Decision Support System Framework and its Implementation for Handling Complaints in Ethiopian TVET Institution

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Abstract— A Decision Support System (DSS) is a computer-based, interactive information system, i.e. it inherits the qualities about information systems in general. The term interactive implies that there is an exchange between the system and the user. A complaint management system is a set of procedures used in organizations to address complaints. In doing so, it tries to improve qualities, customer satisfaction, and decision-makings of the organization. Inadequate complains handling mechanisms currently in existence, where in the organization is not responsive to complaints. There is inadequate structure in place within the organization to handle such incidences. the researchers conducted an applied research experimental through an Intelligent Decision Support System for Managing Complaints (IDSSMC) that enables Ethiopian Polytechnic TVET Colleges handles complaints via web-based interface integrated to a mobile application with SMS notification. The system enables users of the system to register and submit their complaint by using system website or mobile application. This study employed a descriptive developmental method of research design. Descriptive method was used in discussing the results of the testing phase while the development method was used during the system development. The system shall ensure the TVET system users to register submit and follow their complaint status using the system website and the mobile based application. This enables to collect complaints from large group of people from anywhere and anytime. Finally, it is highly recommended to integrate a Model driven DSS method that could add more intelligence to this business or another one, hoping this project could be used as a starting point.

Keywords - component; Decision Support System, Complaints System, TVET, Data Mining, Ethiopia

I. INTRODUCTION

In today's competitive environment, product and service innovations are re-defining accepted level of performance. Effective complaint management is fundamental to the provision of quality service. Complaints management system provides a mechanism for obtaining feedback from customers, resolving disputes and reforming policies and procedures [1]. A Decision Support System (DSS) is a computer-based, interactive information system, i.e. it inherits the qualities about information systems in general. The term interactive implies that there is an exchange between the system and the user. A DSS primarily supports managerial activities at various levels. The purpose of a DSS is focused on improving the effectiveness of the decision-making process, rather than its efficiency. The effectiveness of decision-making concerns timeliness, accuracy, and quality, while efficiency is the cost of making the decision, e.g., cost of the decision-maker working hours [2].DSS provides support for decision-makers when they deal with semi-structured and unstructured problems. Support is provided in all four phases of the decision-making process, i.e. intelligence, design, choice, and implementation. Thus, focus can be both on decision-making as well as implementation of decisions. A DSS may provide support for both interdependent and multiple independent decisions [3].

A complaint management system is a set of procedures used in organizations to address complaints. In doing so, it tries to improve qualities, customer satisfaction, and decision-makings of the organization. The TVET system is highly dependent on external industries and which is subjected to high change, unless it incorporates all the possible input including complaint raised from customers (stakeholders) and manages it effectively, it would be difficult to meet the labor market needs both in terms of quality and quantity. In simplest terms, complaints are statements about expectations that have not been met. They are also, and perhaps most importantly, opportunities for an organization to reconnect with customers by fixing a service or product breakdown. In this way, complaints are gifts customers give to business or services [4].

After the introduction of Educational and Training policy in 1994, the number of formal and non-formal TVET provision centers in Ethiopia has mushroomed, according to MOE, it is planned to increase the number of TVET centers from 15 in 1994 to 10,388 in 2006. This big expansion in the TVET system of the country has created a large group of customers or stakeholders such as students, trainers, industries and related. These stakeholders would raise complaints on trainings, assessments, or in other areas of the TVET system [5]. Creating an opportunity to forward these complaints, collecting complaints and taking an appropriate action are highly expected from organizations to succeed. An organization with an effective complaint management system has the capability to cope up with the changing world as well as smart leaders use complaints for much more than simply turning around unhappy customers (stakeholders). They use complaints as fuel to improve current operations and enhance the quality of product and service. Organization uses complaints as critical segments in their training and development efforts. Complaints are analyzed to glean subtle clues about what customers might expect in the future. Most important they use complaints to stay perpetually grounded to the market place and connected to the market place [6].

Inadequate complains handling mechanisms currently in existence, where in the organization is not responsive to complaints. There is inadequate structure in place within the organization to handle such incidences. Many institutions do not have a proper complaints handling system, relying on manual systems, which results in complaints not being handled, passed on effectively, or lost. In addition to this the manual system does not have any means of analyzing complaints, which degrade the value of complaints. An automated complaint that facilitate and encourage stakeholders to forward a complain on the TVET system of the city could contribute to the development of quality TVET system throughout that could increases the satisfaction of customers (stakeholders)[6]. It also has a contribution in reducing the good governance problems which is currently a hot issue throughout the country.

Understanding the above-mentioned problems, the researchers conducted an applied research experimental through an Intelligent Decision Support System for Managing Complaints (IDSSMC) that enables Ethiopian Polytechnic TVET Colleges handles complaints via web-based interface integrated to a mobile application with SMS notification. The system enables users of the system to register and submit their complaint by using system website or mobile application. Once the user registered to the system, the system will send a registration confirmation notification (RID) through email and SMS. Users can follow status of their forwarded complaint online using website of the system or their mobile phone. The forwarded complaint automatically routed to the respective bodies that is in charge of handling that complain. This will reduce time needed to process and allows responsible personnel to provide a solution for complaint. The system will send confirmation message to the user called complaint-tracking number (CTN).The user checks the status of their complaints using CTN. The Addis Ababa TVET system bodies will react on the complaint respectively and then the user can get this feedback. The system generates various reports based on criteria, include: specific date or range of dates, or complaint category, which is set by the user. The system displays the summary of the forwarded complaint along with the detail information of submitted complaint. It also make some sort of data mining techniques like clustering and summarizing in finding new facts that is used as an input for decision making process for the executive bodies of TVET. To enable submission of complaint online, the system integrate the website and the mobile application of the system.

II. RELATED WORKS

Lee and Lee [7] conducted a study entitled "An experimental study of online complaint management in the online feedback forum" using reference influences in marketing and existing information systems (IS) literature on the role of feedback in the electronic market, we developed hypotheses exploring the relations among pervious customers' feedback in the online forum, successful complaint management against the negative feedback, and potential costumers' initial trust toward online retailers. In an experimental study, they tested the hypotheses using 68 college students that visit forged online retailer selling used notebook computers. Our results show that stores can recover from potentially damaged reputations through effective complaint management. The results also implicate that negative feedback adversely affects initial trust.

