AN E-MANAGEMENT SYSTEM FOR NIGERIAN CIVIL AVIATION AUTHORITY: A REVIEW

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Abstract

E-management system for Nigerian Civil Aviation Authority is a thesis designed to enable electronic information system that will aid Nigerian Civil Aviation Authority and flight customers to obtain firsthand information on flight schedule, turn-around maintenance and customers comments on their experience why flying with the airline. This paper aim at design a system that can automatically generate a SMS alert to management when an airline is due for routine maintenance check.

Introduction

The Nigerian Civil Aviation Authority (NCAA) is the regulatory body of the Nigerian aviation industry. Initially, the Civil Aviation Department (CAD) of the Federal Ministry of Aviation was responsible for the management and maintenance of Nigerian Airports and other navigational facilities [1]. However, when the Nigerian Airports Authority (NAA) was created, CAD ceased to exist. The Nigerian Airports Authority commenced operations in 1978.

In line with the recommendations of the National Policy on Civil Aviation in 1989, the Federal Civil Aviation Authority (FCAA) was established by Decree 8 of 1990 to take over the regulatory functions and provide air traffic and aeronautical telecommunication services. In August 1995, a re–organization of some government establishments within the industry led to the scrapping of the Directorate of Safety Regulation and Monitoring (DSRAM) and the Directorate of Economic Regulation and Monitoring (DERAM) in the Federal Ministry of Aviation, which were respectively charged with the safety and economic regulatory functions of the defunct FCAA.

The Air Traffic Services (ATS) and the Aeronautical Telecommunications (AEROTELS) arms of the erstwhile Authority were thereafter merged with the Nigerian Airports Authority (NAA) to form the Federal Airports Authority of Nigeria (FAAN).

Meanwhile, the International Civil Aviation Authority had prescribed to its member-states, the establishment of Civil Aviation Authorities (CAA) that should be given the mandate to ensure compliance with air navigation regulations and laws, which are generally referred to as Standards and Recommended Practices (SARPs). The SARPs are also specified in the convention on International Civil Aviation, to which all member – states are signatories.

Therefore, in pursuit of this international structure, the functions earlier performed by DSRAM and DERAM were later re-assigned to the Nigerian Civil Aviation Authority (NCAA), which was created for that purpose.

The Nigerian Civil Aviation Authority was established by Act No. 49 of 26th May, 1999. It effectively commenced operation in January 2000. The mission of the Authority is; to provide aviation safety and economic regulatory services in the most efficient, effective, quality and technology – driven manner, to the satisfaction and benefit of all stakeholders, consistent with the highest international standards and the sustainable development of the industry and national economy NCAA, 2009). This was predicted, based on the belief that aviation should readily enhance economic and social development.

Safety Management Systems (SMS) in Aviation

Safety management is defined by International Civil Aviation Organization (ICAO) as a management process, with responsibility at two levels: the state level and the level of the individual service providers. States are responsible to establish a safety program, which is an integrated set of regulations and activities aimed at enhancing safety. According to ICAO [2]. it is noted that as part of such program, individual service providers such as aircraft operators, airport operators and air traffic providers are required to implement SMS acceptable to the state that as a minimum satisfy the followings:

- Identifies safety hazards
- Ensures the implementation of action necessary to maintain agreed safety performance
- Aims at a continuous improvement of the overall performance of the SMS
- Provides for continuous monitoring and regular assessment of the safety performance

A framework for representing the minimum requirement for the implementation and maintenance of SMS by an organization is provided by ICAO, which includes the four major

components and twelve elements shown in Fig. 1. These four major components of an SMS are generally accepted as a means of compliance to satisfy SMS requirements.

