Remote Queue Handling At Filling Stations (EasyQ)

Salman Afghani, Saad Ahmed Khan, Hassaan Shahid Butt, Muhammad Waqas and Muhammad Ishfaq Javed

R&D Department of Engineering and Sciences,
Army Public College of Management and Sciences (APCOMS), Rawalpindi, Pakistan

Abstract: *In countries with social and economic disorder, people are daily part of different queues in different situations, especially for the working class after a hectic day at office when they have to be part of long queues at Filling stations. And after waiting for several hours, they aren't sure that they will be able to get the Fuel. It makes the people uncomfortable because it disturbs their daily routine. This factor effects heavily and adversely on the economy of developing countries.*

I. Introduction

Different queues at different places on daily basis alter the very core of organized activities. Lower and Middle class people get largely affected and this accounts for the 99.9% of the population (Using Cars).

EasyQ is a Remote Queue Handling software solution for filling station consisting of EasyQ Mobile Application, EasyQ Central System and EasyQ System at Filling Station. It will help in reducing traffic congestion, time and stress management, adopting human friendly practice, minimize fuel burn and pollutant emissions using dynamic scheduling and queuing which will remotely handle the long queue of customers allocating them with spatiotemporal contrivance for segmenting the long queues into smaller ones not just in space but time as well.
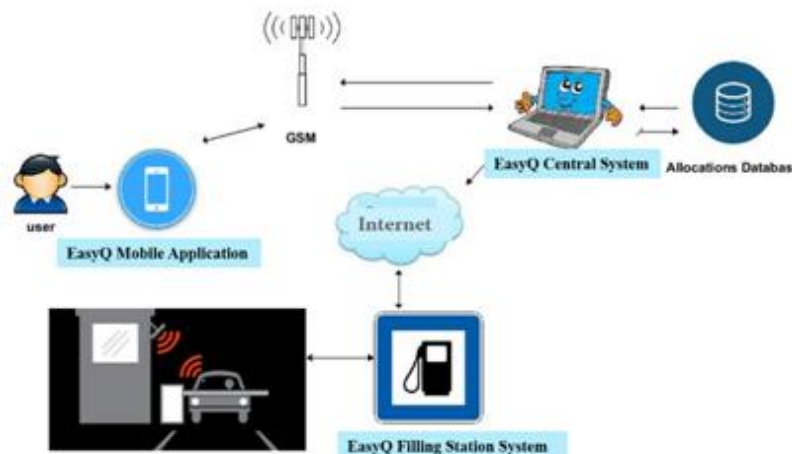

Figure 1: Deployment Diagram (Basic Layout of End Result)

1. Description of "EasyQ" System

The EasyQ (Remote Queue Handling at Filling Station) is a solution which helps users to find the closest filling station based on the user's current location. The solution is composed of three modules:
i.   EasyQ Central System,
ii. EasyQ Filling Station System
iii. EasyQ Mobile Application

The application will be available to download from either mobile phone application store or related services, which will be responsible to send user information along with location to the Central System and receive the allocation detail back from the Central System.

The Central System will allocate user the closest filling station based on location provided managing the queues spatiotemporally using special algorithm and save the user information for further use. After allocation of filling station, the user and the System at Filling Station will be informed precisely regarding the time and filling station. When the user will visit the allocated filling station authentication is done using RFID technology. Authentication includes the vehicle authentication and allocated time and filling station authentication.
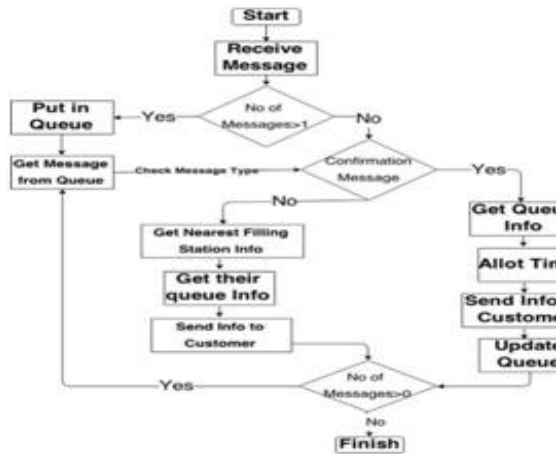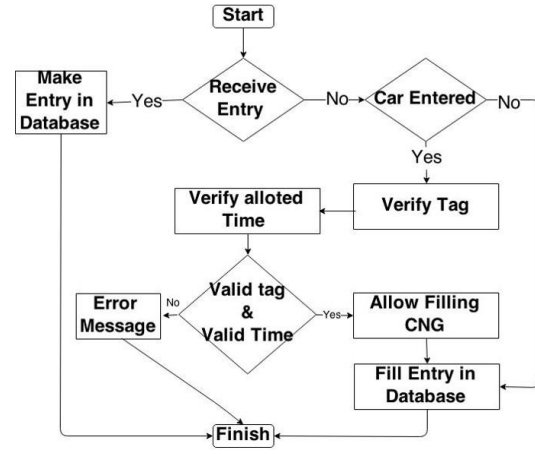
Figure 2: Main Systems Interaction