Macleish[8] conducted a study on Customer Complaint Management System (CCMS) which include Quality Functional Deployment (QFD), fuzzy logic, Kano's methods, Voice of the customer (VOC) and Go-See-Think-Do (GSTD). The result was a customer complaint management system that provided a methodical approach to addressing customers' complaints and correcting the associated manufacturing component.

Ramphal [9] proposed a complaints handling system for the Hospitality Industry. Such a system must firstly be supported with an appropriate culture, commitment, facilities and personnel open to managing complaints and secondly for ensuring customer centric processes that are acceptable to the customer and to improve their satisfaction. The ISO 10002 standard provides guidelines on planning, operating, maintaining, analyzing and improving a complaint handling system.

Bomble and Raut[10] proposed a an android based complaints management system for municipal corporation. The Application was able to help the common people under the jurisdiction of a municipal corporation to register their grievances about day to day problems in their ward through a mobile application. It will provide a common man to deliver his complaints and problems to municipal authority as well as let the municipal authorities to address the problem in a short period of time. It provides an interface to register one's complained and follows it up. It provides a camera module which helps clicking up a picture of any problem that people are facing and upload its image along with the complaint. Global Positioning System (GPS) unit tracks the location of complaint.

Hakiri[11] develop a conceptual framework for an efficient complaints management system for bank through exploratory study. He analyzing the contents of real complaints in 4 different banks allowed us to form a database. This database allows researchers and bankers alike a better view of banking complaints and will give us the opportunity to suggest concrete recommendations on how to improve complaints management. The study allowed for generating some managerial implications and recommendations of which the first relates to listening to customer.

Tolle and Ramdani [12] design a Module E-Complaint System Based on Geo-tagging and Geo-fencing. The support system is in the form of e-complaint system installed on smart phones equipped with geo-tagging techniques to determine exactly where the complaint is made (location) and geo-fencing method to determine which territory the complaint belongs to. In this study, the researcher explained the process of designing module for geo-tagging and geo-fencing-based e-complaint system. Several experiments were conducted to find out the accuracy of these techniques. With 94% accuracy, geo-fencing was a suitable technique to apply. In addition, geo-tagging techniques using EXIF of a digital image was considered the most suitable technique for the e-complaint system rather than other geo-tagging techniques.

III. DSS FRAMEWORK AND UML ANALYSIS

In order to design and develop an appropriate prototype for Addis Ababa TVET system a framework proposed which integrates mobile and data driven DSS as presented in Figure 2. The user a complainant may use either web interface or mobile application, whereby handle by the database acquisition system analyze using multi dimensional analysis from the data warehousing. This will then help and assist decision makers to make right judgment on the complaint being made using this decision support system.
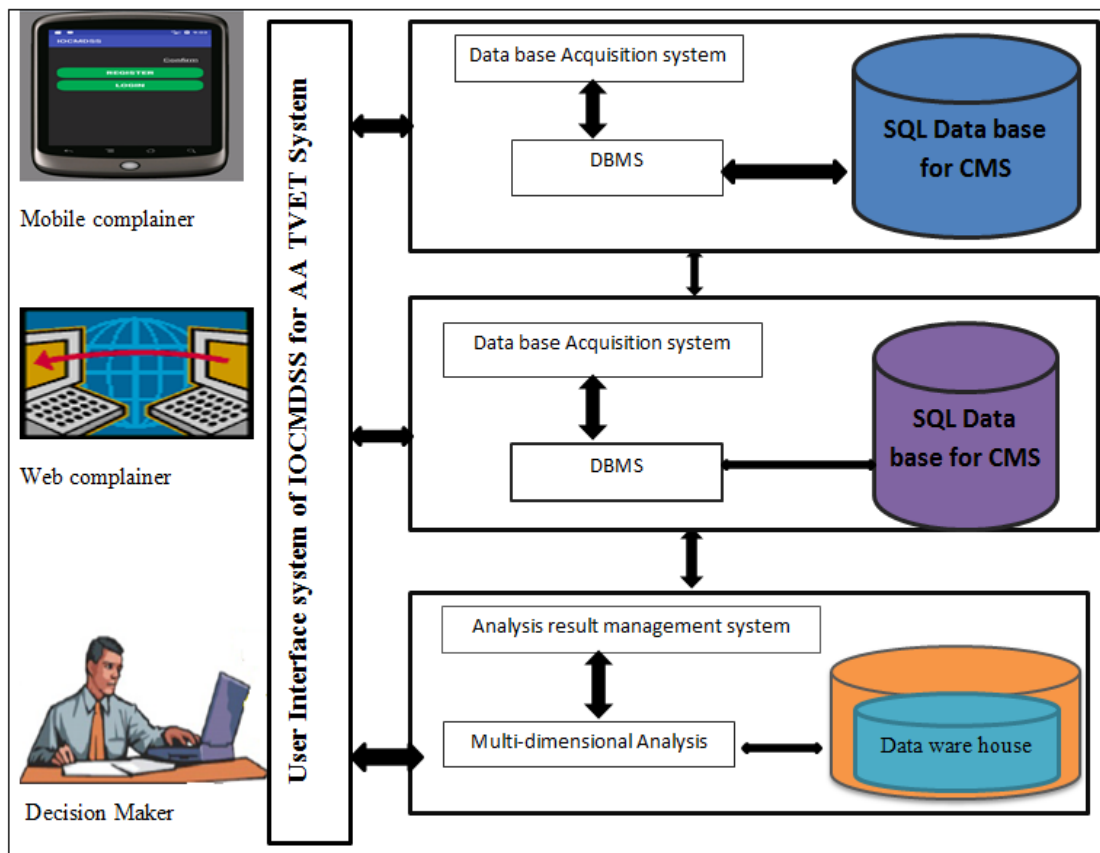

Figure 2: DSS Framework of Complaints Management System for Ethiopian TVET System

3.2 System Analysis

Since complaints management is a vital component of every decision-making framework and is especially relevant to agencies that have service-oriented roles in the public sector and also exercising good governance issues with respect to increasing customer's satisfaction. With increasing expectations from the public, TVET system bodies/agencies need to respond to complaints in an effective and timely way. The chosen case study area for our project work, an integrated online complaint management decision support system for Addis Ababa TVET system that incorporate Addis Ababa TVET bureau and Addis Ababa occupational competence assessment and certification center (OCACC) which are independent regional TVET education sector government bureau that cooperatively works and responsible for delivery of outcome based TVET education delivery and assurance of those college training completers and anyone needs to take with assessment of qualification competency respectively.

