AUTOMATED CONSTRUCTION MANAGEMENT SYSTEM

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ABSTRACT

Despite the growing popularity in construction industry, construction management software still remained virtually an untapped technology among construction firms as popularly adopted by oil and gas sector. However, construction management software is a project management platform that helps companies in processes like budget management, communication, decision-making, design, and job scheduling with the main goal of making the construction business processes a lot easier through software automation procedures. This research work is primarily aimed to develop a construction management system for construction companies, project managers, civil engineers, public and private organizations and corporate individuals to solve construction challenges between clients and Construction Company. It provides an efficient way for clients and contractors to interact confidently and confidentially without the access of any third party. In this research, an online based approach was employed for accessibilities of the automation to stakeholders using HTML, CSS, JavaScript, PHP and Xamp as developmental tools.

Keywords

Automation, Building, Construction, Project, Software

1.0 INTRODUCTION

Despite its growing popularity among builders big and small, construction management software has remained a virtually untapped technology for many construction companies. Construction management software by definition is a project management tool designed specifically for construction professionals. It offers a range of benefits to members of the construction industry, streamlining processes that used to be done manually, which include communication, decision-making and job scheduling, among others. A notable rise in construction management software demand is seen to come from the oil and gas sector. This is owing to the fact that it helps boost transparency in brownfield, onshore, and shale construction projects. In the same manner, the software also helps in maintaining oil and gas plants and deep-water oil and gas developments. This demand is also seen to fuel the construction management software market.

This Construction management software functions a project management platform that helps companies in processes like budget management, communication, decision-making, and job scheduling, to name a few. However, Construction management tools have significantly improved the construction sector in terms of productivity, efficiency and company competitiveness [1]. The features of construction management software typically help builders automate their work and documentation processes, cost estimation, accounting, scheduling and computer-aided design which are essentially the purpose of construction management software.

1.1 Problem Statement

The lack of a construction management system has resulted to most construction companies failing to plan properly and thereby not getting the desired outcomes and deliverables for most capital and construction projects and make real the three variables

of a project; time, cost and scope. Due to these, there is a need for construction management system to alleviate the problems encountered by these companies in order to get resources that will be sustainable for their construction projects.

1.2   Research Goal

This research is aimed at developing a construction management system for construction companies, construction project managers, civil engineers, public and private organizations and corporate individuals. The scope of this project will also provide the following:

- Defines the project objectives and targets of particular relevance to the construction phase
- Describes the process for identification and control of risks specific to the construction phase
- Details the proposed strategy for the construction phase of a project, with particular regard to establishment resourcing, site organization and construction controls.

2.0 LITERATURE REVIEW

According to Knoepfel (1992), construction is a key sector of every society, economy and culture. Most of the management, design, construction and maintenance activities are carried out by small and medium-size private companies. Large construction companies are undertaking a considerable share of the market in construction projects. It requires knowledge of modern management as well as an understanding of the design and construction process. Construction projects have a specific set of objectives and constraints such as a required time frame for completion. The construction industry plays a central role in national welfare, including the development of residential housing, office buildings and industrial plants, and the restoration of the nation's infrastructure and other public facilities.

However, Trading companies that implement construction projects must focus on the basic guidelines of project management such as effective coordination, established project goals, time/cost management factor, risk analysis and human resource management; among others..

2.1   Design and Construction Process

Design is an integrated process cutting across creating the description of a new facility, installation and other forms of construction artefact being represented by detailed plans and specifications. Meanwhile, Construction planning is a process of identifying activities and resources required to make the design a physical reality via implementation of design envisioned by architects, civil engineers and specialty engineers. Good project management in construction process must pursue the efficient utilization of labour, material and equipment.

With an automated construction management system, efficient documentation of daily activities involving the use of Diaries, logs, and daily field reports in keeping track of the daily activities on a job site each day is taken into consideration by the systems developer [5]. This is often refers to as the capital project management software, computer construction software, construction management software, project management information systems. . This lead to a more enhanced software-application field of construction collaboration technology which has been developed to apply information technology to construction management [3].

However, the software developer critically looks into the Risk management aspect of the proposed system. This consists of a series of steps that help a software development team to understood and manage uncertain problems that may arise during the course of software development and can plague a software project.

