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"Kreen" an Electronic Platform for Towing Service as an Alternative Solution for Writing on Walls Phenomenon in Iraq

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Abstract: Over the last fifteen years, "Writing on walls" has been dramatically used by kreen (tow truck) owners to distribute their contact information (phone numbers) in all cities around Iraq. This phenomenon has severely distorted cities and badly affected the environment, especially in Baghdad. This paper presents design, development, and implementation of *Kreen*, a special e-service platform for towing service in Iraq delivered through a smart mobile application with online database. *Kreen* provides solution for the aforementioned problem as an alternative way for the towing service providers (kreen owners) who are individuals or small groups having tow trucks. Kreen owners can create accounts within *Kreen* by providing their contact information which will be delivered to customers as a sorted list according to the nearest kreen to the current location of broken car depending on Global Positioning System (GPS). The application was developed using Android Studio IDE from Google and Java programming language. All the functionalities of the application and its database were extensively tested on many Android platforms with version from (KitKat 4.4 to Android 11), then it was published on Google Play Store. The results showed that the platform performed accurately in all locations and modes.

Keywords: Tow truck, Mobile application, E-platform, Towing service, Android, GPS, Writing on walls

1. Introduction

Technology can be used to solve many technical and social problems. It can provide systematic solutions for complex problems and reduce time and efforts for daily tasks. Electronics service platforms and smartphone applications (apps) are examples of technologies that have been exploited to provide such solutions to meet the needs of mobile devices' end users. In last decade, smartphone apps have been targeting many fields such as health, education, transportation, etc. In health field, many apps have been developed to monitor personal health and fitness for the smartphones' end users, for example*MyFitnessPal, Headspace, Fooducate,* and so on [1], [2], [3], [4].

Similarly, in education field, smartphone apps have been used in online training, learning, and meeting like *Meet* from *Google, Zoom, Free Conference Call (FCC),* and many others. Online education has been massively used, especially during Covid-19 pandemic where many universities and academics institutions use online education as an alternative to the traditional education classrooms system [5].

In the same way, transportation has taken researchers' and developers' interests to develop many solutions through smartphone apps to solve problems related to timing, cost, and trip planning, for instant *Google Maps, Citymapper, Waze, Transit,* etc.

Putting in mind the impact and enormous benefits of the mobile applications, innovative solutions for many daily life problems can be developed to save customers' time and money. This paper deals with development and implementation of a smart mobile application (*Kreen*) which is a towing e-service platform that has been developed as a solution for the problem of "Writing on walls" phenomenon. This phenomenon has been dramatically spread out in Iraq during the last fifteen years and caused massive distortion of environment, especially in Baghdad. The application provides an innovative and automated way to distribute contact information of the kreen owners as well as reduces time, effort, and cost for customers to find a proper towing service for their broken cars.

The rest of the paper is structured as follows; Section 2 addresses the related work. A background about the problem and the proposed solution as well as details of the application design will be given in sections 3 and 4. Implementation will be presented in section 5. In section 6, results will be discussed. And finally, the conclusions and the future work will be given in section 7.

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2. Related Work

Smartphone applications and e-service portals have been used by researchers and developers to provide innovative solutions to solve many problems. These solutions became crucial part of customers' daily life to save their time, money and efforts while doing their daily duties.

As a powerful scientific research instrument, Dufau et al. [6] has exploited smartphone app in collecting data from thousands of volunteers from all around the world for experiments in cognitive science. These massive data were used to test cognition universal theories.

In [7] a real-time wearable monitoring device was design to recognize and classify peoples specific actions based on an acceleration data that collected for their bodies by acceleration sensor. The monitoring system used smartphones application to manage the collected data and monitor users' activities.

Kassem et al. [8] developed a smart medication dispenser to help elderly patients to take their medication on time without missing scheduled pills. The main part of the system is a smartphone application that contains a user-friendly interface to control the medication schedules.

Hasan [9] developed an app with electromyographic (EMG) sensor to build a rehabilitation system to help partially hand impaired patient with their physical exercises. The app provides graphical user interface (GUI) to instruct and motivate patients to do their exercises by themselves at home.

In [10], researchers developed a mobile application to help students learning human body anatomy. With the help of augmented reality, students can visualize and examine human organs in 3D models which can enhance their learning capabilities.

