SMART SYSTEM TO ASSIST CITIZENS: MAKING CIVIC LIFE COMFORTABLE BY USING ADVANCED SMART TECHNOLOGIES

Ibtehal Hassan Al Saleh[1]
Zahra Hussain Al Hassan[2]
Noor Zaman[3]
College of Computer Sciences and Information Technology,
King Faisal University, Saudi Arabia

ABSTRACT

Around world across the countries, each government is responsible for facilitating public by providing civic facilities through local municipalities. Since these services will directly effect on the citizens life quality and also reflect the brighter face of the countries. Municipalities strive hard to continuously improve these services; it became one of the main concerns of developed nations. It is hard for municipalities to reach their target of high quality services and discover all problems without involving the citizens' helping hand on this issue. Our project namely Smart System to Assist Citizens (SSAC) aims to resolve this issue in simpler way by enabling all citizens to assist municipalities using their smart devices. Our system aims to allow any citizen to report his\her observations and send any suggestions to the Municipality by using fast and easy communication channel by forwarding snapshot of affected area. Since one picture worth thousand words, our application uses the modern smart phone features such as enabling automatic extraction of GPS coordinates of the reported issue area. Municipalities can manage these issues throw the administration server. So, our project will involve the community in decision-making which will be a powerful technological engine for change in citizen's life.

Key Words: Smart System, GPS, Android, Web-Based, Google Map.

INSPEC Classification : A9555L, A9630, B5270

1. INTRODUCTION

With more than half of the world's population already living in cities or neighborhoods, and with the urban population projected to grow by more than one billion people between 2015 and 2030, the race is on to improve our cities and neighborhoods. Improving services while cutting costs and saving time became a major factor to provide services that ensure the best life quality for every citizen. Authorities like municipalities are responsible to lead the improvement revolution for all type of services by using any possible tools to reach the target of successful System. Since the creativity always starts with individuals; we made a general study about the Municipality of our area Alhasa, we investigate the problems with difficulties and came out with creative solution which can improve the Municipality services. Once you need to report Inquiry about any issue, you will face several difficulties. First difficulty is the location of Alhasa Municipality which is built in the heart of HOFUF crowded city and that makes it almost unreachable at rush hours. Second, it is hard to find the concern person who can receive your observation notification and take action , then if someone decide to call the Municipality he\she have to wait very long time before getting the usually negative answer which redirect to another phone number .

Our proposed project idea is to design a mobile application that helps residents to report their observations by using a very simple way, whenever a citizen encounters a problem using the application he\she will take a photo, the GPS will coordinate the location and then send it to the Municipality via Internet. So there is no more wasted time for visiting the Municipality building or on the phone reporting about the problem and no more headaches of searching where?, how? And who is responsible for the issue.

2. PROBLEM STATEMENT

During the previous decade Municipality of our area Al-Ahsaa shows a lot of shortening in term of providing the local basic services to the residents of a city including water, streets, schools, food inspection, fire department, and other health department issues and transportation. The citizens start to complain about the situation after several repeated fatality and painful injured incidents happened. Once the government starts making the change to improve the Municipality' services they stuck with several difficulties. First, the huge areas of Alhasa which is 534,000 KM2 [1] and also the province and population growth were the biggest challenges which stop a lot of plans and personal efforts of improvements [2].Second, The ignoring of service improvements importance and continuing the same level of services will cost us more losses in lives and property and stops our dream of continuing the same race with word nations of having the best life quality [3].

Our responsibility as a part of the society is to help the Municipality to find a radical solution by standing next to each other and involving every single citizen in our rescue project to get the most benefits by cooperating with government in their development path.The idea of our project is to develop a mobile application to connect the citizens directly with the Municipality of Alhasa[4]. It has been realized that citizens are not only best placed to identify problems in their communities; they are also capable of addressing them. When the citizen submits the case, it is routed into the municipalities' work order management system so that it gets immediately to the right person to fix the problem. At the end by educate the citizens and receive their notifications with full

cooperation and fast reaction from the Municipality members we will reduce the incidents, get better live quality and start build the shining future for the generations[5].

3.   LITERATURE REVIEW

Municipal services or city services refer to basic services which are provided by the governments. A lot of citizens and residents prefer to help their municipalities by giving them some information about some issues which are needed to be fixed instead of waiting for the solutions. There are numbers of existing systems have become increasingly tried to directly improve the relationship among citizens and their government and to complement citizen's participation in cities improvement processes. The following sub sections will explore some of the recent works in this field one by one [6][7].

3.1 Alhasa Immediate Support Chat

Alhasa municipality provides a window chat that could be launched by the browser. This chat helps citizens to communicate easily with the municipality departments during office hours. Citizens can use this chat to send any message to the responsible department of alhasa municipality.

3.2 I-Hasa Mobile Application

The i-Hasa is an intelligent application to deal with Alhasa municipality easily .i-Hasa app offers the following features:

• Access to the real-time updates on news and events of AlHasa.
• Access to all the electronic services such as Administration communications, Tenders, Bids, Invoices, Violations, Health certificate, Rental services. .
• Public can submit their complaints.
• Point of interest with interactive maps for all the locations in Alhasa such hospitals, hotels, government services, etc [8].

3.3 Web-Based Alhasa Municipality Site

A citizen can visit the Municipality website and report about the issue. He/she can write the issue by filling an available form on the website. Citizens can report any municipal issues at any time. Also, there is no need to call and wait for answers and that can save the citizen's time. On the other hand, there are also some disadvantages of this existing system such as:
- Citizens have to theatrically describe the specifically location of the issue.
- Citizens have to fill out long inquiry and submit it without any attachments such as picture.
- Citizens will not get any response message when the problem has been solved [9][10].

In this paper we discus some technologies and the available tools to find a modern system which fills the gap and provides an organized solution to help citizens in reporting new issues. Smart System to Assist Citizens is a combination of an Android smart phone application and a dynamic administration website. With our system, citizens can keep tracking their submitted issues via the app which could encourage them to report more problems to increase their interactivity with the system. And to increase the reliability of the submitted issues, SSAC requires national number as an identity proof

of the user [11][12].

