Framework for Developing and Implementing an Automated Hospital Management System on an Intranet

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ABSTRACT

This paper examines the framework for developing and implementing an automated hospital management system (AHMS) on an Intranet. After reviewing the various existing systems of records management in hospitals today which leads to misplacement of drugs details, late release of reports and insecurity of records and other electronic health care versions. This framework handles the information flow process between a waiting patient and the doctor in-charge. Unified Modeling Language (UML), System Context Diagram (Level 0 DFD), Level 1 & 2 Data flow diagram were used in modeling the system.

Keywords: Intranet, Implementation, Automated Hospital Management System.

INTRODUCTION

Generally, Automation plays an important role in the global economy and in daily experience. Engineers strive to combine automated devices with mathematical and organizational tools to create complex systems for a rapidly expanding range of applications. An Automated Hospital Management System (AHMS) is a system that is used to manage patient information and its administration. It is meant to provide management and staff, with information in real-time to make their work more interesting and less stressing. The scope of the services in hospitals is basically curative and preventive and is offered in clinic unit, and x-ray in the hospital. Other services include admission (ward) in-patient (where drugs are issued), and family planning. The hospital offers 24 hours services to its staff and the entire public. The records of patients in hospitals have over time been run down due to large numbers of patients; this led to poor record keeping since it is a paper based system. The manual processing has led to a variety of problems which includes; unnecessary duplication of the data especially for in-patients and out-patients, inconsistency of data may occur since records are kept in more than one location, which makes it hard to analyze the data collected, hence difficult to trace the flow of patient past medication data.

According to Jantz (2001) the emergence of computer based information system has changed the world a great deal, both large and small system have adopted the new methodology by the use of personal computers; to fulfill several roles in the production of information therefore computerizing the documentation of patient record to enable easy manipulation of the input process and output will bring us to this existing new world of information system. Patients records and disease pattern documentation is concerned with documentation of information obtained from patients and their particular health system in order to function properly. If this information is not documented perfectly, it may cause some data to get lost, and hence, the health system will not be efficient. According to Tang (2001) in examining the document system that is in existence in hospitals that is mostly manual, much importance has been placed on creating a system that document the in-patient record using a computerized database system with a secure procedure for accessing it. Patient information past and present is extremely vital in the provision of patient’s care which guides the physician in the making of right decision about their diagnosis. The rapid growth of information technology made it easy to choose the health care
industry to borrow a page from the air industry for the sake of patient’s safety. Pilots have instant access to the data they need in weather condition and mechanical function to make information decision about navigation and delay.

The specific objective of this study is to provide a standard format on how information are represented and to eliminate the high error rate generated with manual way of processing data.

The absence of a well established information system to serve patient and staff has led to inconveniences in the hospital system; this has tantamount to the loss of patient and staff records. This is basically because of the weaknesses of the manual way of processing patients records which includes over reliance on paper based work. Paper files consume a lot of the office space, slow recording, processing and retrieval of patient details. Accessing and sharing of information by different departments/units is difficult due to poor information management.

LITERATURE REVIEW

Hospitals are the main healthcare providers in developing countries (Clifford, Blaya et al. 2008). For this reason hospitals ought to be the primary target institutions when aiming to improve health information systems in developing countries. However, electronic information systems in hospitals in developing countries are “rare to nonexistent” (Rotich, Hannan et al. 2003). In an environment where the awareness and appreciation of electronic hospital information systems (HIS) does not exist, implementing an HIS would be a serious challenge (Idowu, Cornford et al. 2008). Against all odds, if a hospital in a developing country did decide to transform its information system and implement an HIS, there would be surprisingly sparse literature on useful experiences to guide that hospital through the transformation. This is because literature on “implementation” of hospital information systems is extremely limited (Ovretveit, Scott et al. 2007), and whatever literature is available is predominantly from developed countries where the circumstances, systems, processes, and cultures are different from that of developing countries.

Health care delivery is in the midst of a revolution that is expected to continue through the nineties and to result in major changes in the way the industry is structured before the next century (Brown & McCool, 1990; Eastaugh, 1992b; Standard & Poor’s, 1991). The crux of the problem is driving the need for change is inadequate access to health care despite uncontrollable costs. Shortell, Morrison, and Robbins (1985) suggested that a combination of factors – including the change to a prospective payment system, increased competition, rapid technological change, and new consumer expectations would generate an increasingly challenging environment for hospitals. The health care environment is indeed hyper-turbulent today, and the industry is undergoing radical restructuring (McEntee, 1993).

Some observers describe the transition in health care as a paradigm shift. Shortell et al (1985) indicate that the commercialization of health care is accompanied by a fundamental change from a focus on operational management to an emphasis on strategic management. In general, there is increasing recognition that health care organizations need to think in strategic terms (Cleverly & Harvey, 1992a; Ginter, Duncan, Richardson, & Swayne, 1991; Liedktka, 1992; Parry & Parry, 1992).

