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Development of an Android App for Monitoring PMS in Gas Stations

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***Abstract*—The use of mobile phones (smart phones) have gone beyond just making phone calls and sending text messages to specialized applications such as object recognition, patient health monitoring, security and navigation, amongst others. In this paper, BRAZ named after the authors is an android App for monitoring fuel situation in gas stations. This research was particularly motivated by the uncertainty faced by consumers of Premium Motor Spirit (PMS) in locating the closest gas station. PMS is an essential commodity in the daily life of almost every individual. Consumers have been complaining about the high petrol prices and everyone wanting to access the cheapest and closest station available in order to save expenses. Therefore, with a single click on BRAZ, the list of gas stations with the product is provided to the user in real-time. Also included are the price/litre, car density, and a GPS location of the station which can lead user to the location via Google map. This is particularly of advantage to visitors who are not familiar with the road network of the town. A validation test carried out on a random sample of 60 users gave 80% of users' acceptability.**

Keywords-Premium Motor Spirit; Android Mobile App; USSD code; SMS; USSD gateway; GPS.

I. INTRODUCTION

Since the discovery of petroleum product in Nigeria, it has been an essential commodity in the daily life of most, if not every individual. It comes in a variety of forms including vehicle usage and domestic usage. Petroleum products for vehicle usage include Premium Motor Spirit (PMS) and diesel while for domestic usage includes kerosene and gas. These products have been quite unstable in both their supply and pricing creating a huge challenge for the consumers of these products.

This research is concerned with providing a smart solution to some of the challenges faced by petroleum companies in disseminating information about their price, the location of the filling station and the availability of products. Another challenge is that of consumers accessing that information, which include services offered by the petrol stations and their current prices in order to make plans according to the situation at the petrol stations. Consumers would like to know the location of the petrol station and their price. To this end, there has not been a smart platform for sharing information between PMS consumers and suppliers. The proposed platform herewith will provide consumers a convenient way toget update of the situation at the petrol station on their android mobile device and compare with other petrol stations. This enables transparency and open access to information about petroleum products as well as time management to the consumers. The rest of this paper is organized as follows: Section II presents a brief review of some related works, while section III presents the system design. Implementation of the proposed system is discussed in Section IV, while obtained results are presented in section V. Conclusion and suggestions for further research is presented in Section VI.

II. RELATED WORKS

Android operating system has gained immense popularity and now runs on many smart phones. The advent of smart phones has changed the way lots of things are done. Several Android Apps have been developed and apply to different areas of specializations. In [1], an object recognition system using an Android App have been proposed. The App was implemented to assist a mobile navigation robot recognize object. Canny and Hough transforms were used as part of the algorithm to improve the recognition of selected objects. The authors in [2] presented a GPS supported city bus tracking and smart ticketing system using an android App. The system uses a GPS-GSM module to access dynamic vehicle location and send it to a server. Users can then access this information from the android App. Reagan and Devi[3], proposed an android App for intelligent dosage planning for diabetics. The App runs a linear equation created from ANFISGA (a combination of Adaptive Neuro Fuzzy Inference System (ANFIS) and Genetic Algorithm (GA)) algorithm. It collects data from the patient and gives out the dosage level required for the patient. In [4], an android App for participating in argumentative online debates was proposed. The App provides a platform for user to present argument from a handheld device using Twitter. It also allows users to visualize opinions of other micro debaters, explore ongoing debates and see where the consensus lie. The authors in [5] proposed an android App designed to provide safety for women. It helps women to easily contact necessary authorities whenever they are in danger. A single click on the App identifies users' location through GPS and sends an SMS comprising this location to some pre-registered contacts.The application helps in live tracking of the location of victim through GPS. In [6], the authors used android App to diagnose faults in rotating machines. The

smartphone performs fault detection by analyzing acoustic signatures generated by a rotating machine in running condition. Android Apps have also been used in the area of agriculture [7]. In [8], a low cost Mobile health care monitoring system using an android applicationwas proposed. Similar application of android app in health carewas also presented in [9].

III. SYSTEM DESIGN

To design the proposed system, a preliminary study was first carried out. This was done by issuing out questionnaire to PMS suppliers (i.e. Gas stations) and consumers of PMS. This provide the researchers with gas station and consumers' preference about the product as well as their acceptability of the proposed system.The questionnaire required responders to provide information such as availability of internet access, of both the gas station and consumers, willingness of gas stations to provide information about their products and services to consumers, amongst others. The results obtained from the analysis of the responses are provided in the result section of this paper.

