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Application for Road Accident Rescue

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Abstract: ***Road accidents rates are very high nowadays. Timely medical aid can help in saving lives. This system aims to alert the nearby medical center about the accident to provide immediate medical aid. Road accidents area significant cause of injuries and fatalities worldwide. The prompt response of emergency services plays a crucial role in minimizing the impact of these accidents. In this context, the development of mobile applications can greatly assist in improving the effectiveness and efficiency of accident rescue operations. This abstract introduces Rapid Rescue, an Android application designed to enhance the response to road accidents and facilitate the rescue process. Rapid Rescue provides a comprehensive set of features aimed at streamlining the communication and coordination among emergency responders and victim. The application leverages the power of mobile technology to provide real-time information and prompt assistance, ultimately contributing to faster response times and improved outcomes. The Android application in the mobile phone will send text messages to the nearest ambulance responder. Application also shares the exact location of the accident and it can save time.***

Keywords: Traffic accidents; accident detection; on-board sensor; accelerometer; android smartphones; real- time tracking; emergency services; emergency responder; emergency user; ACCISHIELD; ACCISHIELD Go;

I. INTRODUCTION

The rise in traffic and reckless driving has resulted in a surge of accidents on highways, often without timely communication to emergency responders and family members. This has led to delayed help for those in need. Road accidents are a major cause of fatalities, with approximately 1.3 million deaths and 20 to 50 million non-fatal injuries occurring annually worldwide. Road traffic injuries are the leading cause of death among young people aged 15-29 years and cost countries 1-3% of the gross domestic product (GDP). Without action, it is predicted that by 2020, road traffic crashes will result in the deaths of around 1.9 million people annually.[2]

To address this issue, an android smartphone system can detect accidents and notify emergency responders with the exact location of the user in distress. This system allows emergency responders to keep track of the user's location and provide timely assistance. With the rise of vehicles, it is essential to have a system that provides immediate hospital and police services, as well as immediate location tracking. This system is useful in traffic, hospital, and transportation settings and is especially beneficial in rural or populated areas.[4]

The number of deaths due to road traffic accidents is alarming, affecting young adults between the ages of 15-44. Even countries with good road safety measures experience an increase in road accident deaths every year. To address this global crisis of road safety, there is a need for systems that prioritize human life safety and provide fast access to emergency.

More than 90% of road traffic fatalities occur in middle-income countries, with even higher rates in low-income countries. In Pakistan, for example, an average of 15 individuals lose their lives every day due to traffic accidents. From 2004 to 2013, data from the Pakistan Bureau of Statistics revealed that 55% of road accidents resulted in deaths, which is considered alarmingly high by experts. During this period, a total of 51,416 individuals died in 97,739 road accidents across the country, with a death rate of 55% per accident.[3]

One of the main reasons for fatalities in traffic accidents is the lack of prompt first aid provision, often due to emergency servicesnot receiving information about the accident in time. Every minute counts in such situations, and even a one- minute decrease in emergency response time can increase the chances of saving a life by up to six percent.

To reduce response time and save lives, the implementation of enhanced traffic technologies is necessary. Therefore, the objective of this research is to design and implement an automated system that can detect vehicle accidents and report them to the nearest available responders using smartphones. This system aims to address the emerging problems and reduce casualties as much as possible. By decreasing emergency response time, the detection system can help reduce fatalities due to vehicle accidents.[4]

The system will also provide other essential emergency services, including Fire Brigade, Police Department, and Medical emergency services. To achieve this, we will leverage Android smartphones to detect accidents and report them to the nearest available emergency responders, providing them with the precise location of the users in emergency

II. OBJECTIVE

The main objective of the Application for road accident Recuse is an Android application that aims to enhance the response to road accidents and facilitate the rescue process. The information highlights the significance of road accidents as a cause of injuries and fatalities worldwide and emphasizes the importance of timely medical aid. The abstract explains how mobile applications can improve the effectiveness and efficiency of accident rescue operations and introduces Rapid Rescue as an example of such an application. The abstract also outlines the features of Rapid Rescue, such as streamlining communication and coordination among emergency responders and victims, providing real-time information and prompt assistance, and sharing the exact location of theaccident. Overall, the objective of this information is to provide a brief overview of Rapid Rescue and its potential to contribute towards minimizing the impact of road accidents and ultimately saving lives. The information could be used as an abstract for a paper orarticle discussing the development, implementation, and evaluation of Rapid Rescue.[3]

III. PROBLEM STATEMENT

The prevalent issue of road accidents in developing countries, particularly on highways or curved roads, has emerged as a leading cause of fatality. The escalating vehicular traffic on roads and the high incidence of accidents, particularly those involving four-wheelers, highlights the dire need for timely medical intervention in order to salvage precious lives. Unfortunately, the current situation is such that the lack of prompt ambulance arrival at the accident site or in transferring the victim to the hospital, in the aftermath of the accident, has led to an alarming number of casualties. Consequently, it is imperative to ensure timely medical attention and transportation of accident victims to medical facilities.

However, a major challenge to this effort is the delayed response and rescue operations following the occurrence of a road accident. This delay puts the injured individuals at further risk of complications, thereby intensifying the severity of their injuries. To tackle this problem, a highly efficient Android application is required that can connect accident victims with the nearest emergency services and furnish crucial information to expedite rescue operations. This application would, in turn, mitigate the severity of injuries sustained by the victims and increase their chances of survival.

Road accidents have emerged as a significant cause of injuries and fatalities on a global scale. The delayed response time of emergency services due to various factors such as traffic congestion and communication barriers is a crucial concern that demands immediate attention. In such a scenario, an Android application capable of rapidly detecting road accidents, alerting nearby emergency services, and providing real-time information pertaining to the accident site, can prove instrumental in facilitating prompt rescue operations. Such an application would serve to reduce the gravity of injuries sustained, save precious lives, and ultimately enhance road safety in a comprehensive manner.

IV. METHODOLOGY

The methodology for building and deploying the android application for accident rescue requires a comprehensivemethodology that includes the following steps:

Problem Identification: The first step is to identify the problem of delayed emergency response and rescue efforts in the caseof road accidents. This includes understanding the causes of delayed response and identifying the gaps in the existingemergency response systems.

Requirement Gathering: The first step is to gather the requirements for the application by conducting research and analysis of the target audience, user needs, and the problem statement. This will help in identifying the core functionalities and features required in the application.

