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Generic Approach for Customer Management System

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Abstract

Customer Complaints are considered as valuable and significant information that can be utilized to attain customer satisfaction. Accordingly, a complaint handling system can address customer dissatisfaction and prevent similar problems from reoccurring. The aim of this paper is to investigate the level of relationship between the complaints and complaint behaviors of the customers who benefit from the services offered. In this paper, a generic approach for the Customer Complaint Management System is proposed to have the ability to minimize customers' dissatisfaction and on the other hand to motivate customers to take part of controlling the quality of the services provided. The "Service" was used to connect different databases from different platforms to retrieve certain data. The system starts by discussing the service implementation with the web-application interface development. Afterwards, the three main Services that were used in the proposed e-complaint web service were explored to get the Citizen and Staff data and how it's working. Then, these services were implemented in the web application each according to the operation that calls the service to retrieve certain data. Moreover, the most important reports extracted from the evaluation result were explored. For implementing the model, a web application was developed to exhibit the ability of the model as well as efficiency in e-Gov since it could be developed thoroughly. It was supposed that to complete the e-complaint system cycle, there is a need for five modules to implement this cycle; first module related to the "Citizen" who wants to fill his/her complaint; second module the "Admin" who manages the system users; third module the "Agent" who will deal with the Citizen complaints; fourth module the "Staff" who will analyze the causes and actions of each complaint; and fifth module the "Supervisor" who views the overviews reports and takes decisions for improvements. For evaluation purposes, a random generator has been created, which was able to generate random complaint scenarios that serve as input to the proposed model for creating Citizen Complaints. By applying these several test scenarios to the proposed model, it proved that it's applicable to be applied to real data if it is available and would provide the same performance. The experimental results clearly indicate that using the Service-Oriented Architecture (SOA) is suitable to aid in creating e-complaint systems. The system was implemented using random generator by entering samples of data for 3 years. Also, the system has been tested with 12,015 complaint cases; 11,162 cases are solved and 848 cases still unsolved. The number of governors covered by the system is 29 areas. According to the results, the system counted the cases of gender as 5640 cases of male and 6375 cases of female. Also, counted Married/Single cases as 4674 married citizens and 7341 single citizens. The system also has received 6999 feedbacks.

Keywords: e-Complaint, Complaint Management System, Complaint Handling System, SOA.

1.Introduction

In today's market, interest in using the internet in many areas is increasing; we can see various services are being offered through IT environment. Utilizing websites as a tool to interact with users has some benefits for providers and users. From Users' point of view, first it is easy to access; that means users wherever they are they can access the internet to invoke service. Second, it is easy to interact; if a website interface was user-friendly that means it is easy for the user to interact with, this part completely depends on how users can find the service which they are looking for. Finally using IT environment is time-saving since users don't need to refer to the providers directly. From the providers' point of view, web-based tools are time and money saving, ease of offering new products /services, and easy to contact and announce clients.

The evolution of web-applications such as Portals is increasing with the continuous improvements in the appearance of new requirements and features. Therefore, developing "Web Services" using the "Service-Oriented Architecture" paradigm is a commonly accepted concept. On the other side, most of the user's complaints are apparent when a system has inappropriate communication among organizations, their employees, and customers (Citizens). Poor communication can result in poor services or products being provided by the organization or government. Any organization can attain an efficient success factor by raising the user's satisfaction when focusing on the matter of complaint handling. Therefore, each organization needs to develop its internal and external communication towards its staff and customers to achieve success. A proper communication can decrease user dissatisfaction, but it cannot resolve the complaint.

Complaints usually embrace all about life aspect including food, friends, jobs, products, and services that we have either used or bought such as public transportation and weather condition. Complaining and muttering have been a part of our life, while some people are very good at the complaining matter.

Nevertheless, most of the organizations are not very good or expert in handling complaints and suggestions. Sometimes, this issue is assumed by many organizations as totally an unimportant matter and hard to be handled. The ability to handle complaints in an effective way is an art and skill that can be learned. Training staff to handle complaints confidently and efficiently is very important to give an excellent service to customers while the company will gain a good profit. This study will be emphasized to the governmental services context in managing complaint.

Paper organization. This paper is organized as follows: Section 2 gives a brief about the existing work concerning the problem under study. Section 3 provides the proposed model structure. Section 4 explains the system analysis. Section 5 illustrates the system design. Section 6 explores the system implementation. Finally, section 7 concludes the research under study.

2. Literature Review

Out of the previous related work done concerning student complaint, the most recent research was: Afify, et al. (2017) [2], presented a generic automated mechanism approach for academic advising in the university system. This paper presented a novel model for e-Academic Advising System as a web-based application. The authors developed a system which simplifies and supports the academic advisors in providing the advising services to their students; also, to explore the design and implementation of a computerized tool to facilitate this process. The proposed model resulted in a model that the staff and advisor can access to follow-up the student complaints and suggestions. As well, the students who enrolled can raise a complaint, and provide suggestions in any subject. Finally, the head of the department can receive KPIs reports to follow-up his department.

