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RescueLink: A Mobile-Based Emergency First Aid and SOS Assistance System

Anand Sharma[1], Niharika Alone[2], Vaishnavi Gaonkar[3], Siddivinayak Mittapelli[4],

Prof Swati Bhoir[5]

Department of Computer Engineering, Indala College of Engineering, Kalyan, Maharashtra, India[1-5]

Abstract: Providing clear first aid information, quick access to trusted contacts, current location and information on nearby services is crucial during emergencies. However, if there is poor internet connectivity on a phone this becomes difficult to manage. This paper looks at the design of a proposed mobile application called RescueLink. This paper uses research from literature on a first aid learning application for school based professionals [1], mobile health, location based services, OpenStreetMap, local data and cloud synchronisation. The design of a first aid guide, SOS features, GPS location, local service information, downloadable maps and delayed synchronisation should be considered. Safety, privacy, data up-to-date and error handling should all be considered. RescueLink is a proposed system and no clinical validation or experimental analysis has been done.

Keywords: Emergency assistance, first aid, mobile application, offline, SOS, usability.

1. INTRODUCTION

Using a smartphone can help give access to emergency information, trusted contacts and location sharing. However, it should be easy to understand and reliable. An emergency app should not have multiple screens for critical actions and important information should not be lost due to no network. Poor connectivity, limited device resources and little experience using emergency applications may be found in schools, community settings, travelling and humanitarian situations.

Santana et al. looked at validating and usability of a mobile application to teach first aid to professionals within basic education [1]. This is a good starting point for this review. This paper looks at RescueLink as a wider concept for providing first aid information and emergency assistance. However, this study was looking at their own application not RescueLink.

RescueLink is an offline based mobile application. It should include features such as first aid guide, local emergency contact, SOS event logging, GPS location capture and sharing, nearby emergency service information, downloadable maps, optional offline routing, user managed medical profile and emergency history. This paper looks at the design considerations and risks involved with these features. No results will be shown as this is a proposed system.

II. REVIEW

A narrative design review has been carried out. This is not a systematic review and no experiments were carried out. The main source of information used is the Santana et al. study from 2025 [1]. Other information has been used to give context to mobile health applications, OpenStreetMap, maps and offline based software. Information has been organised into sections including quality, usability, emergency features, offline, mapping, synchronisation and privacy.

This is a design and architecture review. No participants have been recruited and the first aid information has not been independently validated. The architecture should be seen as a proposed system which will need to be reviewed by experts, implemented and tested.

III. FIRST AID INFORMATION AND USABILITY

A. Quality of Information

First aid information should be seen as critical to safety. Providing incorrect, unclear, outdated or incorrectly ordered advice may cause harmful delays. RescueLink should use trusted sources and have a documented review process by qualified first aid or healthcare professionals. The guides should provide an overview of the situation, immediate actions,

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what not to do, warning signs and when to seek professional help. If there are different guidelines for children and adults this should be clear. The app should aid professional care and not replace it.

Santana et al. highlighted the difference between ensuring the information provided is accurate and visually appealing and that it is usable by people [1]. RescueLink should follow this. Having a well designed screen does not mean the medical advice is accurate. Accurate information may not be easy to follow if it is buried in menus or using unfamiliar language.

B. Stressful Situations

During an emergency the user may be stressed and have little time to navigate the screen. Common actions should be easy to find, use simple wording and have large touch areas. Instructions should be simple and in easy to read text with good contrast. Colours can be used to indicate priority but too much attention to visuals may be distracting. Considerations should be made for accessibility, language and varying digital experience.

As this is just a review by developers we cannot guarantee that the application will be usable by the target audience. In the future the application should be tested by representative users carrying out realistic tasks. Structured feedback and a known usability questionnaire should be used. Any study would need an appropriate protocol and real participants. No usability score has been given as this has not been validated.