1) *Requirement Analysis:* The second step is to gather and analyze the requirements for the application. This involves identifying the key features that the application should have, such as real-time accident detection, notification of emergency services, and sharing of location information.
2) *Design:* The third step is to design the application architecture and user interface. This involves determining the system requirements, creating use case diagrams, designing the database schema, and developing the user interface mockups.
3) *Implementation:* The fourth step is to implement the application. This involves writing the code, integrating the components, testing the application, and debugging any errors.

4) *Deployment:* The fifth step is to deploy the application on the Google Play Store. This involves creating a developer account, publishing the application, and testing it on various devices.
5) *Integration:* The next step is to integrate the various features of the application, including location tracking, emergency services notification, and real-time communication, to ensure that the application works seamlessly.
6) *Testing:* The application should be thoroughly tested to ensure that it functions as expected and that there are no bugs or errors. Testing should include both manual and automated testing to ensure the quality and reliability of the application
7) *Maintenance:* The final step is to maintain the application. This involves fixing any bugs, updating the application tosupport new features ordevices, and providing technical support to user [4,5].

V. USE CASE DIAGRAMS

A. *Accishield*

It shows the Top-Level Use Case of Accishield, which indicates the user's full interaction with the system. It shows the user is firstly registering himself, user can then log in to the system using Mongodb email and password authentication. He/she can view/update his profile at any time after authenticated. The user can turn on Automatic Monitoring which will register an accelerometer service running in the background, it can now detect all kinds of jerks produced by the user on his/her smartphone and correctly differentiate between accidents and normal routine jerks.

Upon detecting the right accidents, the system will generate an alert containing an alarm sound on the emergency User's phone. users will be able to cancel sending alert to emergency responders in case of false alert (accident didn't occurred) under 15seconds.

Accishield will get User's location using Google Location API and save it to Mongodb real time database, then search for nearest emergency responders from User's location and will send an alert notification to the nearest emergency responder (containing User's location) using FCM.

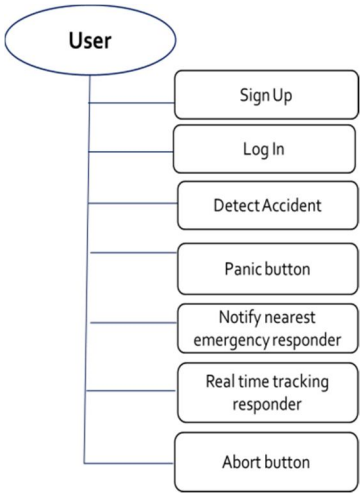

Fig1. user module

Accishield will also send SMS to the emergency contacts containing location of the User. When emergency responder accepts the request sent by User, Accishield will show real time location tracking of responder to the emergency User on a Google map. Accishield will also provide details about responders (name, vehicle number, phone, etc.). In case of other emergencies users can select the type of emergency he/she is in (Fire, Ambulance, Police), then by pressing panic button the system will search and notify nearest responders available for the selected type of emergency.

B. *Accishield Go*

The system also consists of an application for emergency responders. Responders will be able to select the type of emergency services they provide and other information related to it. This application will show emergency notifications that are sent by emergency Users and provide real time location tracking of their locations. In case of medical emergencies,the system will also guide responders to a nearest hospital from emergency location.

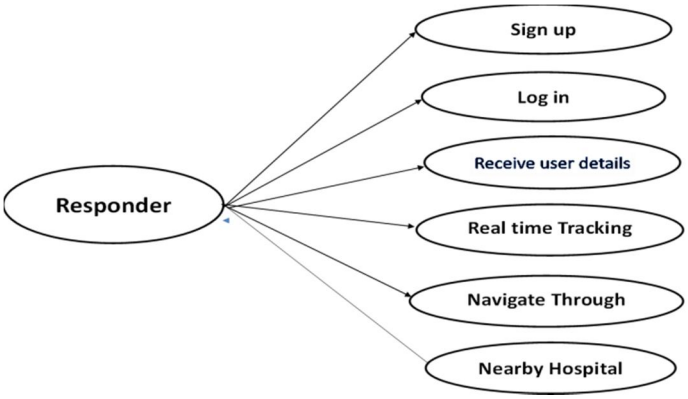

Fig2.Responder module

Fig. 2 shows the Top-Level Use Case of Accishield Go, which indicates the emergency responders' full interaction with the system. It shows the responders firstly registering themselves, responders can then log in to the system using Mongodb emailand password authentication, responders can view/update their profile at any time after authenticated.
Emergency responders can then receive emergency requests from emergency Users using FCM.
When Accishield Go receives emergency requests, an alert with sound and vibration triggered will be shown with location of the emergency. When requests are accepted by the responders, responders will be able track the location of emergency Users in real time on a Google map with shortest route to location of emergency Users using Google Directions API. Accishield Gowill also show details about Users (name, address, blood group, etc.) when emergency User is rescued, if Users are in need of medical assistance Accishield GO will guide responders to the nearest hospital from emergency locations by utilizing Google Places and Google Directions API.