Figure 3: Interaction at Filling Station

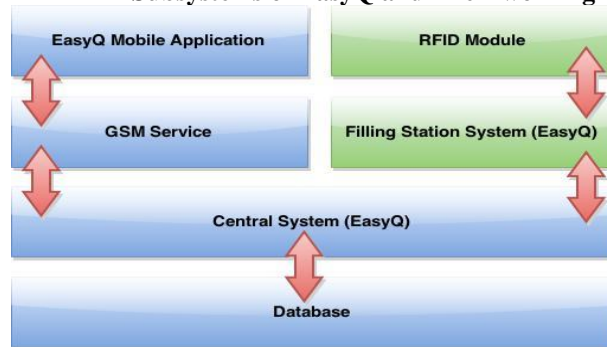**Subsystems of EasyQ and Their working**

Figure 4: Architecture Diagram

1.1. Mobile Application:

A mobile application for android smart phones that will be available for download from Playstore or related service, which will be responsible to send user information along with location to the Central System. The user will have to enter following information into the application on first interaction

- User name
- Vehicle id
- User preference (time or location)

These information is visible on main screen of application below the "Send Request" button. Send Request button will be tapped to send user information to Central system, this information includes:

- User name
- Vehicle id
- User preference
- User location in terms of latitude and longitude (calculated using GPS)

Upon swapping the main screen a drawer will appear which will have following options related to application

- View My Allocation
- Edit Setting
- About
- Help

1.1.1. View My Allocation:

Upon selecting this option, a window will appear which will show the latest allocation information received from Central System against the successful allocation request else this window will contain noting and display "Allocation will be shown here"
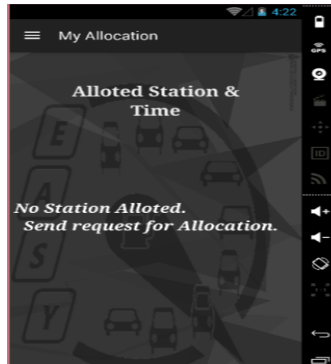
Figure 5: EasyQ Mobile Application Product 1

1.1.2. Edit Setting:

Upon selecting this option, a window will appear which will contain the same setting options which were saved by user when firstly interacted with application. User can edit the saved information here.
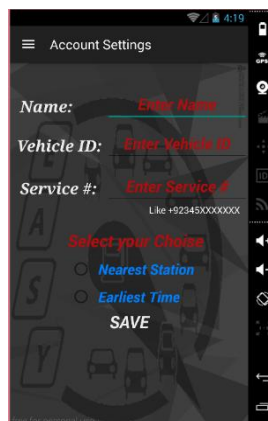

Figure 6: EasyQ Mobile Application Product 2

1.1.3. About:

Upon selecting this option, a window will appear containing the information related to application and developers.
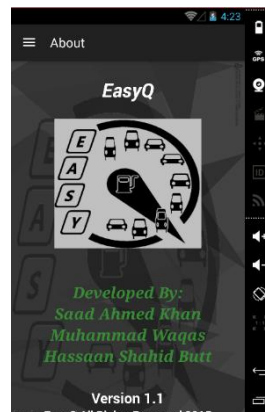

Figure 7: EasyQ Mobile Application Product 3

1.1.4. Help:

Upon selecting this option, a window will appear which will further provide following two options to the user related to seeking help.
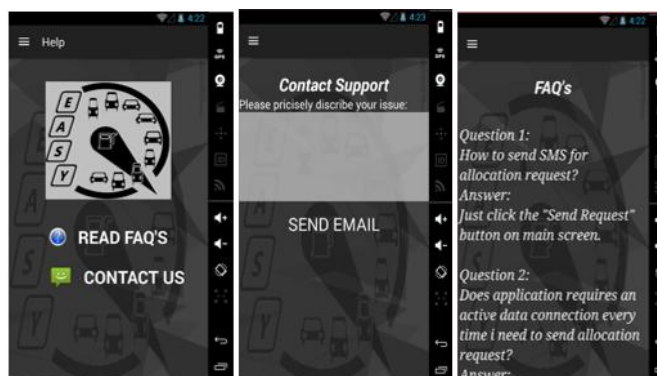
- Read FAQ's
- Contact US