Feedback obtained from questionnaire provides the background for BRAZ design. Fig. 1 shows the data flow diagram of BRAZ system, it basically shows how information flows in the system. The system blocks comprises of the User, Petrol stations and BRAZ Admin and several processes such as login, get update, give update and manage mobile App.

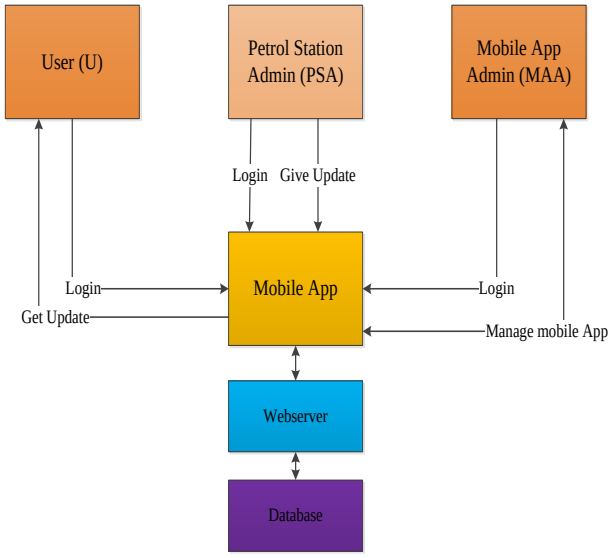


Figure 1. System block diagram

An operation flowchart of the proposed App is given in Fig. 2 and followed with the system implementation.

IV. SYSTEM IMPLEMENTATION

The Mobile Application consists of four (4) parts.

- Android App
- Webserver
- Database
- Application interface

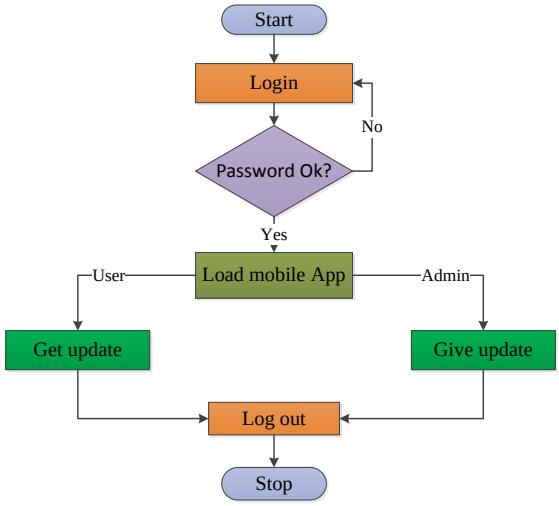


Figure 2. System flowchart

The Android App was developed on Eclipse with Java Programming Language for the functionality and Extensible Mark-up Language (XML) for the Graphics User Interface (GUI) design. The web scripts used was Hypertext Pre-processor (PHP) and the database used was My Structured Query Language (MySQL). The entire system consist of the previously mentioned units which interact with each other. The database stores the users' login details, all updates on current situation of the gas stations among others. The mobile App which serves as gateway to the various users get its information from the database through a webserver. The webserver serves to save and retrieve the needed information from the database. The various users (public users, petrol station admin, and mobile App admin) can interact with the mobile App through the application interface which provides them with the following functions.

A. *BRAZ Back-End*

Here, the Mobile App Administrator (MAA) assigns username and password to various Petrol Station Administrators (PSA), by clicking on adding station users. It can also edit petrol station, remove petrol station, view stations and monitors the various petrol station administrators as they carry out their functions. The PSA can log in to view account with the username and password provided by the Mobile App Admin (MAA). The PSA can add its other branches of petrol stations, Edit petrol station as well as remove petrol station. PSA gives information about the fuel stations. Information such as the name of the petrol station, the location of the station, the price of petrol, their status (whether there is fuel or not) and the coordinates (provided from smart phone GPS) of the petrol station is given. Each petrol station administrator (PSA) is only able to view and manage information about the petrol stations they represent.

B. *BRAZ Front-End*

The front-end provides the Users the ability to register with their e-mail and password, after which they can login to view account on the mobile App or get update about each

petrol station such as the name of the petrol station, their location, the price of their petrol and their status (i.e. PMS availability). The user can comment on the update using the mobile app and get direction to the gas station via Goggle map.