Also, the researchers found out that of the most appropriate to the research topic, was: Afify, et al. (2011) [1], presented a new model of e-Complaint web service based on Service Oriented Architecture (SOA). In this model, the authors attempted to recover the relationship between Citizens and the Social Solidarity. The Proposed model aimed to develop an e-Complaint Web-based that targets the subsidiary lifecycle. The cycle starts with the distribution of different services that were provided through subsidiary. Those services were applied to different people

based on their needs. Due to different obstacles, those services may not be applied in the appropriate way.

For that, the need for a system that detects Citizens problems and supplies them with appropriate feedback was raised. This system was able to handle complaints by recording and giving feedback for each raised complaint. The study outcome was a helpful reference to detect users' needs from the e-complaint and the handling process of this complaint in the body of any organization.

Razali, et al. (2011) [11], presented a new complaint management system. The manual process of complaint handling between customers and the university was monitored to develop the new complaint management system. New complaint management system known as e-Aduan was developed. Both customers and management had access to the new system to complaint and retrieve feedback. Through this study, the authors had also identified workflow procedures to be followed by the management to address customers' complaints and comments. This new scenario produced a good impact to both customers and management; customers now had a platform to communicate their dissatisfaction and the management would be able to act immediately upon any customer feedback.

Pyon, et al. (2011) [10], believed that customer complaints through call centers were adequate to support the analysis of service improvement in the financial service industry. Hence, they proposed a web-based decision support system for business process management employing customer complaints, namely Voice of the Customer (VOC). The system was handling data for service improvement and involves VOC conversion for data enrichment and included analysis of summarization, exception, and comparisons.

Najar, et al. (2010) [9], tried to improve the relationship between citizens and government by presenting a new model based on Service Oriented Architecture (SOA). The presented model in the governmental sector, on one hand, gives the governments the ability to minimize citizens' dissatisfaction and on the other hand, encourages citizens to participate in controlling government body such as governments' staffs and organizations. Trappey, et al. (2010) [13], developed and analyzed a framework of complaint handling system for a Japanese restaurant chain. The complaint handling process overcomes the deficient approach of previous complaint handling through process re-engineering. Thus, it was giving benefits to the operations between headquarter and branches of the restaurant. A formal integrated process

modeling (INCOME) approach was used to define the complaint handling model and its process. The new framework included complaint reporting, compensation

diagnosis, and complaint analysis. Furthermore, the model has the capability of the decision supports on complaint resolution automatically by the system.

Hansen, et al. (2010) [7], identified two clusters of retailers from the cluster analysis. The clusters were non-active complaint handlers and medium-active complaint handlers. The complaint handlers regarded the complaint handling as having higher strategic relevance for the medium-active than the complaint handlers for the non-active. The medium-active complaint handlers also were more inclined to compensate the complaining customers for the loss they might have experienced. The results obtained were indicating that retailers hesitate from inciting customers to complain. This was unfortunate, as dissatisfied customers should be regarded as a strategic asset, which potentially could provide retailers with important knowledge concerning their products and services and thereby helping retailers in improving their marketplace behavior.

Breitsohl, et al. (2010) [4], presented a hypothesis of credibility and congruence in behavior orientation that increased the understanding of complaints and assessments of complaint dialogue. The study highlighted that predictable outcomes for the related online complaint managers and marketers alike were implying of post-complaint communication into corporate image and relationship management as well as using credibility as a benchmark for online customer satisfaction and positive e-word-of-mouth.

Galitsky, et al. (2009) [6], proposed a novel approach for modeling and classifying complaint scenarios associated with customer-company dialogues. These dialogues were designed as labelled graphs, where the company and client can interact through communicative actions and provided arguments that support their points. The authors proved that argumentation given a compliment to the implementation of machine learning logic on communicative actions and to improve the results of classification accuracy.

Au, et al. (2009) [3], examined nine complaint categories of Hong Kong's Hotel across different origins of the complaints. The results reveal that although no significant relationship was found between e-complaint categories and hotel class, the age group of reviewers is significantly associated with specific types of complaints made online. The authors presented several types of management responses against all e-complaint categories to recommend the managerial reactions.

Vos, et al. (2008) [14], highlighted the importance of complaint management was acknowledged of learning from complaints. Still, the concept of organizational learning has

not yet been embedded in the field of complaint management. Therefore, a research accomplished to adjust a general model for organizational learning to the concept of complaint management. The results of the research

categorize a variety of complaint management practices along two elements of organizational learning: triggers and modes of learning (i.e. Informational Learning or Interactive Learning).

This collection of practices can be used as a managerial guideline for improving the processes of learning from complaints. Kopparapu, (2008) [8], proposed a natural English enabled mobile interface which could be used to lodge complaints. The aim was to employ the existing web portal infrastructure and supply a fast complaint registration. The system enabled and assisted citizens to lodge the complaint and seek redress through their mobile phone in natural language.