SMS for Maintenance Repair Organization (MRO) although new; is now required for all airline operators to plan towards its implementation as required by the Nigerian Civil Aviation Authority (2009). Within the context of Approved Maintenance Organization (AMO), an airline management needs to understand the complexities associated with its aircraft maintenance operational environment, develop a safety programme, as well as implement and monitor systems within the maintenance outfit that will ensure compliance with safety standards.
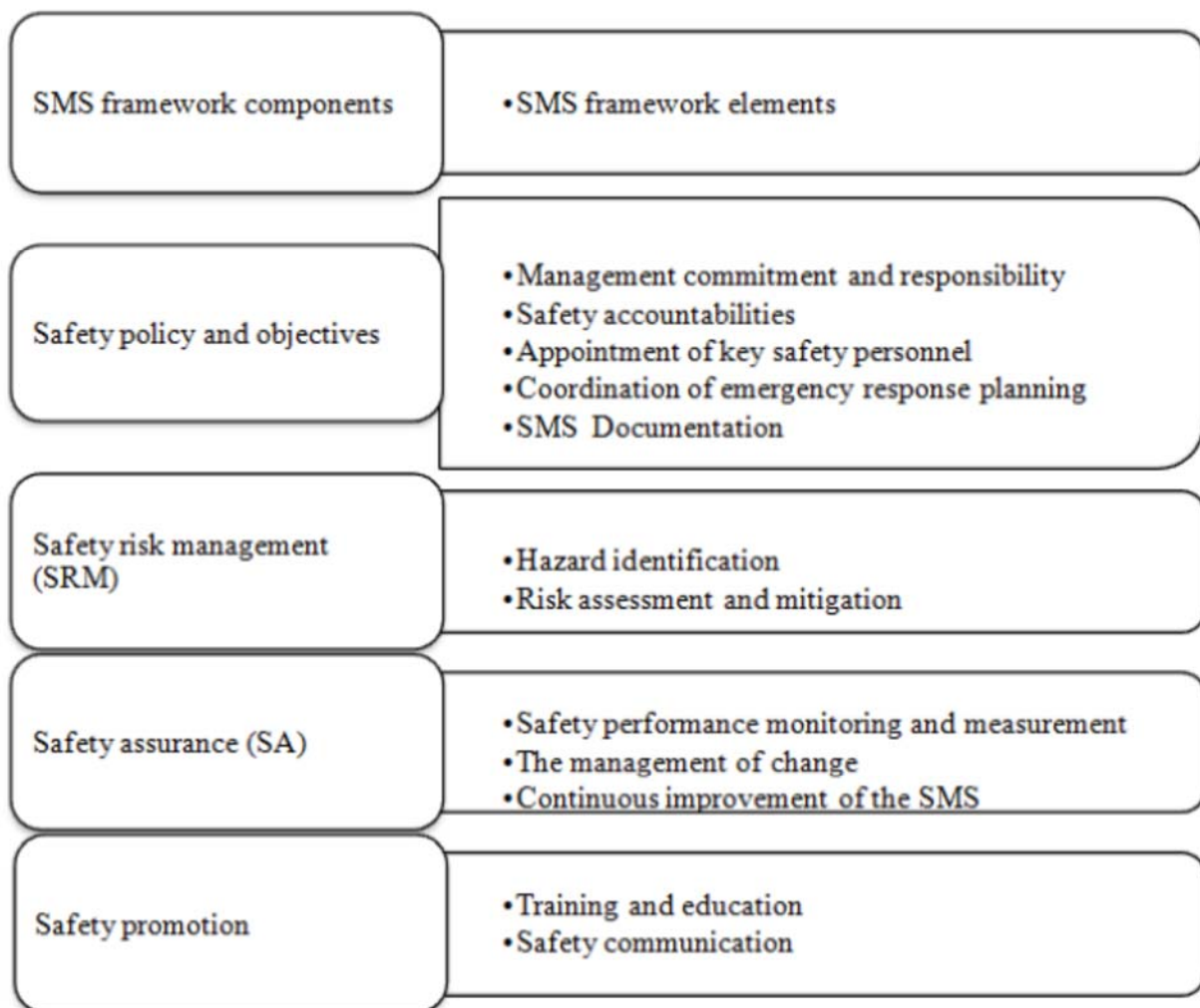
SMS framework components	• SMS framework elements
Safety policy and objectives	• Management commitment and responsibility • Safety accountabilities • Appointment of key safety personnel • Coordination of emergency response planning • SMS Documentation
Safety risk management (SRM)	• Hazard identification • Risk assessment and mitigation
Safety assurance (SA)	• Safety performance monitoring and measurement • The management of change • Continuous improvement of the SMS
Safety promotion	• Training and education • Safety communication

Fig. 1: ICAO SMS Framework Components and Elements [2]