2.2   Risk Analysis

In the developmental phase, it is beneficial to perform a comprehensive risk assessment [9] of all threats that can realistically occur to the organization now and in the future (Table 1).

Table 1: Risk Consideration

Risk Type	Remedies/Plans
Hardware Failure	Back up must be taken at each specific interval
Schedule Spillage	Reorganize team so that there is proper understanding of project and people therefore understand each other's job.
Rapidly Change in requirements	For this risk we must have to analyze new requirements that proper changes made

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3.0   METHODOLOGY

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Project management methodology adopted involving planning and scheduling for this research is as follows:

- Work breakdown structure
- Project network of activities
  - ➢ Critical Path method (CPM)
  - ➢ Resource Management
  - ➢ Resource Leveling
  - ➢ Risk Assessment

3.1   Architectural Requirements

Based on the functional requirements, the architectural roles required by the Engineer for this research involves:

- Work inspection
- Change orders
- Review payments
- Materials and samples
- Shop drawings

3.2   Brief Existing and Proposed System Settings

In the existing system, records such as construction data, employee details, customer details, product details, sales and purchase of land and buildings, materials and tools are maintained manually [7]. This involves handling of large record books consisting of both relevant and irrelevant information; thus making it difficult to find out the required information as per necessity. Meanwhile for the proposed settings, this research is designed with a goal to making the existing system more informative, reliable, fast and easier thereby reducing the burden of managing large construction data.

3.3   System Requirements

- Dual Core (minimum) multimedia system with higher memory
- Web server: Wamp/Xamp server.
- OS : Windows/Linux
- Language : PHP, HTML, CSS, MYSQL(Back-end)
- Editor : Notepad++ Editor
- Browser : All

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4.0   USE-CASE DIAGRAM

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4.1   Member/Client

Using the Use-case diagram for member/clients in the construction management system [8], some phases must be created (Fig. 1) for systems efficiency.
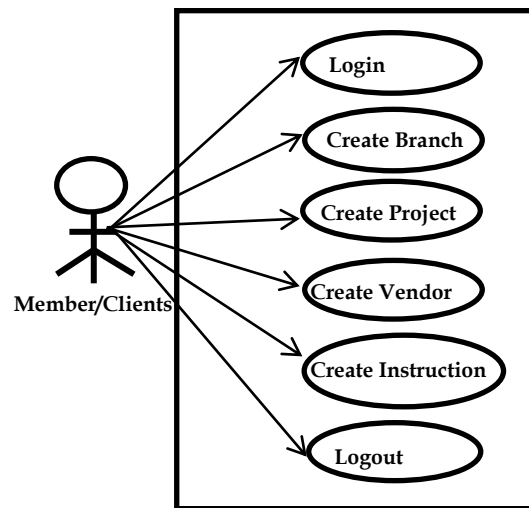
Fig. 1:   Member/Clents Phases

4.2   Administrator

The system administrator managing the autonomous system for the organization however performs the following roles/ activities (Fig. 2)
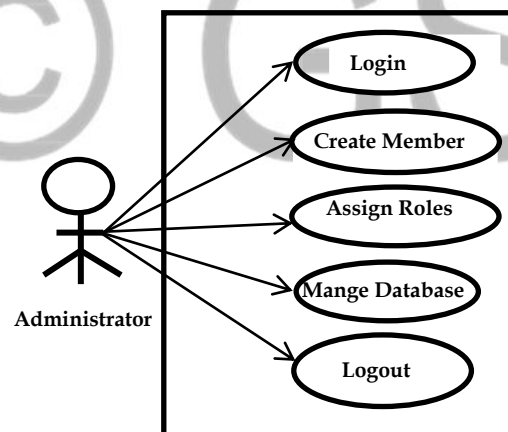