C. Activity Diagram
Fig.3 is showing the sequence of activities held in the system.

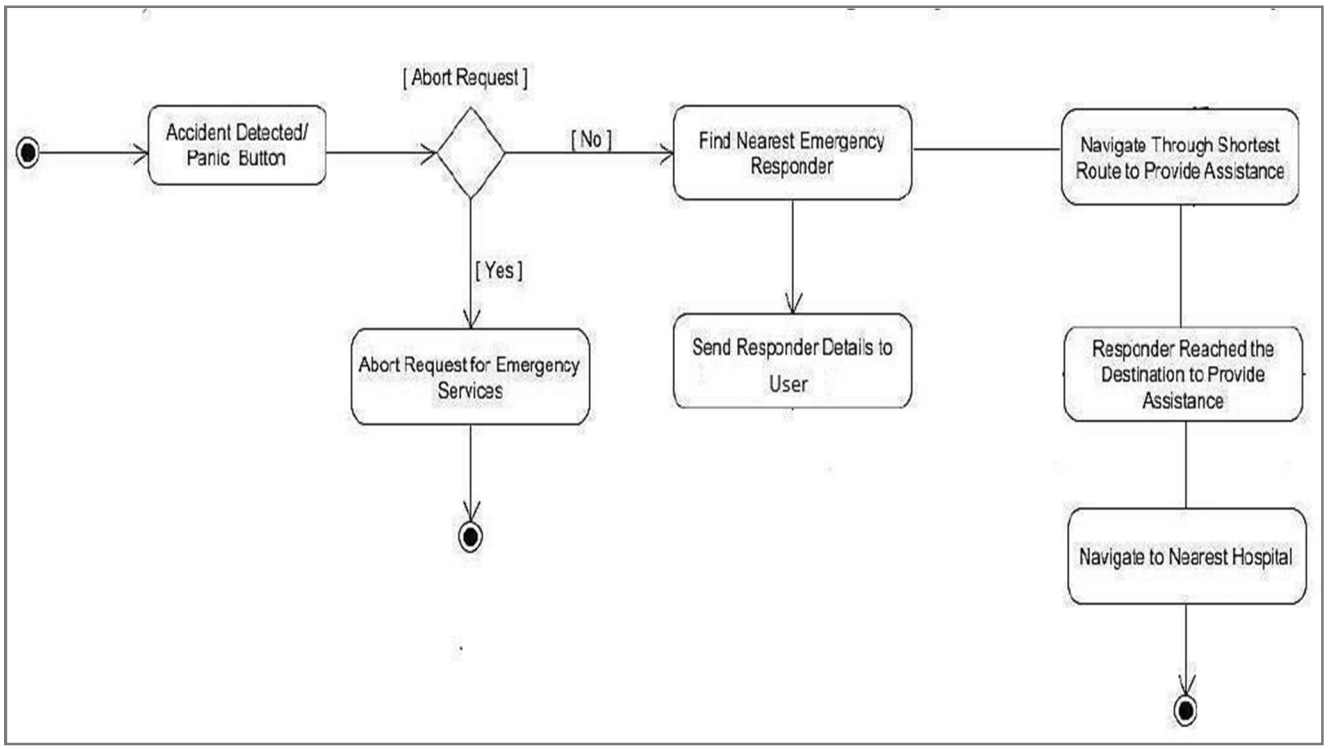

Fig. 3. Overall system activity diagram.

D. Sequence Diagram

In fig, sequence diagram shows the sequence in which emergency Users' application, Mongodb and responders' application are performing their work.

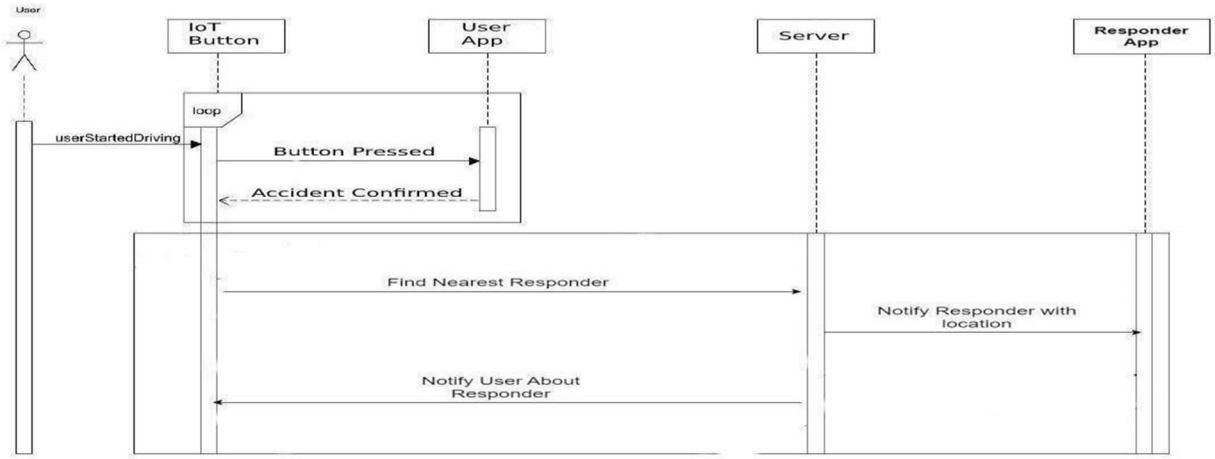

Fig. 4. System sequence diagram.

VI. DESIGN

A. Front End Design

1) Accishield

Emergency Users' side application Accishield is developed in React native programming language using Visual Studio as IDE. This prototype application is developed for android operating system having a minimum API level 17, and target API level 26. The application is fully working and implemented on the Android smartphon

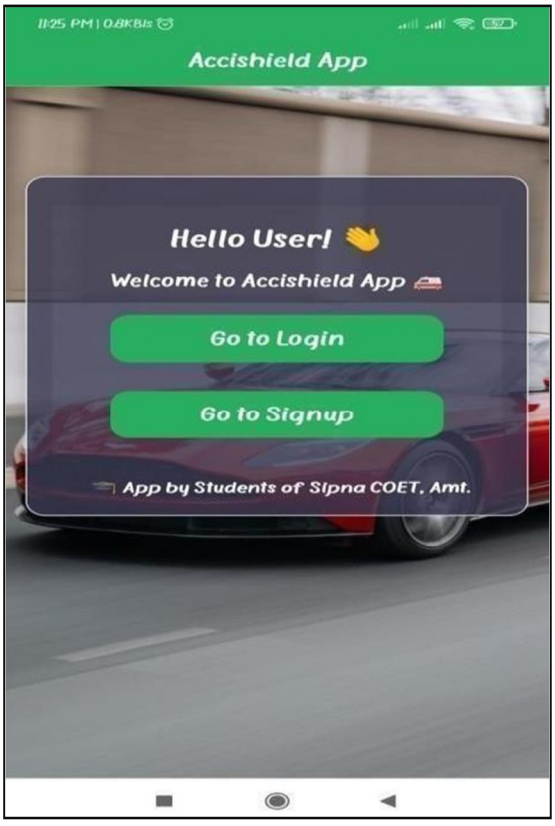

Fig. 5 Log in screen (Accishield).

Fig.5 shows log in screen of Accishield, users can use email and password that they used to register, to log in to the system. After users logs in to the system, they will be able to use all system features.

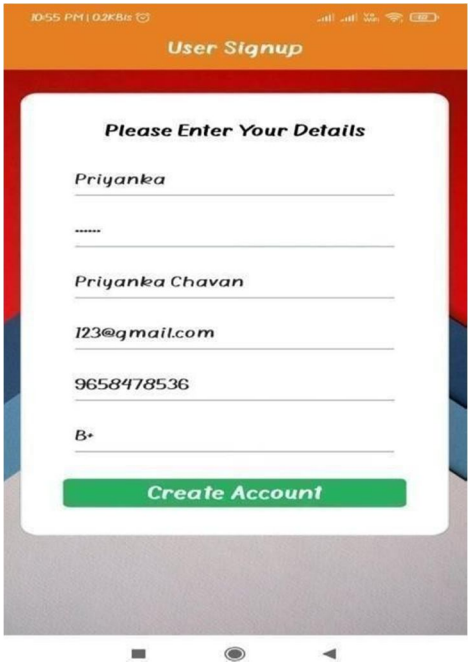

Fig. 6 Sign up screen (Accishield).