The Internet of things (IoT) Revolution of Technology

The Internet of things (IoT) is the between systems administration of physical gadgets, vehicles, structures, and different things installed with hardware, programming, sensors, actuators, and system availability which empower these items to gather and exchange data [3]. The IoT enables items to be detected or controlled remotely across existing system infrastructure creating open doors for more straightforward of the physical world into computer-based systems and resulting in improved efficiency, accuracy and economic benefit in addition to reduced human intervention. Only IoT can connect physical world to the web.
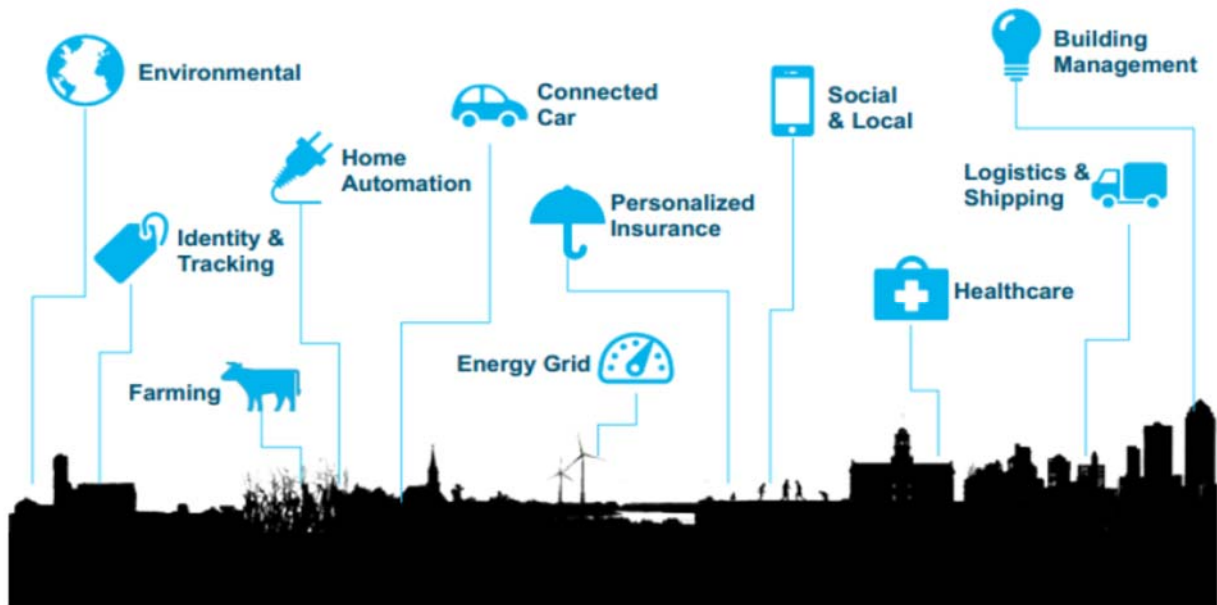
Fig. 2: IoT Connecting the Physical World to the Web [3].

The IoT is more than internet connected consumer gadgets. Sooner or later every IT organization will need to create a framework to support it. Energy companies already use networked sensors to measure vibrations in turbines. They feed that data through the network to computing systems that analyze it to predict when machines will need maintenance and when they will fail. Jet engine manufacturers embed sensors that measure temperature, pressure, and other conditions to improve their products. Even a gift basket business can deploy sensors to constantly monitor the temperature of perishable products [3].

E-Registration

E-registration is a system that could easily manage its body while also providing added bonuses, with a main goal being to ease the transfer of information. The management system requires a tremendous amount of data and documentation, and this e-registration solution allows institutions to focus less on processing paperwork and more on what matters most -meeting the information needs of their clients by having a cost-efficient, secure registration process that allows for easy access to files. Intranets and portals are supposed to provide an infrastructure through which end-users can gain effective access to information sources needed to assist in daily tasks such as effective decision making, planning and research [4]. Scope of e-registration include programmes which will contain a detailed information of the aviation industry since first date of enrolment and up to date including all flight information and procedures required, and particularly the registration and following -up schedules as well as checking up the absence among others [5]. [6] Gives the key principles that should govern a portal rollout. The first is simplicity: This means that users want a simple and clear web environment. The second principle is dependability: in his view, the site and its contents should be available always and should be predictable. The third is quantifiable value: users should feel self-sufficient and realize added value from using the portal. Another principle is personalization: the portal should be in a way that users can be able to change the site to their personal preferences. Lastly, systematic management: long term success requires a systematic approach and long term commitment.

[7] Argued that apart from the supply and configuration of hardware, there are other considerations as far as the system design and operation were concerned were as follows: First, the system had to be robust and self-validating, to reduce errors to the barest minimum. The system should also be flexible as far as the mode of registration of candidates (availability of offline or online options) is concerned.

Thirdly, it should have an assurance of the security of the network, application, database and payment system. Fourthly, the system should have seamless integration of the infrastructure with the existing resources. Another consideration is that the system should have scalability and adaptability of the architecture to ensure that it would be capable of handling future increases in volume of data and procedural changes. The system should also be user-friendly, easy to follow instructions worded in simple, precise language with help line support, eliminating the need for

candidates to visit Offices to resolve any difficulties related to e-registration. Besides, the system should also have un-interruptible power supply since the service would be available all the days all the time. Another consideration is that the management should development the Human Resources in order to ensure a hitch-free migration to a paperless system of registration. They should ensure that the technical Staff is well trained as system/network administrators. They would also have to be equipped to handle first level troubleshooting. Besides, the Wide publicity of the systems change would be required. This will be achieved by producing Training manuals for operators of the system.