Coussement, & Van den Poel, (2008) [5], introduced a methodology to improve complaint handling strategies through an automatic email classification system that distinguishes complaints from non-complaints. Hence, complaint handling became less time consuming and more successful. The system combined traditional text information with new information about the linguistic style of an e-mail. The linguistic information that combined into a classification model with traditional text-classification variables given a remarkable rise in predictive performance.

Sultan, et al. (2008) [12], developed an Agent-based Complaint Management system (ACM) oriented by web application called e-Complaint which was made for students and lecturer to make complaints about their dissatisfaction about the Faculty of Science Computer and Information System. This system could record and give feedback for every complaint raised faster than before by improving the current (CMS) with the software agent. The software agent used as operator assistance and send email to the department that must solve the complaints. This ACM predicted and recognized to whom the complaint received would be forwarded with minimal human intervention according to library keyword recognition proposed as an intelligent element.

3. Proposed Model Structure

In this section, the researchers tried to develop a model in terms of electronic complaints, which can support complaining from poor service quality and delivery.

After a series of reviews on available research methodologies, the researchers found WSDM (Web Site Design Method) as an appropriate model for designing e-complaint web service in terms of an e-complaint model based on SOA. The research simplifies the idea for some parts of the services; webpage design Rational Unified Process (RUP) was utilized as a guide for how to effectively use the Unified Modeling Language (UML) in research.

The advantage from this proposed model is the easy way of handling the Citizen's complaints on what dissatisfies

them. For that, the new Complaint Management System is necessary to get better workflows and make each department contribute in the process of solving the Citizens' complaints.

Figure 1: Conceptual Framework

The following sections will describe, illustrate and explain the main processes and modules of the system then how each user will interact in the system according to his/her role in the overall cycle of the e-Complaint Management System.

4. System Analysis

In this section, the researchers show the working flow process of the proposed model to explore how the system works. The working flow process identifies the needed steps in designing and implementing the model.

The proposed complaint handling model consider being a platform, or web-application that is built to ensure that the complaint process is addressed and handled properly.

Figure 2 illustrates the main processes in the workflow process of the proposed complaint handling model.

- Confirm the Citizen authenticity,
- Creating the Citizen complaint,
- Classify the complaint according to its priority,
- Search in the knowledge base for related reference or similar case to find a quick solution,
- Assign a complaint to the responsible staff who will identify the rules on how to solve and follow-up the complaint cases.

4. System Design

This section explains how the system has been designed. The system design phase is considered as a method used to

realize the system elements as the architecture, modules, and components. Additionally, the various interfaces of those components and the data that goes through that system. Its purpose is to satisfy the specific needs and requirements needed for a business or an organization through the coherent and well running system

Figure 2: Proposed Working Flow Process

1) System Architecture

- *To-BE Academic Advising System:*

The researchers divided the proposed model into 3-tiers that consist of the following, as shown table 1:

Table 1: Proposed Model Tiers

Tiers	Description
Storage - tier	It contains data about system users and their profiles, Citizens information, available resources, and social association profiles.
Business - tier	It consists of the core of the system. i.e. complaint handling and feedback components.
Presentation - tier	It consists of web-based user interface.

Figure.3. illustrates the proposed layered SOA architecture that consists of three tiers each tier serves a certain task. The proposed system could be generally applicable for any web-based e-complaining system.

Figure 3: Academic Advising Architecture

2) Implementation Design

After explaining the proposed model architecture, the next step is the implementation design of the system. In this phase, the researchers tried to design an appropriate web application for Citizens Complaints purpose in terms of service complaints. Therefore, this phase started with use case diagram and continued with sequence diagram then ended with a class diagram.

A. Use Case Diagram

In Use Case diagram we have eight-actors divided into two types first the main users on the proposed system and second the services available, as shown in figure 4. Both types interact within the system's boundary, as shown in figure 5.

1. Scenario Overview

When a Citizen has an issue with the Social Solidarity the next steps followed:

- A Citizen login to the web and fills in a new complaint in the complaint form or contacts the Agent and states the matter.
- The Agent enrolls the complaint case through opening the complaint system and creates the new complaint entry. Furthermore, updates the complaints and records information on each failure associated with the complaint.

- The Staffs of the service department handle the complaints and delegates each complaint to the responsible one.
- Each department deals with the assigned complaints according to the management rules then analyzes the actions and causes to get results. After that, propose a satisfying solution for the Citizen's problem.
- If this solution is satisfactory for the Citizen, then the statement of the complaint is closed. If not, then in charge of department updates the original complaint and the operation starts over again.
- The top management can extract and view KPIs (Key Performance Indicators) reports for improving provided services and handling methods to help in decision making according to the staffs of the service department analysis.

2. Roles

Table 2: Roles for Actors in the Proposed Model

Actors	Description
<i>Admin</i>	Create system users, manage their privileges, manage lookups in SYSDB and manage site survey.
<i>Citizen</i>	Make Complaints against the provided services.
<i>Agent</i>	Record the Complaint in the web-based then update complaint according to solving procedure.
<i>Staff</i>	Manage the Complaints causes and actions in the system then provide solutions.
<i>Supervisor</i>	View overview reports improving services provided to help in decision making.
<i>Civil registry</i>	Has all Citizens SSN, Name... etc.
<i>Social Solidarity</i>	Has Citizens details that deserve services.
<i>Staff Data</i>	Has all staff details who works on Social Solidarity and could be assigned to deal with Complaints.