Fig. 6 shows sign up screen of Accishield, users provides email, password and other details (name, phone and bloodgroup)in order to register. After registration all information will be saved at Mongodb database.

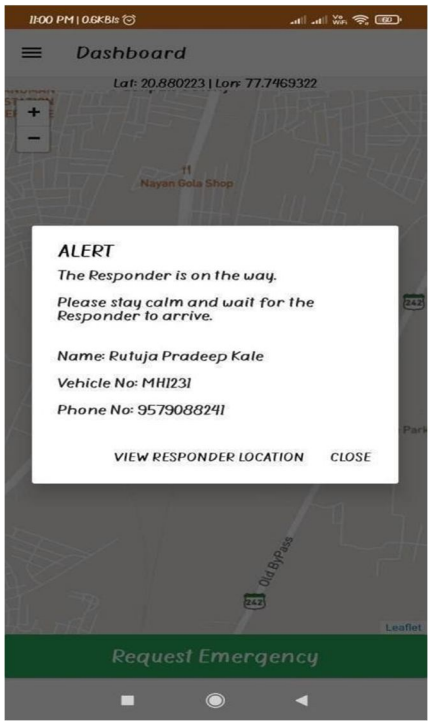

Fig. 7 Navigation drawer (Accishield)

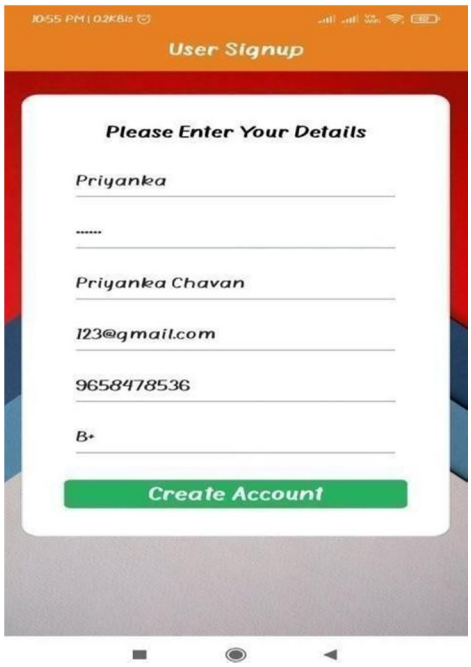

Fig. 8 Sign up screen (Accishield).

Fig. 8 shows sign up screen of Accishield, users provides email, password and other details (name, phone and bloodgroup)in order to register. After registration all information will be saved at Mongodb database.

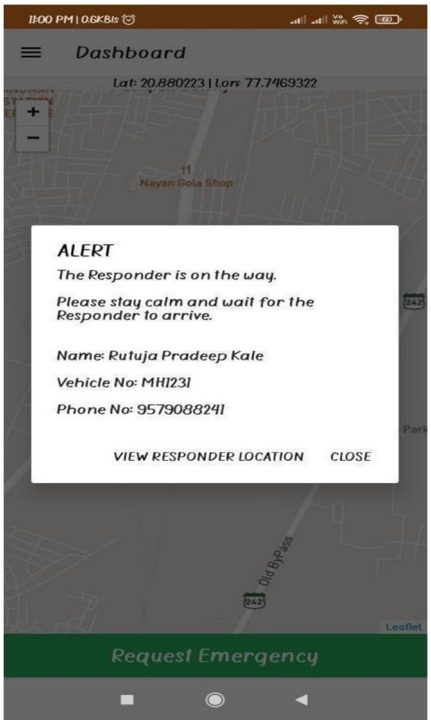

Fig. 9 Altert Message

Fig.9 shows, users of Accishield can turn on “Automatic Monitoring”, the system will register an accelerometer service running in background; it can now detectaccidents.

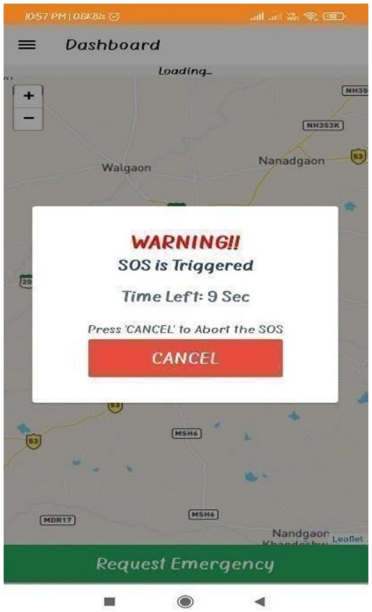

Fig.10 Panic button alert dialog (Accishield).

Fig.10 shows, when user of Accishield presses the panic button, the systemwill present an alert dialog to confirm theaction before sending an emergency request to responder, this will help in situations when panic button is pressed accidently.

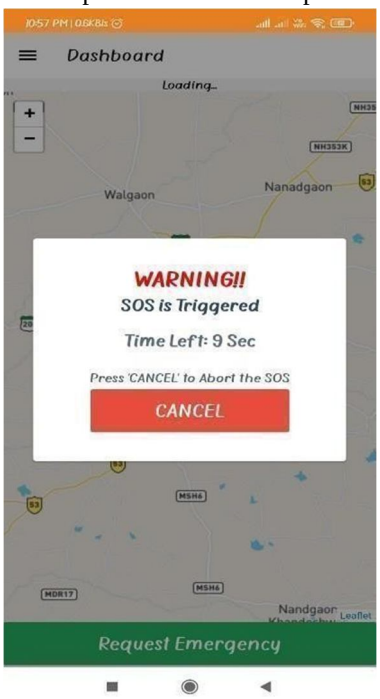

Fig.11 Accident detected alert dialog (Accishield)

Fig.11 shows when Accishield detects an accident, will present an alert dialog with a 15 sec count down timer, in caseof false alert the user can abort sending request by pressing “Cancel” button. If there is no response from the userin 15 sec, it will be considered as an actual accident and the system will send an emergency alert to the nearest emergency responder and also to the emergency contacts.