4.   RESEARCH METHODOLOGY

4.1.   Conducted Survey
SSAC analysis to empower citizens' help to develop a strategic plan that maximizes Municipality's strengths minimizes its weaknesses. The main aim was to understand the people aspects of the application, to capture the details of what they want, and to explore their opinion about the idea of the application and what kind of challenges we will face.

4.2 Materials and Methods:
The study was conducted in Saudi Arabia. An online questionnaire was distributed among the peoples (n = 450) 200 were female while 250 were male. The questionnaire was in Arabic and English languages at the same time, and contains ten questions, initiated On October 2014.

4.3 Survey Questions:
1. Which mobile operating system you are using? ?
   o   Android
   o   IOS (Apple)
   o   Other:
2. Have you ever seen any cases in Alhasa, which are need to report about it? ?
   o   Yes
   o   No
3. Have you really tried to report about any problem, which you have seen? ?
   o   Yes
   o   No
4. If you tried to report about any problem, which way did you use?
   o   Calling the Municipality
   o   Visiting the municipality website
   o   visiting the municipality's location
5. Do you think that developing an application to help citizens to report about any problem which is related to the municipality will be useful?
   o   Yes
   o   No
6. How much do you agree with this statement? "The produced system has met all the goals originally set out."
   o   Strongly Agree
   o   Agree
   o   Disagree
7. Do you think the system will improve the quality life of citizens?
   o   Yes
   o   No
8. How much do you agree with this statement? "The produced system is useful"
   o   Strongly Agree

- o   Agree
- o   Disagree

9. How much do you agree with this statement? "I would use the system"
- o   Strongly Agree
- o   Agree
- o   Disagree

10.   How much does the system will impact your city?
- o   A lot
- o   Somewhat
- o   Not very much
- o   Not at all

4.4   Statistical Analysis:

Defining requirements and managing customer expectations is a key part of collecting requirements process. Several tools and techniques can be used to facilitate this process and capture the exact and detailed requirements. One of the tools, which we have used, is questionnaires and surveys technique that involves seeking response from participants using Google online questionnaires and surveys.

4.5   Results & Discussion:
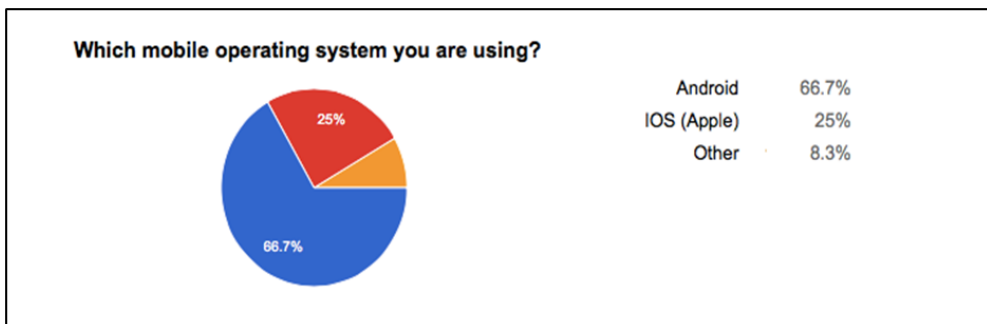
Figure 1: Result of Question 1

As shown in Figure 1, approximately more than half of people (66.7%) reported that they are using Android devices while (25%) use apple devices.
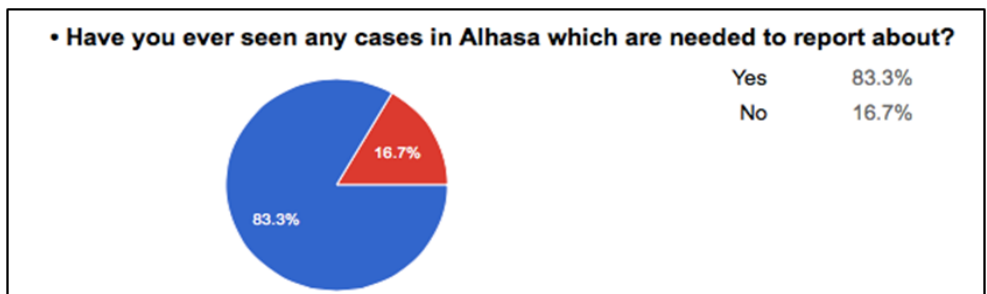
Figure 2: Result of Question 2

As shown in Figure 2, the majority (83.3%) people have been seen cases in Alhasa, which are need to report about it.

Have you really tried to report about any problem which you have seen?

Yes	25%
No	75%
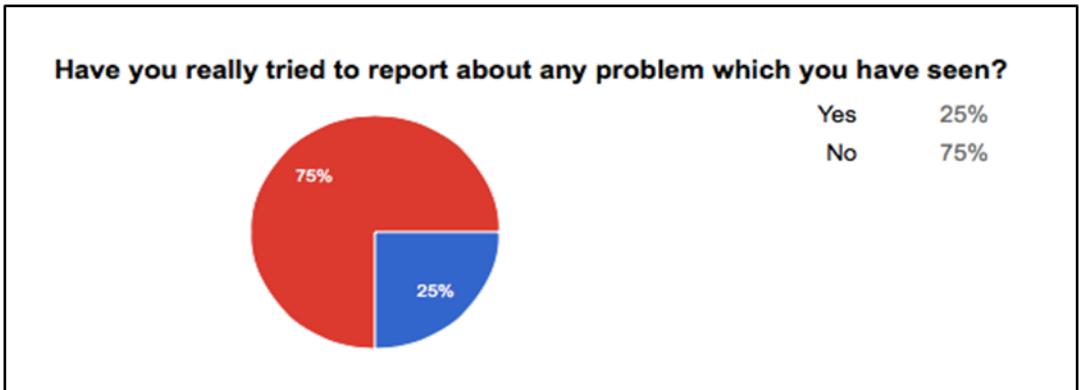
Figure 3: Result of Question 3

