KumbhConnect – Smart Information and Safety App for Kumbh Mela

Vaishnavi Hembade[1], Dnyaneshwari Waje[2], Vivek Pawar[3], Siddhesh Shewale[4],

Prof S. B. Chaudhari[5]

[1,2,3,4]*Department Of Information Technology, Sandip Polytechnic, Nashik, India.*
[5]*Project Guide, Department Of   Information Technology, Sandip Polytechnic, Nashik, India.*
[1] *hembadevaishnavi043@gmail.com* ,[2] *siddhesh.shewale20@gmail.com* ,[3]
wajednyaneshwari674@gmail.com ,
[4] *vivek.s.pawar1@gmail.com*,[5] *sarangi.chaudhari@sandippolytechnic.org*

--***--

Abstract - KumbhConnect is a smart mobile application developed to assist pilgrims during the Kumbh Mela by providing reliable information, navigation support, and enhanced safety services through a single digital platform.

The Kumbh Mela is one of the world's largest religious gatherings, where managing crowd movement, accessing accurate information, and ensuring pilgrim safety become major challenges. Traditional information sources such as banners, announcements, and volunteers often prove insufficient in handling the scale and dynamic nature of the event.

The proposed system offers a user-friendly mobile solution built using Flutter and Firebase technologies. It enables pilgrims to register securely and access essential services   such as SOS emergency alerts, real-time location tracking, navigation to ghats, temples, kunds, camps, water stalls, and   stores using Google Maps integration. The application also provides updated event and ritual schedules, including important Snan and Aarti timings, which are managed centrally through a cloud-based database. An SOS feature allows users to instantly share their live location with emergency contacts and nearby help centers, improving response time during critical situations. Additionally, a simple rule-based chatbot assists users by answering frequently asked questions related to rituals, locations, and medical help. Push notifications are used to deliver important announcements, safety   alerts,   and   event reminders.

Overall, KumbhConnect enhances safety, accessibility, and information transparency for pilgrims while reducing confusion and dependency on manual assistance. The application demonstrates an effective use of mobile and cloud technologies to support large-scale religious events, making it a practical and socially beneficial digital solution.

Keywords: Kumbh Mela, Smart Mobile Application, Crowd Management and Safety, Pilgrim Assistance, SOS Emergency Services, Location-Based Navigation, Real-Time Information Systems, Firebase Cloud Platform, Google Maps Integration, Chatbot-Based Support

1.INTRODUCTION

The Kumbh Mela is one of the largest religious and spiritual gatherings in the world, attracting millions of pilgrims from different parts of the country and abroad. Held at sacred locations, the event involves mass bathing rituals, religious ceremonies, processions, and spiritual discourses. Due to the enormous crowd size and temporary infrastructure, pilgrims often face challenges such as difficulty in navigation, lack of accurate information, safety concerns, and delays in accessing emergency assistance.

Traditional methods of information dissemination during the Kumbh Mela—such as notice boards, loudspeaker announcements, and volunteers—are often insufficient to manage real-time updates and individual needs. Elderly pilgrims, first-time visitors, and people unfamiliar with the location face greater difficulties in finding ghats, temples, camps, water facilities, and medical help. In emergency situations such as health issues, lost persons, or overcrowding, the absence of quick communication and location tracking can lead to serious risks.

To address these challenges, KumbhConnect is proposed as a smart mobile application that integrates modern digital technologies to support pilgrims throughout the Kumbh Mela. The application provides essential information, live navigation, safety features, and timely notifications through an easy-to-use interface. By combining   location   services,   cloud-based   data management,   and   mobile   communication,

KumbhConnect aims to improve safety, reduce confusion, and enhance the overall pilgrim experience.

2. LITERATURE REVIEW –

Large-scale public gatherings such as religious festivals and mass events involve complex challenges related to crowd management, navigation assistance, safety monitoring, and effective communication. Researchers and developers have increasingly explored the use of mobile technologies and smart digital solutions to address these issues and improve the overall experience for participants. Location-based service (LBS) applications integrated with GPS technology have proven to be particularly useful, allowing users to access realtime navigation, receive location-aware notifications, and locate essential services during large events [1].

Recent studies have also highlighted the importance of cloudbased platforms in supporting scalable and reliable mobile applications. Cloud services, including Firebase, provide features such as real-time data synchronization, secure user authentication, and efficient information delivery, which are critical for managing rapidly changing environments like religious gatherings and festivals [2]. Furthermore, emergency response research emphasizes the need for integrated SOS systems with location-sharing capabilities, enabling faster response times and improving safety in crowded scenarios [3].