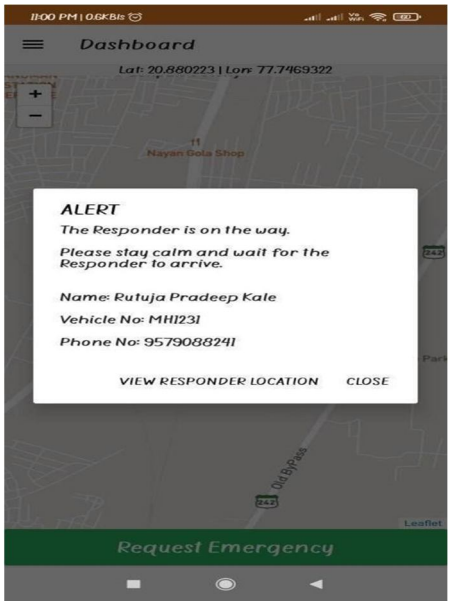

Fig.12 Responder details (Accishield)

Fig.12 shows, when an emergency request sent by emergency User is accepted by emergency responder, Accishield will show details about that responder to the User. Accishield will show real time location of emergency responder on a Google map to the emergency User.

2) Accishield Go

Emergency responder side application Accishield is developed in React native programming language using Visual Studio as IDE. This prototype application is developed for android operating system having a minimum API level 17, and target

API level 26. The application is fully working and implemented on the Android smartphone.

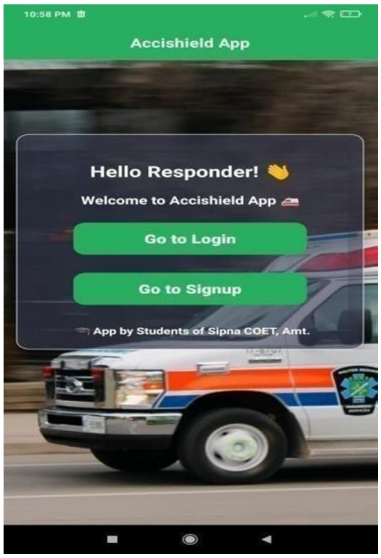

Fig. 13 Log in screen (Accishield Go)

Fig.13 shows log in screen of Accishield Go, emergency responder can use email and password that they used to register, to log in to the system. After emergency responders logs in to the system, they will be able to use all systemfeatures.

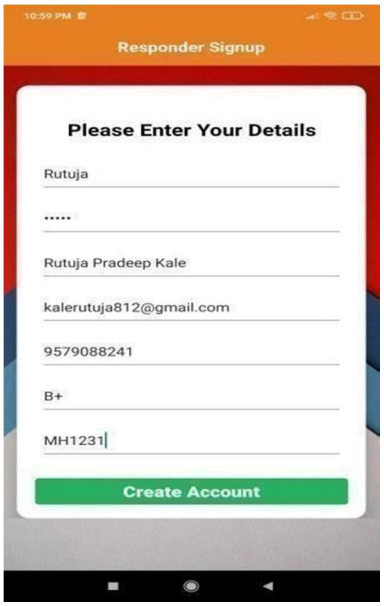

Fig. 14 shows sign up screen of Accishield Go, emergency responder needs to provide email and password andnamein order to register. After registration all information will be saved at Mongodb database.

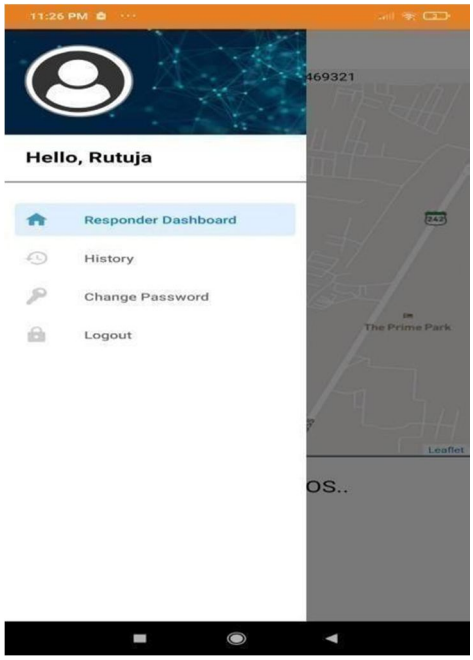

Fig. 15 Navigation drawer (Accishield Go).

Fig.15 shows home screen of Accishield Go, responders can turn on the switch to go Online, responders can nowreceive emergency requestssent by emergency User.

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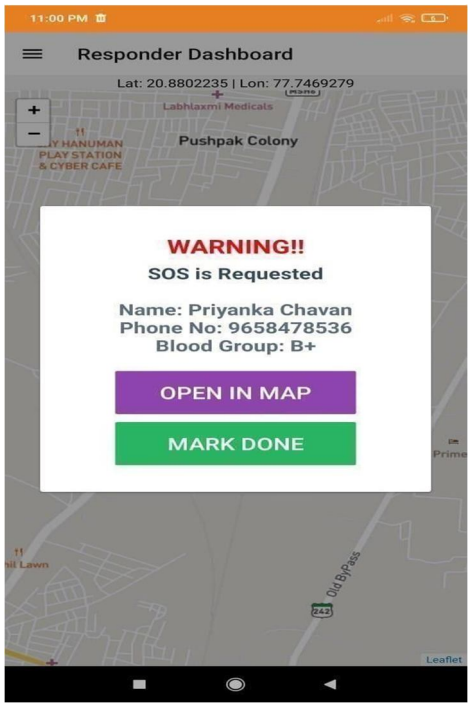


Fig. 16 Emergency alert screen (Accishield Go).

Fig.16 shows the navigation drawer of Accishield Go, emergency responders can view history of previous emergencies, update their information, change password, and select the type of emergency services they provide, e.g.Ambulance.
Fig.shows, when an emergency request by emergency User is accepted by emergency responder, Accishield Go will show details (name, phone,blood group, andaddress) about that emergency User.

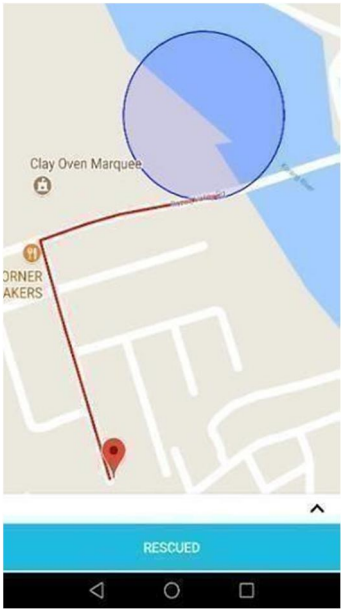


Fig.17 Real time tracking of User (Accishield Go).