As shown in Figure 3, on this question more than half of the participants (75%) didn't try to report about any problem which have been seen
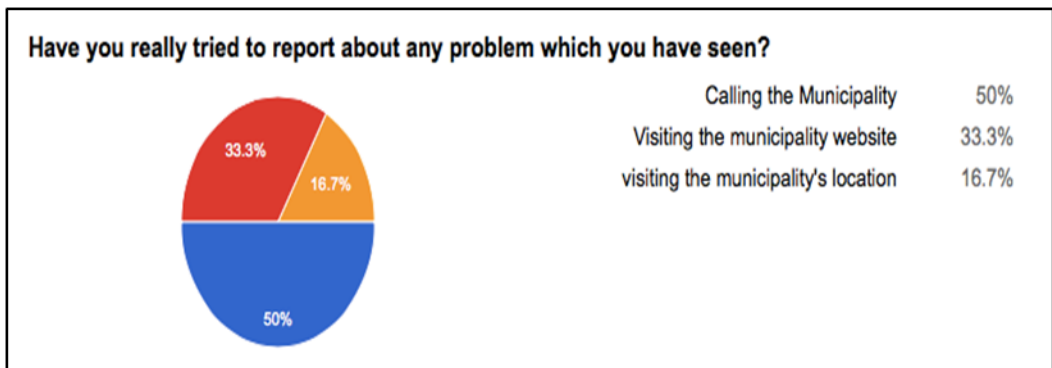
Have you really tried to report about any problem which you have seen?

Calling the Municipality	50%
Visiting the municipality website	33.3%
visiting the municipality's location	16.7%

Figure 4: Result of Question 4

As shown in Figure 4, approximately most participants report about problem using calling the municipality office way. The most second way used is visiting municipality website.

If you never tried to report about any problem which you have seen, what is the reason?

You didn't know who is responsible about these issues	25%
You didn't have time	50%
You think that municipalities have to discover these problems	25%
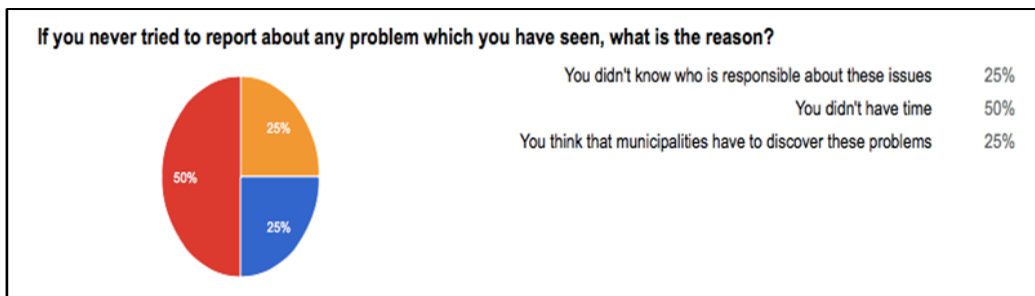
Figure 5: Result of Question 5

As shown in Figure 5, half of people (50%) think that the reason which prevents people from reporting about any problem is the time.
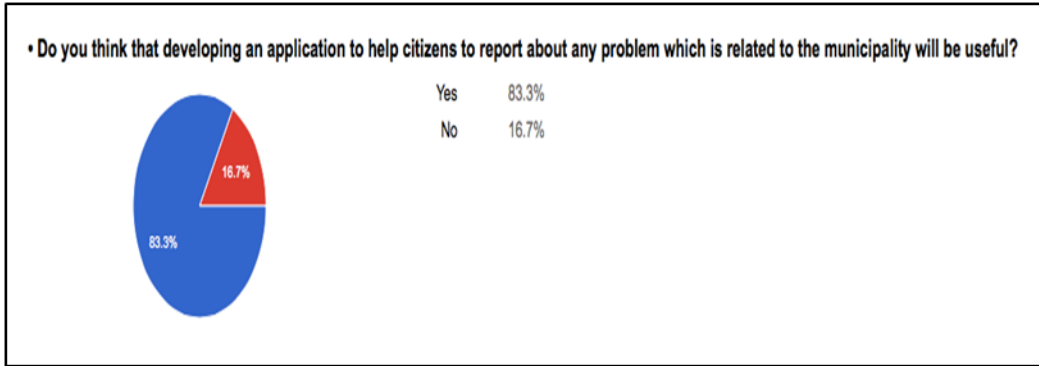
Figure 6: Result of Question 6

As shown in Figure 6, a big majority (83.3%) think that developing an application to help citizens to report about any problem, which is related to the municipality, will be useful.
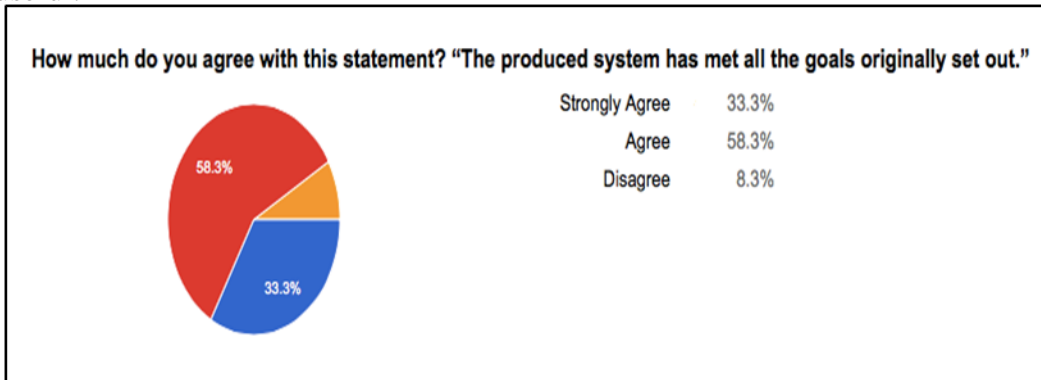

Figure 7: Result of Question 7

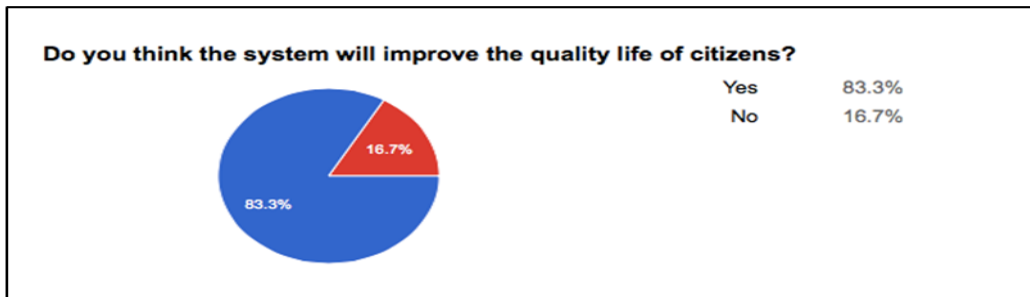As shown in Figure 7, more than Ninety percent agreed that the SSAC has met all the goals originally set out.