C. BRAZ link to Google Map for Navigation

The App provides route planners via Google Maps. This can be done by clicking on 'Get Directions', there are about four modes of transportation available depending on the area: driving, public transit, walking, and bicycling. Just as other Google web applications, Google Maps uses Java Script extensively, When a user clicks on view Google map on BRAZ App, it links to the map app available on the Android phone, where the location of the user will be indicated by a navigation symbol on the map and indicate the direction from the location of the user to the location of the petrol station. This is particularly of advantage to visitors who are not familiar with the town road network. In the next section, results obtained from our survey and analysis of the App is presented.

V. APP DISCUSSION, ANALYSIS AND RESULTS

Results presented in this section are divided into two: results from questionnaire and results from the developed App.

A. Results from the Administered Questionnaire

Sixty (60) questionnaires were issued out to both PMS users and gas stations admin out of which all came back valid for analysis. 15 were issued to the filling station admin and the remaining 45 were issued to random users.

Analysis from the questionnaire for the petrol station admin shows that out of the administered questionnaire, 7% were from Abu Hafsah oil and gas, 14% from Total service station, 13% from Oando petrol station, 13% from Maryland Petroleum Company, 7% from Maza-waje petroleum limited, 13% from Forte Oil service station, 13% from A. A. Rano, 7% from NNPC and 13% from Garima petroleum limited.

From the analysis, 26.67% of the petrol stations have internet access and 73.33% do not have internet access. 80% of the petrol stations are willing to provide information on the fuel situation online and 20% are not willing to provide information online. 13.33% of the petrol stations are willing to provide information hourly while 26.67% daily and 60% are willing to provide information about fuel situation weekly.

Analysis from random users, of the 45 questionnaires administered to users within Minna, Niger State, 11% buy fuel from Abu Hafsah oil and gas, 11% from Total service station, 9% from Oando petrol station, 7% from Maryland Petroleum Company, 9% from Maza-waje petroleum limited, 18% from Forte Oil service station, 13% from A.ARano, 9% from NNPC, 9% from Garima petroleum limited and 4% from Conoil.

From the analysis, 89% of the users have access to the internet and 11% does not have access to the internet, which means 89% of the users prefer an Android Mobile App while 11% of the Users prefer SMS Based information. This implies that only 11% of the consumers will need to use a USSD code to get update from the database.

B. Results from the Developed App

The first step in using the App is to launch it from its shortcut. Once BRAZ App is opened, Sign in and Sign up interface will be shown.Existing Users can sign in using their username and password while new users can create their login details. This process is shown from the snapshots of Fig 3. The MAA Signs in as an admin, while the PSA Signs in as the station Admin and user Signs in as a user. All sign in operation requires a username or e-mail and password, if the password is incorrect the user will be denied access to the App as shown in Fig. 3,and if the admin password is incorrect, access will be denied as shown in Fig. 4.

However, if the password is correct then user/admin will be granted access to the App by loading the Mobile App. Fig. 5 shows user interface where users can view all the petrol station information in BRAZ App. The user can select state, city/province as well asthe area to be viewed and click 'view' stations.The App load the stations available in database for that moment with all the available updates. The user can get information such as the station name, the address of the station, their status i.e. whether there is fuel or not. It is indicated with Yes or No. The station latitude and longitude will direct the user to the location of the petrol station on Google map if the user clicks on view Google Map. Users can add comment under any of the petrol station by clicking on the station and response will appear as shown in Fig. 6.

The MAA can sign in as an Admin with a password. The MAA is directed to an interface to view stations, Add station Users, Add petrol Station, Edit and Remove petrol Station as shown in Fig. 7.

