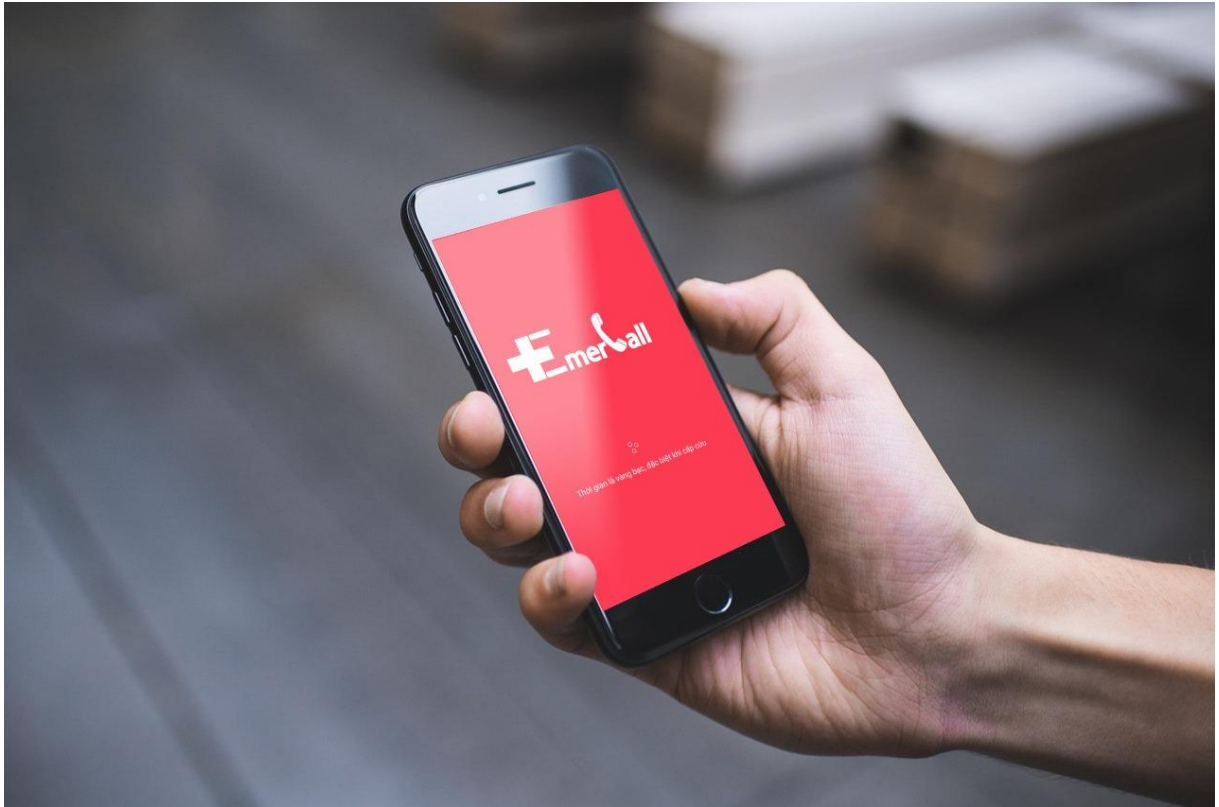


Da Nang Mobile App Development Contest 2018



PROJECT REPORT



EMERGENCY REAL-TIME ASSISTANCE SYSTEM “EMERCALL”

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Da Nang City, November 4th, 2018

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I. BASIC INFORMATION

1. Author/Development team:

TT	Team member	Year of Birth	Team role (leader/ coworker)	Phone number	Email	Personal ID
1	Trần Hữu Nhật Huy	2000	Leader	0982656824	huy9515@gmail.com	191914372

2. Project name:

EMERGENCY REAL-TIME ASSISTANCE SYSTEM “EMERCALL”

3. Software availability:

☒ Yes

+ CD available: ☒ Yes

☐ No

+ Digital distribution service for downloading this app:

● Name of app:

+ Internet link for downloading this app:

☐ No

+ Promise to have the app available on: November 10th, 2018

II. PROJECT REPORT

1. Introduction

1.1. Current situation

In normal life, there are hundreds of thousands emergency cases that occur across Vietnam. The availability of a sustainable, quick-responding emergency system is undoubtedly important. However, our emergency system, from my point of view, still has several problems that may affect its efficiency.