IV. PROPOSED ARCHITECTURE FOR RESCUELINK

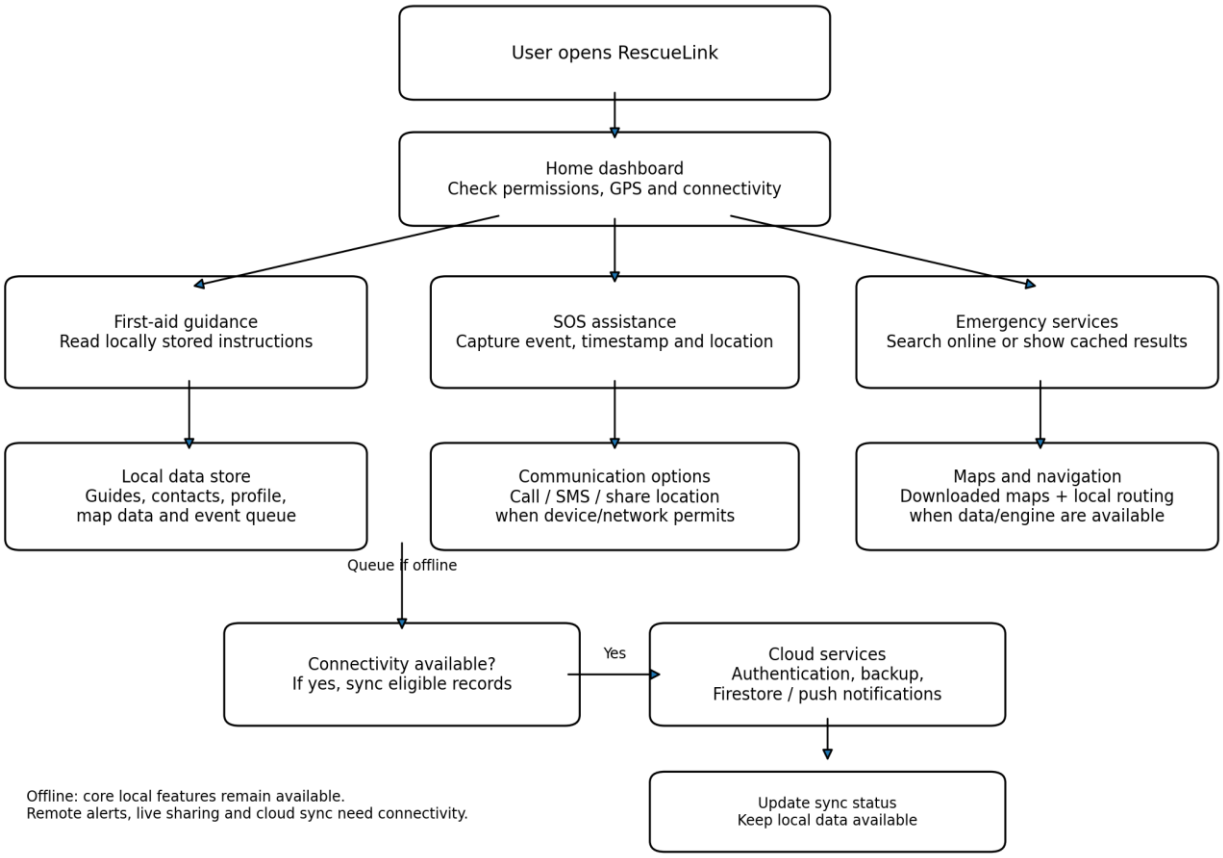


Fig. 1 shows the flow of events(FoE).

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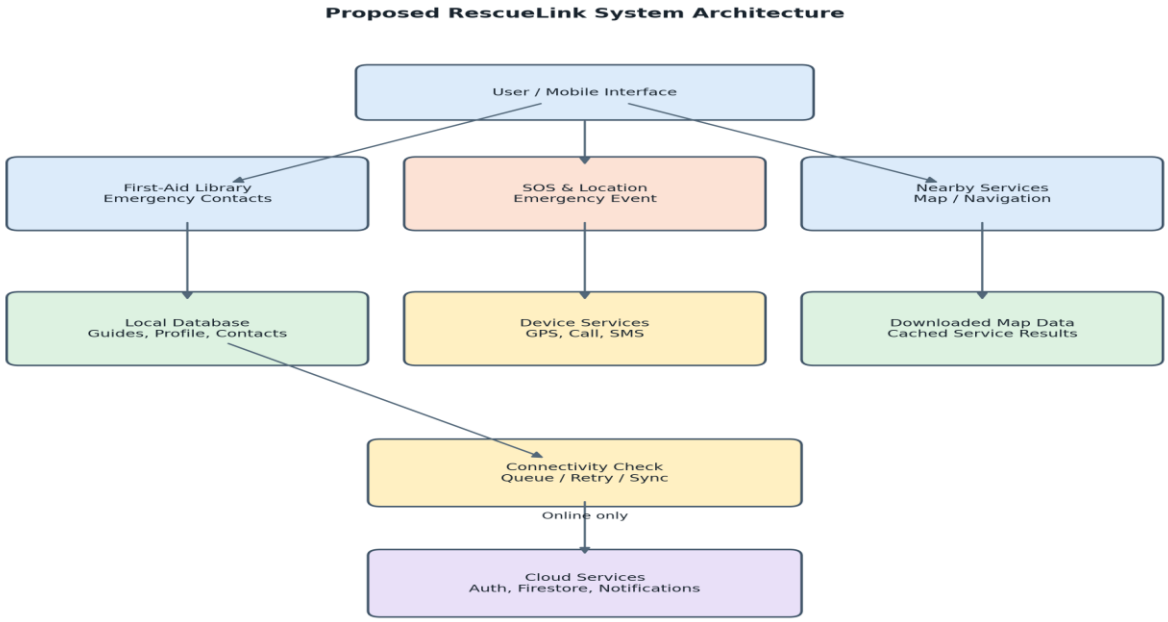