Mohammad et al. [11] developed a GPS based transportation smart mobile application. The application can track users' movements, give the shortest path of the trip, provide approximate time of arrival to destination with information about traveling vehicle, and short messaging service (SMS).

In [12], Kumari and his team implemented an IoT based smart management system for vehicles and buses. The system contains a mobile application that can display vacant seats available on a bus to help users in taking decision to secure a seat for travel.

In [13], researchers provided a detailed review about the mobile applications impact and their role in transportation in urban mobility.

3. Background

This section presents some relevant background information and motivation related to the development of the platform and the application *(Kreen)*, the problem of "Writing on walls", and the solution as well as details of the application design.

A. The Problem of Writing on Walls

More than a decade, "Writing on walls" has been dramatically used by kreen owners to promote their business in all cities of Iraq. If you drive or walk in Baghdad, you will see Arabic hand written phrases *(kreen for rent)* with phone numbers everywhere on walls, fences, statues, bridges, concrete blocks, roads, and highways as shown in Figure 1. This phenomenon has severely distorted the features of the city and badly affected the environment. Although of this huge distortion, drivers spend lots of time and money and find it hard to get serviced to tow or repair their broken cars, especially on highways outside cities. Sometimes, most of the written phone numbers are unused or deactivated when they are called, which will frustrate drivers who need to be rescued quickly. Moreover, the Mayoralty of Baghdad banned Writing on walls and enacted fines and penalties, but the problem still persists due to the lack of an alternative solution. To solve this problem, an alternative creative ways have to be provided to the kreen owners to advertise their business using technology without need to write on walls.

(a) Wall.

(b) Statue (Courtesy of image (Al-Awsat)).

Figure 1. The "Writing on walls" phenomenon.

B. The Proposed Solution

As a solution for the aforementioned problem, in this study a towing e-service platform has been designed, developed, implemented, and delivered through a smartphone app (*Kreen*). The platform provides an alternative solution for the kreen owners to advertise their business through creating their own accounts within the app. Instead of writing on walls, they can register by providing their contact information such as name, phone numbers, truck type, address, and work time which will be delivered to the customers in a suitable way. The app is very simple to use where the customers can open it to get a list of kreens which are sorted according to the nearest one to the current location of the broken car depending on the Global Positioning System (GPS) of the customers' smartphones. The customers can find all the necessary information about the kreen that suits their needs and call real active phone numbers within the app through cell phone calling service or view map for further information about the surrounding region where they are and the distance between their current location and the chosen kreen as well as the approximated time for arrival.

4. Kreen Application

In this section, the design of the Kreen application will be descried in detail. All functions of the application will be explained with screenshots and figures. First of all, Figure 2 shows the procedural design diagram of the application. Second, a detailed description for each activity of the Kreen app is given as follows:

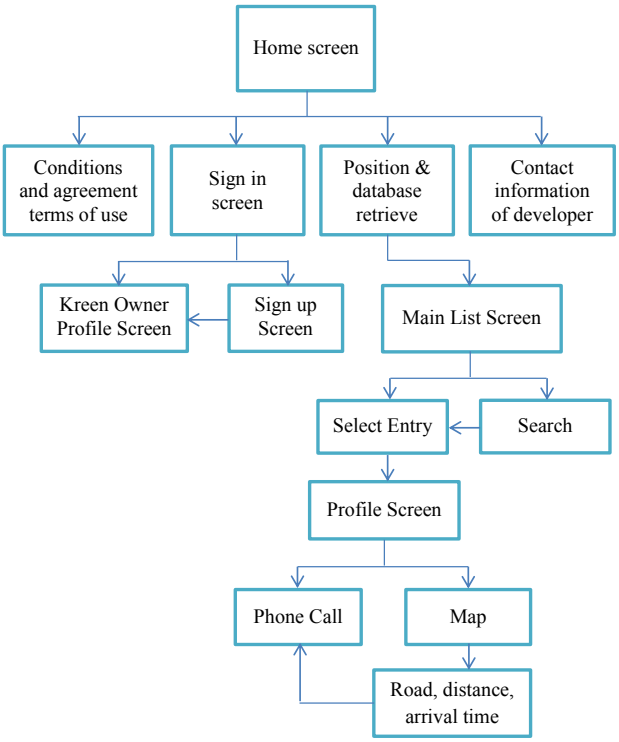


Figure 2. Procedural design diagram.