The system simplifies Managing process of complaints. The system enables users of the system to register and submit their complaint by using system website or mobile application. Once the user registered to the system, the system will send a registration confirmation notification (RID) through email and SMS. Users can follow status of their forwarded complaint online using website of the system or their mobile phone. The forwarded complaint automatically routed to the respective bodies that is in charge of handling that complain. This will reduce time needed to process and allows responsible personnel to provide a solution for complaint. The system will send confirmation message to the user called complaint-tracking number (CTN).The user checks the status of their complaints using CTN. The Addis Ababa TVET system bodies will react on the complaint respectively and then the user can get this feedback. The system generates various reports based on criteria, include: specific date or range of dates, or complaint category, which is set by the user. The system displays the summary of the forwarded complaint along with the detail information of submitted complaint. It also make some sort of data mining techniques like clustering and summarizing in finding new facts that is used as an input for decision making process for the executive bodies of TVET. To enable submission of complaint online, the system integrate the website and the mobile application of the system The software development methodology used in the study was Rapid Application Development (RAD). RAD technique allows "Rapid" application development, with development time to 30 or maximum of 90 days [15].Unified Modeling Language (UML) was utilize to analyze every function of the system in object-oriented approach which combines several modeling techniques whereby most are in diagram form and standard notations. Figure 3 shows the Use Case Diagram elaborating the different functions of the system and the interaction between different actors that manipulate the system.
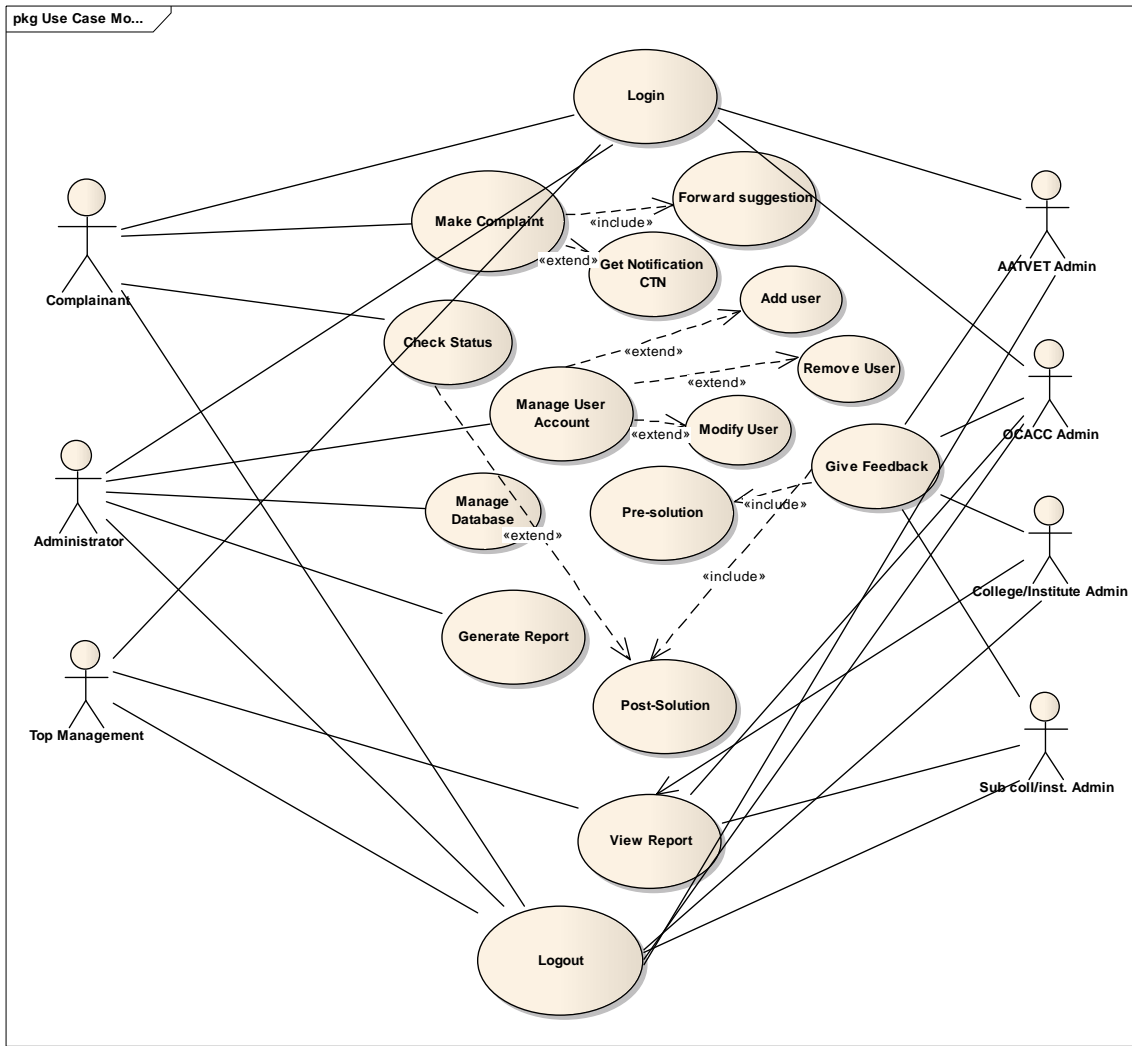
Figure 3: Use Case Diagram of a Complaints Management System for Ethiopian TVET System
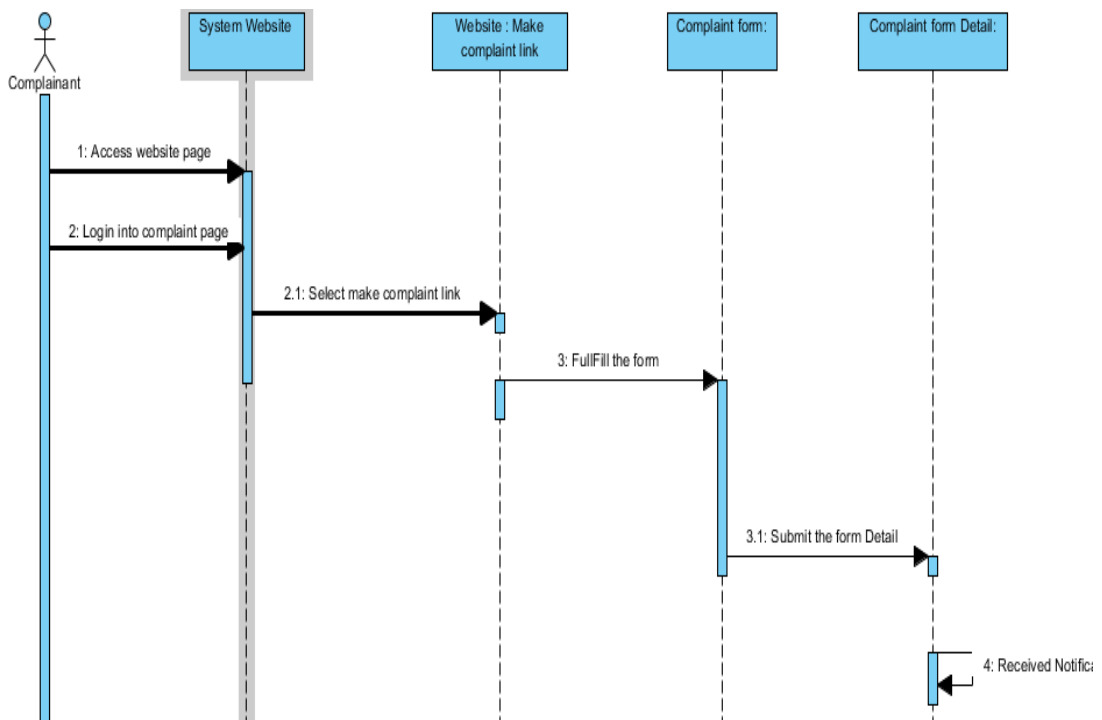