Fig. 2 shows the conceptual architecture for the RescueLink mobile application.

A. First Aid Guide and Emergency Contacts

The first aid guide should be stored locally so that the information is available without internet. Updates can be downloaded when there is internet available. A version number and date showing when it was last reviewed/updated should be included. Emergency contacts should also be available locally. However, making a call or sending an SMS will depend on the phone, permissions, SIM/network availability and operating system functionality. The interface should not show that a message has been sent successfully.

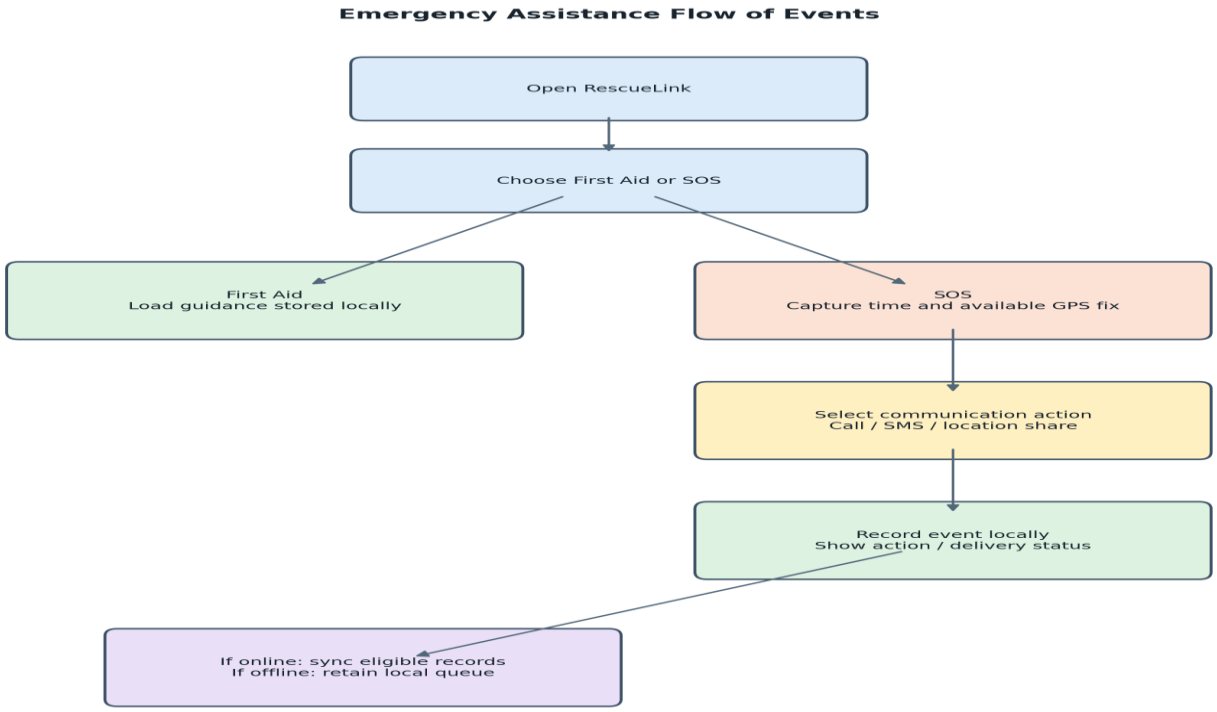


Fig. 3 shows the flow of events for first aid and SOS.