Figure 4: Roles Illustration

A. Sequence Diagram

In this subsection, the researchers summarize the flow of the key functions of the system using the sequence diagram to better understand how the processes run together and in which order. The major functions of this system defining the following: the type of users the system deal with, the system manages and the roles assignment, users' complaint created, all complaint handling standards, process complaint resolution, and all complaints follow-up.

Figure 5: Proposed Use Case Diagram

- **First user:** The Citizen (complainant) who makes a complaint and check for existing complaint status, as shown in figure 6.
- **Second user:** The Administrator who adds new users or manages system privilege for whom exist on the system by assigning their roles and manage local system database, as shown in figure 7.
- **Third user:** The Agent who enrolls and manages Citizen's Complaints by priority classification and then follows up by searching the knowledge base for solutions; in case of the solution not found then submit the complaint case to the responsible staff of the service department to handle it, as shown in figure 8.
- **Fourth user:** The responsible Staff of the service department who manages the waiting complaints by describing and analyzing the causes and actions for each complaint. Then resolve the complaints according to the management rules and propose preventive measures to ensure that this complaint will not fail again. Finally, back the complaint case to the agent to follow it up. After that, the agent updates the complaint status or closes the complaint case if it resolved, as shown in figure 9.
- **Fifth user:** The Supervisor who take decisions according to the KPIs reports, as shown in figure 10.

Figure 6: Citizen Sequence Diagram for the Proposed E-Complaint System

Also, there are three main services that integrate with the proposed system, as follows:

- **First service:** The Social Solidarity service which contains the entire Citizens' information that deserves the services each according to his region and Governorate.
- **Second service:** The Civil Registry service which contains the entire Citizens' identity information, if they deserve services or not, also to validate the identity of the Citizen who make the complaint in order to improve the provided service as general.
- **Third service:** The staff service which contains the entire staffs' information, each according to his department and role to deal with cases on the system.

The following diagrams Shows the flow for the five main system users dealing with the system and how they integrate with the three services for calling required data.

Citizen Sequence diagram:

1) Admin Sequence diagram:

Figure 7: Admin Sequence Diagram for the Proposed E-Complaint System

2) Supervisor Sequence diagram:

Figure 8: Supervisor Sequence Diagram for the Proposed E-Complaint System

3) Agent Sequence diagram:

Figure 9: Agent Sequence Diagram for the Proposed E-Complaint System

Figure 10: Staff Sequence Diagram for the Proposed E-Complaint System

B. Class diagram

This diagram describes the systems' structure through showing systems' classes, attributes of classes and relations between class. In this system we have three main classes 'Citizen' class, 'Complaint' class, and 'User' class. Each one of these three main classes has a general relationship with other classes, as shown in figure 11

- There is a 1-to-n relation between 'Marital Status' class and 'Regions' class with 'Citizen' class. Which means that each Citizen must define his marital status such as (single, married, widowed, divorced) and the location he belongs to on the web. There is a dependent relationship between 'Governorates' class and 'Regions' class as each governorate contain many regions.
- Also, there is a 1-to-n relation between 'Complaint' class and each of 'Complaint Status' class, 'Complaint Causes' class, 'followUp' class and itself. As each complaint has status such as (open, in progress, pending, solved, closed...etc); also, each problem raised through some causes led to that complaint; each complaint could be followed up in a way of interaction between Citizens and Users through the complaint and the complaint may have a reference as previously related complaint from the same Citizen for that it has a self-relationship. 'Sub classification' class depends on 'Classification' class and has a relation 1-to-n with the 'Complaint' class.
- Each user on the system must have a role for that there is a relation 1-to-n between 'Role' class and 'User' class.
- Each complaint takes a status added by the user for that there is a relation 1-to-n between 'User' class and 'Complaint Status' class.
- Each Citizen who refers to the web service can take a survey in a way to but feedback and state a problem acquire. All feedback will be recorded in the 'Site Survey' class. This class is dependent on each Citizen enter the web.
- 'Questions' class and 'Answers' class are dependent classes used by admin. Admin defines the questions for each question there are many answers has a certain score.
- 'Civil Registry Service' class and 'Social Solidarity Services' class are provided to offer different services in the system if the user has the authority to get these services. These classes will rout user to the related page that they requested for.
- 'Knowledge Base' class is an independent class where users can add keywords to help them in solving complaints and search for the nearest solution.

Figure 11: Class Diagram for the Proposed E-Complaint System

5. System Implementation

After explaining the proposed system analysis and the proposed system design, the next step is the proposed implementation of the system.

This section, will first discuss the service implementation with the web-application interface development followed by exploring the most important reports extracted for the evaluation result.

A.Implementation Development

1)Services

The word 'Service' has many definitions based on the context in which it is used and based on the industry in which the service is provided or performed.