Figure 8: Result of Question 8

As shown in Figure 8, approximately more than half of the participants (83%) think that the system will improve the quality life of citizens.
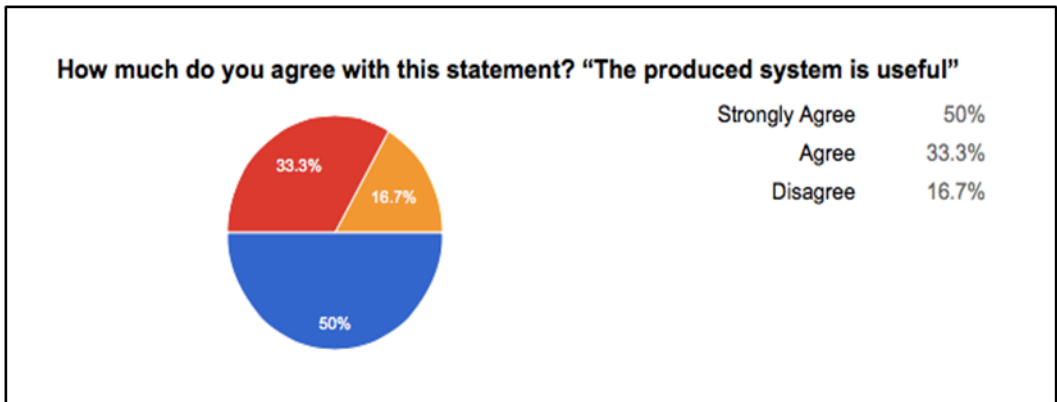
Figure 9: Result of Question 9

As shown in Figure 9, more than Eighty percent of participants agreed that SSAC system would be useful.
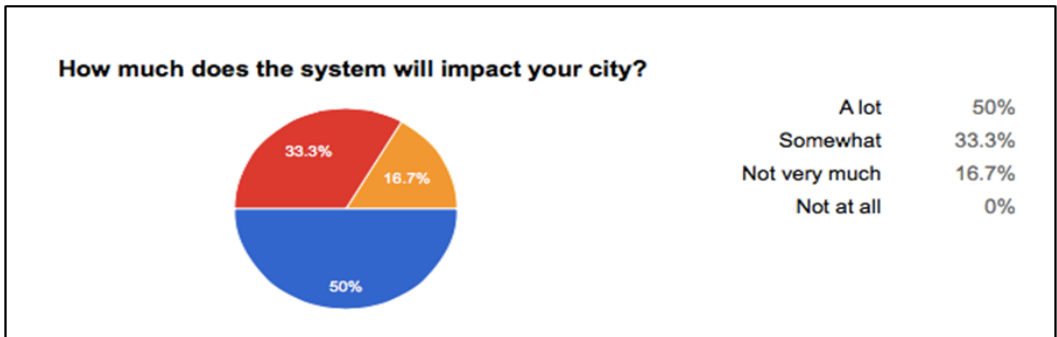
Figure 10: Result of Question 10

As shown in Figure 10, approximately most participants (85%) would like to use SSAC system
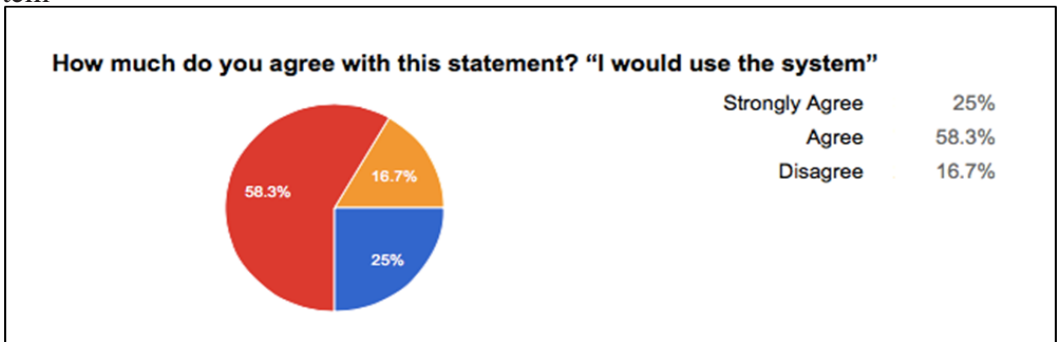
Figure 11: Result of Question 11

As shown in Figure 11, more than Eighty-five percent of participants agreed that SSACsystem would influence their city.

4.6 Survey Observation Analysis

The conduct of survey went very well. The main aim was to understand the people aspects of the application, to capture the details of what they want, and to explore their opinion about the idea of the application and what kind of challenges we will face. Each question had a different aim. According to the results as shown in Table.1, we found that vast majority (83%) of people have seen a lot of issues during their daily life and think that they should report about these issues. On the other hand, only few people (25%) have really tried to report about these problems!. A huge majority of citizens agreed that technology is the most efficient way to report and to communicate with the responsible entities and most of them support the idea of Smart system to Assist Citizens (SSAC) and think that it will improve citizen's life quality and it will have a direct impact on cities development. Moreover, huge percentages (85%) think that they would use the system once it's available for them.