Firstly, emergency calls made by civilians are still through ordinary telephone hotline. This contains various potential risks, for instance, the information given by the caller may be incorrect, incomplete by the chaotic scene of the emergency cases or disturbed telephone signal. In addition, the geographical location of the caller, when being expressed by telephone call, may be ambiguous (especially in big cities, with enormously large sectors filled with thousands of crossed ways and paths). These drawbacks can detrimentally affect an emergency case.



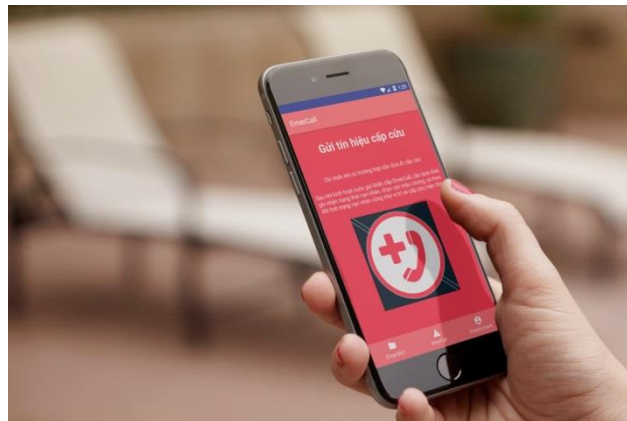
In an emergency case, time is precious

Secondly, according to my surveys, a large portion of Vietnamese people, regardless of gender, age, or educational level, are lacking or uncertain about basic emergency knowledge, especially first-aid methods. This is a result of the overlooked importance towards first-aid knowledge from the civilians and the students, even when they are taught in secondary school's curriculums. This has led to thousands of deaths each year due to the lack of first-aid methods.



In emergency cases, first-aid methods are immensely important. This helps mitigating victim's injuries and damages, while waiting for the victim to be transported to hospitals

Recognizing these problems, I decide to develop this project:
EMERGENCY REAL-TIME ASSISTANCE SYSTEM “EMERCALL”.



1.2. Research purposes

- Develop a fast, accurate communicative assistance system which can support the transportation process of victims in emergency cases.
- This system can allow civilians and hospitals to real-time acquire and update location information of each other, as well as victim's status. This will help the ambulances to approach their designated victims faster, while preparing for his/her current status.
- Provide a database of proper first-aid methods, which can be easily accessed by civilians at any time, especially in sudden emergency cases.

1.3. Potential applicability

- This project, as I expect, can be tested and applied at medical infrastructures such as hospitals and private clinics whose ambulances are available. The applications in this project can be approached widely, since there are numerous smartphone users in our country.
- This project reaches its maximum efficiency in big cities and metropolises with complex transportation systems and infrastructures.

2. Project presentation

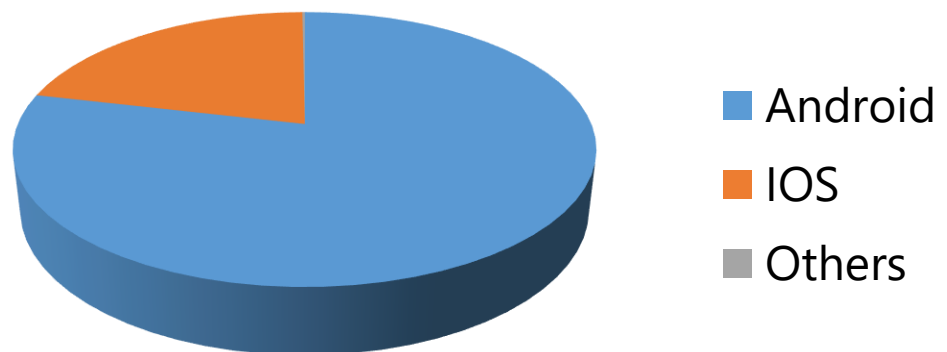
2.1. Technologies and methods

2.1.1. Technologies, tools, software used

2.1.1.1. Android platform

Since this project aims to support the community, I would like to develop it on a widely used environment, so that it can reach as many people as possible in the future. Thus, I choose Android as the first platform to develop my applications, because of its major presence in the market share of smartphone operating system recently.