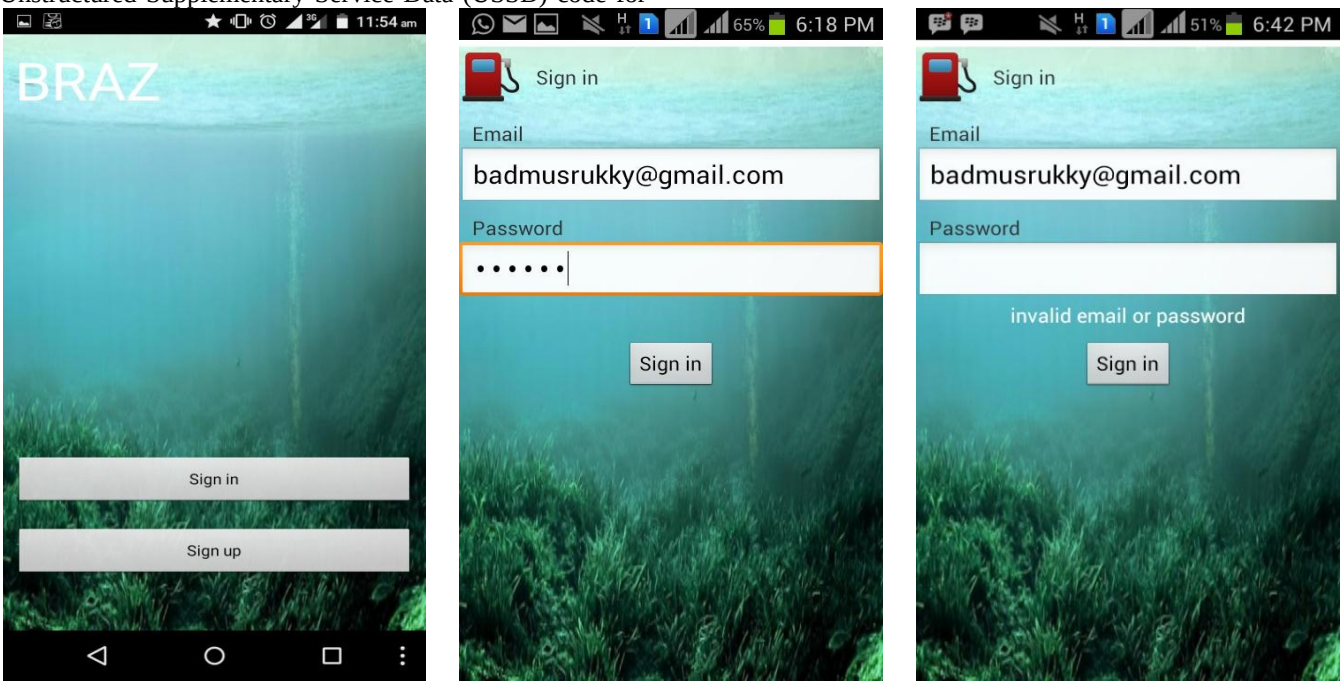
The view stations button allows the user to view all petrol station information, while the Add Station Users enables the MAA to register the PSA with the station name as the username and a password that can be used to sign-in to the account. In the Add petrol station button, the MAA can add a petrol station, edit and remove petrol station as shown in Figs. 5, 8, 9, 10 and 11 respectively.

The PSA can sign in to the app after being registered by the MAA with a username and password. Whenever PSA login, they can add their branch petrol stations with the necessary information as shown in Figs. 12 and 13. PSA can also edit their information and remove their petrol stations.

VI. CONCLUSION AND FUTURE DIRECTION

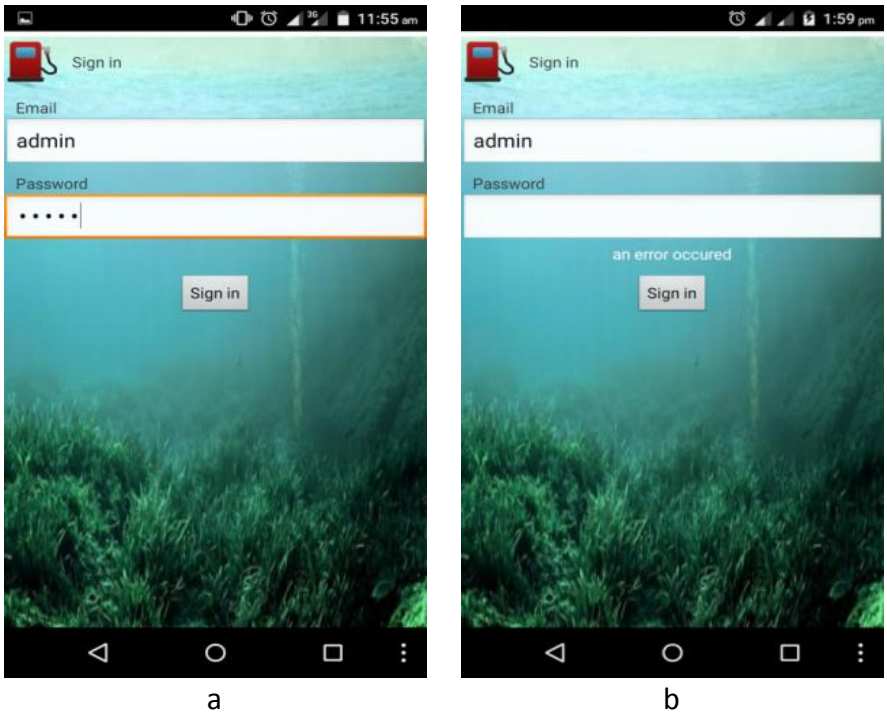
In this paper, BRAZ, an Android based Mobile App for monitoring fuel situation was presented. Analysis of the administered questionnaire shows that over 90% of PMS consumers are interested in using the App to get update about fuel situations and other services. This has been taken to represent a greater percentage of the population, thus an android based mobile application was developed to tackle this issue. Validation test carried out shows that over 80% of the sampled users were in agreement that BRAZ solved the challenges faced in accessing information about petrol stations. Others gave suggestions on how the system could be improved. Thus, future work include increasing the