Fig 2:   System Administrator's roles

5.0   SYSTEM FLOW

The system flowchart showing the overall system functionalities / operations (Fig. 3) is depicted below
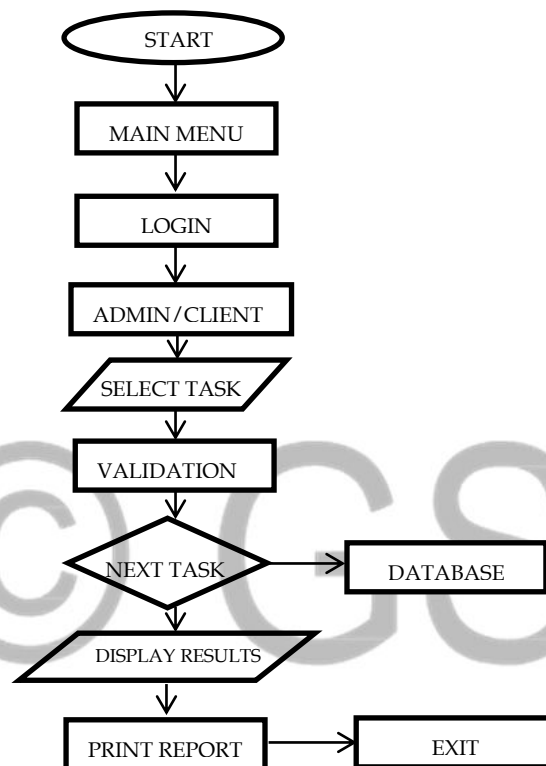

Fig. 3: Overall System Flow

5.1   Software Design

Software design is a model of a real world system that has many participating entities and relationships. It acts as a basis for detailed implementation and as a communication medium between the designers of subsystems by providing information to system maintainers about original intentions of the system designer. The system Database design produces a detailed logical data model for physical storage of parameters needed to generate a design in a data definition language which can be used to create a database.

5.2   Physical design

This was the physical realization of logical design. Tables, forms and reports were created and relationships defined among these tables and security constrains set. During the physical design, expected schemas were translated into actual database structures for mapping the followings:

i.   Entities to tables
ii.   Relationship to foreign key constraints
iii. Attributes to columns primary unique identifiers to primary key constraints
iv.   Unique identifiers to unique key constraints
v.   Attributes to columns.

6.0   SYSTEM IMPLEMENTATION/DEVELOPMENTAL PHASE

This involved putting together or building various elements of a system. In this stage the actual system was recognized. The technical architecture defined in the design stage was the baseline for developing the system. The interface was designed using HTML, PHP and Java script languages. The database was designed in MYSQL basing on Xamp Server software. MYSQL provides a high level of security to the database, that is, authentication is carried out during the logging in to the database or on DML commands.