Smartphone OS market share
September 2018
(gs.statcounter.com)



2.1.1.2. Android Studio

Android Studio is the official integrated development environment (IDE) for Google's Android operating system, built on JetBrains' IntelliJ IDEA software and designed specifically for Android development. With this IDE, I can utilize various extensions and tools for project development and future upgrades.

2.1.1.3. Firebase API

Firebase is an API that lets developers easily sync and store data in real-time. Developers can use the service to build their apps without having to manage servers or write server-side code. Firebase uses WebSockets to achieve real-time communication between clients.

Firestore Real-time Database provides data in JSON files, and real-time synchronization between all client's connections, as well as its 2048-bit certified SSL connection with high security.



I decide to choose Firestore as the main database real-time server for my application system. In this project, this API will offer real-time connections and data exchanged between clients.

2.1.1.4. Google Map API

Google Maps is a free web mapping service developed by Google. It offers satellite imagery, aerial photography, street maps, 360° panoramic views of streets (Street View), real-time traffic conditions, and route planning for traveling by foot, car, bicycle and air, or public transportation.



I decide to use Google Map API for updating, exchanging and displaying geographical locations between civilians and ambulances during emergency cases.

2.1.2. Programming language: Java

2.1.3. List of software, tools, technical systems and infrastructures used in the development of this project

2.1.3.1. Android Studio 3.2.1

- Android 9.0 (Pie) SDK Platform, API Level 28
- Android SDK Tools 26.0.2
- Android Emulator 26.1.4
- Google Play Services 49

2.1.3.2. Firebase API

- Google Services plugin 4.2.0
- Firebase Core 16.0.4
- Realtime Database 16.0.4

2.1.3.3. Google Map API

- Map Javascript 3.34

2.2. Features

2.2.1. Overall

Emergency Real-time Assistance System “EmerCall” (hereinafter referred as **EmerCall system**) consists of 3 Android applications, which are intended to distribute to hospitals, ambulance drivers and civilians. When an emergency case occurs, the system will be switched to “active state”, and 3 applications will automatically real-time synchronize with the database server, sharing information about the condition and location of the victim as well as the incoming ambulance. This will help the ambulance to approach the victim faster, meanwhile, the victim and people around can consult first-aid methods archived within the application, minimizing victim’s damages while waiting for the designated ambulance.

In addition, with this system, medical facilities can monitor the information of users and ambulances for directing and controlling purposes. This serves as a foundation for a promising medical system for both civilians and hospitals in the future.

2.2.2. EmerCall application

EmerCall is the first application in EmerCall system, which is intended to be used by civilians. It offers these features:

- Initiating an emergency call.

- Sending information of the victim: gender, age, current status and geographical location to the database server.
- Displaying current location of designated ambulance on the way.
- Allowing civilians to consult first-aid methods archived within the application, minimizing victim's damages while waiting for the designated ambulance. This feature can be accessed at any time and will be automatically activated in "active state".
- Archive user's basic information, for future development to become a widely used medical system.

2.2.3. EmerCall Ambulance application

EmerCall Ambulance is the second application in EmerCall system, which is intended to be set up in Android devices on ambulances, used by ambulance drives and hospital employees on it. It offers these features:

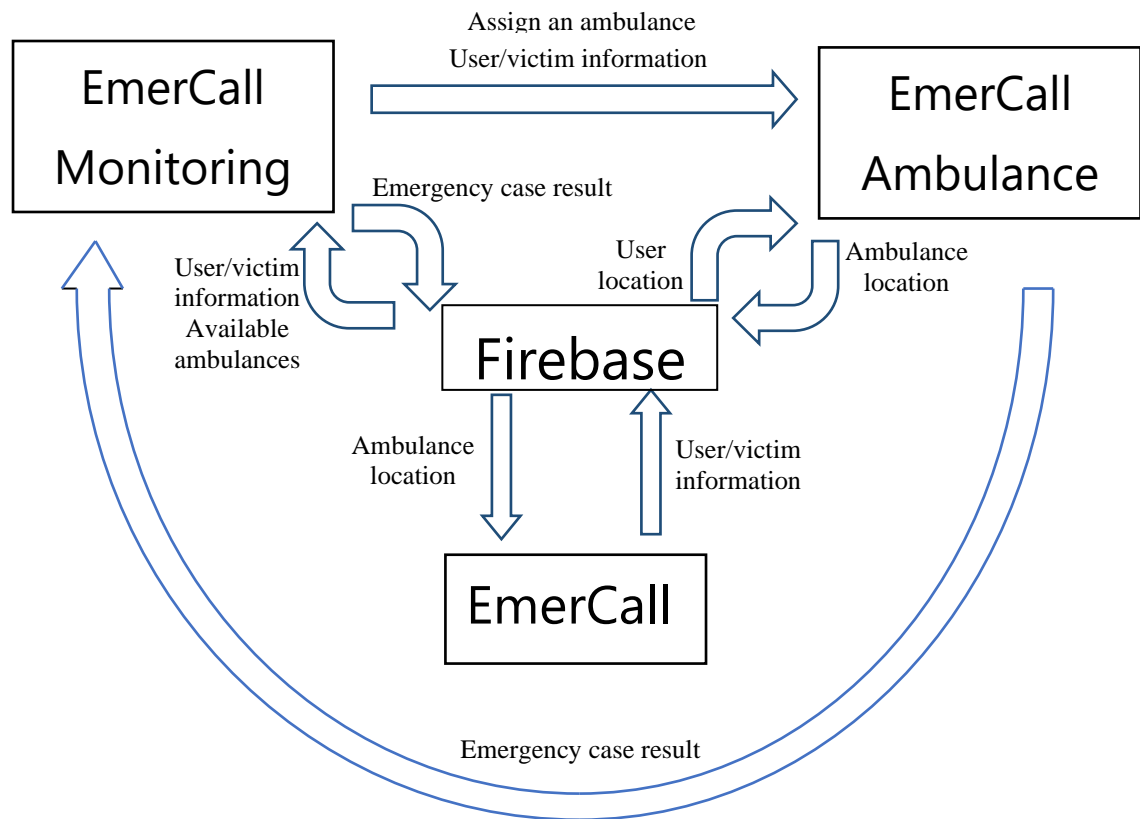
- Receiving information of the victim: gender, age, current status and geographical location to the database server.
- Displaying current location of the victim/emergency caller, helping the ambulance to approach the site faster.
- Confirming the result of an emergency case. In the future this will contribute to the medical system project. Currently this feature helps avoiding fake emergency calls.
- Archive ambulance's basic information.

2.2.4. EmerCall Monitoring application

EmerCall Monitoring is the last application in EmerCall system, which is intended to be used by hospital employees whose job is to receive emergency calls and assign an ambulance in return. This application offers these features:

- Receiving emergency calls from civilians, as well as victim's information of each call.
- Assigning ambulances for emergency cases in waiting list.
- Monitoring information of civilians and ambulances connected to the system.

2.3. Functional structure



Functions of the 3 applications in EmerCall system during a basic emergency case

During an emergency case, EmerCall undergoes 6 main steps:

1. When an emergency case happens, civilians – EmerCall application users – will send an emergency signal. It contains information of the caller, as well as victim's gender, age, and current status, all are sent to Firebase Real-time Database on the server. This signal also triggers user's EmerCall application to the "active state".
2. The database will redirect information, brought along by the signal, to the EmerCall Monitoring application used by hospital's employees.
3. This employee will assign an available ambulance to approach the victim/caller. Then, EmerCall Ambulance application of the selected ambulance will be triggered to its "active state". At this time, it will receive victim's information – gender, age, and current status – from EmerCall Monitoring application.
4. On the way, EmerCall Ambulance and EmerCall applications will display each other's geographical location (showed by Google

Map fragment of the 2 applications). Meanwhile, EmerCall application's first-aid archive will be automatically activated for user's reference purposes.

5. After finishing the transportation of victim, users of EmerCall Ambulance application will confirm the case's result. In case it was a fake call, the user who activated the emergency call will be counted as one fake call. Finally, this result will be sent to EmerCall Monitoring, and be updated onto database server.

6. In case a smart device is detected to have sent 3 fake calls, the EmerCall Monitoring application will block this device's accessibility to EmerCall system. Since EmerCall system uses Unique Device Identifier (**UDID**) of devices for recognition, this block is irreversible unless contacting system's administrators for unblocking.

2.4. Algorithms

Algorithms for real-time connections focus on continuously updating status of the 3 applications and transferring data between them and the database, through the database.