Figure 4: Sequence Diagram for Making Complaints

Figure 4 shows a sequence diagram on making complaints. Here the complainant after registered and confirm registration, can access the welcome page that he/she perform his/her activities, initiate the complaints by filling the required data in the form and submitted with confirmation. The system has three main components: the web and mobile application client, web server and Database server. User can access the system through a web and mobile application client as can be show in Figure 5. In here, the Web and mobile application client component defines users of the system which access the system using web based application through Http protocol and an integrated mobile based application. The client send request using browser software found on a client machine and/or the mobile application of the system deployed on a mobile device, then the system responses for request reaches to the system through Internet. When a request is made on a web page through the browser, PHP that is residing on the web server processes the request. It connects to the database to retrieve the requested information and sends its response back to the browser, which displays the output on another web page. When a request is made using the mobile application of the system the request sent to the system through the web service developed which is responsible to convert the mobile application that is developed using JAVA programming language to PHP programming language, which is used to access the database server. Successful request made through the mobile application will be accompanied by the message generated by the web service which will be sent as SMS to the requestor using GSM network, this indicate the web service is used as the mobile client.
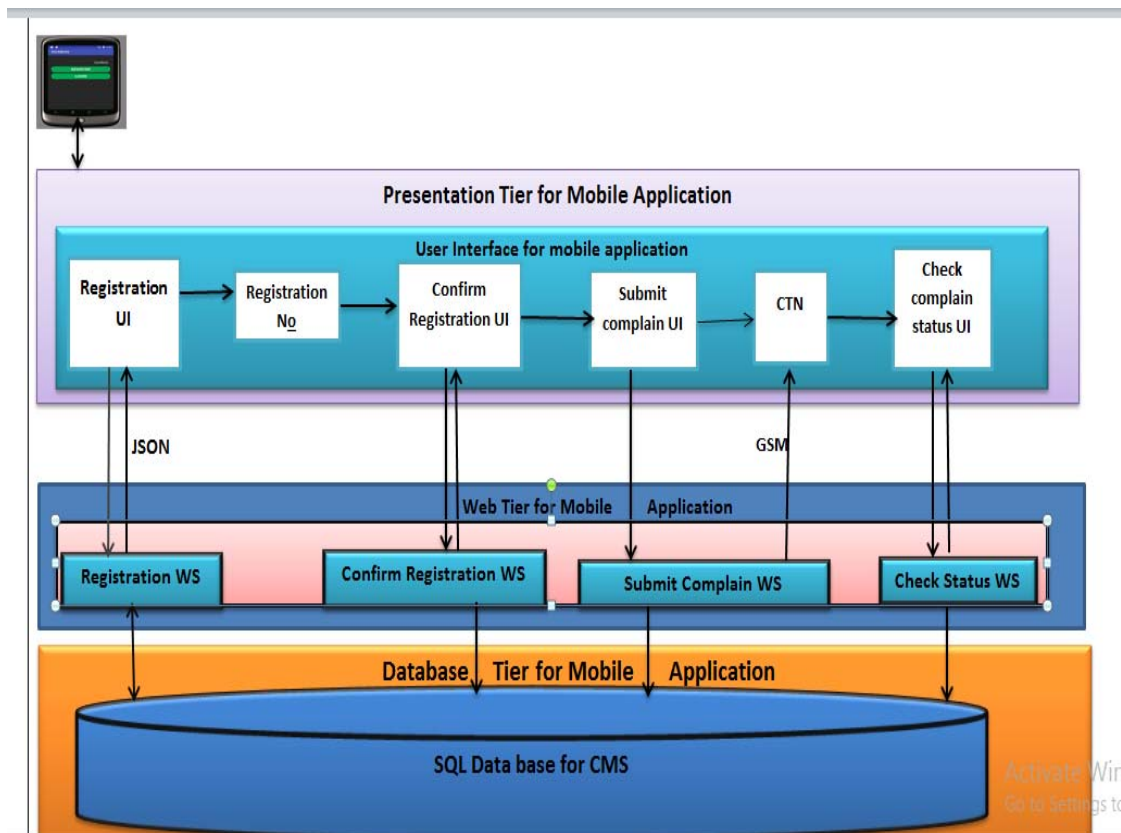