There are very few researches that have been done so far concerning e-registration. These include; [5] who did a research on Students' Perceptions of E-Registration at Ladoke Akintola University of Technology. The research was aimed at highlighting acceptance and use of both major and minor features of the e-registration portal of Ladoke Akintola University of Technology, which empowers users to apply for enrolment, register for courses, search for information, meet requirements and other news as well as access other e-resources after signing in/logging in. The paper revealed that the Lautech portal was used mostly for course registration by the students who had a high perception of use of e-registration in comparison with manual registration. A research by [8] on the Social Factors Affect Students' Use of Online Registration established that the major social factors influencing students' use of online registration include: students' majors and classes, academic emphasis and family income. However, the study did not find significant gender impact on using the online service.

[9] In a study titled, availability, accessibility and use of ICT in management of students' academic affairs in Makerere University found that this emerged because of the problem of mismanagement of students' academic records despite the technological advancement that had advanced in the University. The findings of his research indicated that internet facilities, computers, management information systems, electronic databases all were available and accessible to administrators, lecturers and students though with restricted access for viewing results, record keeping, setting and marking exams. ICT for registration was used for tracking students' registration progress by administrators and academic progressing.

[7] focused on establishing the process change resulting from the deployment of Information Technology (IT), the challenges posed to Council by the shift to e-registration of candidates, the benefits of the process transformation and possible expansion of the scope of IT application to Council's operations in future; realized that the Council continued to reap the benefits of e-registration while continuing to seek innovative ways of applying modern tools such as IT, to enhance the efficiency of its operations.

The paper identified the following benefits with e-registration: first, it enables candidates to register from any location without visiting the examination offices, it enhances the efficiency of data capture and shortens processing time as manual checking of entries and scanning of OMR entry forms are dispensed with, it minimizes errors because it is self-validating in design and most of the data required are selected from a drop down menu. Fourthly, it allows longer periods of registration. Fifthly, it eliminates the cumbersome tasks of manual processing and physical transfer of entry data on tapes, it minimizes problems of storage space since entry forms, entry schedules, CASS schedules and OMR entry forms are no longer required. Besides, e-registration also dispenses with the problems of printing entry documents annually and disposing of unsold ones. Facilitation of the capture of continuous assessment scores of school candidates is also another important benefit of e-registration. As noted therefore, there are very few researches that have been done in this area; and even these few have not directly focused their attention on the e-registration of examination.

The shift to e-registration of students has been faced with a number of teething problems. The shift to e-registration was challenging not only to students but also to the IT Service Providers. The challenges were two-fold, the main one being adequate maintenance of the IT infrastructure in order to minimize down times. The second challenge was ensuring the success of the 100% migration to e-registration, given the concerns raised that the low level of computer literacy in the Country did not augur well for such an initiative [7].

Materials Required

For effective implementation of this paper the Nigerian Civil Aviation Authority staff was interviewed to gather some materials from their personal experiences on areas of information management. This helps to provide the useful materials on airline maintenance monitoring procedures and existing security mechanism in use.

Also some web application languages were used to design the new system. These includes; Hypertext Markup Language (HTML), Hypertext Preprocessor (PHP), MySQL, Cascaded Style Sheet (CSS), Java Script, Dream weaver, and Fireworks. Dream weaver is an HTML-based application that is used to generate graphical user interfaces. The scripting language behind the development of the new system is PHP and JavaScript. JavaScript is used to add functionality beyond standard HTML to a web page. It adds interactivity to web site. MySQL is used together with PHP in website development and is open source software. These are the materials needed to actualize the paper objectives.

Analysis of the System

Nigerian Airlines currently operates in excess of 20 aircraft and flies over 50 scheduled flights a day to over 30 destinations. Maintenance planning is a complex, decision-intensive task that is managed at the Maintenance Operations Center (MOC), and monitored by Nigerian Civil Aviation Authority. The employees are responsible for planning all maintenance on aircraft owned or leased by Nigerian Airlines. The aircraft routing might change as a direct result of weather, crew constraints, unanticipated maintenance, air traffic control restrictions, or other events. Making certain that all aircraft receive their maintenance on time in such a dynamic environment is a difficult and time-consuming task.

The process of routing aircraft for maintenance has evolved over the years but until recently was still a manual process or partially automated (use of Microsoft word or excel sheet for documentation), involving many large paper documents.
The Maintenance Operations Center comprises several different organizations, numerous telephones, speakers, paper documents, and people, all performing their part of a global task to safely route aircraft for maintenance requirements.

The flight operations system (FOS) is a near real-time transaction-processing system that contains all information pertinent to the daily airline operation. FOS is used to control, communicate, and track the execution of the daily plan. This system maintains information such as flight schedules, maintenance information, and aircraft assignments and all these information are documented either manually of the use of Microsoft excel sheet will be applied. Hard-copy documents were heavily relied on to perform the tracking and planning functions performed by the maintenance operation controllers. The paper documents are replicas of the information that

could be retrieved through transactions from the FOS system. The thesis documents are described in the following subsections.