Survey Question	Agree	Disagree
1. Are you using Android mobile system?	66.6%	33.3%
2. Have you ever seen any cases in Alhasa, which are need to report about it? ? *	83.3%	16.7%
3. Have you really tried to report about any problem, which you have seen? ?	25%	75%
4. Do you think using new technology is the most efficient way to report about problem?	80%	20%
5. Are you agree with statement "the most reason prevent people from reporting about problem is the time "?	50%	50%
6. Do you think that developing an application to help citizens to report about any problem, which is related to the municipality, will be useful?	83%	16%
7. How much do you agree with this statement? "The produced system has met all the goals originally set out."	91.6%	8.3%
8. Do you think the system will improve the quality life of citizens?	83%	17%
9. How much do you agree with this statement? "The produced system is useful"	83%	17%
10. How much do you agree with this statement? "I would use the system"	85%	15%
11. Does the system will impact your city?	84%	16%

Table 1: The Results of the survey

4.7 System Analysis

Systems analysis is a problem solving technique that decomposes a system into its component pieces for the purpose of the studying how well those component parts work and interact to accomplish their purpose. It is extremely important that the proper mental planning of a research project is considered before the data collection ever begins. Otherwise, problems may be encountered after the data have been collected and it may then be late to correct them.

4.8 UML Diagrams:
4.8.1 Context Diagram:

Context diagram is a diagram that defines the boundaries between the system, or part of a system, and its environment, showing the entities that interact with it. This context diagram in figure.12 shows the main agents of our project (Smart System to Assist Citizens) which are:

- Administrator (back end of the system).
- User (front end of the system).
- Database server (PHP MyAdmin).
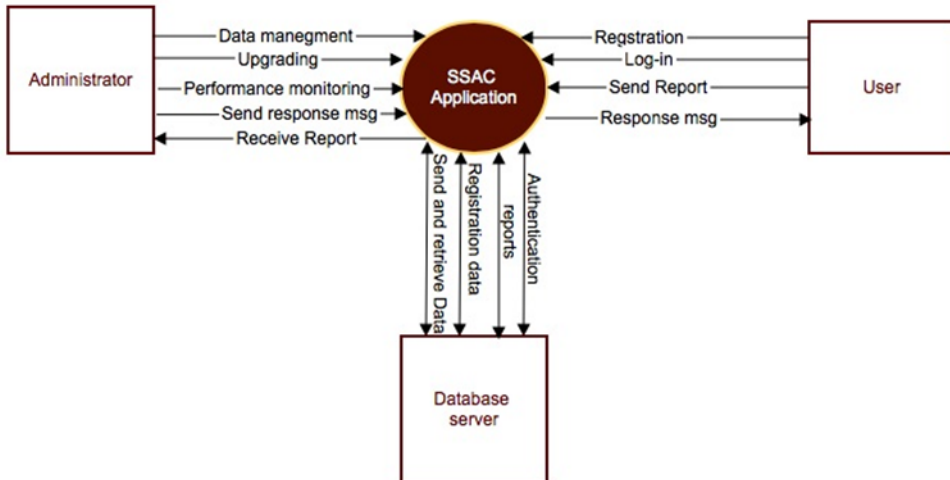
Figure 12: Context diagram for Smart System to Assist Citizens.

4.9 User

User registers, does log in and takes picture send it to the Municipality's database server.

4.10 Administrator

The administrator responsibilities:
• Browse issues: The administrator will browse the issues that are presented on the city map, as an ordered list with submitted details.
• Distribute responsibilities: The administrator will Assign one or more officers per category and split the administration effort across the municipality departments.
• Monitor progress and update citizens: Resolve issues and inform citizens by email

or through a progress indication bar (Open->Acknowledged->Closed).
• Provide direct feedback: Provide written feedback to the citizens for each specific case.

4.11 Database server
Responsible for
- Saving the reported issues.
- Authentication
- Storing and retrieving the data.

4.12 Data flow diagram DFD:
DFD can function as a modeling technique capable of analyzing customer requirements and transforming them into a visible structure. It is mainly used in software development to analyze functional requirements and establish the full design of the system under development. So, different components of the system can be identified at various level of abstraction. This can help to estimate the project duration more accurately as it identifies the entire functional component, hence, make it easy to estimate the task for each one.

4.12.1 Level 0:
This level is concerned with identifying the source and sink of data that describes the inputs and outputs of a system at its entirety.
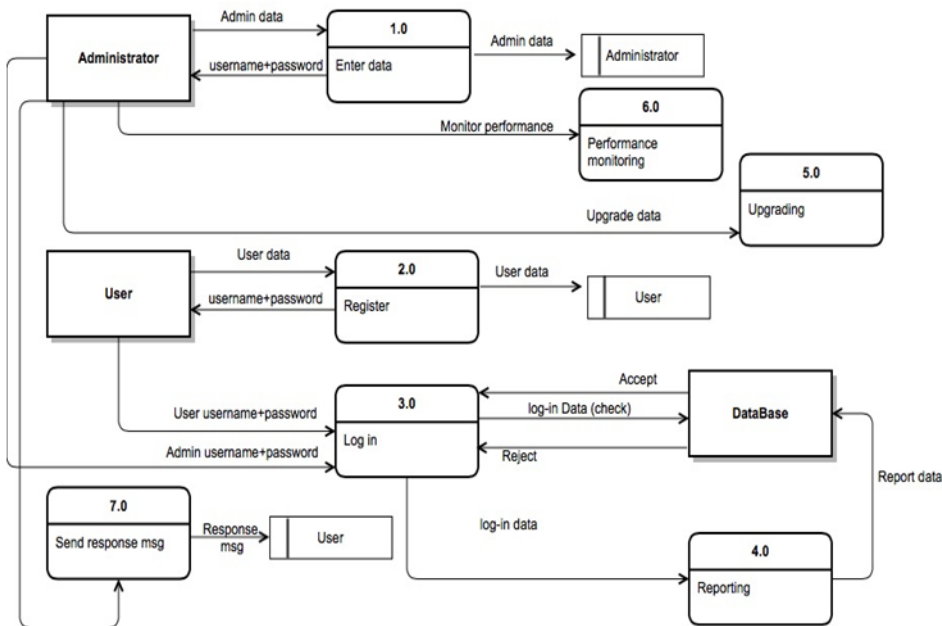
Figure 13: Data flow diagram (Level 0)