Figure 5: Three-tier System Architecture

Figure 6 shows the Class Diagram model that describes the static structure of the symbols in the new system. This model allows to graphically representing symbol diagrams containing classes. Create a class diagram that will be the building block the system will develop. Class diagrams should show the objects the system is comprised of and how they are interrelated. It shows the e nine classes that have been identified in this system which are complainant, complaint, TVET_ Service, Complaint Officer, complaint category, complaint feedback status, complainant Type, feedback and Top Management.
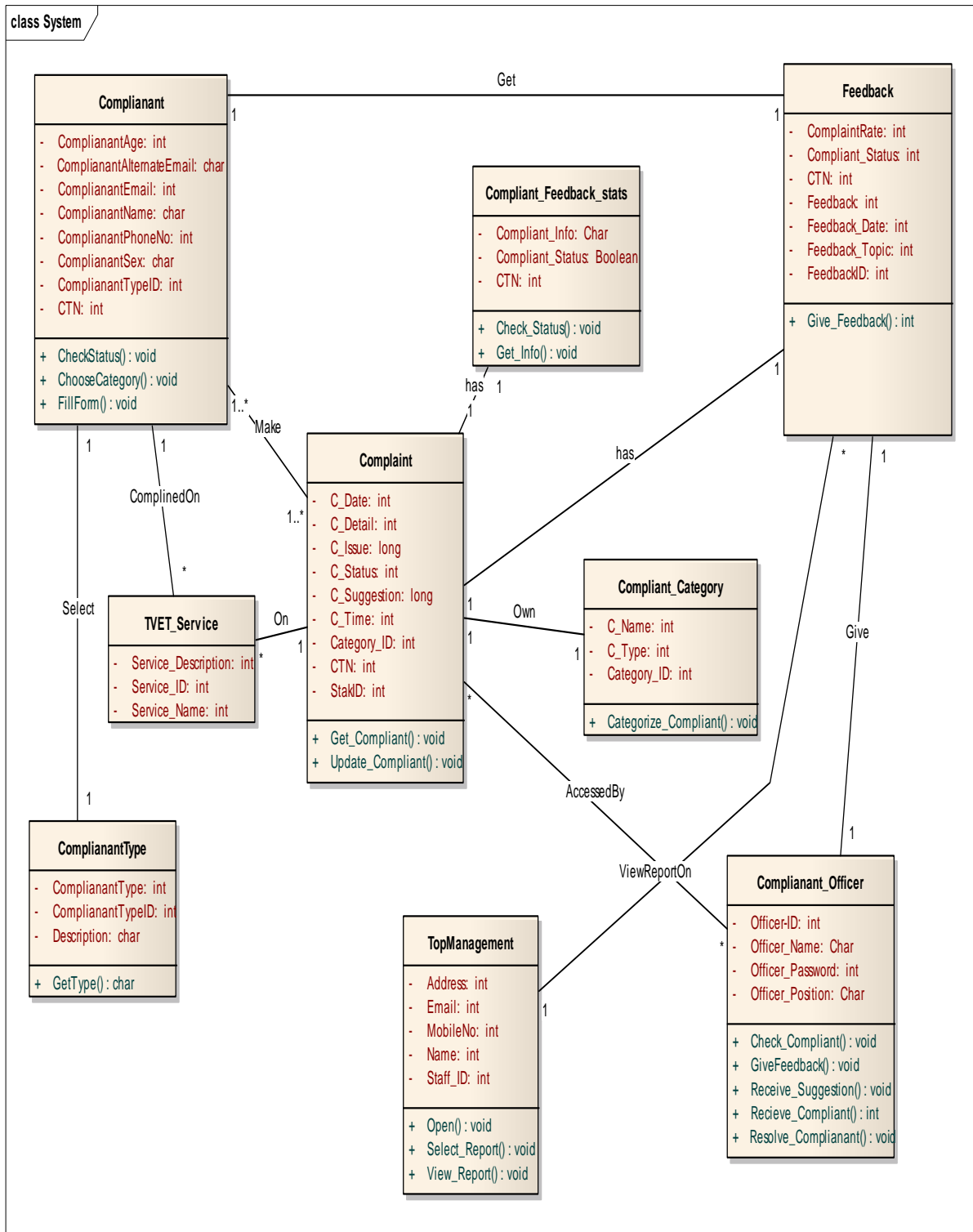
Figure 6: Class Diagram

IV. DESIGN AND TESTING

The complainant after registered and confirm registration, can access the welcome page that he/she perform his/her activities. The complainant main page (welcome page) consists of different menu and dashboards links as shown in Figure 7. It includes menus on making complaints, checking the status of the complaints, and reporting features.
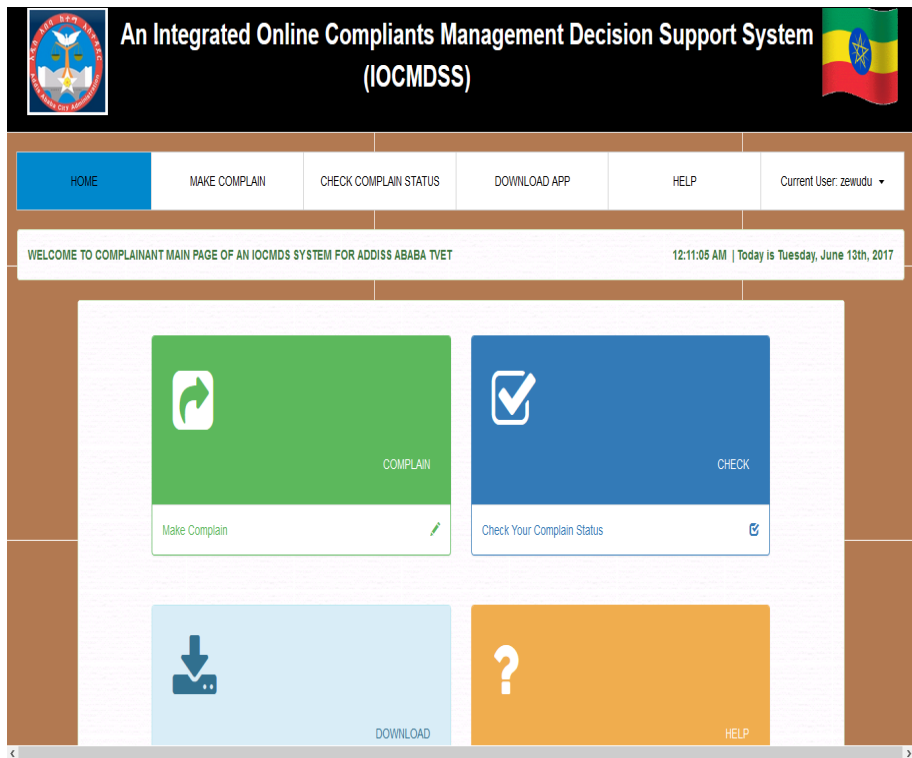
Figure 7. Complainant Main Page