Data stored on Firebase are designed in JSON trees with various nodes in parent-child relationship, each node contains a pair of key and value (or child nodes). When a new emergency signal appears, the server will "listen to" that change in status and "catch" that event, allowing EmerCall Monitoring application to recognize that signal almost immediately. This is the main algorithm for EmerCall system to effectively detect and respond to any emergency signals.

2.5. Database

I design a JSON database tree containing all information of objects which connect to the system, and each Firebase respiratory will be allotted to a hospital, or to an EmerCall Monitoring application. In short, when EmerCall system is applied in real life, each hospital will have a database like this:



Database structures used in EmerCall

In this database:

- Node “ambulances” contains child nodes whose keys are UDID of devices connecting to the system. These child nodes contain ambulance’s ID (“id”), current geographical location in longitude (“longitude”) and latitude (“latitude”), number of transportations (“times”), current availability (“status”, 0 means “available”, 1 means “not available/in transportation”). When an ambulance is assigned to a victim/user, node “destination” will contain UDID of the device used by that victim/user.
- Node “bannedUsers” contains UDID of banned devices. These devices are no longer be able to connect to EmerCall system.
- Node “hospitalLocation” contains hospital’s longitude (“longitude”) and latitude (“latitude”).
- Node “userStatus” contains signal status of devices whose EmerCall application is connected to this database. These child nodes use device’s UDID as key, and current signal status as value (“status”, 0 means “available”, 1 means “not available/in transportation”).
- Node “users” contains child nodes as devices connected to this database, with UDID as key for each device. These child nodes

contain number of calls (“callCount”), current geographical location (“location”), user information (“userInfo”), current status (“status”). When an emergency signal is sent, “status” will toggle its value from 0 to 1, node “patient” will update victim’s current status; and after an ambulance is assigned to this victim/user by EmerCall Monitoring, node “targetAmbulance” will contain UDID of the device on approaching ambulance.

2.6. Overall assessment

2.6.1. Advantages

- Thoroughly assisting an emergency case, for both the ambulance and the victim/user.
- Optimizing all the processes of an emergency case compared to ordinary hotlines, greatly increasing victim’s survival chance in emergency cases.
- Having potentials to become a powerful digital system for medical monitoring services and civil infrastructures in the future.

2.6.2. Disadvantages

- Users may find this application difficult to use at first, especially when performing strict processes in “active state”.
- The current system can only be applied at small to medium hospitals and medical facilities, due to limited budget and experience of the author.

2.6.3. Project’s potentials in Vietnam

- Currently in Vietnam, nearly all types of emergency calls are through telephone hotlines. Given enough time and resource for development, EmerCall project will become the first system in Vietnam that can resolve current difficulties of emergency calls.
- EmerCall can become perfect in big cities and metropolises with high population density and complex transportation network.
- In the future, by implementing additional features, this system can become fully independent, self-operating, multi-tasking, not just for receiving and responding emergency cases, but it can even achieve further applications in healthcare provision and medical monitoring. In the end, a fully-automatic civilian health supervisor system can be completed.

2.6.4. Future plans for improvement

Given time and resource, I would like to develop EmerCall system with following stages:

1. Improve user interface and experience, upgrade database to meet a larger scale with more hospitals connecting to the system.
2. Optimize locating, transmitting, data updating, real-time synchronizing algorithms in order to reduce probability of bugs and mistakes from the systems and users.
3. Automate all the processes of EmerCall Monitoring application. Completing this stage means that this system will no longer need hospital employees to operate EmerCall Monitoring, all the works will be done automatically. A comparable example is Grab or Uber applications, with well-supported and automatic ecosystem.
4. Implement additional features to further upgrade EmerCall system to a larger scale that can serve a whole city or even a region in healthcare provision and medical monitoring.