4.12.2 Level 1:

As you can see in Figure.14, this level identify the basic functional elements of a system user and the admin and the sequence of their interaction?
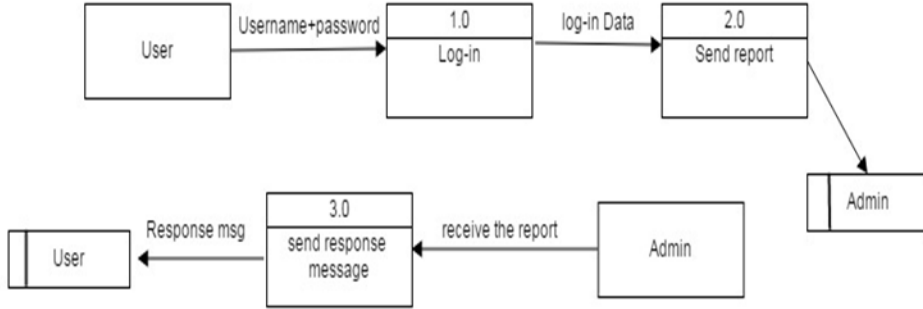
Figure 14: Data flow diagram (Level 1)

4.12.3 Level 2:

Figure 15 shows the identification for the sub-components of each functional element and their organization.
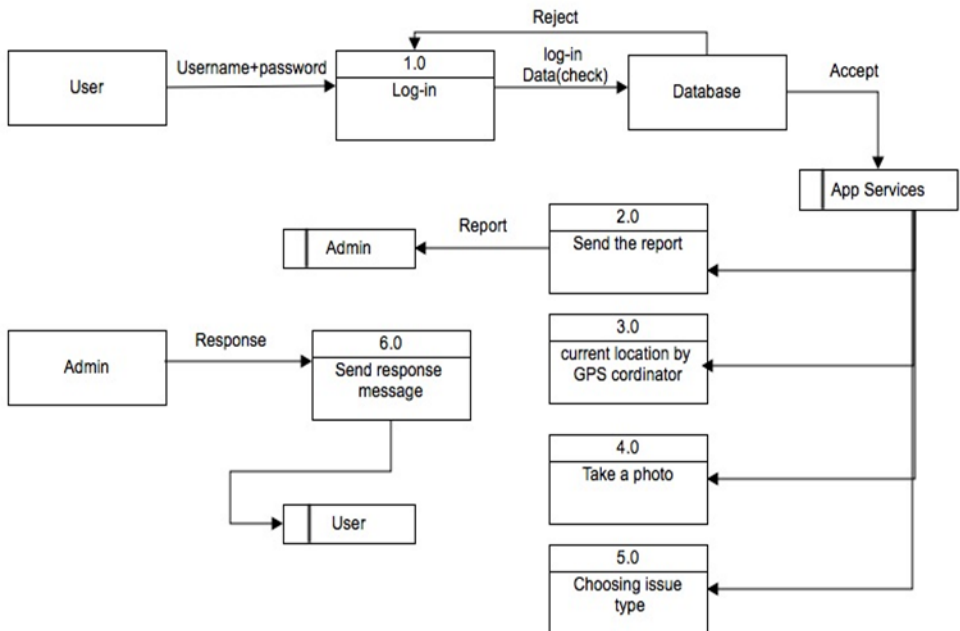

Figure 15: Data flow diagram (Level 2)

4.13 Entity relationship diagram ER:

After making data flow diagrams, we had a view of the main functions and processes in our system. Another important stage in the development is creating Entity Relationship diagrams, which will help us understanding the relationships between the entities of the system. Figure.16 shows the relationships between main components of SSAC system.

Figure 16: Entity relationship diagram of the system (Smart System to Assist Citizens)

4.14 Entities and attributes:

The section contains entities and attributes that were collected from functional requirements. In addition, we made normalization to organize the database on proper way. An entity represents a real-world object or concept that contains attributes. An attribute represents some property of an entity.

Entity name: Administrator:
The system administrator sign in then check and manage the reported issues.
 Identifier:
- A-Name.
- A-Password.
- A-address.
- A-Id.

4.14.1 Entity name: Reports

The reports will be done by users and managed by administrator.
Identifier:
- R-photo
- R-location.
- R-Description
- R-Track number.

4.14.2 Entity name: User
Users will make a registration, sign in and then send reports.
Identifier:
- U-Name.
- U--Id.
- U-Password.
- U-Email.
- U-Phone number
- U-National number

4.15 Identify relationships types
There are four specific types of relationships that can exist between a pair of entities; many to many, many to one, one too many and one to one relations.Table.2 shows the types of the relationships between the entities in our SSAC system.

Relationship	Type	From	To
Check/View /Count	1:N	Administrator	Reports
Belong to	N: N	Reports	Users
fill	1:N	User	Reports
Saved on	N:1	Reports	Back end system

Table 2: Relationship type

5. BRIEF ABOUT SSAC GUI

There are about more than 700.000 applications in the android market store app. These applications made to make our life easier, more efficient, and more flexible and each one of them can help the user in different ways. Thinking about user interfaces we can see that it is one of the most important factors of software development that decides

the fate of the applications. Users want something attractive, usable and easy to use at the same time. For that, we have designed an attractive user interface to cope with the requirements that people need.

Figure 17: SSAC app interface

After launching the application, main screen will be shown containing our logo (see Figure 17) and five buttons register, login, about us, contact our location and about us. These buttons will help the app users to reach different functionalities of the app easily. In the same time, the application will also check if the device has connected to the GPS and Internet. GPS is needed for automatic coordinate the user location. Wi-Fi or Mobile Network is needed, as we have to connect to the server for authentication, and upload the reported issues.
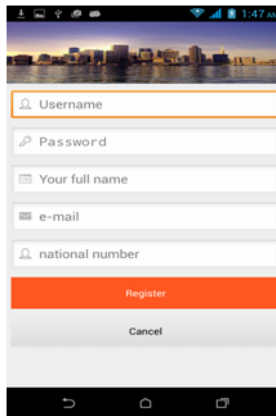
Figure 18: Registration

Figure 18 shows one of the functional requirements which is registration. It Contains five text boxes specifying the following (User name, Password, Your full name, e-mail, national number). So, it provides facility to the users who wants to register. This is the first step that users should do; by this process users can create a personal account in the SSAC server. User data will be saved in the remote database of SSAC server. If this step has been done correctly then users can sign in into the app using their usernames and passwords.
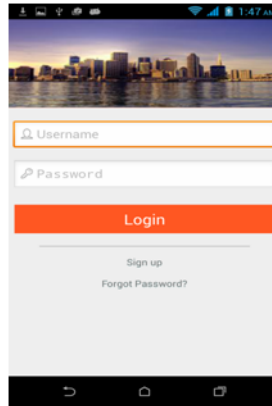
Figure 19: login page

Figure 19 shows one of the functional requirements which is sign-in. Login is essential for any application to connect a user to their data, from remembering history, saving progress, to retrieving purchases or achievements. It contains 2 text boxes (User name and Password). The user should enter the same information, which was provided by him/her in the registration page. After checking the authentication by SSAC server, users can access the app and get benefits of it.