DEFINITION 1. A service is "a component of an automated sub-process representing a unit of work". It performed as part of a business function, such as verifying customer contact information or validating recent customer purchasing activity ...etc. (e.g., "Get Customer Record").

The new catch-all word "Services" is making its rounds in the industry of late. But, just like the term "Component", it's a word that is easily overloaded with different kinds of meanings. The term Service is used in a few other industry buzzwords, namely Web Services, Service Oriented Architecture (SOA), Enterprise Service Bus (ESB) and

Application Service Provider (ASP). It's an extremely overloaded term. However, the researcher defines Service as a software entity that is designed in isolation, however, provides near frictionless interoperability. It's a strange almost mythical combination of competing requirements, which it is both isolated and interoperable. Services are not Objects nor are they the same as Components; however, that doesn't mean that Services using Objects or Components cannot be implemented. This fact causes a lot of confusion, just because you can implement something with X does not imply that the same thing is an X. That X is just the implementation strategy; the actual thing that's implemented which is called Services has certain well-defined characteristics.

In this study, the researchers use the 'Service' to connect different databases from different platforms to retrieve certain data. In the following section, the researchers will explore the three main Services that used in the proposed e-complaint web service to get the Citizen and Staff data and how it's work.

1.1 CivilRegistryService

This is the first service used to retrieve 'Citizens' details from the 'Civil Registry' if they don't belong to the 'Social Solidarity' Citizens. The service works as follows:

```

namespace CivilRegistryService
{
    public class CivilRegistryService : ICivilRegistryService
    {
        public User SearchForCitizen(string U_NationalID, string Name)
        {
            if (string.IsNullOrEmpty(U_NationalID) || string.IsNullOrEmpty(Name))
            {
                throw new ArgumentException("Invalid Search Criteria.");
            }

            CivilRegistry_Users obj = All_CivilRegistry_Users.Instance.SearchForUser(U_NationalID, Name);
            User returnResult = new User();

            if (obj != null)
            {
                returnResult.Email = obj.U_Email;
                returnResult.Name = obj.U_Name;
                returnResult.NationalID = obj.U_NationalID;
                returnResult.Exists = true;
            }
            else
            {
                returnResult.Exists = false;
            }

            return returnResult;
        }
    }
}

```

Figure 12: Civil Registry Service (Code Snippet)

Service description:

- Service name:** CivilRegistryService,
- Function:** SearchForCitizen,
- Parameters:** U_NationalID and Name from type string,
- Signature or Return Type:** User,
- Function operation:** check the two supplied inputs,
- Service main operation:** start the search with given data, check if it's found fill return object and set property found, else not found without data

1.2 SocialSolidarityService

This is the second service used to retrieve 'Citizens'

details from the 'Social Solidarity'. The service works as follows:

Service description:

- Service name:** SocialSolidarityService,
- Function:** SearchForCitizen,
- Parameters:** SocialNo. and Name from type string,
- Signature or Return Type:** User,
- Function operation:** check the two supplied inputs,
- Service main operation:** start the search with given data, check if it's found fill return object and set property found, else not found without data.

```

namespace SocialSolidarityService
{
    public class SocialSolidarityService : ICitizenService
    {
        public User SearchForCitizen(string SocialNo, string Name)
        {
            if (string.IsNullOrEmpty(SocialNo) || string.IsNullOrEmpty(Name))
            {
                throw new ArgumentException("Invalid Search Criteria.");
            }

            SocialSolidarity_Users obj = All_SocialSolidarity_Users.Instance.SearchForUser(SocialNo, Name);
            User returnResult = new User();

            if (obj != null)
            {
                returnResult.Address = obj.U_Address;
                returnResult.Email = obj.U_Email;
                returnResult.Name = obj.U_Name;
                returnResult.SocialNumber = obj.U_SocialNumber;
                returnResult.Exists = true;
            }
            else
            {
                returnResult.Exists = false;
            }

            return returnResult;
        }
    }
}

```

Figure 13: Social Solidarity Service (Code Snippet)

1.3 StaffService

This is the third service used to retrieve 'Staff' details from the 'Staff DB'. The service works as follows:

```

namespace StaffService
{
    public class StaffService : IStaffService
    {
        public List<User> SearchForStaff(string SearchPattern)
        {
            List<User> returnResult = new List<User>();

            foreach (Staff_Users u in All_Staff_Users.Instance.GetByUName(SearchPattern))
            {
                returnResult.Add(new User()
                {
                    Email=u.U_Email,
                    Name=u.U_Name,
                    NationalID=u.U_NationalID
                });
            }

            return returnResult;
        }
    }
}

```

Figure 14: Staff Service (Code Snippet)

Service description:

- Service name:** StaffService,
- Function:** SearchForStaff,
- Parameters:** Pattern (custom search) from type string,
- Signature or Return Type:** List of User,
- Function operation:** New list of objects of the return type,
- Service main operation:** select data iterate in the search result and make a new object in each round then add it to the return list. For implementing the model, the researchers tried to develop a web application to exhibit

the ability of the model as well as efficiency in e-Gov since it could be developed thoroughly. The researchers implement the three services in the web application each according to the operation that calls the service to retrieve the certain data, as shown in the following subsections.