Make complaint page of the complainant is the most crucial page of the IOCMDSS system, what a complainant is full fill and submit his/her complaint to the sector as reflected in Figure 8. This page has a complaint including suggestion part that has a field to be filled or chosen like (Concerned Body/Stakeholder, concerned Body Directorate, concerned Body Directorate Department, Complaint Issue, Complaint Detail, Suggestion Detail, Attach Evidence) and after completing the complainant click on the link "Submit" to forward his/her complaint to the system. The system notifies the CTN including acknowledgment through user's email and/or mobile phone and also displays a message.
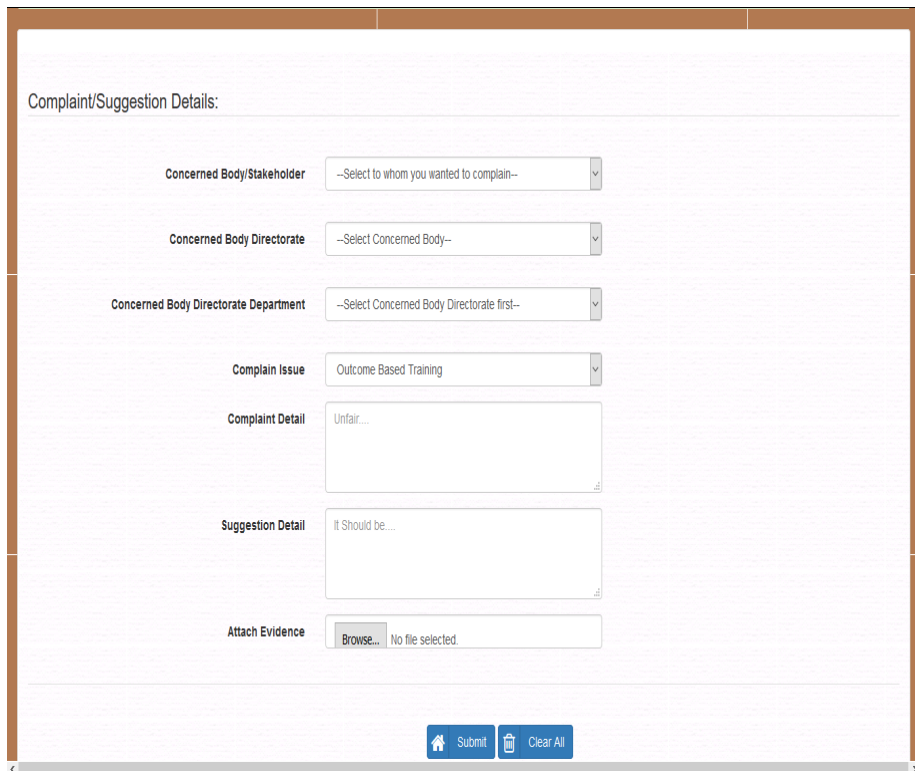
Figure 8. Making a Complaints

Check complaint status page of the complainant is a window that is displayed to the user/complainant in order to check the status of complaint, which is previously submitted to the system by a user as reflected in Figure 9. So to do so the user should login into the system from the homepage by entering his/her valid username and password and accessing the complainant main page .Then the user can click on the menu bar link "CHECK COMPLAIN STATUS" or can use the check status dashboard. After get the check complaint status page, the user is required to enter a valid Complaint tracking number (CTN) and click on the link "Check" to get the status of the complaint already submitted.
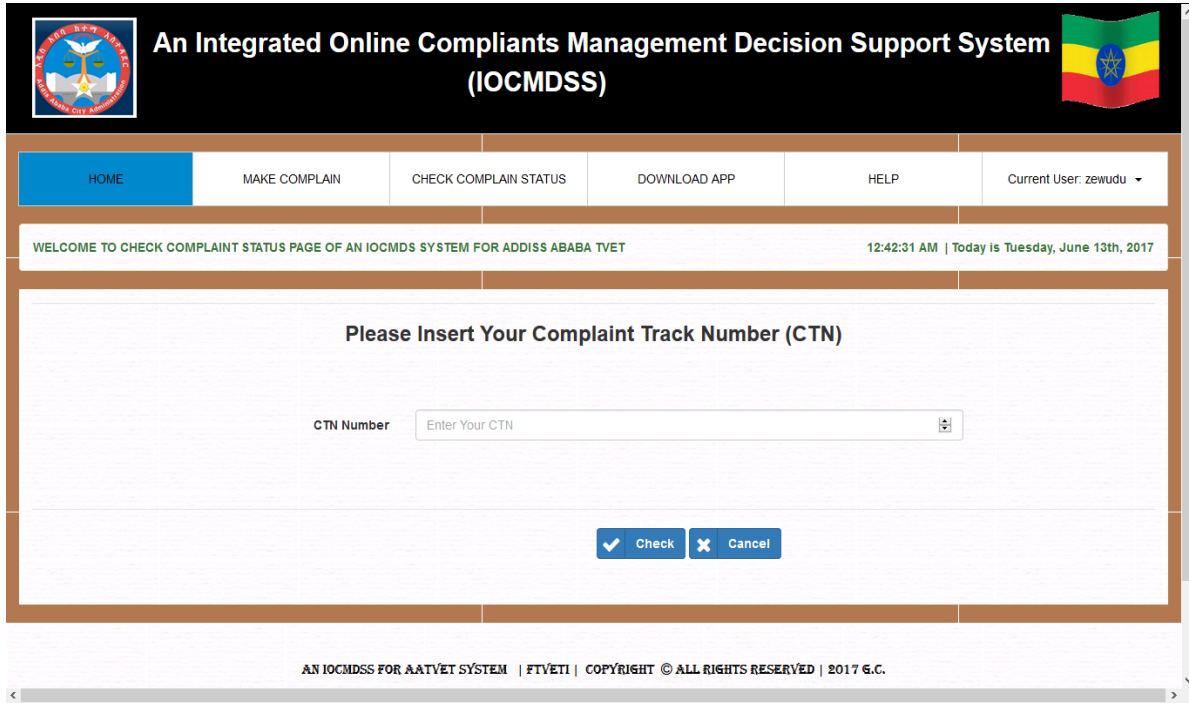
Figure 9. Checking the status of a complaints