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B. SOS

An SOS flow may be included to log the time, location availability, chosen contacts and action taken. The screen should be clear to show if the user is creating an alert, opening the phone's calling/messaging application or confirming the message has been sent. If the device is offline RescueLink may store the event locally and mark it for syncing at a later date. There is no guarantee that an alert will be sent to a remote contact or live location.

C. Medical Profile and Emergency History

A medical profile could be included for users to optionally store information such as blood group, allergies, medications, health conditions and emergency notes. As this is sensitive information only the necessary information should be collected. The information should be secure and users should be able to view/delete it. An emergency history could be included to log the type of event, time, location availability, actions taken and if it has been synced. The interface should not suggest that a call/alert has been successfully sent unless there is reliable confirmation.

V. OFFLINE BASED ARCHITECTURE

A. Local Data

An offline based design should have the phone as the main source of critical information and actions. Network based services should provide extra functionality but not be required for every screen. RescueLink could store the first aid guides, contacts, preferences, cached service list and unsent events locally. This could be done using a local database such as SQLite.

Users should be able to see what information is stored locally, when the cached information was last updated and if there are any items to be synced. If there is no network the application should explain what is happening and provide a sensible way to try again. Before adding cloud synchronisation consideration should be made for handling conflicts and duplicates.

B. Cloud Services

A cloud service could be used for managing accounts, backups, multi-device accessibility and push notifications. Firebase Authentication and Cloud Firestore could be used for managing identities and cloud based records. Firebase Cloud Messaging could be used for sending notifications when the device and relevant services are online. However, this will not make the phone accessible if it is offline. Locally stored records should be synced once connectivity is available. This will depend on authentication, access and retry.

C. Connectivity

There may be issues with connectivity such as slow, limited or inability to connect to a specific service. RescueLink should consider timeouts, partial responses, denied permissions, disabled location services, no GPS fix and old cached data. Critical screens should not rely on analytics, images or other unnecessary network requests.

VI. LOCATION, OFFLINE MAPS AND EMERGENCY SERVICES

A. GPS

A phone may be able to find its co-ordinates using satellite positioning. However the time taken and accuracy may vary based on the environment and satellite visibility. GPS will not provide images, address or route information. If location is available the time and accuracy should be logged. Permissions should be requested at an appropriate time. The user should know what information will be shared.

B. Downloadable Maps

OpenStreetMap provides geographical information which can be displayed using compatible tools [2]. To use maps offline the necessary map data should be downloaded. If turn by turn or route information is required the road network and routing engine should be available locally.

Downloading maps will take up space. This will depend on the area, zoom levels, format and how often it is updated. RescueLink should allow users to download maps for supported regions. Users should be able to see how much space it

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will take up and remove any regions they no longer need. The application should show when the map data was last updated. Route calculations using offline data should be clearly marked as they may be out of date.

C. Nearby Emergency Services

If there is internet available RescueLink could use the OpenStreetMap Overpass API to search for mapped hospitals, clinics, police stations, fire stations etc. This depends on how complete and consistent the map data is. It also depends on the availability of the service and user connectivity. The Overpass searches will not work offline by default. RescueLink could cache previous results. However each entry should show when it was retrieved. This is not a complete or up to date directory.

The application should only show information that is available. Do not make up any phone numbers, addresses or information about the facilities. If the information is available users should be able to call the number or open a supported navigation option. Users should be directed to official emergency assistance if needed.