Figure 3. The home screen.

A. Home Screen

In programming of smartphone applications, a screen is called an activity, but for simplicity the term screen will use instead in the rest of this study. To organize the user's experience, the home screen contains the logo of the app at the middle top of it, two buttons (TOWING TRUCK DRIVER and NEED TOWING SERVICE?) at the bottom, and contact information of the developer plus the *conditions and agreement terms of use* in the taskbar at the top right corner as shown in Figure 3. The home screen is responsible for many tasks as follows:

- Determines the current location of the user's smartphone depending on the built-in GPS.
- Synchronizes and update the local database depending on the database on server for offline mode.
- (TOWING TRUCK DRIVER) Button, this button has some functionalities that are dedicated for kreen owners:
  - For a new registration, it directs the kreen owner to sign in screen from which he can navigate to sign up screen to fill in necessary registration information.
  - For registered kreen owner, if the he signed out previously, he will be directed to sign in screen; otherwise he will be directed to his own account's profile from which he can edit, sign out, or delete his account permanently.
- (NEED TOWING SERVICE?) Button, this button is dedicated for customers who need the towing service. For the first time only, the users have to agree on a pop up message of the *conditions and agreement terms of use* in order to get the main list of the kreens.

Figure 4. The sign in screen.

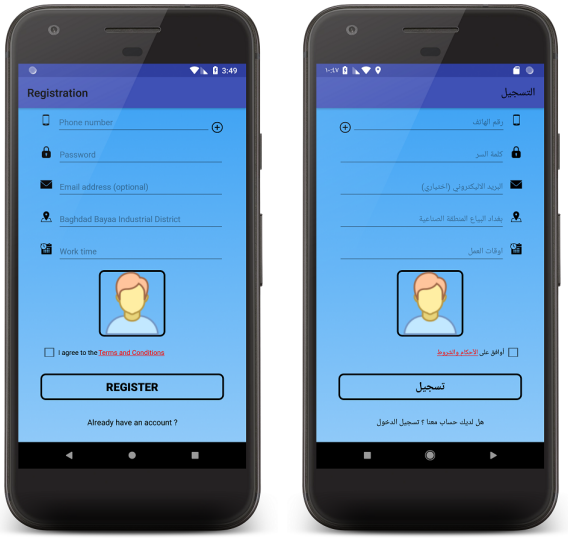


Figure 5. The sign up screen.

B. Sign in Screen

The sign in screen contains two input boxes (edit text view) to input the log in credentials of a kreen owner and a button for log in. In addition, the text, *"Create account? Sign up"* can be hit to navigate to the sign up screen to create a new account for new kreen owners. The log in credentials depends on the user's phone number which is unique and must be active to log in to prevent multiple entries. Figure 4 shows the sign in screen.

C. Sign up Screen

The sign up screen contains many input boxes to input all the necessary information of a new kreen owner such as name, truck type, phone numbers, password, email (optional), address, work time, and an avatar picture for the account profile. The new kreen owner must agree to the *conditions and agreement terms of use* in order to be registered and create the account. When the kreen owner clicks the *Register* button, the app will obtain the latitude and longitude coordinate of the given address using Geocoding process in order to be used later to determine the nearest kreen in the list of kreen owners. All the entered information as well as the latitude and longitude will be uploaded to an online database which will be synchronized on all devices to update the local database for offline mode. In addition, kreen owner can navigate back to the sign in screen by tapping on *"Already have an account?"* as shown in Figure 5.

D. Kreen Owner Profile Screen

This screen is dedicated for the kreen owners who are registered and have accounts within the *Kreen* app. They can edit and update their information, change or remove the avatar picture, sign out, or delete the account permanently as shown in Figure 6.

E. Main List Screen

This screen contains a list of towing service providers (kreen owners) that is sorted according to the nearest one to the current location of the broken car. Each entry of the list is a card view to display the most important information about the kreen owner such as name, truck type, address, and avatar picture to make it easy to customers to navigate and choose the suitable kreen to tow their broken cars. The customer can search for the suitable kreen according to name, truck type, or address using the search box at the top of the list screen as shown in Figure 7. If the customer taps the chosen entry, he/ she will be directed to the profile screen of the chosen kreen owner.