In Fig17, Accishield Go will show real time location of emergency user on a Google map to the emergency responder.upon rescuing emergency User, if the User is in need of medical assistance, Accishield Go will guide emergency responders to the nearest hospital from emergency location.

3) Back End Design

In our proposed system we used only cloud-based server Mongodb for data storage, user authentication, file sharing, location sharing and push messaging. Here we will discuss how Mongodb is utilized in our system.

B. User Authentication

1) Registration

In case of registering to the system user has to provide name, email address, password, phone, etc. Once user isregistered into the system a passive user id will be generated and this id will always be used to identify user andAccess backend.

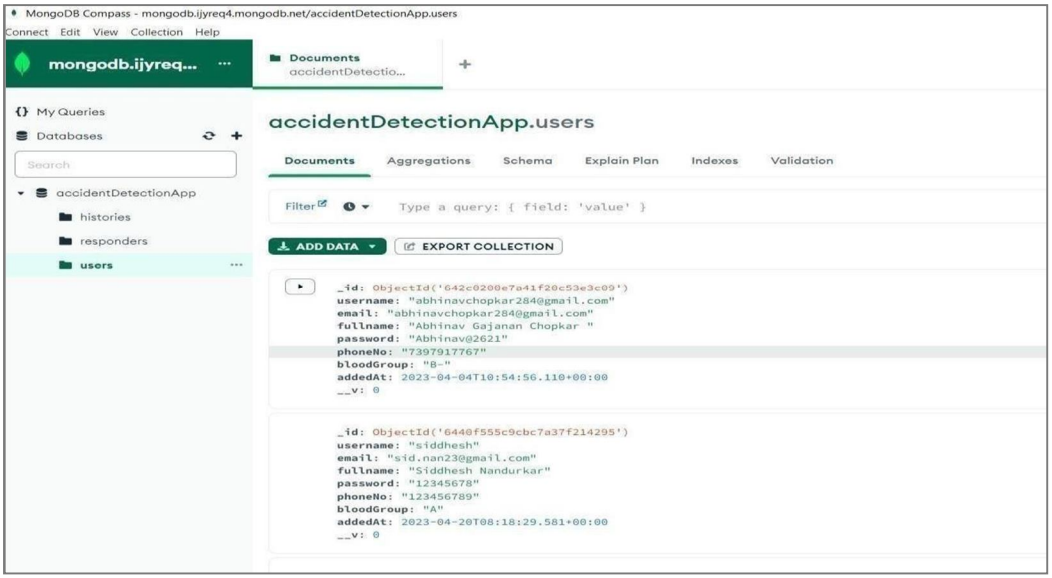


Fig. 18 User authentication database snapshot.

2) Log In

User has to provide email and password to login. Once the user is logged in, it is not necessary to login every time unless user is logged out. The Mongodb authentication system provides the user id which is synced with a device token that matches the user authenticity. Fig. 18 shows registered users, these users are authenticated and can log in to the system to use all system features.

3) Real Time Database

Responders Fig.19) shows the node in Mongodb database where real time location data of responders currently online will be saved.

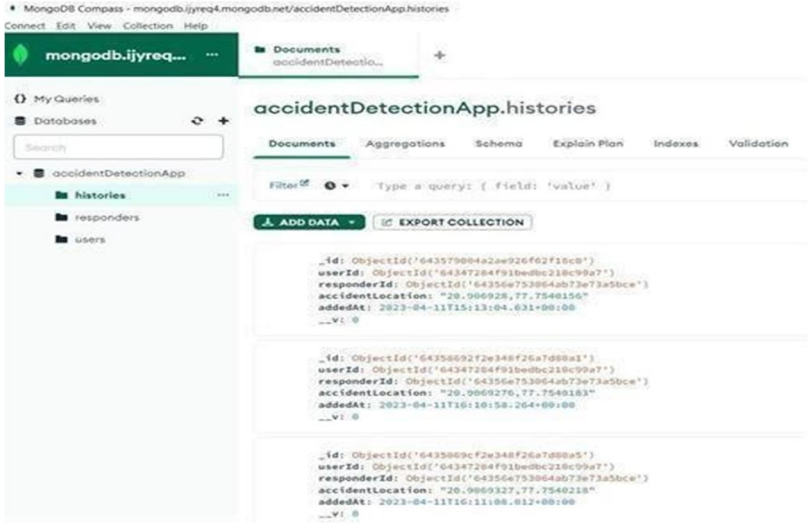


Fig. 19) Emergency requests database snapshot

4) Pickup Request

In Fig.20) this node in Mongodb database will contain emergency requests that are sent by emergency Users, with their location. Each request will be created with a separate child node using the id of User that sent the request

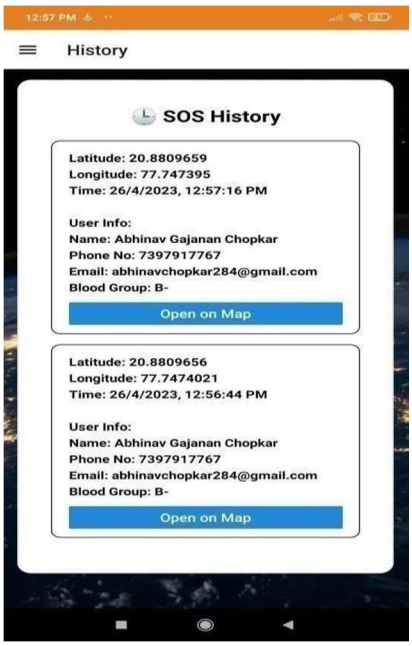


Fig.20) Emergency requests database snapshot.

5) Users Information

In Fig.iv), when a Accishield user signs up, all information about that user will saved underthis node in Mongodbdatabase. It will contain details about Users like, name, email, phone,blood group, history, etc.