coverage to cover all states in Nigeria, integration of Unstructured Supplementary Service Data (USSD) code for users without smartphones to be able to access the system.



(a) (b) (c)

Figure 3. User interface (a), sign in page (b) and response page to invalid entry (c)



a b

Figure 4. Interfaces showing Admin login (a) and response to wrong entry page (b)

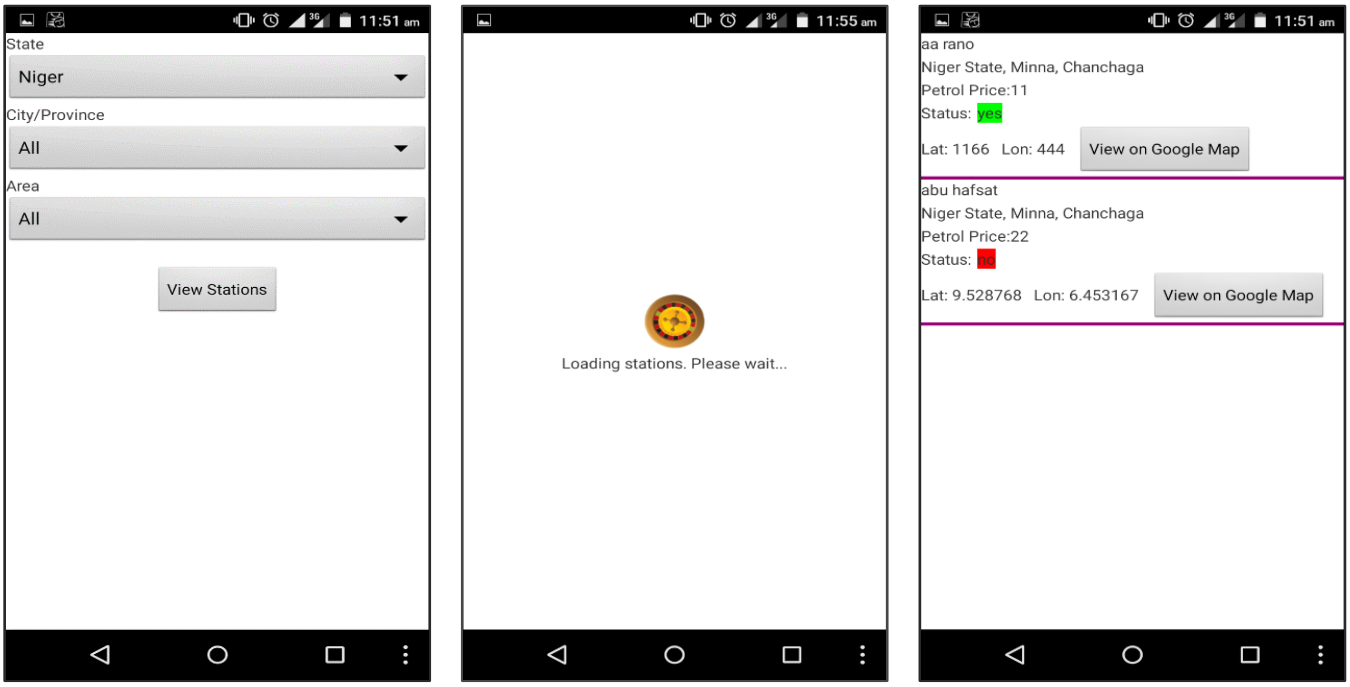


Figure 5. Three consecutive interfaces showing how users can view gas stations in a particular area in Niger State

