. Conclusion

Armor Application uses Bluetooth low-energy signals and tokens to identify COVID-19-infected persons in the surrounding areas. Social distancing notifications and digital contact tracing are two aspects of a smartphone application related to COVID-19.

The application uses Bluetooth signals to detect other users when they are within a set distance typically 6 feet or 2 meters and informs the user to maintain their distance. The goal is to help users stay away from close contact and prevent the transmission of COVID-19.

Users may freely update the app with information about their COVID-19 status, which can then be used to alert other users who could have encountered the infected individual. To stop COVID-19 from spreading, Bluetooth signals are used, which can establish whether two users are sufficiently close to one another for a certain period.

All the registered users now can mark themselves as COVID-19-infected persons. Users will be able to update their COVID-19 status whenever they are affected by the virus. This feature enhances and encourages responsible behavior.

The registered users will also be able to share their application QR code with friends which enables seamless integration into their friend lists. With this user can easily connect with their friends on this platform which in turn promotes social engagement. As per our commitment to user privacy and security, we also implemented a feature that allows users to whitelist their trusted friends. With this, the users can enhance their control over who can access their data and interact with them. In the same way, users can also be able to remove friends from their whitelist which provides the flexibility to adjust their trusted connections over time.

Users can also delete their accounts by visiting the settings page, ensuring that they have the autonomy to manage their presence on this platform. This feature is strictly incorporated for the user's convenience and control.

Making it simpler to locate and isolate possible instances is the aim. It is critical to keep in mind that user uptake and engagement, Bluetooth signal accuracy, and the notification system may all influence how well consumers will react to these features.

VIII. HISTORY OF UPDATES

We updated our conceptual architecture diagram as per the professor's feedback from the previous sprint. conceptual architecture diagram gives a general overview of the main parts of the system and shows how they work together to accomplish the required functionality.

The Armor mobile application, which was created with the React Native framework, gets installed by users. The Armor mobile application, which was created with the React Native framework, gets installed by users. To scan neighboring devices with unique keys, we are employing Bluetooth Low Energy (BLE). The devices that will be in the range are scanned. These keys are sent back and forth between the BLE and the Deep Neural Network-based Machine Learning Service before being further analyzed and saved in the database.

The Cloud Fire store houses all the data, including who is infected with the virus and the individuals the user met, and Firebase is the local database from which the system routinely requests information. All notifications and alerts will be delivered to the mobile application in accordance with the scenario, and the user may then take the appropriate action.

IX. REFERENCES

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