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Development of an Electric Vehicle Helper Application for Emergency Rescue

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Abstract. This paper designs and develops an emergency rescue service for electric vehicles (EVs), which are likely to suffer from the battery depletion during their trips. Our design defines the interaction among three parties of EV drivers, the rescue server, and emergency vehicles to process the dispatch request and systematically meet the user requirement. Particularly, a comprehensive mobile application is developed on the Android operating system to help users to promptly send a rescue request to the server and monitor the request processing status. This user interface allows users to automatically specify its location and necessary personal information as well as view the distribution of emergency vehicles through user-friendly maps. Our design is scalable for a large number of emergency vehicles and rescue requests, accelerating the large deployment of EVs in our daily lives.

Keywords: electric vehicle, emergency rescue service, helper application, dispatch processing

1 Introduction

The large deployment of EVs (Electric Vehicles) cannot be expected without an intelligent information service especially supporting easy maintenance and tour planning [1]. It can be achieved by comprehensive interoperability between diverse grid entities such as EVs, charging facilities, tracking systems, power networks, and so on [2]. Many countries are making an effort to build such an information infrastructure for EVs, while the Internet of Energy (IoE) for Electric Mobility is an example of such information framework developed by a European research project [3]. According to their experience, EV services must focus on charging operations and

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necessarily include mobile application parts to deal with inherent mobility of EVs, taking advantage of a variety of information.

Nowadays, mobile phones have remarkable computing capacity and interfaces with diverse on-board devices [4]. They can work as not only an in-vehicle computing device but also a gateway device seamlessly communicating with remote high-end servers via ubiquitous wireless channels. Moreover, their display units provide rich graphic interfaces to drivers through an appropriate mobile application developed by Android and iOS programming. In this regard, this paper designs and develops a mobile helper application for EVs, particularly focusing on emergency rescue processing and driver activity record collection, for the sake of alleviating the range anxiety problem and hosting diverse EV information services [5].

2 Service scenario

Figure 1 depicts the service scenario of our emergency rescue system. How it works can be explained by the flow of messages among three actors including the EV which wants to request a rescue service, the emergency rescue server which coordinates the rescue transactions, and the emergency vehicle which will be dispatched to the requested spots.

1. An EV driver first sends a reservation request message to the emergency rescue server via the cellular network, specifically, CDMA (Code Division Multiple Access) in Rep. of Korea.
2. The rescue server acknowledges the receipt of the request.
3. The server checks the availability of emergency vehicles and selects the best one according to the distance and the SoC (Status of Charge).
4. The picked vehicle either accepts the order or reject. If rejected, the server repeats Step 3.
5. The server sends the reservation confirmation to the EV driver, who will now wait for the emergency vehicle, possibly doing other work.
6. The emergency vehicle is dispatched and supplies the electricity enough for the EV to reach the nearby charging station.
7. The emergency vehicle reports the completion of its service to the rescue server.

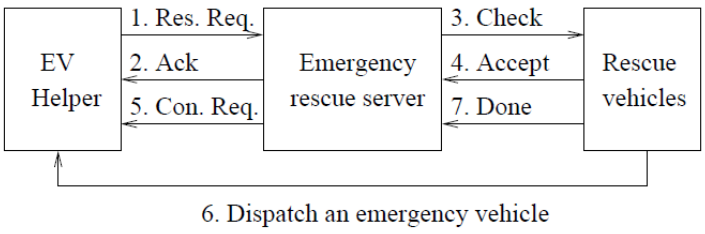

Fig. 1. Service scenario

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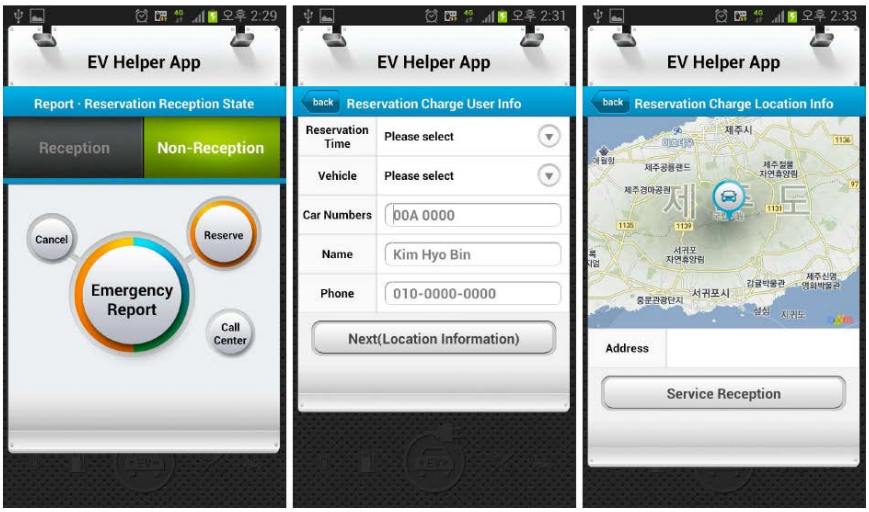
Next, Figure 2 shows our mobile application implemented on the Android operating system. To begin with, as shown in Figure 2(a), the initial menu allows the user to file an emergency rescue request in addition to the reservation cancellation and the call center connection. For the emergency rescue request, most information fields including the caller name and the vehicle number, are preregistered while the current location of the vehicle can be automatically obtained from the embedded GPS receiver as depicted in Figure 2(b). Finally, Figure 2(c) shows the map-based display which marks the current locations of both the issuer vehicle and the emergency vehicle on the way. The respective coordinates are provided by the emergency rescue server which keeps tracking the current location of each emergency vehicle for an efficient dispatch.



(a) Initial menu (b) Reservation request (c) Map interface

Fig. 2. EV helper implementation

3 Conclusions

In the modern power system called the smart grid, the information technology is an essential component for its intelligent management and operation. EVs can benefit from computational intelligence and ubiquitous connectivity to accelerate their large deployment. The EV helper application, implemented in this paper, makes it possible for EV drivers to overcome emergency situations mainly stemmed from battery depletion. The application provides a comprehensive user interface on mobile devices and well-defined computing architecture in the emergency rescue system. Our implementation can accommodate not only more in-vehicles sensors for more accurate diagnosis but also more emergency vehicles to be responsive to emergency

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rescue requests. To this end, a variety of information will be efficiently managed and a sophisticated dispatch algorithm will be developed in the rescue server.

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