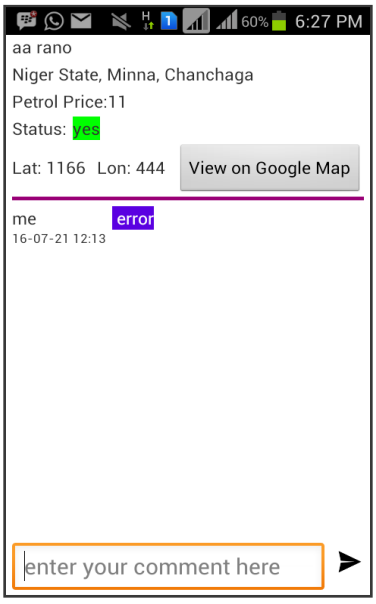


Figure 6. Snapshot of User Add Comment page

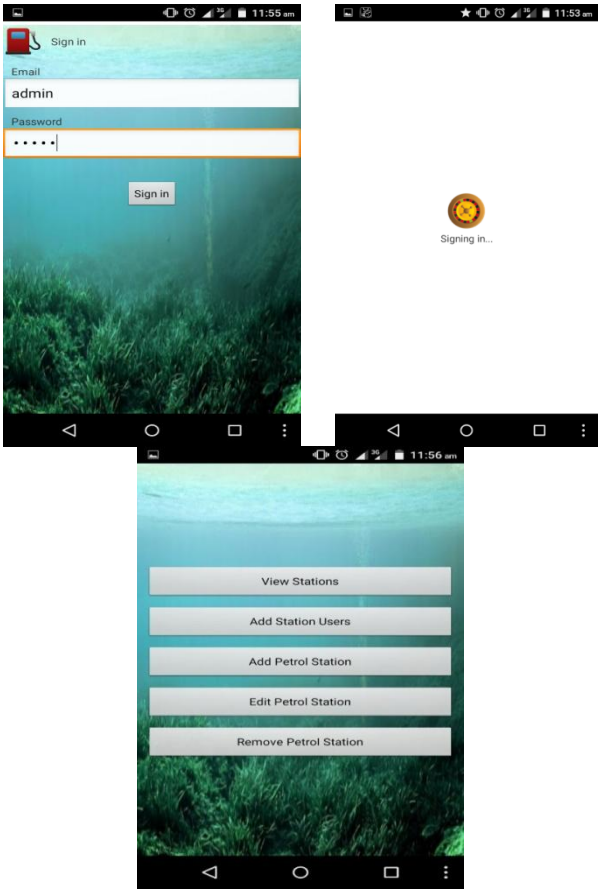


Figure 7. Snapshot show how MAA is granted access to the App

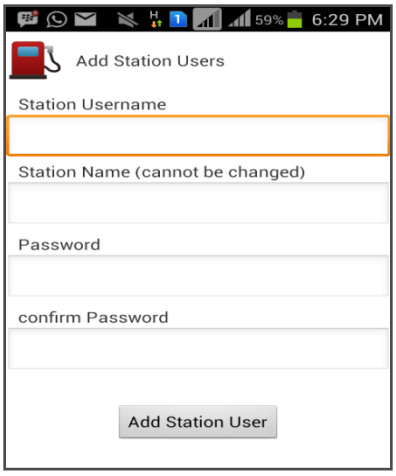


Figure 8. Snapshot showing interface for MAA to Add Station Users

Figure 11. Snapshot showing process of removing petrol station request

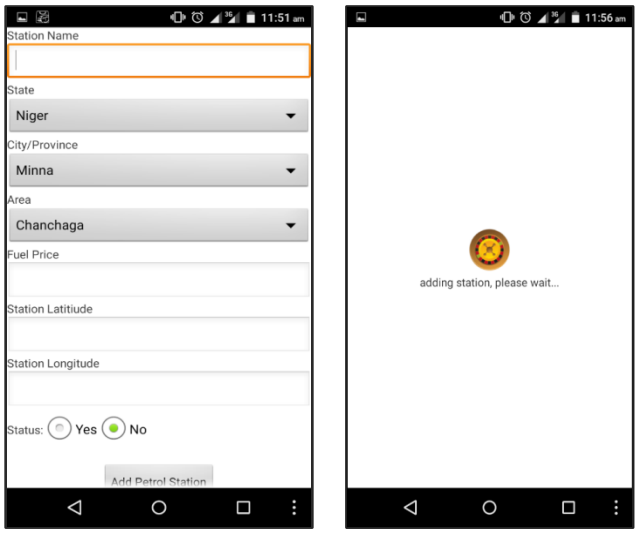