Make complaint page of the user/complainant allows making and submitting complaint to the system. Figure 10 shows the page of the mobile application that includes field to be filled or chosen like Complaint Detail part text box that a user is write the complaint, Suggestion Detail part text box that enables to put his/her expectation or recommended solution, Attach Evidence part that allows to attach evidence for the complaint. After completing the form, the user is required to click on the link "Submit" to forward the complaint to the system. The system generates CTN and notifies SMS through mobile phone. The make complaint page of complainant is figured below.
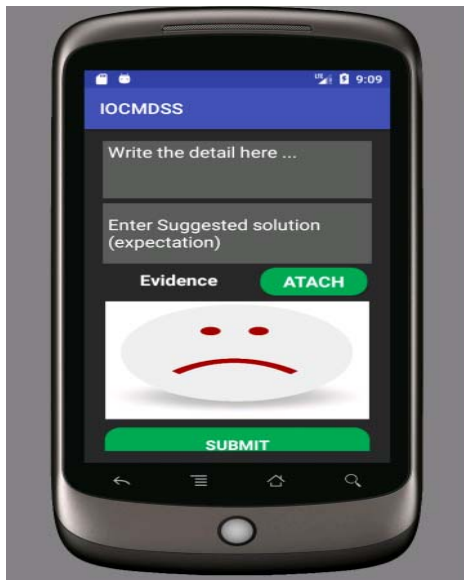

Figure 10. Mobile Application for Making a Complaints

If a complaint is handled properly by giving the associated feedback the system will be considered it as a "Feed backed" complaint or it can be feedback directly as "Invalid" if the complaint hander believe the complaint is in appropriate as reflected in Figure 11. At the same time complaints not yet feed backed titled as Urgent indicate those complaints which the complaint handler believed to be handled pretty soon but not able to because of some circumstances and those complaints to be seen in the future fail under pending categories. Finally it contains Report and Chart components that are used to display list of complaint from the database in printable formats and for displaying analyzed results from data warehouse as a decision support respectively.
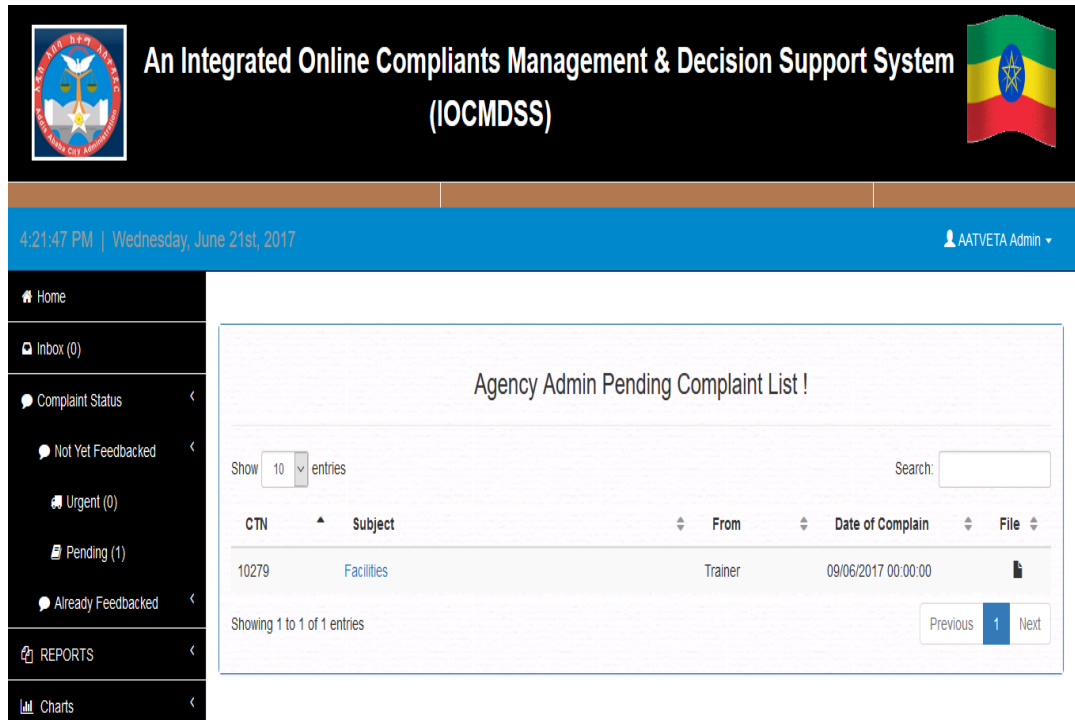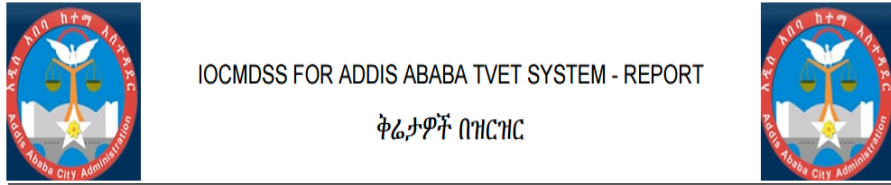

Figure 11. Checking the status of a complaints

Figure 12 shows the page that the system Admin generally can prepare a report from the persistent database by providing the criteria. It includes list of subject/complaint issue, complaint, suggestion, status, complainant rate, feedback given detail, sex, age, complaint type, date of complaint, and total number of complaint. After selecting the report time frame like beginning date and ending date by the Addis Ababa TVET system administrator the system will generates the report.