III. APPENDIX

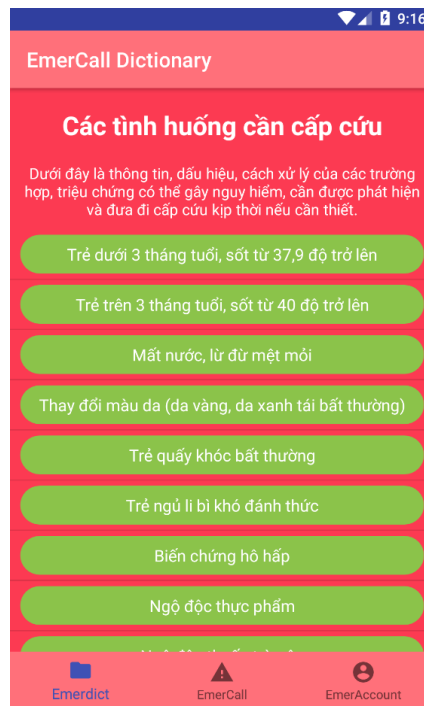
1. Images of applications

Note to examiners: due to unexpected changes in Google services regulations and recent Android version upgrades, currently there are various bugs and technical conflicts in my applications, rendering them unavailable for presentation at this time. I truthfully apologize for this inconvenience. Please use these images for your reference.

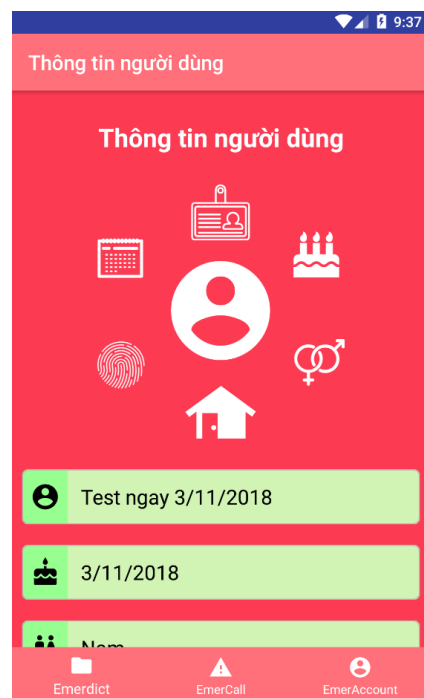
1.1. EmerCall



Emercall home screen, at the center is a big button for sending emergency signal



EmerCall Dictionary, containing various emergency cases/symptoms and their corresponding proper treatment methods



EmerCall Account, containing user information: name, date of birth, gender, address, personal ID and medical ID

EmerCall (đang kích hoạt)

Đã gửi tín hiệu cấp cứu

Vị trí của bạn đã được gửi đi. Yêu cầu nhập đầy đủ tuổi, giới tính người bị nạn, sau đó quan sát người bị nạn và chọn những triệu chứng/biểu hiện của nạn nhân trong danh sách dưới đây. Cuối cùng, nhấn Xác nhận phía dưới màn hình.

☐ **Nam**

☐ Giảm trương lực cơ

☒ Gãy xương

☒ Vết thương hở, chảy máu

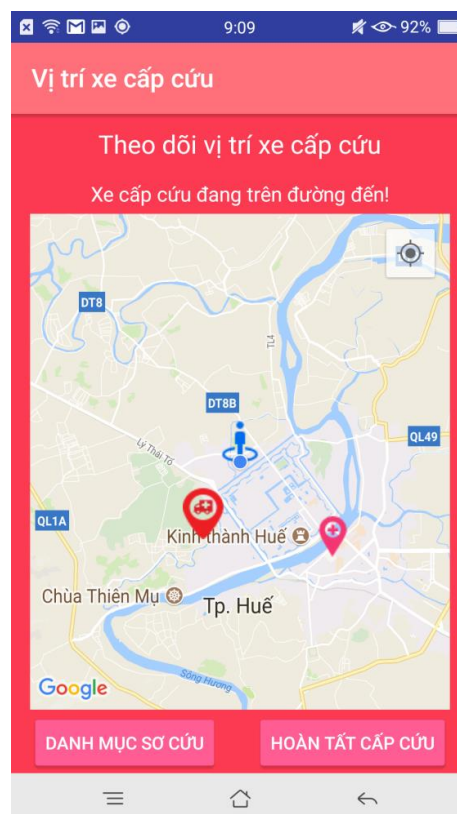
☐ Đột quỵ: tê người, mất thị lực, đột ngột chóng mặt

☒ Ngất xỉu, mất ý thức

☐ Nhồi máu cơ tim: tức và đau ngực, đột ngột mất thị lực, đau rát dưới xương ức.