Figure 9. Snapshot showing interface to add petrol station

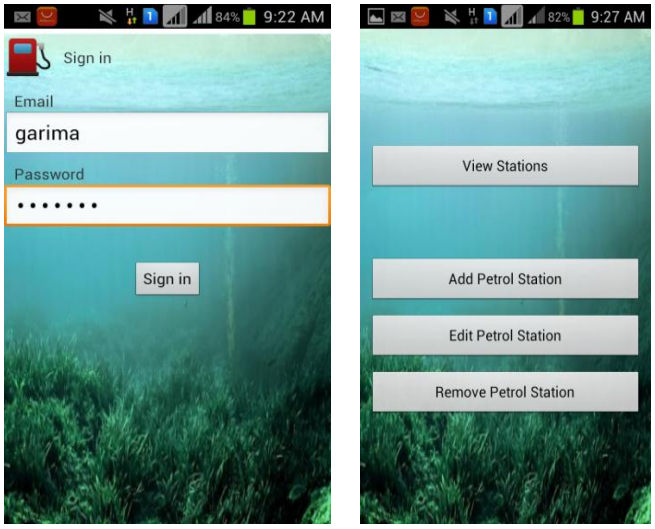


Figure 12. Snapshot showing sign in and PSA interface

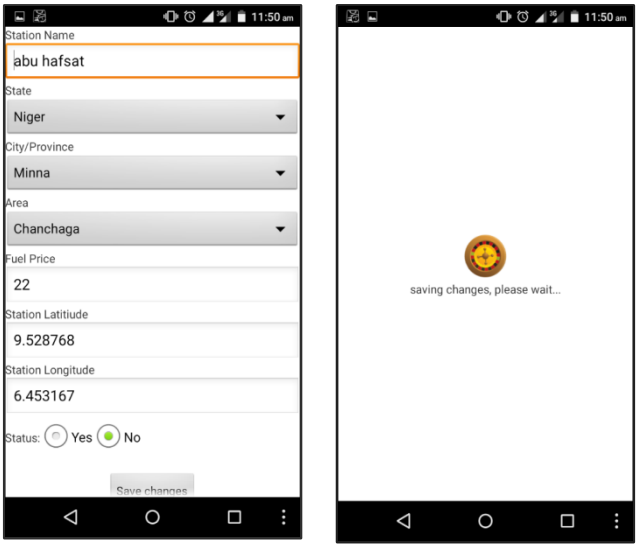


Figure 10. Web page interface to edit petrol station

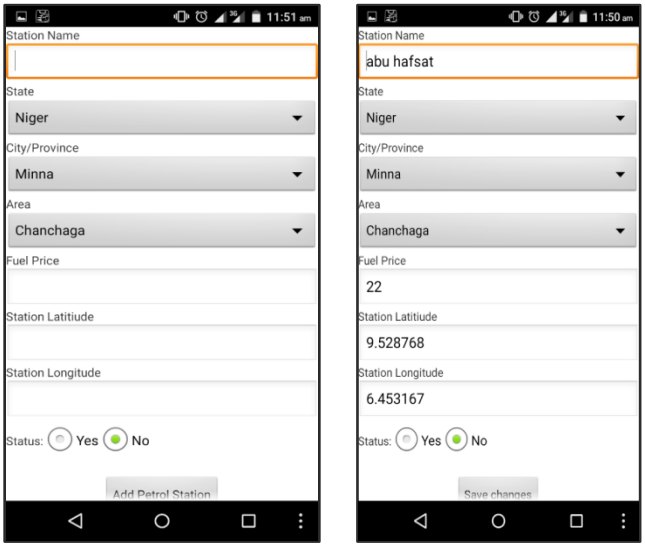


Figure 13. Snapshot showing PSA Add and Edit Petrol Station pages

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