Figure 8: EasyQ Mobile Application Product 4

1.2. Central System:

The Central System will be responsible for allotting user the closest filling station based on user preference managing the queues spatiotemporally using special algorithm and save the user information for further use. After allocation of filling station the user and the System at Filling Station will be informed precisely regarding the time and filling station.

After receiving the allocation request from the mobile application it will be passed through following modules
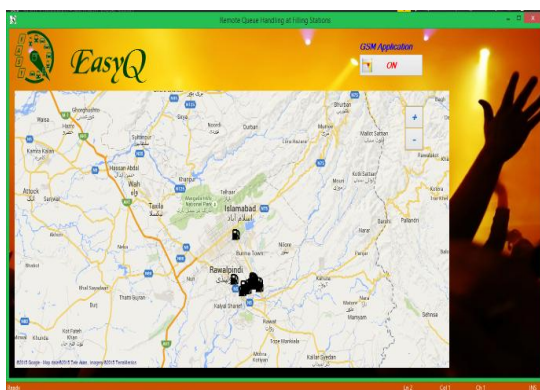

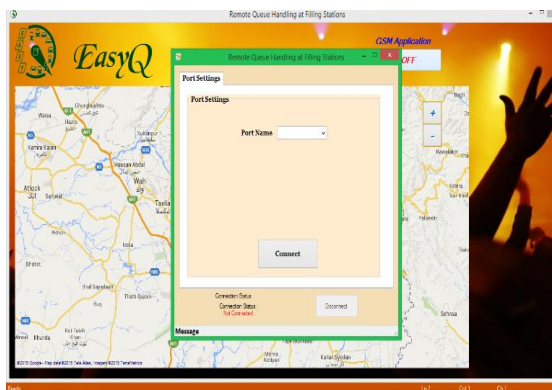Figure 9: EasyQ Central System Product 1

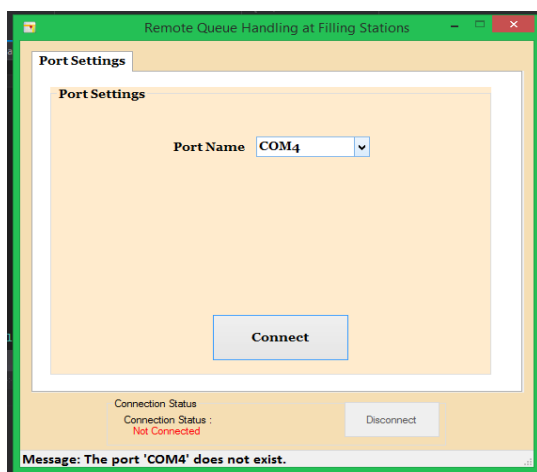Figure 10: EasyQ Central System Product 2

Figure 11: EasyQ Central System Product 3

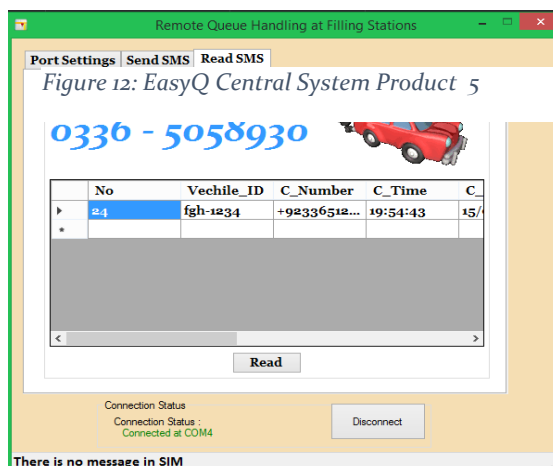Figure 12: EasyQ Central System Product 4

Figure 13: EasyQ Central System Product 5

Message Filtration
- Information extraction
- Allocating
- Sending Allotted information

1.2.1. Message Filtration:

When a message is received, the Central System will check for spam message using an algorithm which will ensure either the correct syntax is followed by the sender or not by matching it with the sample syntax. If the message syntax is detected correct it will be passed to information extraction module and if the syntax is not detected correct the message will be dropped or discarded.