2) Modules

E-CCMS is used to manage customer complaints, corrective and preventive actions and other case types with a focus on the development of strategies for improvement. The following is an overview of some of the functionality within e-CCMS.

In this study the researchers supposed that to complete the e-complaint system cycle there is a need for five modules to implement this cycle; first module related to the 'Citizen' who want to fill his complaint; second module the 'Admin' who manage the system users; third module the 'Agent' who will deal with the Citizen complaints; fourth module the 'Staff' who analyze the causes and actions of each complaint; and fifth module the 'Supervisor' who view the overview reports and take decisions for improvements.

2.1 Citizen Module

In this module, there are two services required to get the Citizen data first one is the 'Civil Registry Service'; this service called when the Citizen who need to login not in the 'Social Solidarity DB' and login with his 'NationalID' and 'Name', the second one is 'Social Solidarity Service';

this service called when the Citizen who need to login belongs to the 'Social Solidarity DB' and has a social number, in this case, the login with his 'SocialNo.' and 'Name', as shown in figure 15.

Figure 15: Citizen Login Screen (Authentication)

After the Citizen successfully, login the system manages to ask citizen if he/she wants to take a survey, as shown in figure 16.

Figure 16: Take a Survey (Citizen Module)

The following snap show sample of the Survey Page appears to Citizen when he clicks the 'Now' button, as shown in figure 17.

Figure 17: Survey Page (Citizen Module)

Figure 18 shows the Citizen main screen; if he/she has a waiting follow up it will appear in the complaint statistics

that's if Citizen complained before.

Figure 18: Citizen Main Page

Figure 19 shows If Citizen wants to check the status of his old complaint, view comments etc.

Figure 19: Previous Citizen Complaints

Figure 20 shows the follow-up page if Citizen wants to comment in Changes.

Figure 20: Follow Up Page (Citizen Module)

Figure 21 shows if Citizen wants to make a new complaint.

Figure 21: Make a Complaint Page (Citizen Module)

Figure 22 shows the edit info. Page for Citizens, this page also appears by default as a first screen for Citizen who enters the web for the first time to complete his data to be saved in 'Local System DB'.

Figure 22: Edit Info. Page (Citizen Module)

2.2 Admin Module

In this module, there is one service required to get the Staff data from 'Staff DB' this service will be called when admin tries to add new users to the system, as shown in figure 24.

Figure 23 shows the Login Screen to get started with the web-application. Only Authenticated users can login. This account is created by the Administrator only. This also is provided to all the main system users such as (Admin, Agent, Staff, and Supervisor) to keep track of all the system activities each according to his role in the system.

Figure 23: Admin Login Screen

Figure 24 shows the main screen in the admin module consists of two tab the first one is "Add User" in this page when the admin wants to import a new user to the system he searches for users from the 'Staff DB' through calling the 'Staff service' to be added in the 'local system DB' then assign roles to them.

Figure 24: Add New User Screen (Admin Module)

Figure 25 shows the second tab “Manage User” in this page admin can search for users from the ‘Local system DB’ and change their role or deactivates or activates them. While figure 26 shows the lookups.

Figure 25: Manage User Screen (Admin Module)

Figure 26: Lookups (Admin Module)

2.3 Agent Module

In this module, there are two services required to get the Citizen data; the agent will try to login as an authorized user on the system same as admin, after that, the main page that contains the basic tasks will have appeared, as shown in figure 27.

Figure 27: Agent Main Page

When the agent tries to add new complaint delivered to him even by call or face-to-face or by complaint letter he starts searching for the Citizen first then adds his complaint, as shown in figure 28.

Figure 28: Add New Complaint Page (Agent Module)

Here agent can search for waiting complaints list, as shown in figure 29. Then filter and assign them, as shown in figure 30. After that view details of the complaint to solve, as in figure 31.

Figure 29: Complaint Inbox (Agent Module)

Assign	Title	Date	Complaint No.	Classification	Priority	Days To Solve	View
☐	new complaint	31:07:2018 06:54	310720110011	Sub0C0	Low	7	View
☐	agent complaint4	24:07:2018 10:56	240720110011	Sub0C0	Low	7	View
☐	agent complaint1	24:07:2018 10:34	240720110021	Sub1C0	High	1	View
☐	new com2	31:07:2018 06:55	310720110051	Sub4C0	Normal	5	View
☐	agent complaint2	24:07:2018 10:50	240720110081	Sub2C1	Low	7	View

Figure 30: Assign Complaint Page (Agent Module)

Figure 31: Complaint Details (Agent Module)

Figure 32: Basic Tasks (Agent Module)

2.4 Staff Module

In this module, no service will be called only staffs tries to add new solutions, define causes and actions; in other words, make a complete analysis for complaints.

Figure 33. shows the staff main page that appears after login as an authorized user on the system.