6.1   The Homepage
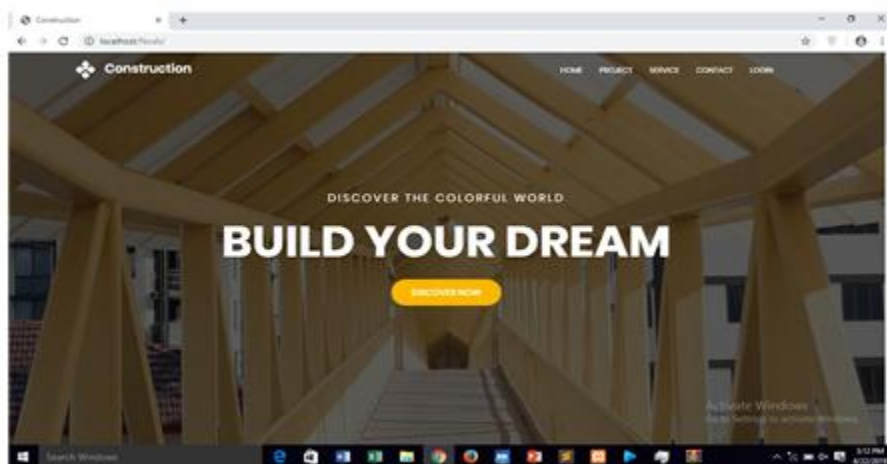
Fig. 4: Home Page

This is the homepage of the system which allows users and/or clients to navigate through the website (Fig. 4); get to know more about the offers and services that is been rendered and provided.
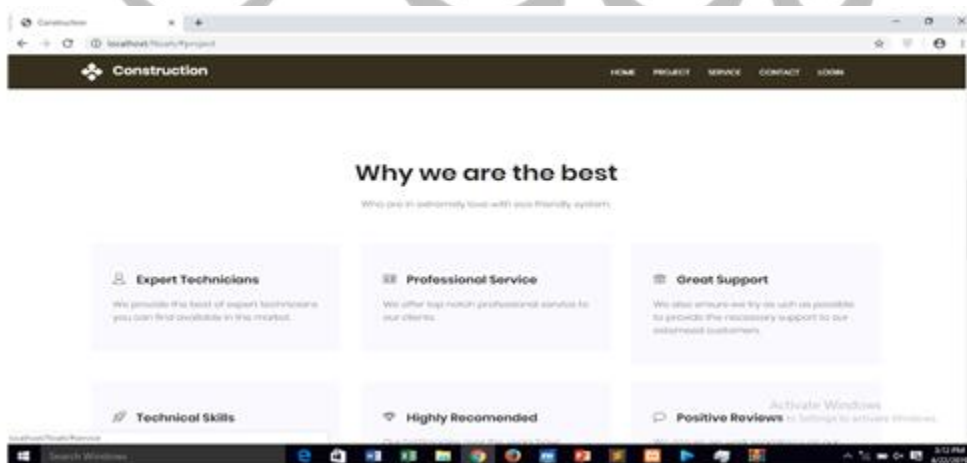
6.2   Services

Fig. 5:   Available services

This is the services pages that lists the services and offers hat is been provided by the system (Fig. 5). It allows user and/or clients to navigate through a variety of options and choose which one bets suites their needs.
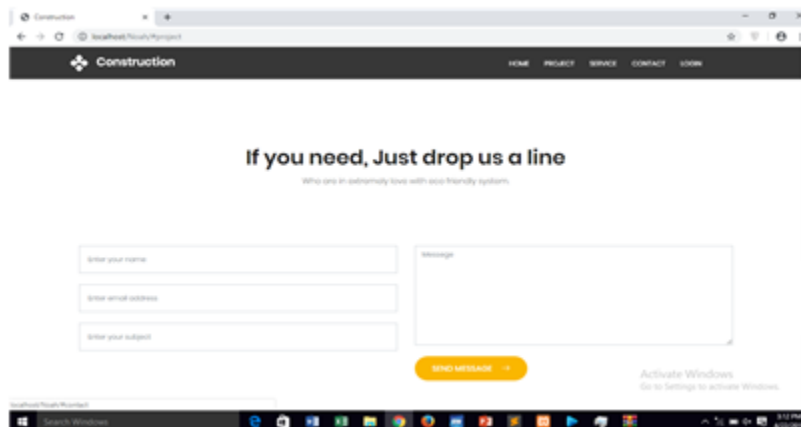
6.3   Contact Page

Fig. 6:   Contact services

The contact page (Fig. 6) allows clients to send directly to and for us. It provides a platform whereby users can give feedback or ask questions from the company via email. It makes the system more interactive.
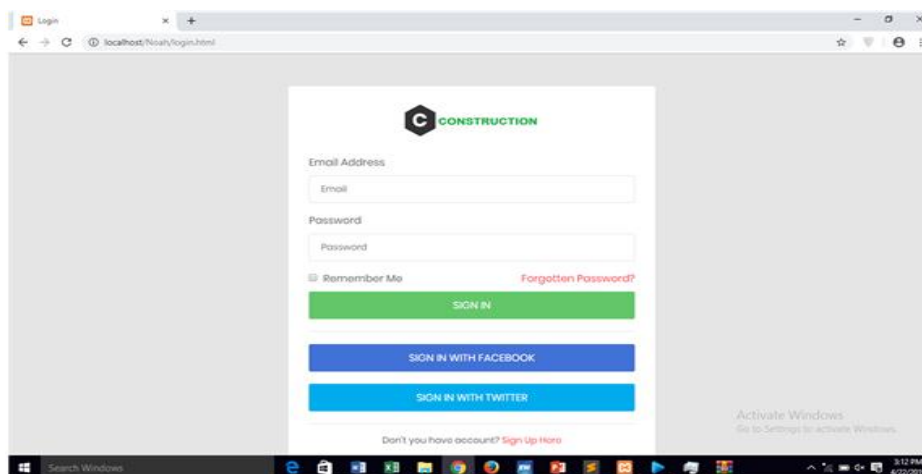
6.4   Login Page

Fig. 7:   Login phase

This is the login page that gives clients access to their profile (fig. 7) where they can view existing, ongoing and completed projects that is been carried out by the construction company.