1.2.2. Information Extraction:

This module will extract the user name, preference, latitude, longitude, vehicle id and user phone number from the message and will save this information to database and pass it to the allocating module.

1.2.3. Allocating:

Based on user's preference, latitude and longitude information extracted from user message this module will allocate and reserve best available slot for the user, save it to the database and pass the process to the next module.

1.2.4. Sending Allotted Information:

This module will reply the user with the allotted time and station and also will share the same information including RFID tag information against vehicle with the particular station.

1.3. System at Filling Station:

Filling Stations will be connected the Central System using azure technology, each filling station can view the allotted vehicle its RFID tag information and the time against it. This information will be used for authentication using RFID technology when the vehicle will enter the vicinity of the station either the vehicle entered is allotted the particular station and time or not. If the vehicle is found allotted filling will be allowed and the status of the allocation will be upgraded against the particular vehicle.

II. Conclusion

Aiding the manual system with latest tool that can enhance productivity is the necessity for overcoming and dealing the current crunch situation. Introducing dynamic queuehandling, artificial intelligence and GSM service will boost the entire system making it more efficient and effective and initiating the need of new standard of work, thus making it different from all of the solution available in the market.

In future many enhancements can be introduced into the implemented system that can make the system a standalone application and a very useful and time saving solution for everyday productivity. Following are some recommendations for the interested developers and upcoming students who want to improve or extend the product.

- My Allocation option in the EasyQ Mobile Application can be improved and a map can be introduced in it which can show the user graphically the distance between user and the allotted station location.
- User can be presented with three best options and asked to choose the one that suits him/her the most.
- Central system can be enhanced with real time map induction pointing user location when received allocation request.
- Simple phone users can be entertained by using the number that is easy to remember and a simple format so that the user can type and send his/her location.
- Billing and payment can be introduced into the system at filling station end it will help the station administration regarding the monthly intake and also help users keeping their record.
- RFID verification at filling station end can be enhanced and using the data from government institutions theft vehicle can be pointed and detected against registered complaints.

References

[1].   Investopedia, "Queuing Theory," 2001 http://www.investopedia.com/terms/q/queuing-theory
[2].   M. Rouse, "Queue," 2005 http://whatis.techtarget.com/definition/queue
[3].   Z. R. Mohsin., "The Crisis of Internally Displaced Persons (IDPs) in the Federally Administered Tribal Areas of Pakistan and their Impact on Pashtun Women" 2013. http://frc.com.pk/wp-content/uploads/2013/07/6
[4].   B. Reporter, "BPCL provides automation system to fuel stations," 2011. http://www.business-standard.com/article/companies/bpcl-provides-automation-system-to-fuel-stations-111100400006_1
[5].   Raytheon, "AutoTrac Air Traffic Management System," 2011. http://www.raytheon.com/capabilities/products/autotrac.
[6].   Qmagik, "Queue Management System," 2011. http://www.qmagik.com

Authors Biography

1.   DR. SALMAN AFGHANI
      Was born in Pakistan in 1958. Professor, PhD, Advanced man machine systems, MPhil, Industrialautomation, MS Mechanical Engineering. Currently working as HOD Research and Development at SE Department APCOMS, Rawalpindi, Pakistan.
      Research Interest:
      Man Machine systems, robotics intelligent all-terrain vehicles& submersibles, Zoological and Botanical computers, Non-intrusive botanical genetics using computer simulated time acceleration technique.
2.   Hassaan Shahid Butt
      Was born in Pakistan in 1993. Research Assistant, BS Software Engineering.
      Research Interest:
      Queuing Theory, Application Development and Computer Networking.
3.   Saad Ahmed Khan
      Was born in Pakistan in 1992. Research Assistant, BS Software Engineering.
      Research Interest:
      Queuing Theory, Application Development,Software Design and Algorithms.
4.   Muhammad Waqas Khattak
      Was born in Pakistan in 1992. Research Assistant, BS Software Engineering.
      Research Interest:
      Queuing Theory, Application Development, Software Design and Algorithms
5.   Muhammad Ishfaq Javed
      Was born in Pakistan in 1989. Electrical Engineer with specialization in Electronics.
      Research Interest:
      Robotics, Electronics Circuits, Microcontroller Programming, System Integration