Figure 33: Staff Main Page

Figure 34 shows when the staff tries to search for the complaint causes and actions.

Figure 34: Cause Search Page (Staff Module)

Figure 35 shows when the staff tries to view certain complaint details or try to edit complaint cause or assign it.

Figure 35: Complaint Details (Staff Module)

Figure 36 shows when the staff tries to add new cause or action.

Figure 36: Edit Causes and Actions Page (Staff Module)

2.5 Supervisor Module

In this module, there is no service will be called the only supervisor tries to view due complaints, as shown in figure 38 then assign them to active staffs according to user statistical report, as shown in figure 39; also view all critical reports that will help in decision making and improvement cycle.

Figure 37 shows the supervisor main page that appears after login as an authorized user on the system. Hear supervisor can view if there is any waiting complaint or overdue complaint that needs to be handled; also, the supervisor can assign complaints and view the statistical reports.

Figure 37: Supervisor Main Page Screen

Figure 38 shows the due complaints that need to be handled. Hear supervisor can search by certain date and assign complaints to certain staff; also view its details.

Figure 38: Due Complaints (Supervisor Module)

Figure 39 shows the assign complaint tab on the supervisor module.

eComplaint System
"We're committed to improve our services to you"

Welcome : Supervisor | LogOut

Assign Complaint | Use Complaints

Assign Complaint

Search

Complaint No. :
Title :
Region : - Select -
Type : - Select -
Agent : - Select -
Assign to Staff : - Select -

Assign

Assign	Title	Date	Complaint No.	Classification	Priority	Days To Solve	View
☒	new com1	7/19/2018 11:08:31 PM	1907201100173	Sub0C30	Low	7	View

Complaint System 2018

Figure 39: Assign Complaint (Supervisor Module)

Figure 40 shows when the supervisor tries to view certain complaint details or assign it to staff.

eComplaint System
"We're committed to improve our services to you"

Welcome : Supervisor | LogOut

Assign Complaint | Use Complaints

Complaint Form

Complaint Details

Complaint No. : 1907201100173
Title : new com1
Date Received : 7/19/2018
Classification : Sub0C30
Region : East Java
Reference Complaint : /

Keywords

Key Words : "Each Word Separated by comma"
No SQL*Plus

Assign

Date	From	Status	To	Comments
28/07/2018 09:31	Admin1	Staff Assistance		request help
28/07/2018 11:09	Agent6	Open		
28/07/2018 11:07	Agent6	Assigned		request need testing system to solve

Complaint System 2018

Figure 40: Complaint Details (Supervisor Module)

B. Evaluation Results

Due to time and resource constraints, the researchers were unable to incorporate the proposed model into a physical governmental system or any organization.

However, using several test scenarios applied to the model shows that it is applicable to be applied on real data if it is available and will have the same performance.

For evaluation purposes, a random generator had been created which is able to generate random complaints scenarios that serve as input to the proposed model for creating Citizen Complaints. The experimental results clearly indicate that using SOA is suitable to aid in creating e-complaint systems.

KPIs Report Analysis

This section will explore the most important Key Performance Indicators (KPIs) in the proposed e-complaint web service.

DEFINITION 2. Key Performance Indicator is "an industry jargon term for a type of Measure of Performance". KPIs

are commonly used by an organization to evaluate its success or the success of an activity in which it is engaged. Sometimes success is defined in terms of making progress toward strategic goals, but often, success is simply the repeated achievement of some level of operational goal (zero defects, 10/10 customer satisfaction etc.).

Accordingly, choosing the right KPIs is reliant upon having a good understanding of what is important to the organization. 'What is important' often depends on the department measuring the performance - the KPIs useful to a Finance Team will be quite different to the KPIs assigned to the sales force, for example. Due to the need to develop a good understanding of what is important, performance indicator selection is often closely associated with the use of various techniques to assess the present state of the business, and its key activities. These assessments often lead to the identification of potential improvements; and consequently, performance indicators are routinely associated with 'performance improvement' initiatives. A very common method for choosing KPIs is to apply a management framework such as the balanced scorecard.

The researcher has implemented the system using random generator by entering samples of data for 3 years (2016, 2017 & 2018). Also, the researcher has tested the system with (12,015) complaint case; 11,162 cases are solved and 848 cases still unsolved. The number of Governorates covered by the system is (29).

Refer to research result; the researcher counts the cases on the system by gender as: 5640 cases by male and 6375 cases by female. And count Married/Single cases as 4674 married citizen and 7341 single citizens. The system also has received (6999) feedback.

The following section is related to the 'Supervisor Module', the researcher will explore the most important KPIs extracted from the e-complaint system based on SOA as an evaluation result for this study.