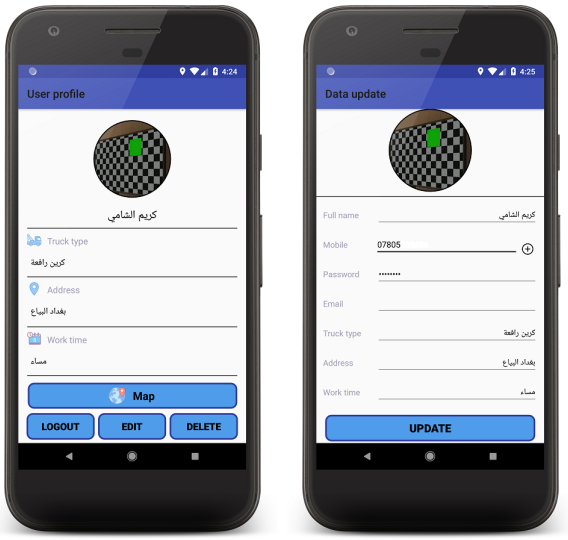


Figure 6. The kreen owner profile screen with update screen.

F. Profile Screen

This screen is dedicated to the customers who need towing service. It contains all the necessary information about the kreen owner such as name, avatar picture, truck type, address, and work time as well as two buttons for *Call* and *Google map*. The customer can call to get serviced or open a map for further information. When the customer taps the call button, a pop up message will appear to inform him/her about the calling policy of the *Kreen* app. If the policy gets confirmed, available phone numbers will be provided if the particular kreen owner has more than one phone number; otherwise, the call will be directly set as shown in as shown in Figure 8.

Figure 7. The main list screen with search box.

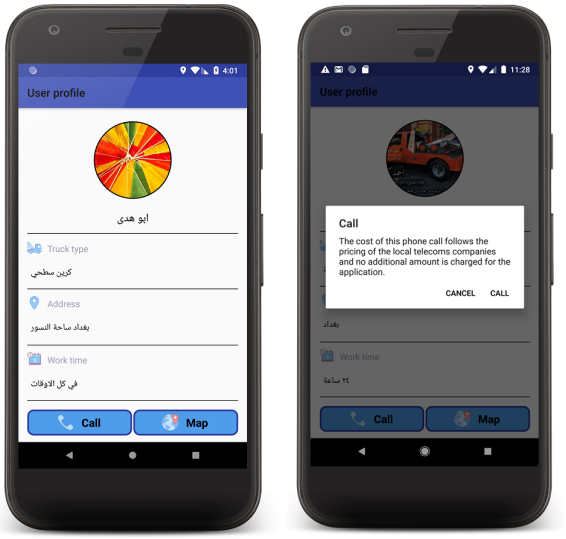


Figure 8. The profile screen and calling policy.

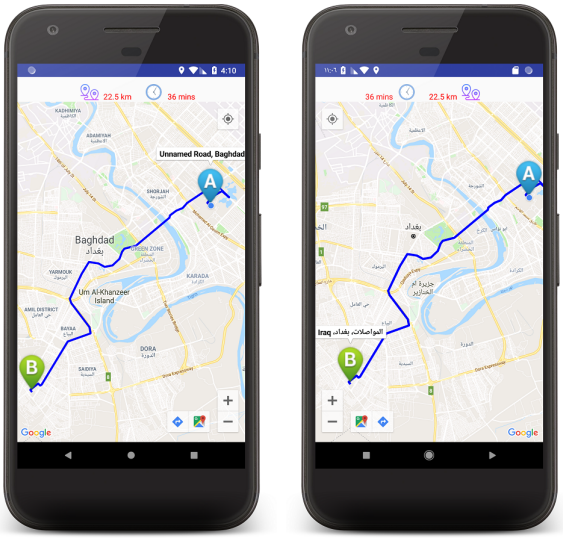


Figure 9. The map screen.

G. Map Screen

The map gives more information about the region where the customer is and the current location (marker A) as well as the location of the chosen kreen owner (marker B). The map draws the shortest road between the two markers in blue and calculates the approximate distance between them in kilometers and arrival time in minutes as shown in Figure 9.