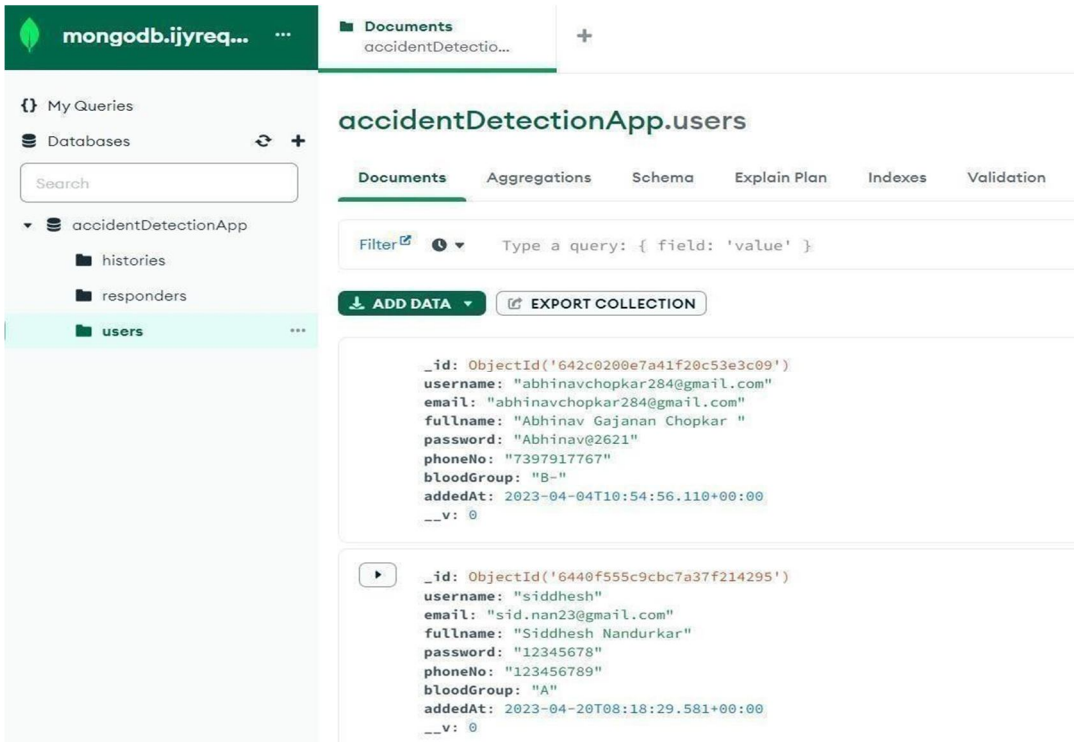


Fig. iv) user information

6) History

In Fig. v), this node in Mongodb Database will contain information about previous emergencies that each responder has successfully responded to. It will contain User id, responder id, location, destination, time, etc. foreach emergency.

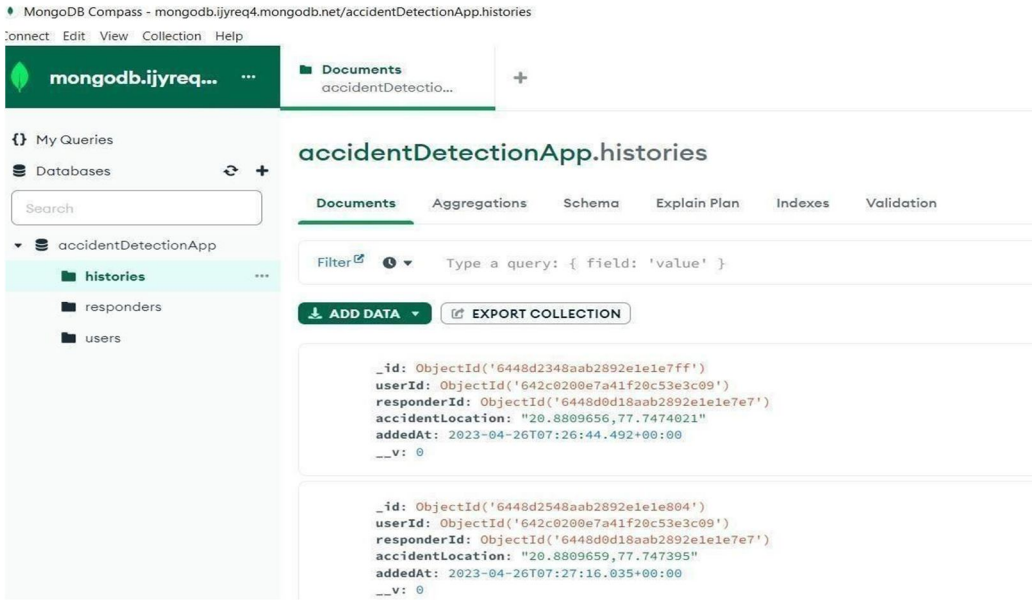
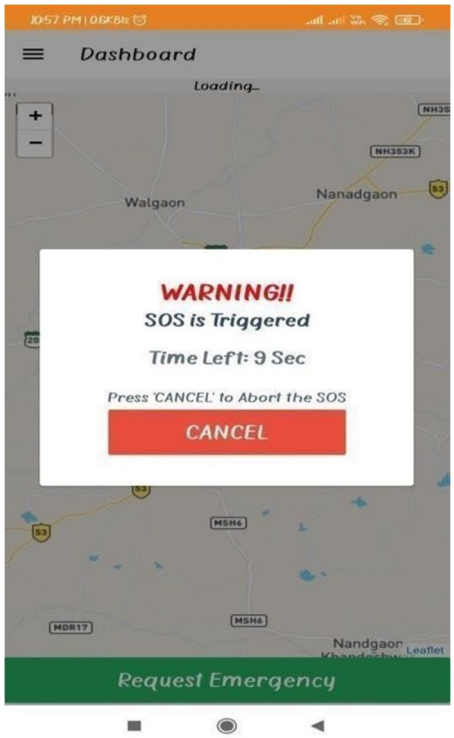
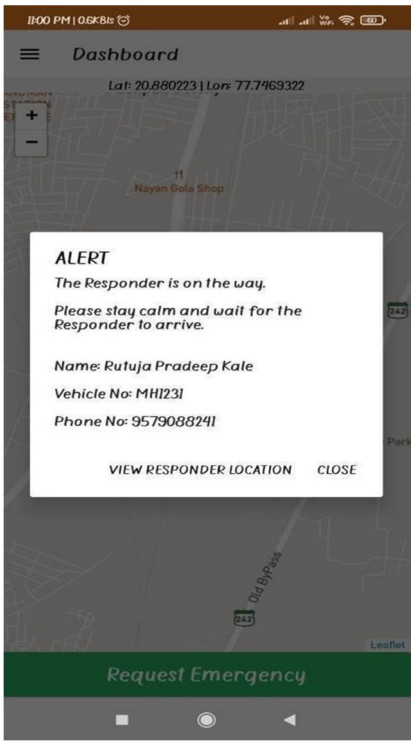