Hospitals differ in numerous ways. An increasingly important characteristic for distinguishing hospitals is their generic strategy types. Eastaugh (1992a,b), Ginn and Young (1992), Zajac and Shortell (1989), and Shortel, Morrison, and Friedman (1990), among others, have used the Miles and Snow (1978) topology to categorize hospital as Prospectors, Analyzers, and Defenders, based on their strategic characteristics. Martins (1976) argue that data within an organization is increasingly being regarded as a basic resource needed to run the organization.

DESIGN METHODOLOGY

Components of the Proposed Automated Hospital Management System (AHMS)

This study examines only four basic components of an Automated Hospital Management System (AHMS), and they are as follows:

1. Receptionist
2. Nurse
3. Doctor
4. Administrator
The System Architectural Design of the AHMS

System architecture creates a blueprint for the design with the necessary specifications for the hardware, software, people and data resources (Senn, 1992). In many cases, multiple architectures are evaluated before one is selected. The system architecture also gives a high level view of the new system with the main components of the system and the services they provide and how they communicate. The AHMS is illustrated in Fig 2 below.

The Structured Diagrams for the AHMS Users and Administrator

These structured diagrams show the various modules of the AHMS that the users and administrator can handle.
Context Diagram (Level 0 DFD) and Level 1 & 2 DFD Diagrams
According to Roger (2005) system context diagram (SCD) resides at the top level of the hierarchy. It establishes the information boundary between the system being implemented and the environment in which the system is to operate. It also describes the system data flow, but Yeates & Wakefield (2003) is of the opinion that DFDs represent the data flow in a system at a particular level and that there is a DFD at a higher level called Context Diagram or Level 0 DFD. The following shows the level 0, 1 & 2 DFD of the AHMS.
Fig. 4a  Level 0 DFD (Context Diagram) for the AHMS

Fig. 4b  Data flow diagram between user / administrator and AHMS

Fig. 4c  Data flow diagram between administrator and the AHMS
Fig. 4d  Data flow diagram between users and the AHMS

Fig. 4e  Data flow diagram of the staff users and its processes in the AHMS
System Modeling using Unified Modeling Language
According to Wikipedia (2013) Unified Modeling Language (UML) is a standardized general-purpose modeling language in the field of object-oriented software engineering. It includes a set of graphic notation techniques to create visual models of objects-oriented software intensive systems. Schmuller (2002) is of the opinion that UML provides a wide array of diagrams that can be used for analysis and design at both the system and the software level. Larman (2001) states some of the different type of UML to be deployment diagrams, activity diagram, and the use-case diagrams.

Deployment diagram for AHMS
Fig. 5 Deployment diagram for the AHMS

Activity diagram for AHMS

Fig. 6 Activity diagram for the AHMS
Use-Case diagram for the AHMS

![Use-Case diagram for the AHMS](image1)

**Fig. 7** Use-Case diagram for the interaction between users in the AHMS

Sequence Diagram for the AHMS

The sequence diagram for the AHMS shows the interaction of task between the different AHMS users.

![Sequence diagram for the AHMS](image2)

**Fig. 8** Sequence diagram for the interaction between users in the AHMS
We have presented a framework for developing and implementing an Automated Hospital Management System (AHMS). This design is most suited on a Local Area Network (LAN) platform. The design supports four (4) key players in a hospital system monitoring the flow of in-patients from the receptionist to the nurse on duty and then to the doctor in-charge. When developed and implemented the workflow of the AHMS will be in this order. The patient seeking for a doctor’s attention comes into the hospital and the first person that should attend to the patient is the receptionist on duty. The receptionist captures patient’s basic information into the system and forwards it to the nurse. The nurse views the patient’s history and captures or records the patient’s complaints and forward the new patient history to the doctor. The doctor conducts physical examination on the patient, diagnose ailment, prescribe drugs, generate reports, etc. The administrator of the system is saddled with the responsibility of system backup on a daily basis in case of physical damage, virus invasion or natural disaster, recovery will be made almost immediate; the administrator can also perform the following functions: add new patient information, search for patient information, view patient list/history, print patient list/history, lock the application, edit/delete patient information, view system log trail, reset system, create new system users, etc. The AHMS will grants only registered users with the correct privilege and password access to the application. This process has automatically taken care of the numerous problems and challenges faced the manual information processing, and the system log trail will monitor all user activity on the system.

CONCLUSION AND RECOMMENDATIONS

Based on the design architecture of an automated hospital management system, we will conclude as follows: That the absence of a well established information system to serve patient and staff has led to inconveniences in the hospital system today. Manual way of accessing and sharing of information by different departments/units could be very difficult due to poor information management. Introducing an Automated Hospital Management System (AHMS) to hospitals and clinics is the key to good information management, and our proposed framework will bring about a great change.

In recommendation, serious efforts should be made by both the government and private owned hospitals/clinics/maternity homes to automate all their information processes; this will enhance workers attitude to work; it will improve working conditions in terms of information accessibility and retrieval; there will be general work satisfaction and increased productivity in terms of savings lives.

FURTHER RESEARCH WORK

The AHMS an application is still under rapid development on both Intranet and Web based platforms. Further research work should consider the area of building an automated workflow system for hospital management using light weight architecture or technique.

REFERENCES