Figure 20: Map page

Figure 20 shows when user successfully sign-in into SSAC app, they will start with being at the map page which has many options and lists at the top which are map, list, new issue, filters, and sittings. Users can choose any one of them.
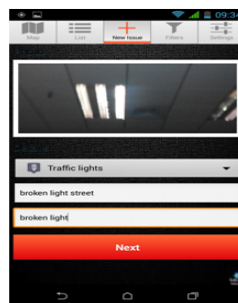
Figure 21: Report a new problem

Figure 21 shows the main function of application; after user login and select add issue from heading tap. Screen will provide facility to the user to take a picture using his/her Smartphone camera, choose the category of the issue and add short title and description. This page has one button, which is next button. This button will help the user to go to the next step, which is allocating the issue.
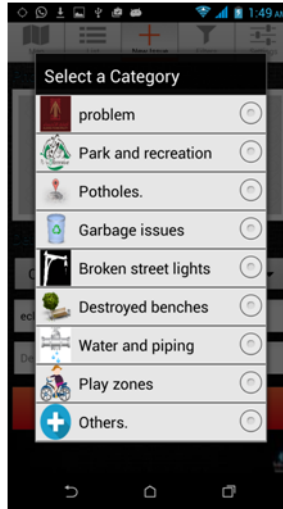
Figure 22: The categories list

Figure 22 shows different categories that users have to select one of them in order to complete their reports. These categories will help the municipality to arrange the submitted issues and will reduce the cost of issues prioritizing.
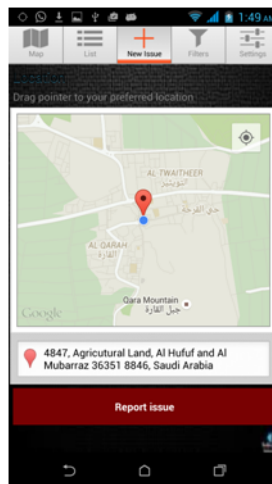
Figure 23: Location page

Figure 23 shows one of the functional requirements which are the location. This page will help the user to point his/her location via GPS coordinator and then press the button "report issue" to send his/her report.
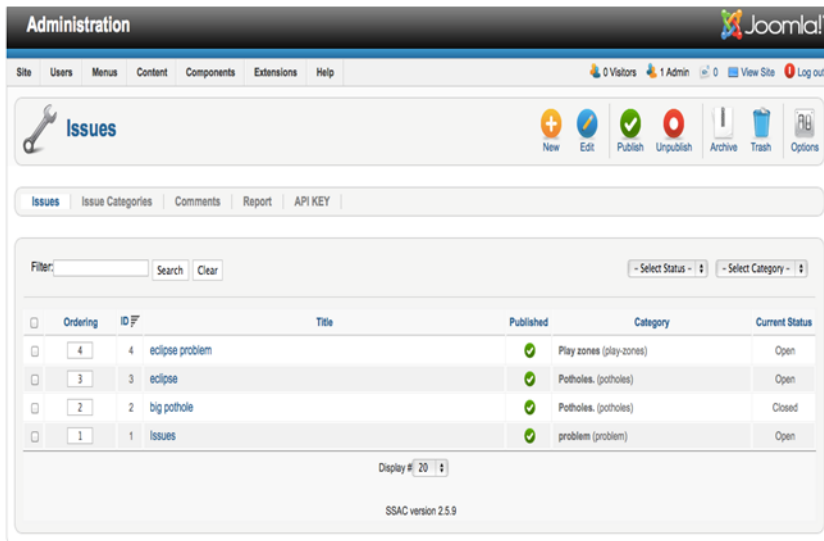
Figure 24: SSAC Joomla administrators

 Figure 24 shows admin side of SSAC that shows the reported issues, which have been submitted by the users. The submitted issues are managed through a web-based environment that is based on Joomla content management system. The management is distributed to the departments of the Municipality.
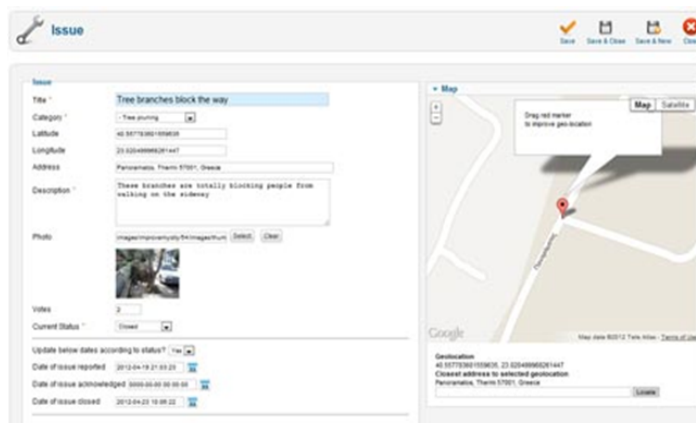

Figure 25: Web-based administrations

The authorized employees manage the entries through a web form, which presents all the available information. Initially the status of each case is "Open". Once the Municipality becomes aware of the case and forwarded it to the relevant department the status changed to "Acknowledged". Finally, once the case is resolved the status becomes "Closed". Then citizens are informed about the status of their requests by email (see Figure 25).

Figure 26: List of categories

Figure 26 shows SSAC categories which have been created by the admin of the system. These categories are the same as the categories in the application side and any change of these categories will directly change the categories at user application side.