Figure 12. Report on the List of Complaints

The system generates two different types of reports from data warehouse in order to support decision making of the system sector representative. The first one is categorical reports by issues, departments, complainer type and the like, that is supported by charts for easy understand and interpretation as reflected in Figure 13. The second one is DSS provide business analytics, which uses an aggregated data cube generated from the data warehouse, which shows the total aggregated number of complaints, which can be drill down further into complainer type, departments, sex, and complainer rate as reflected in Figure 14.
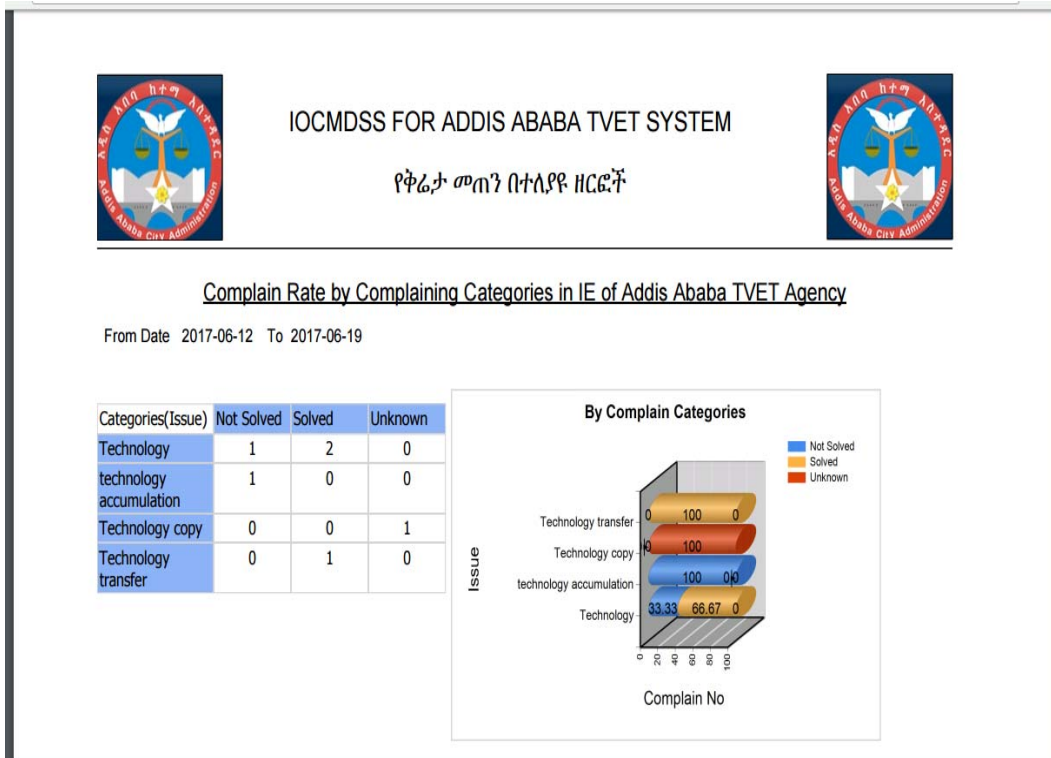

Figure 13.Sample Decision Support Report Generated from Data Warehouse by Complaint Issue

Drill Down of Poly Technic | Tegbared Poly Technic College | Finance from (d1)2017-05-01 to (d2) 2017-06-21

complainer Type	Subject (Issue)	Sex	complain Rated As	Number of Complain
⊟ Trainer				4
	⊟ Occupational Competence Assessment			2
		⊟ Male		2
			Solved	2
				2
	⊟ payroll			2
		⊟ Male		2
			Solved	2
				2

Figure 14. Analytical Reports showing the total aggregated data on complaints filed and solve for Decision Makers

A user acceptance testing was done on 30% of the sample used in requirement gathering using the evaluation tool found as shown in Table 1. The quantitative analysis of the questionnaire indicates that the system is acceptable in terms of functionality, reliability, efficiency and maintainability while usability doubted because of not incorporating languages other than English.

Table 1: User Acceptance Testing Result

Tested Options	Average Mean	Result
Functionality	4.23	Acceptable
Reliability	4.05	Acceptable
Usability	3.05	Somewhat Acceptable
Efficiency	4.57	Acceptable
Maintainability	4.46	Acceptable
Portability	4.44	Acceptable

V. CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

Being able to reach large groups of people and collecting complaints from them, then giving a solution for the collected complaints is not an easy task. The problem becomes worst when collection and processing of complaints is done manually. Addis Ababa TVET System currently uses manual data collection and processing to handle complaints. As seen in different parts of world, the use of ICT in government system improves services provided for citizens. To alleviate the problems observed in the current complaint management of the Addis Ababa TVET System, a web based application that runs on the users' computer (desktop and laptop) and Mobile based Application that runs on an android mobile phone of complaint management system is developed.

In this study, we first understand the current system to get necessary information to have a clear view of the existing system. This is done using observation, interview and revision of documents that the Addis Ababa TVET currently uses to handle complaint. We interviewed workers of the TVET Bureau and OCACC Bureau. Clear view of the current system is obtained from gathered data. Based on requirements gathered, analysis and design documents are prepared. Then we used appropriate tools to implement the system. The system shall ensure the TVET system users to register submit and follow their complaint status using the system website and the mobile based application. This enables to collect complaints from large group of people from anywhere and anytime. Moreover, the system reduces the time needed to collect and process complaints. Enables users to check their submitted complaint and get feedback on it online using the web or mobile phone application. This system facilitates the decision making process of the TVET sector bodies and also can enhance the TVET Bureau, OCACC Bureau, TVET colleges, TVET institutes, TVET polytechnics colleges and other supportive bodies. it also try to minimize the government current hot issues in different public office, good governance challenges.

5.2 RECOMMENDATION

Some of the possible future works that can be added to the system to enhance the performance of the system and make it more useful and be somewhat complete and as well be capable of supporting the different functionalities needed related to an integrated online complaint management system for Addis Ababa TVET System. By incorporating different language processing techniques to the system to enable users to register submit and check status of their complaint, which is currently designed to only one specific language, English. With the increasing, wider acceptance and usage of smart phones worldwide, it is expected that the number of smart phone users in the country will increase. So to accommodate large number of system users simultaneously, enhancing the full functionality and adding some recent technologies on the mobile application, which can be installed on android smart phones, will further modified in the future. Finally it is highly recommended to integrate a Model driven DSS method that could add more intelligence to this business or another one, hoping this project could be used as a starting point.

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