Station Sheets: The station sheets are large double-sided documents that represent the current aircraft routings by fleet type for all flights flown in a single day. The desk maintains two sets of sheets, one for the current day and one for the next day. The station sheets are organized by stations-cities, showing inbound flight number, date and time, aircraft assigned, a maintenance indicator if the aircraft is on a routing, next sequence of flights to fly, outbound flight number, date, and departure time.

The controllers use these sheets to monitor the status of all aircraft and flights flown throughout the day. Special indicators show which aircraft are currently on maintenance-planned routings. All changes or events that occur during the day must manually be updated on the station sheets. It is common to change over 30 percent of the information on these sheets each day.

MPRR: The maintenance planned routing record (MPRR) is used to indicate the planned routing for all the aircraft that are currently planned for maintenance within the next seven days. The controllers would manually find valid routings when planning an aircraft for maintenance. Once a valid route was found, it would be written on this routing record. Changes affecting the routing would necessitate manually rerouting the aircraft for maintenance as well as manually erasing the old routings and writing the new routing on the sheets of the maintenance planned routing record.

Daily Record: The daily record is used by the controllers as a snapshot of the current planned maintenance events. This sheet shows the terminating station-city for this night by aircraft and whether the aircraft is currently on a planned maintenance routing. Changes to an aircraft routing were also manually maintained by the controllers.

Algorithm

Figure 3, 4, and 5 shows the program algorithm represented in flowchart form. Figure 6 shows the login flowchart which contains options for login as user of as an admin. Once admin option was selected, the admin login form will be linked connection B otherwise user login form using connection A.
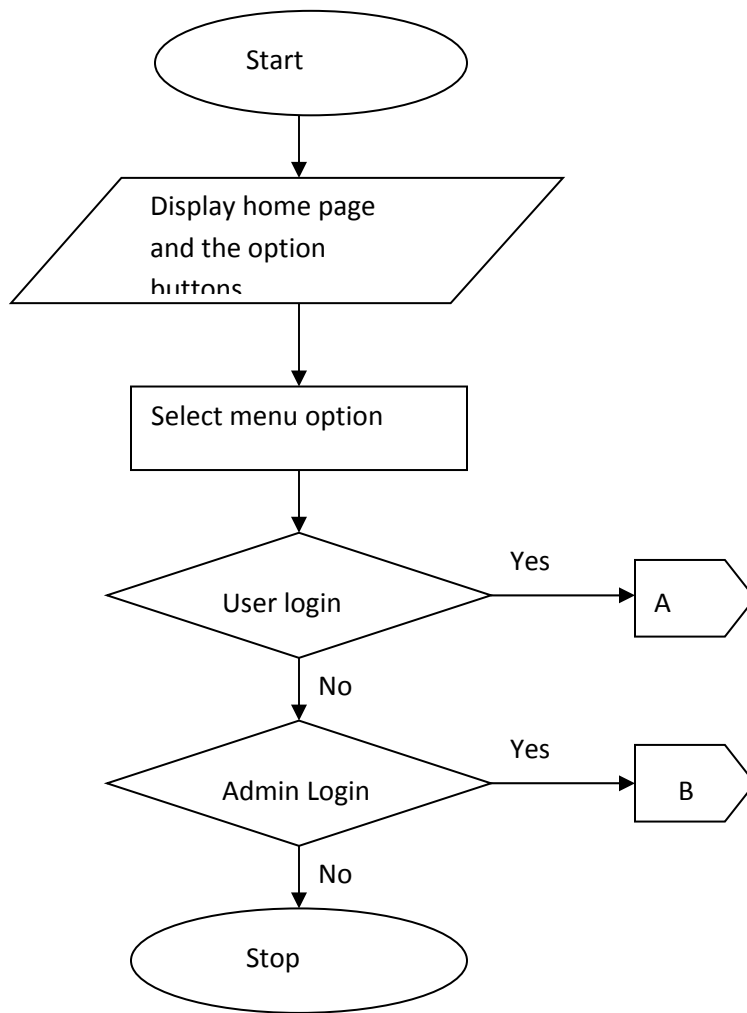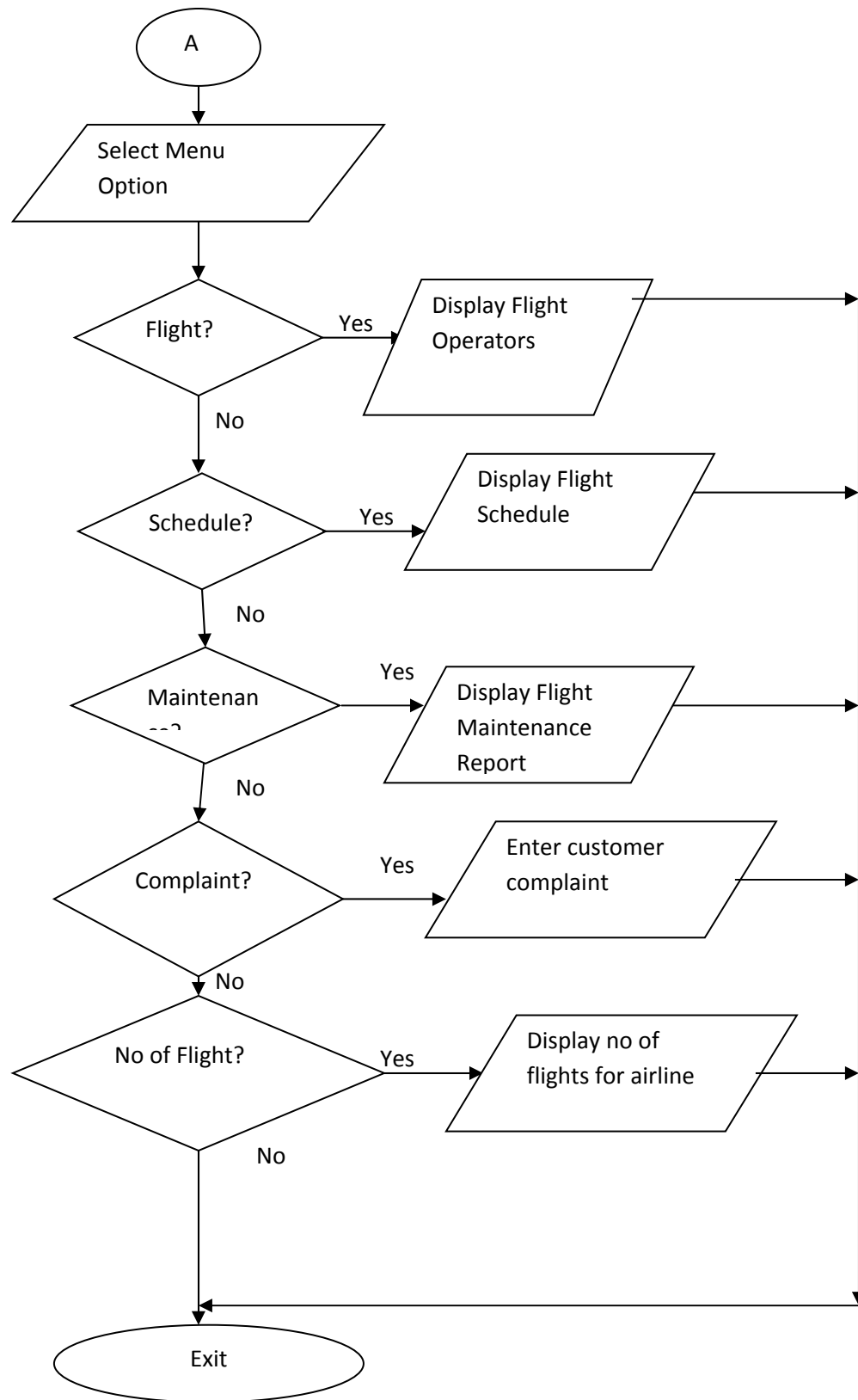
Fig 3: Login Algorithm