Figure 27: SSAC Logs of administrator activities

Figure 27 shows the logs of SSAC administrator. Any edit of anything at admin side will be recorded with its date. This page helps to prevent any manipulation of administration side and will increase the security of the system as well.
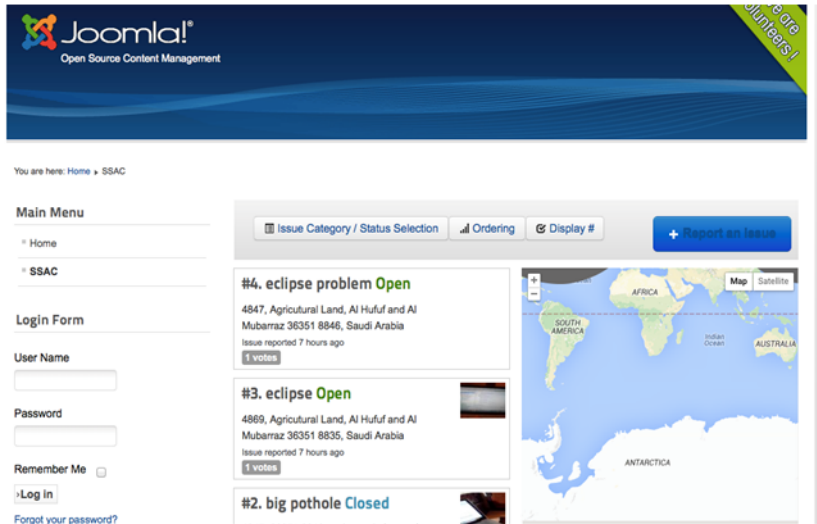
\

Figure 28: SSAC website site

Figure 28 shows the web site of SSAC system. The submitted cases are displayed on the city's map. Each category is presented with a different icon. There is also a cases list with most important information about each case.

6.   RESULT AND DISCUSSION(SSAC OUTCOMES)

The goal of the project is to design a system that will help citizens to communicate with the municipality employees easily and securely. At the successfully completion stage of SSAC, SSAC has the following outcomes:

- SSAC provides ease to all citizens to report any issue easily with one click around 24 hours a day.
- Android application, which allows citizens to report and receive the acknowledgement of reported issues.
- SSAC also provides confirmation to end users once reported issue has been resolved.
- SSAC provides communication link between citizens and workers at municipalities which will be more meaningful.
- Interactive application and easy way to report any issue timely even from remote locations.
- Meeting the requirements acceptation of municipality and citizens
- Fast and easy access to municipality services thus increasing citizen engagement and satisfaction
- High-quality citizen services delivered remotely in effective way.
- Providing cost effective solution to citizens.
- Providing carbon footprint reduction and better traffic flow management as citizens no longer need to travel long distances to municipalities' centers.
- Improving citizen life style by providing civic services timely
- Integrating processes and systems in more effective way.
- Increasing the efficiency by utilizing available resource efficiently
- Improving regulatory compliance.

CONCLUSION

Technology has an influence on our life everywhere we go. New technologies offer the possibility of strengthening citizens' voice, Challenging municipalities of the growing cities to utilize these technologies and to open a communication channel between them and their citizens.As Alhasa Municipality is one of those municipalities that covers a large area and facing a lot of challenges in improving its infrastructure, a much smarter systems are required to help tracking, prioritizing, and solving its new issues. This project aims to help Alhasa Municipality to provide several civic services more effectively and to introduce citizens in city's development process by a new technological way. The main idea of SSAC project is that citizens can become a cost efficient real time sensor of issues and the best source for solution ideas. Citizens can easily report problems and request services by only launching the mobile application of SSAC and send reports with assigned photos, descriptions, and locations. The main advantage of implementing such a system is obviously reflected in the amount of energy saving and accordingly the reduction in the operational cost. This system will enhance the efficiency of reporting by 70% in terms of ease and timings at the same time it will speed the mechanism to address the issues.

FUTURE WORK

We tried our best to develop the application with the given limited time. However, due to lack of time we couldn't develop the application to fulfill the all the required parameters. We are planning to keep improving the application in many ways. First, upgrade the application to have Arabic language version beside the English and Second, Establishing IOS app for I Phone users. Third, extending the geographic limit of the application to accept reported issues from whole Saudi Arabia and then redirect each report to its responsible entity.

ACKNOWLEDGMENT

REFERENCES

[1] Alhassa, "Al-Hofuf Travel Information and Travel Guide - Saudi Arabia", Lonely Planet, African Journal of Business Management, January, 2013, pp.85-95.

[2] Thornley A. Strategic Planning in the Face of Urban Competition. In: Salet, W. – Faludi, A. (eds) 2000: The Revival of Strategic Spatial Planning, 2000, pp.32-36.

[3] Luis M. Correia, Klaus Wünstel "Smart Cities Applications and Requirements"

Networks European Technology Platform, 2011, pp.154-159.

[4] Junglas, Iris and Watson, Richard, "U-Commerce: An Experimental Investigation of Ubiquity and Uniqueness" (2003), pp.132-135.

[5] P. Venkataram, B.S. Babu, "An Authentication Scheme for Ubiquitous Commerce: A Cognitive Agents Based Approach", NOMS Workshops IEEE, (2008), pp.248-256.ISBN: 978-1-4244-2067-In proceeding of:

[6] Hing, j., and Landay j., "A context/communication information agent", Personal technologies special issue on situated interaction and context aware computing, (2001), pp.439-444.

[7] P. Venkataram, B.S. Babu, "An Authentication Scheme for Ubiquitous Commerce: A Cognitive Agents Based Approach" (2008), pp.230-248.

[8] T. P. Liang and D. N. Chen, "Evolution of Information Systems Research," Proceedings of Pacific Asian Conference on Information Systems. Adelaide, Australia, July (2003), pp. 257-269.

[9] David Harel,"A visual formalism for complex systems," Department of Applied Mathematics: The Weizmann Institute of Science (1987), pp. pp. 269-272.

[10] D. Harel "A visual approach to complex systems" Department of Applied Mathematics, The Weizmann Institute of Science (1984), pp.54-65.

[11] D. Harel, A. Pnueli "On the development of reactive systems" K.R. Apt (Ed.), Logics and Models of Concurrent Systems, Springer, New York (1985), pp32-35.

[12] Hui Zhang,XiaolinXu, Jianying Xiao" Diffusion of E-government: A literature review and directions for future directions" Government Information Quarterly, October (2014),pp.42-45.