6.5   Admin Dashboard

The admin dashboard is where most of the operations is been carried out (Fig. 8). The admin can view all the members online, total deliverables completed and the milestones that were achieved. It can also view the progress chart of each project and also the status of each client's work. Other screenshots from the admin page is given below.
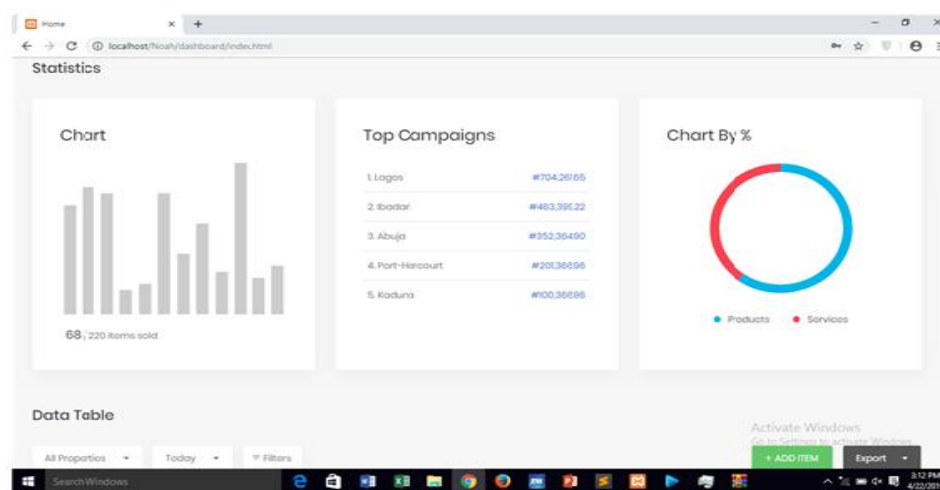
Fig. 8:   System Dashboard

6.6   Progress Report
This is the progress chart displaying the progress per % of each ongoing project (Fig. 9).
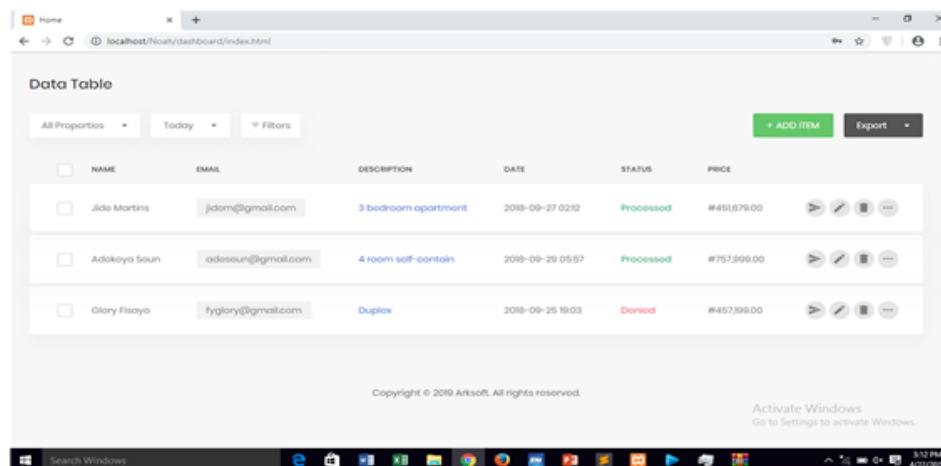

Fig. 9:   Progress Report

This is the data table for each client showing the status of their projects, which also includes the total amount spent and time left for completion of the project

CONCLUSION

Construction management system is an effective remedy to solve construction issues and hiccups between clients and construction companies. It provides an efficient way for clients and contractors to interact confidently and confidentially without the access of any third party by adhering accordingly to client's specification. This is opposed to the manual method, which is stressful, time consuming and sometimes not reliable. This will not only facilitate information processing, but will go a long way in improving the overall general productivity and timely delivery of projects. This brings about a good relationship between Clients, Project Managers and Construction Companies

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