In the context of large religious gatherings such as the Kumbh Mela, traditional communication approaches — including public announcements and static signboards — often fail to deliver personalized and timely information to individual participants. As a result, researchers have proposed mobilebased solutions that combine navigation, safety alerts, and information services. However, many existing solutions focus on isolated functionalities rather than providing a comprehensive and unified platform that addresses multiple user needs simultaneously [4].

To overcome these limitations, the proposed KumbhConnect system introduces an integrated mobile application designed specifically for large-scale religious events. The application combines real-time navigation, chatbot-based assistance, SOS emergency features, and event-related information within a single platform. By leveraging modern technologies such as Flutter for cross-platform development, cloud backend services, and the Google Maps API, the system aims to provide a scalable, user-friendly, and efficient solution that enhances safety and accessibility for event participants.

3. METHODOLOGY –

3.1. Requirement Analysis

In this phase, the major problems faced by pilgrims during Kumbh Mela were identified. These include difficulty in navigation, lack of real-time information, safety concerns, and delayed emergency response. Based on these issues, functional and non-functional requirements were defined, focusing on usability, security, real-time data access, and performance.

3.2. System Design

The system architecture is designed using a client–server model. The Flutter mobile application acts as the client, while Firebase services handle authentication, database management, and notifications. Google Maps API is integrated for location tracking and navigation. The design emphasizes modular components such as user management, SOS service, information modules, and chatbot assistance.

Fig. System Architecture

3.2.1. User Authentication & Profile Setup

Firebase Authentication is used to provide secure login and registration using email or mobile number (OTP-based verification). Each user creates a profile containing personal details and an emergency contact number, which is stored securely in Firestore.

3.2.2. Data Management Using Firestore

All information related to ghats, temples, events, camps, water stalls, and stores is stored in Firebase Firestore. The data is centrally managed and updated by administrators, ensuring that users receive accurate and up-to-date information in real time.

3.2.3. Location & Navigation Module

The application uses GPS to fetch the user's real-time location. Google Maps API is used to display interactive maps with markers for important locations such as ghats, temples, camps, and facilities. Route navigation and distance calculation features help pilgrims reach destinations easily.

3.2.4. SOS Emergency Handling

A dedicated SOS module allows users to send emergency alerts with a single tap. The system captures the user's live location and sends alerts to the saved emergency contact and nearby help centers. The app also displays the

nearest medical and police camps for immediate assistance.

3.2.5. Chatbot Assistance

A simple rule-based chatbot is implemented to handle frequently asked questions. The chatbot processes user queries through keyword matching and provides predefined responses related to rituals, timings, locations, and emergency services.

3.3. Hardware Requirement

3.3.1. Smartphone (Android / iOS)

Required for pilgrims to use the KumbhConnect mobile application with GPS, internet, and notification support.

3.3.2. Processor

Minimum Quad-Core processor for smooth application performance.

3.3.3. RAM

Minimum 2 GB RAM (4 GB recommended).

3.3.4. Storage

At least 200 MB free space for app installation and cached data.

3.3.5.GPS Module

Required for real-time location tracking and navigation.

3.3.6. Internet Connectivity

Mobile data or Wi-Fi for real-time updates, maps, and notifications.

3.4. Software Requirement -

3.4.1. Operating System

(User Device) Android 8.0 or higher iOS 12 or higher

3.4.2. Application Development Tools

Flutter SDK
Dart Programming Language
Android Studio / Visual Studio Code

3.4.3. Backend & Cloud Services Firebase Authentication

Firebase Firestore (NoSQL Database)

3.4.4 . Firebase Cloud Messaging (Notifications)

APIs & Services
Google Maps API

GPS & Location Services

4. PROBLEM DEFINITION -

The Kumbh Mela is one of the largest religious gatherings in the world, involving millions of pilgrims visiting sacred ghats, temples, and ritual locations over a short period of time. Managing such a massive crowd presents significant challenges related to safety, navigation, information accessibility, and emergency response. Pilgrims, especially elderly people, children, and first-time visitors, often struggle to find correct routes, ritual timings, medical help, and essential facilities.

The existing system relies heavily on manual methods such as banners, loudspeaker announcements, printed maps, and volunteers for information dissemination and crowd management. These methods are often ineffective in providing real-time, personalized, and location-specific information. In emergency situations such as medical issues, lost individuals, overcrowding, or panic, the lack of instant communication and precise location tracking can lead to delayed assistance and serious risks to human life.