Fig 4: Customers Module Flowchart

Figure 5 show the menu options on the customers module in the system developed. On login, the customer choose from the options which of the module to call up.
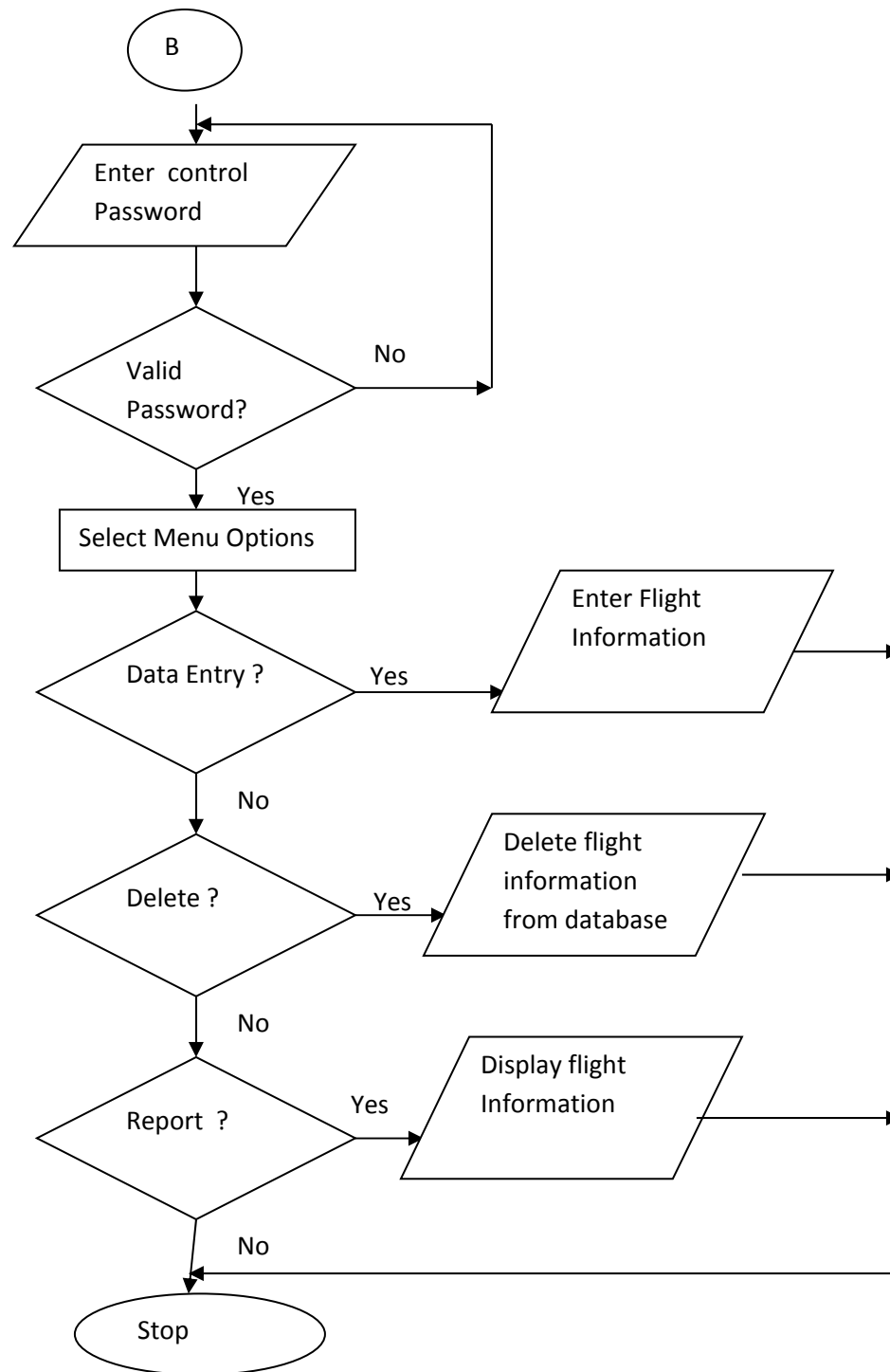