5. Implementation

The application has been designed and developed using Android Studio IDE from Google, Java programming language, PHP, and mysql for database queries. The app gives a sorted list according to the nearest kreen to the current location of the customer. The shortest distance between the current location and addresses of kreen owners is calculated using *Haversine* formula depending on latitude and longitude data as given in (1):

$$Distance = 6378.8 * \arccos\Big[\Big(\sin(KOA_{lat}) * \sin(CCL_{lat})\Big) + \cos(KOA_{lat}) * \cos(CCL_{lat}) * \cos(CCL_{long} - KOA_{long})\Big] \quad (1)$$

Where the value (6378.8) is the radius of Earth in kilometers, KOA_{lat} and KOA_{long} (**K**reen **O**wner **A**ddress) denote the latitude and longitude of the kreen owner address respectively, and CCL_{lat} and CCL_{long} (**C**ustomer **C**urrent **L**ocation) denote the latitude and longitude of the customer's current location respectively. The app works online and offline where no internet connection on highways and supports two languages (Arabic and English). All the data are stored on an online database which is hosted on a website. The database consists of one table (entity) that contains all the data about the kreen owners (attributes) as well as all the necessary data to organize the operations

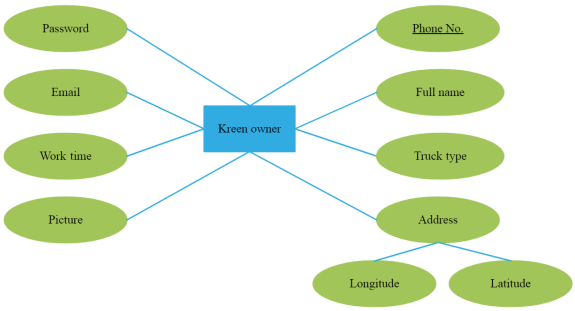


Figure 10. E-R model of the database.

of the application. An API script was implemented using PHP to control data transfer between the application and the database which is accessed using mysql queries.

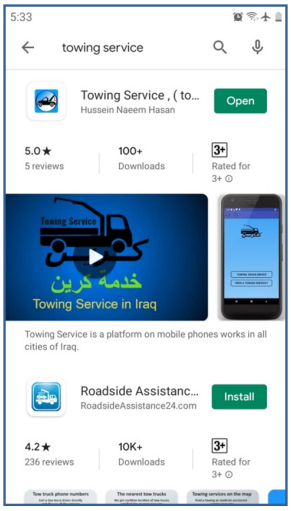
Figure 10 shows the logical design of the database using E-R model representation. All the functionalities of the app were extensively tested on many Android smartphones with version from (KitKat 4.4 to Android 11), then it was published on Google Play Store. Up to the time of writing this paper, there are about 30 real kreen owners' accounts within the *Kreen* App in Iraq distributed in Baghdad, Nasiriyah, and Sulimanyiah as well as to some accounts from outside Iraq (Kuala Lumpur and Botswana) as shown in Figure 11. The *Kreen* App can be adopted by the Mayoralty of Baghdad and municipal directorates in all other cities in Iraq to commit kreen owners using the App and the towing service platform rather than distorting walls.

6. Results and Discussion

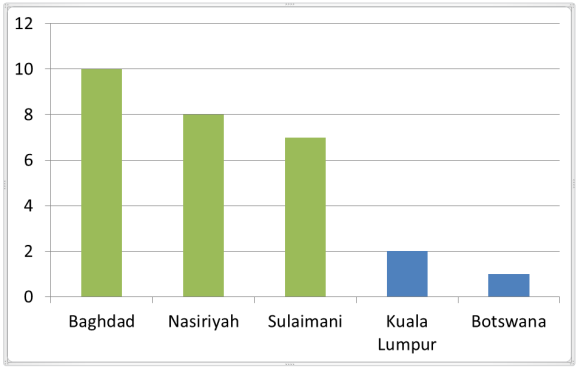
The application *Kreen* has been extensively tested to check its functionalities for efficient results as mentioned in Section 5. The most important functionalities that were tested are the map, and the ability to provide the sorted list of kreen owners depending on GPS data of the customer's current location and kreen owners' addresses, and online/ offline modes.

As stated clearly in detail in Section 5, latitude and longitude of the kreen owners' addresses and the customer's current location were used to calculate the approximate distances. These distances have been used to sort the main list of kreen owners ascendingly and calculate the approximate time of arrival as well as draw the road between two locations. In the drawn road, marker (A) marks the customer's current location and marker (B) marks the kreen owner location.