Additionally, pilgrims face difficulties in locating nearby facilities such as medical camps, police help desks, drinking water stalls, food stalls, and accommodation camps. Information about events and ritual schedules may also be inconsistent or outdated, leading to confusion and missed religious activities. There is currently no unified digital platform that integrates safety, navigation, event information, and emergency support specifically designed for large-scale religious events like the Kumbh Mela.

5.EXISTING SYSTEM -

In the existing system, information and safety management during the Kumbh Mela are handled primarily through traditional and manual methods. Pilgrims depend on banners, posters, public address announcements, printed maps, and the guidance of volunteers to obtain details about ghats, temples, ritual timings, and important events. Navigation within the vast and crowded area is based on fixed signboards and verbal directions, which often leads to confusion, especially for firsttime visitors, elderly pilgrims, and people unfamiliar with the location. Emergency situations such as medical issues, lost individuals, or overcrowding are managed by physically approaching police or medical help desks, which can result in delayed response due to heavy crowds and communication gaps. Information about facilities like medical camps, water stalls, food stalls, and

accommodation centers is not available through a centralized digital platform, making it timeconsuming for pilgrims to locate essential services.

Additionally, updates to event schedules or safety announcements may not reach all pilgrims in a timely manner. Overall, the existing system lacks real-time updates, personalized assistance, and quick emergency communication, making it inefficient for managing a largescale event like the Kumbh Mela.

6.LIMITATION -

The existing system used during the Kumbh Mela has several limitations that affect the safety, convenience, and overall experience of pilgrims. It relies heavily on manual methods such as announcements, banners, and volunteers, which are not capable of providing real-time and personalized information. Due to the massive crowd size, announcements may not be clearly heard, and signboards may be difficult to locate, leading to confusion and delays. There is no centralized digital platform to access accurate details about ghats, temples, ritual timings, or facilities, resulting in inconsistent or outdated information. Emergency response is also slow, as pilgrims must physically reach police or medical camps to seek help, with no instant SOS or location-sharing mechanism available. Navigation is limited to static maps and signboards, which do not consider the user's current location or crowd conditions. Overall, the system lacks efficiency, quick communication, real-time updates, and individual-level assistance, making it inadequate for managing such a largescale religious gathering effectively.

7. Advantages -

The proposed system, KumbhConnect, offers several advantages over the existing manual methods by providing a

smart, centralized, and user-friendly digital solution for pilgrims during the Kumbh Mela. It ensures enhanced safety through a one-tap SOS feature that allows users to share their real-time location with emergency contacts and nearby help centers, enabling faster response during critical situations.

• Provides a centralized digital platform for all Kumbh Mela information
• Enhances pilgrim safety through one-tap SOS with live location sharing
• Enables faster emergency response by showing nearby medical and police camps

• Offers real-time and accurate information about ghats, temples, events, and rituals
• Supports easy navigation using Google Maps with route guidance
• Reduces confusion for first-time visitors and elderly pilgrims
• Sends instant notifications for event reminders, safety alerts, and announcements
• Includes a chatbot assistant for quick answers to common queries
• Saves time by reducing dependency on volunteers and manual help
• Scalable and reliable due to cloud-based Firebase infrastructure

8. CONCLUSIONS

KumbhConnect is a smart and user-centric mobile application designed to address the major challenges faced by pilgrims during the Kumbh Mela, such as safety concerns, navigation difficulties, and lack of real-time information. By integrating modern technologies like Flutter, Firebase, and Google Maps, the application provides a centralized platform for accessing accurate details about ghats, temples, rituals, events, and essential facilities. The inclusion of features such as SOS emergency alerts, live location tracking, push notifications, and a chatbot assistant significantly enhances pilgrim safety and convenience.

The proposed system reduces dependency on traditional manual methods and improves communication and emergency response during large-scale gatherings. KumbhConnect not only helps pilgrims plan their activities efficiently but also supports authorities in managing crowds more effectively. Overall, the application demonstrates how digital solutions can be successfully used to improve safety, organization, and the overall experience of pilgrims during the Kumbh Mela, making it a practical and socially beneficial technological innovation.

REFERENCES

[1].   H. Liu and G. Li, "Location-Based Services and Applications," IEEE Communications Magazine, vol. 49, no. 12, pp. 102–108, 2011.

[2].   2. Firebase Documentation,   Google Developers, https://firebase.google.com/docs

[3].   S. Sharma et al., "Emergency Response Systems Using Mobile   Applications," International Journal of Computer Applications, vol. 179, no. 7, pp. 15–20, 2018.

[4].   M. Singh and A. Kumar, "Smart Crowd Management Using Mobile Technology," IEEE Conference on Smart Computing, 2020.