Fig 5: Admin Module Flowchart
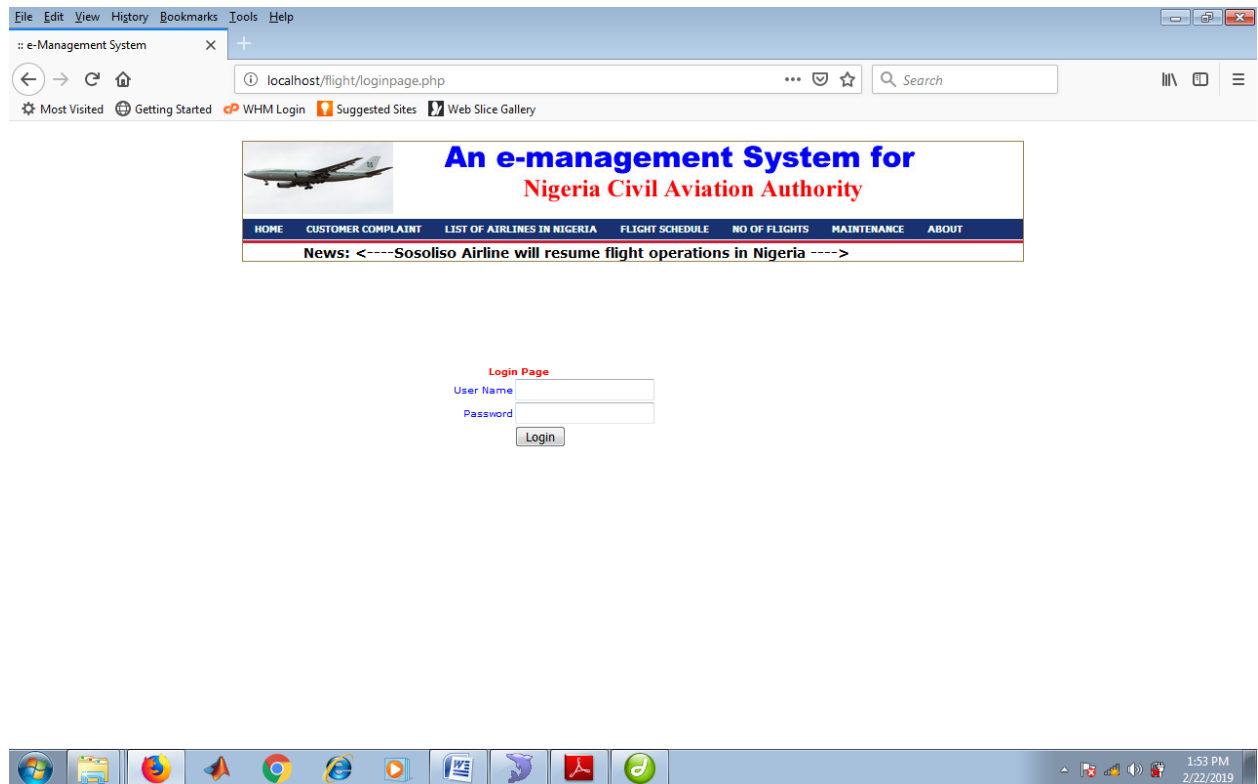
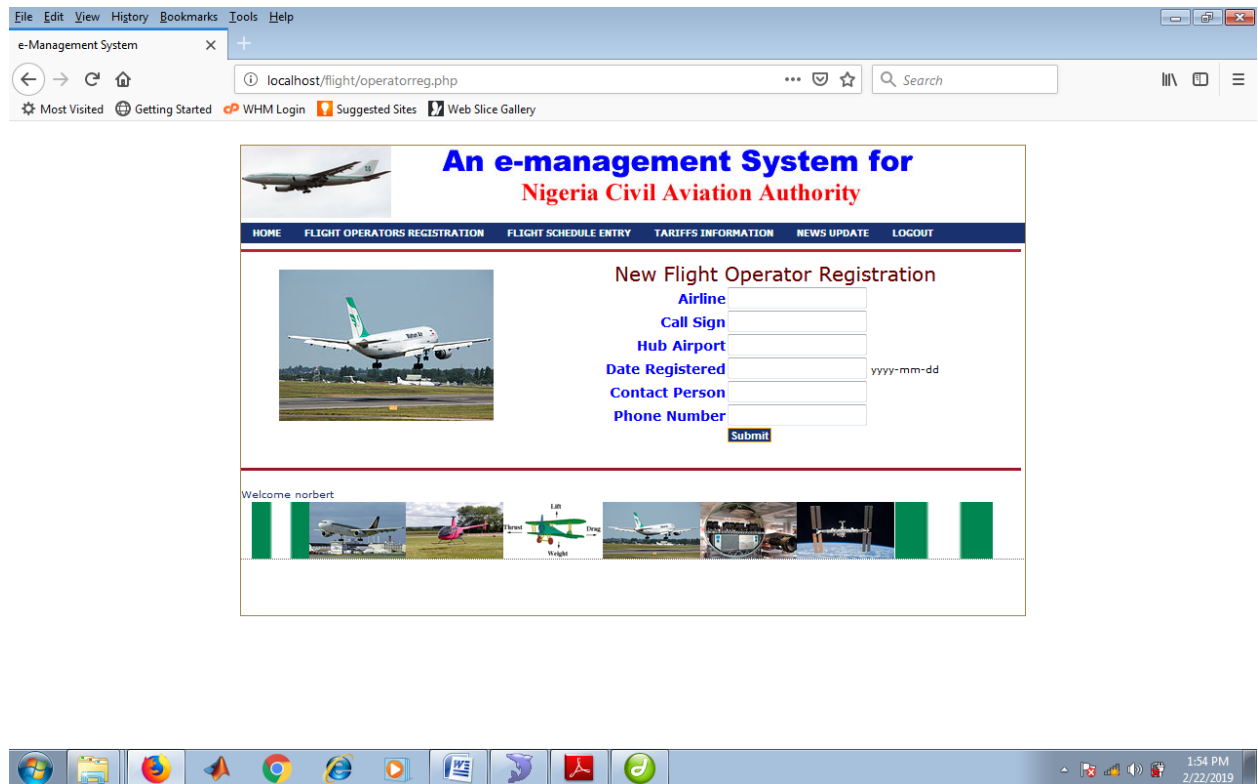## Output Display of E-management system

Fig 6. Login Form

Fig 7. Flight Operator Registration Form

Fig 8. Flight Scheduling Form

Summary

E-management system designed in this project work will assist aviation industries and passengers to have a quicker access to flight information. The new system has provision for customer complaint. The complaint module is designed to enable customers post any of their complaint against flight operators or services online. The complaint posted is accessible to all website visitors. Also, in the new system, the airline module is designed to display flight operators online. This contains their name, call sign, hub airport, as well as display flight schedule online. This allows users to select the airline and the system will display their flight schedule. The admin uses the admin module to create airline information, flight information, flight scheduling, news update, flight maintenance scheduling, and maintain the database. This module can also enable administrator to view database reports. The integration of the whole system into one platform for an effective flight customer information management system is achieved using a robust database – MySQL and a server scripting language PHP.

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