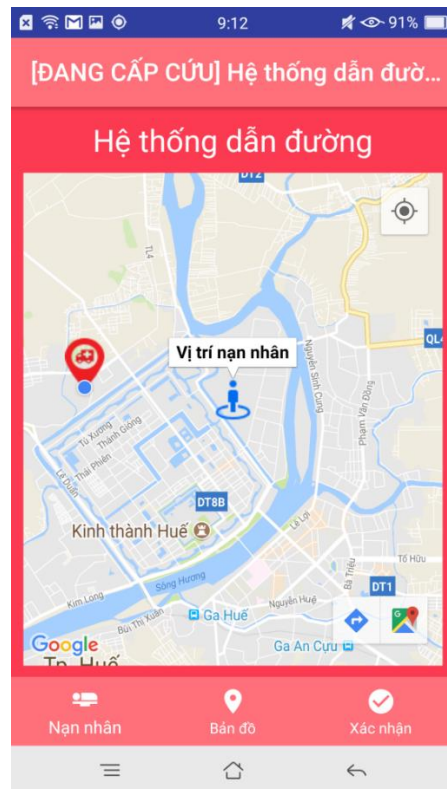
XÁC NHẬN

First screen after sending emergency signal. It requires user to enter victim's gender, age, and notable symptoms/status

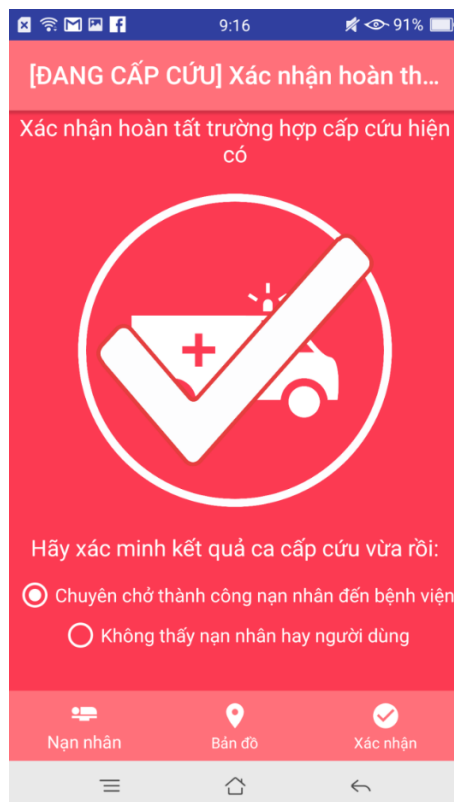


Second screen after sending emergency signal, showing locations of user, ambulance and hospital. The user can also switch to first-aid method list by pressing the lower left button

1.2. EmerCall Ambulance

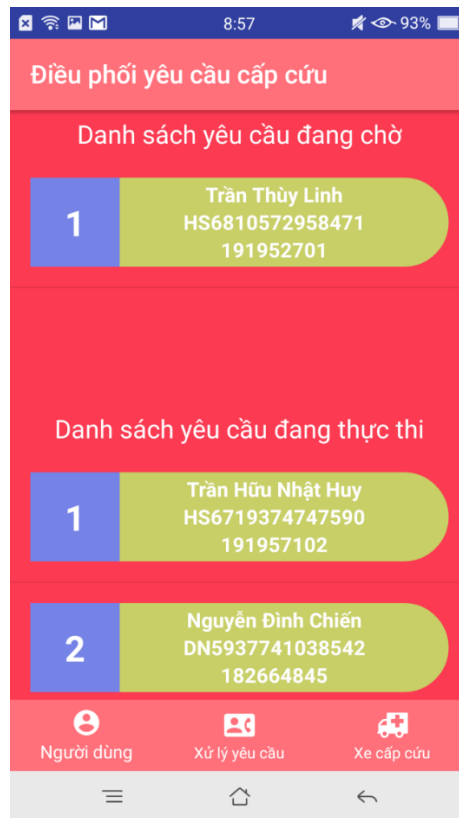


Home screen in “active state”, showing victim/user location, lower left button for victim/user information, and lower right button for confirming transportation result



Confirmation screen, here the user can confirm if the call is real or fake

1.3. EmerCall Monitoring



Home screen, upper list shows waiting cases, and lower list shows in-progress cases (ambulance-assigned cases)



Victim/user information when tapping to a list element



Available ambulances to assign

2. References

wikipedia.org

edx.org

tutorialspoint.com

youtube.com

Da Nang, November 4th, 2018

Project developer
Tran Huu Nhat Huy