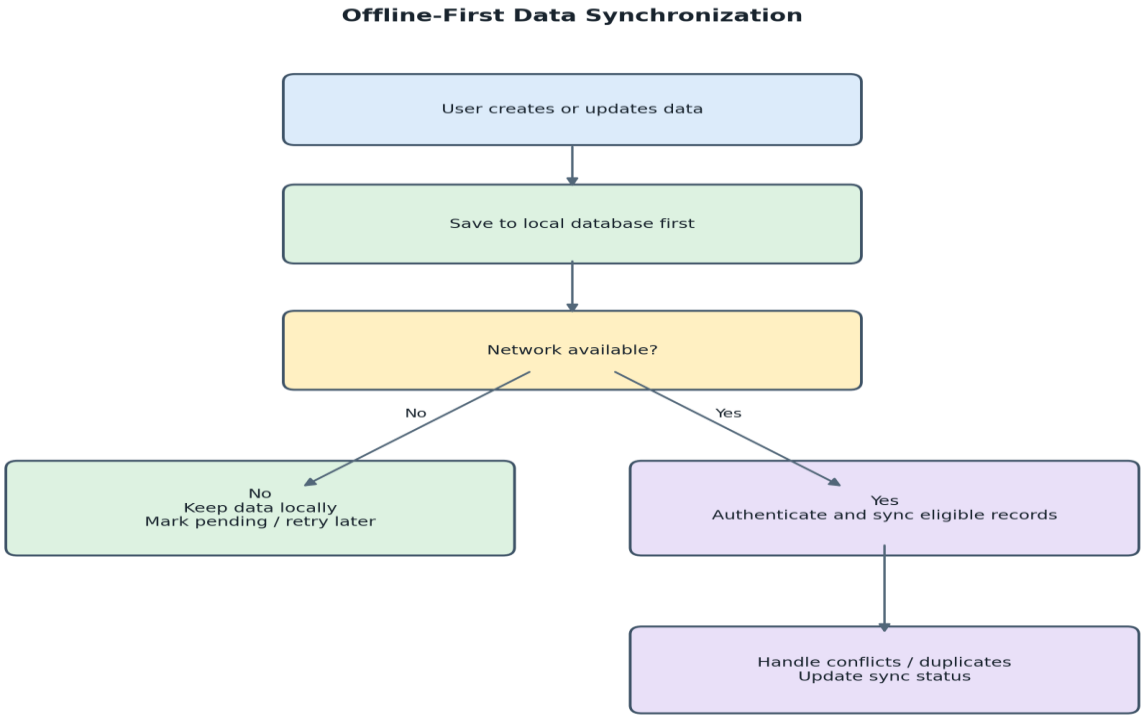


Fig. 4 shows the proposed offline based synchronisation flow.

VII. PRIVACY, SAFETY AND ETHICAL ISSUES

RescueLink may store accurate location, medical information, contacts and emergency history. This data should be handled carefully. Only collect necessary data. Clearly explain consent. Locally stored data should be secure. Use encrypted connections. Restrict access to cloud data. Permissions should be set up so that one account cannot see another user's private information. Never include credentials for external messaging services in the mobile application.

The application should clearly state its limitations. Do not state that an SOS has been sent to a contact unless it has been confirmed. Do not suggest clinicians are monitoring the medical profile. First aid information should include suitable safety advice and be checked against current authoritative sources. Consider accessibility, language, data storage and risks of losing/sharing the phone.

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VIII. DISCUSSION

The topics discussed demonstrate why emergency applications should be designed as connected systems. The quality of information, usability, local data, location, maps, communications and privacy all impact each other. For example, if the user cannot see how old the nearby services are then it is not as useful. If there is no internet then maps may help with orientation but will not calculate routes. If there is an SOS event saved on the phone it may not have been sent anywhere. Clear status messages are a key design consideration.

Santana et al. looked at the quality, appearance and usability of a first aid learning application for professionals in basic education [1]. RescueLink looks at a wider design for emergency contacts, SOS, location, maps and offline based features. This is a proposed extension of the ideas and does not show that this study looked at RescueLink or validated the architecture.

There are many areas to look at in the future. First aid information should be reviewed by experts. The interface should be usability tested by the intended users. The application should be tested in areas with little/no connectivity. Map rendering and local searching should be measured on modest devices. Offline routes should be assessed for quality. Security and privacy should be looked at.

IX. CONCLUSION

This review has outlined a proposed mobile system for providing first aid guidance and SOS. The design includes an offline first aid guide and contacts, SOS event handling, GPS location, cached emergency service information, downloadable maps, optional offline routing, medical profile storage and cloud synchronisation when there is connectivity. This will depend on having validated health information, clear communication on what has and hasn't been sent, careful handling of personal data and reliable behaviour when services fail. This will need to be implemented and evaluated before any claims can be made.

Abbreviations

API – Application Programming Interface. GPS – Global Positioning System. SOS – Save Our Souls / emergency signal. OSM – OpenStreetMap. UCD – User-Centred Design.

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