The application was tested in different locations (Governorates) around Iraq (Baghdad (middle), Nasiriyah (south), Sulimanyiah (north)) as well as different locations within same governorate (Nasiriyah). These tests proved the performance and accuracy of the portal and application to produce the sorted list of the kreen owners according to current



(a) Play store (screenshot).



(b) Kreen owners' accounts within the app.

Figure 11. Information about the app.

location of the customer, provide accurate map, and give identical results in both online and offline modes.

Figure 12 shows a result of a user (customer) in Baghdad, it can be observed that the kreen owners who work in Baghdad were listed in the beginning of the list according to their distances from the current location of the user, also the map gave the road direction in blue as well as the approximate distance and arrival time at the top of the screen. Similarly, Figure 13 shows result of a user in Sulimanyiah where the kreen owners who work in Sulimanyiah were listed firstly.

Additionally, Figure 14 shows the results for different locations in Nasiriyah with different list order according to the current location of the user. It can be noticed that the sixth item (kreen owner) in the resulted list of location 1 became first item in the resulted list of location 2, while others were rearranged according to the updated distance relative to the customer's current location.

Moreover, Figure 15 shows the results of the online and offline modes for (Location 1) in Nasiriyah, where it

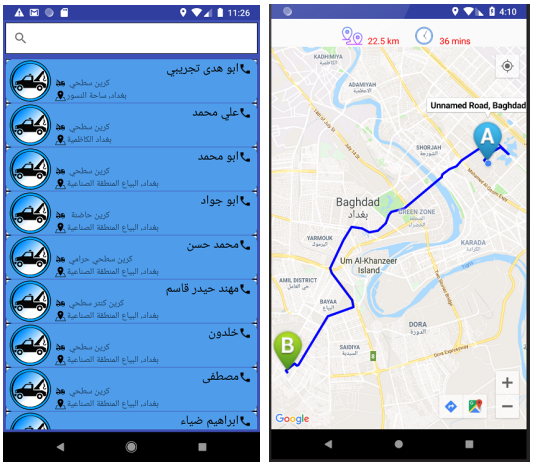


Figure 12. Results in Baghdad (Listed kreen owners and map).

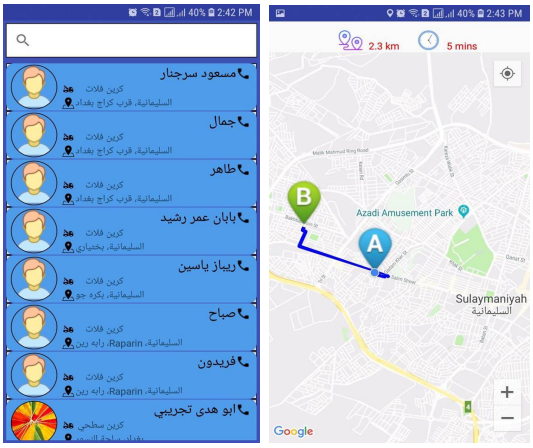


Figure 13. Results in Sulimanyiah (Listed kreen owners and map).

(a) Location 1. (b) Location 2.

Figure 14. Results of listed kreen owners for different locations in Nasiriyah.

(a) Online mode results. (b) Offline mode results.

Figure 15. Online and offline modes results.

can be easily seen that the results were identical for both modes which proof that the *Kreen* app worked efficiently in offline mode where no internet connection (no Wifi signals in all offline figures), especially for regions outside cities and highways. The results show the high performance of the *Kreen* app in processing data and displaying accurate results in many different locations around Iraq. In comparison with the conventional method (writing on walls) to distribute contact information of kreen owners and how to get a kreen to tow a broken car, the proposed solution (*Kreen* app) provides innovative, efficient, and quick way to find a kreen and get serviced effortlessly to save time and money.

7. Conclusions and Future Work

Technology can make our life easier and safer and can reduce time and cost to achieve our daily tasks. Mobile application as a technical service participated in making technology viable and beneficial. In this paper, *Kreen* app has been developed to solve a social problem in Iraq "Writing on walls" and provide an alternative solution for kreen owners to distribute their contact information and promote their business. The results illustrate the accurate performance of the application in different locations and different modes (online and offline). The app can play an important role as a promising alternative solution to provide towing service everywhere in Iraq and reduce time and cost of the service as well as provide safe and reliable service for customers. For future work, the app can be further developed to provide maintenance and fuel services.

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