Table 3: Samples Randomly Generated

System Performance Survey	
1) System Failures Failures to print a complete report.	0
2) Survey Total Days Total days conducted.	1095
3) Number of Complaints Total cases under study.	12,015
4) Number of Unsolved Cases Total number of <u>unsolved</u> cases depends on survey conducted period. (Assigned/Opened/In-Progress/Pending/Closed/Needs Staff Assistance)	848
5) Number of Solved Cases Total number of solved cases depends on survey conducted period.	11,162
6) Coverage Areas Number of Governorates covered by the system.	29
7) Male/Female Cases Total number of Male/Female Cases.	5640/6375
8) Classification Categories Types of Complaints according to case study. (number)	10
9) Citizen Analysis Total number of Married/Single (single-divorced-widowed) cases.	4674/7341
10) Complaint Status Count Total number of solved cases by most active user. (Agent)	252
11) Feedback Total number of Completed/Ongoing feedbacks by Citizens.	6999/3001
12) Association Performance Improvements Dose the system improves the performance of the association?	yes
13) Attitude towards using Feeling unfavourable towards using the system.	No
14) Meets its purpose Dose the system meet its purpose?	yes

Figure 41: Statistical Reports Main Page (Supervisor Module)

As shown in figure 41, there are 12 reports divided into 6 sections according to shown tabs. The first section is according to 'Complaint' here we can search for complaints by a certain date, as shown in Figs. (42, 43, 44, 45 & 46).

Figure 42: Complaints By One-Day View Report (Supervisor Module)

As shown in figure 42, in 6/8/2018 there are 20 complaints entered on the system. And figure 43. shows the number of complaints entered from 31/7/2018 to 6/8/2018.

Figure 43: Complaints by certain-Duration View Report (Supervisor Module)

Figure 44 shows the number of complaints entered for the last month.

Figure 44: Complaints by Last-Month View Report (Supervisor Module)

Figure 45 shows the number of complaints entered for the last quarter.

Figure 45: Complaints by Last-Quarter View Report (Supervisor Module)

Figure 46 shows the number of complaints entered for the year 2011.

Figure 46: Complaints by Year-to-Date View Report (Supervisor Module)

As shown in figure 47, from 31/10/2017 to 31/12/2017 there is 402 complaint case solved and 19 complaint case closed.

Figure 47: Complaints by Status Count for Certain-Date Report (Supervisor Module)

As shown in figure 48, in year 2017 there are 4862 solved case, 561 closed case, 1 assigned case and 1 staff assistance case.

Figure 48: Complaints by Status Count for Year-To-Date Report (Supervisor Module)

Figure 49 shows the work-load report for the year 2017 on solving the complaint cases.

Figure 49: Complaints by Work-Load Report (Supervisor Module)

Figure 50 shows if the supervisor wants to search for a certain complaint case with full details.

Figure 50: Complaints by Complaint Number Report (Supervisor Module)

As shown in figure 51, the supervisor searches with complaint no. (150720110501).

Figure 51: Complaints by Complaint Number Details Report (Supervisor Module)

Figure 52 shows that in year 2018 there are 5438 complaints entered on the system as: 1536 high priority, 1238 normal, 1684 medium and 980 low priority complaints.

Figure 52: Complaints by Priority Year-To-Date Report (Supervisor Module)

Figure 53 shows the number of complaints entered the system in year 2018 for each Governorate.

Figure 53: Complaints by Governorate Year-To-Date Report (Supervisor Module)

Figure 54 shows the number of complaints entered the system in year 2018 for each Region.

Figure 54: Complaints by Region Year-To-Date Report (Supervisor Module)

Figure 55 shows the number of complaints by classification entered the system in year 2018.

Figure 55: Complaints by Classification Report (Supervisor Module)

Figure 56 shows the number of complaints by sub classification entered the system in 2018.

Figure 56: Complaints by Sub-Classification Report (Supervisor Module)

Figure 57 shows number of complaints entered by gender and marital status in year 2018.

Figure 57: Complaints by Citizen Analysis Report (Supervisor Module)

Figure 58 shows the citizen details in year 2018.

Figure 58: Report for Citizens Details (Supervisor Module)

Figure 59 shows the system user analysis in year 2018.

Figure 59: Report for User Analysis (Supervisor Module)

Figure 60 shows the Citizens' feedback on the system.

Figure 60: Report for Citizens Feedback (Supervisor Module)

Figure 61 shows the Citizens' survey analysis in the year 2018.

Figure 61: Report for Feedback Details (Supervisor Module)

6. Conclusion

This study innovated a generic approach for the Customer Complaint Management System.

The researchers have designed and developed the proposed system from the beginning by using recent technologies which opens chances for any organization regardless of its size to build its own system using simple technology tools.

The researchers presented an overview of the development and implementation of the electronic Customer Complaint Management System (e-CCMS) as a web-service based on Service-Oriented Architecture (SOA). The results obtained from the implementation are encouraging and promising for the development of the proposed model or even more complex systems in the future as the Complaints Management is a complex and critical problem. At the end of this study, the researchers highlighted how the system works, who are the main users, services and how they can deal with the proposed system. Finally, the presented model can be helpful in other fields of e-complaining in terms of Citizen Adaption and Citizen Loyalty.

The methodology proved that SOA standards and concepts are feasible to be used in building or transforming e-government solution. It also proved that SOA guarantees flexibility, code free of embedded process rules and solution free from application silos.

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