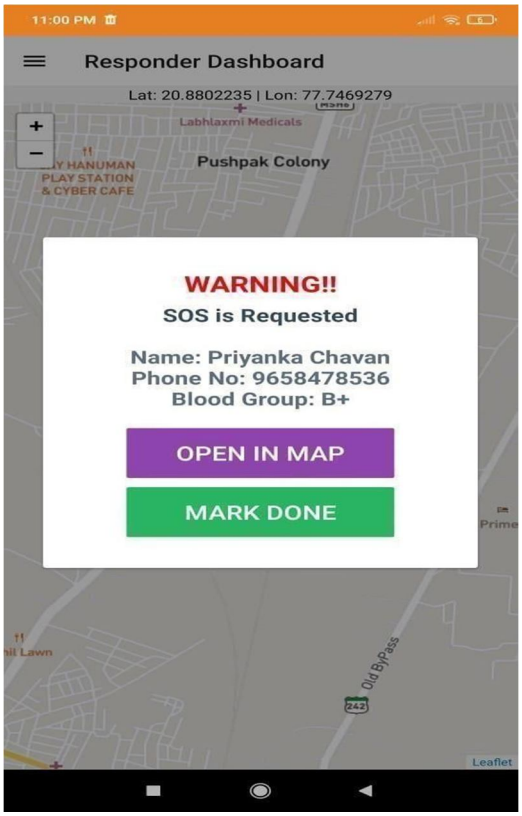
Fig.v) History database snapshot.

VII. RESULT



Accishield detects an accident, will present an alert dialog with a 10 sec count down timer, in case of false alert the user can abort sending request by pressing “Cancel” button. If there is no response from the user in 10 sec, it will be considered as an actual accident and the system will send an emergency alert to the nearest emergency responder and also to the emergency contacts.





When an emergency request sent by emergency User is accepted by emergency responder, Accishield will show details about that responder to the User. Accishield will show real time location of emergency responder on a Googlemap to the emergency User.

VIII. CONCLUSION

In this research, we developed the accident detection and smart rescue system, which uses on board accelerometer sensor to detect accident and generate emergency alert and send it to the nearest emergency responder and will also send an SMS to emergency contact containing location coordinates of the accident. With real time location tracking for both User and responder the system will drastically increase the survival rate of an accident User by providing emergency aid in time. The system will also provide help during other emergencies such as during fire, robberies/theftand other medical emergencies. Emergency responder will be able pin point User's location on a Google map in realtime.

The probability of false positives in a smartphone-based accident detection and rescue system is inevitable. We have added some features to reduce these issues. Here are some features we added to reduce false positives.

1) *Count Down Timer Alert:* On detection of an accident the system will present an alert dialog with 10 sec count down,which the user will be able to cancel in case accident didn't occur.

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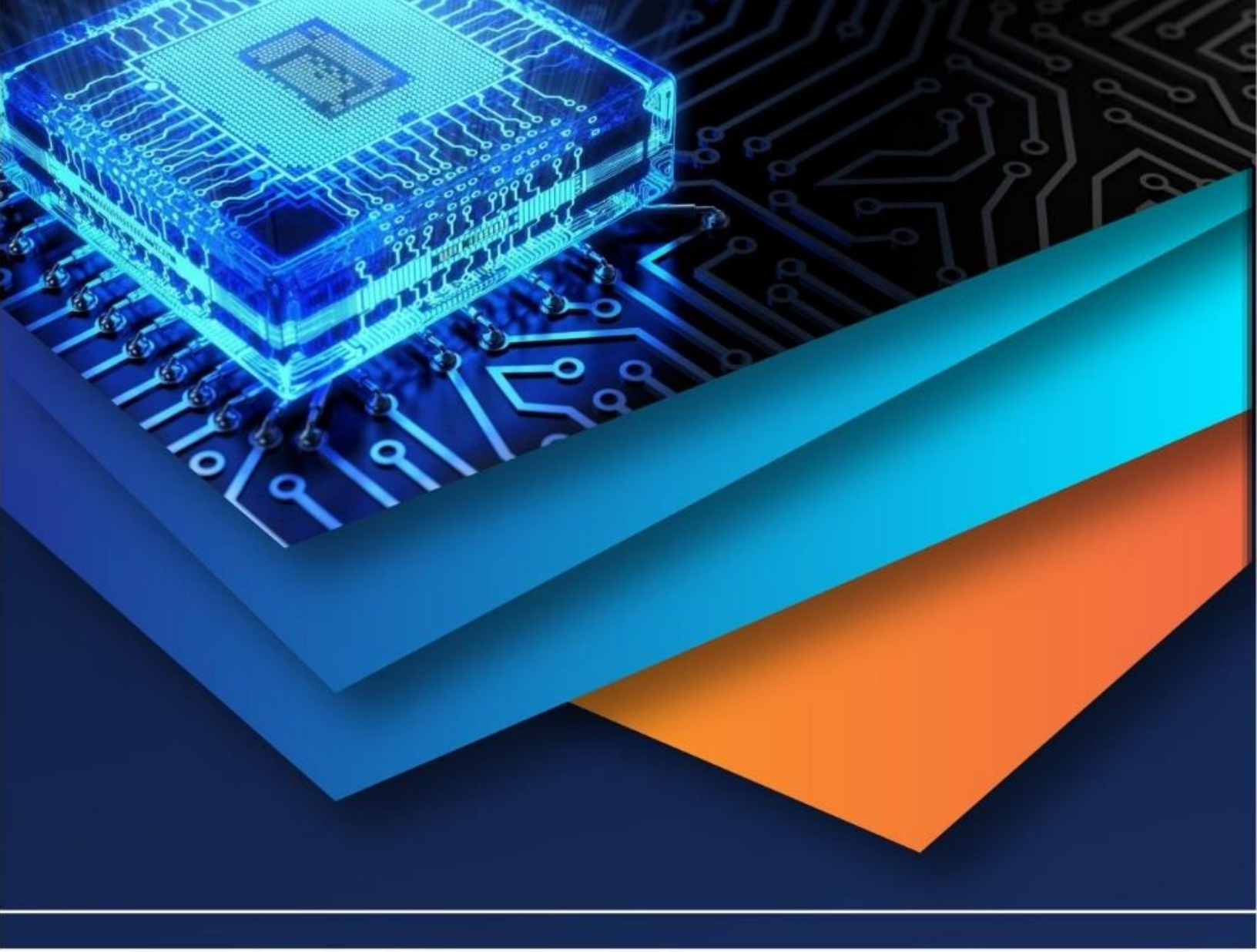

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