

A Cloud-Based Retail Management System

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Abstract. Retail management systems have been deployed extensively as web applications and stand-alone systems. However, in order to maximize return on investment while also improving on retail business efficiency and performance, it is imperative to explore newer technologies that can be leveraged. Cloud computing shows great potential in this regard; and so it is our aim in this paper to develop a cloud-based retail management system. We realize this by first designing the framework of the system and then implementing it.

Keywords: Cloud computing, framework, retail management, point of sale.

1 Introduction

A retail management system is one that is used by retail-inclined organizations like super markets, hardware stores, shopping outlets, e-commerce stores, bookstores, pharmacies and a host of others [1]. Features such as Point of Sale (POS), inventory management, reports & feedbacks, employee management, customer management, and supply chain management are some key components of retail management systems [2]. These systems have mostly been developed and deployed as Web Applications and stand-alone systems [3]. Where they are implemented as stand-alone systems, they tend to be complicated and expensive to maintain by businesses that have little or no IT knowledge [4]. The amount and variety of hardware and software needed to run these systems can also be discouraging [5]. Retailers would require a whole team of experts to install, configure, test, run, secure, and update such systems. In order to maximize return on investment, newer technologies can be explored. Cloud computing in particular shows great potential in this regard [6].

Cloud computing represents a radical change in the way information technology (IT) services are offered to the public [6]. Its concept relies on sharing computing resources rather than owning local servers in order to handle applications [7]. Cloud solutions can be implemented under three major service models namely: Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS). They can be deployed as private clouds, public clouds, community clouds or hybrid clouds [8]. It is of utmost importance that cloud computing be greatly applied in the retail industries because it transverses borders and contributes greatly to any Nation's economy [9]. However, as retailers begin to gravitate towards the cloud-based

approach to retail management, they will desire among other things – a platform independent solution and one that is easy to customize to suit changing requirements. A framework that can serve as a guide for implementation and deployment is also desirable [10]. The rest of this paper is thus structured as follows: Section 2 reviews existing systems in this domain. In Section 3, we focus on the design of the proposed system. In Section 4, we implement the retail management solution called SkyRetail based on our design in Section 3. The key user interface modules are also highlighted and discussed in this section. Section 5 concludes the paper.

2 Review of Existing Systems

Microsoft Dynamics Retail Management System is an application from Microsoft that offers small and midsize retailers a complete point of sale (POS) solution that can be adapted to meet unique requirements [11]. It provides centralized control for multi-store retailers, and integrates with Microsoft Office system programs. It also offers benefits in; ease of use, automation, efficiency, flexible reporting and scalability. It can be deployed for any form of retail enterprise from pharmaceuticals to grocery stores. The system however is not cloud-based and also targets businesses that run Windows operating system – thus it is not cross-platform.

Lightspeed Cloud is another complete point of sale system [12]. It offers a range of complete retail solution for retailers. Among other things, it offers access to the system from both web and mobile browsers. It also handles inventory, customers/employee management and report generation. According to Lightspeed – the software company that developed the solution, their retail solution is: easy to use; continuously upgraded; cloud based; able to run on Web and mobile browsers; always available; easy to set up and install. The drawback of this system however is that it is not available outside of North America.

Epicor Cloud Retail Software is a SaaS retail solution from Epicor Solutions [13]. It serves small to mid-sized retailers who want to leverage their insufficient IT resources. Epicor delivers a model that significantly reduces capital investment, implementation challenges, and on-going requirements of managing IT. With Epicor, retailers are able to integrate their sales channels, order management, POS systems, inventory, and other operations for access to right information at the appropriate time. Epicor cloud retail software supports: merchandising, store operations, CRM, audit and operations management and planning. The system however is difficult to customize so as to suit a particular organization.

From the drawbacks identified in the existing systems, we intend to realize a retail management solution that is cloud-based; platform independent; able to run on Web and mobile browsers and also easy to customize by any retail organization. This is the motivation behind this paper.

3 Design of the Proposed System

Being software, we incorporate the retail management system into our cloud design framework by modeling it at the SaaS layer - above the PaaS and IaaS layer. The design framework of the proposed system uses a layered structure as depicted in Fig. 1.

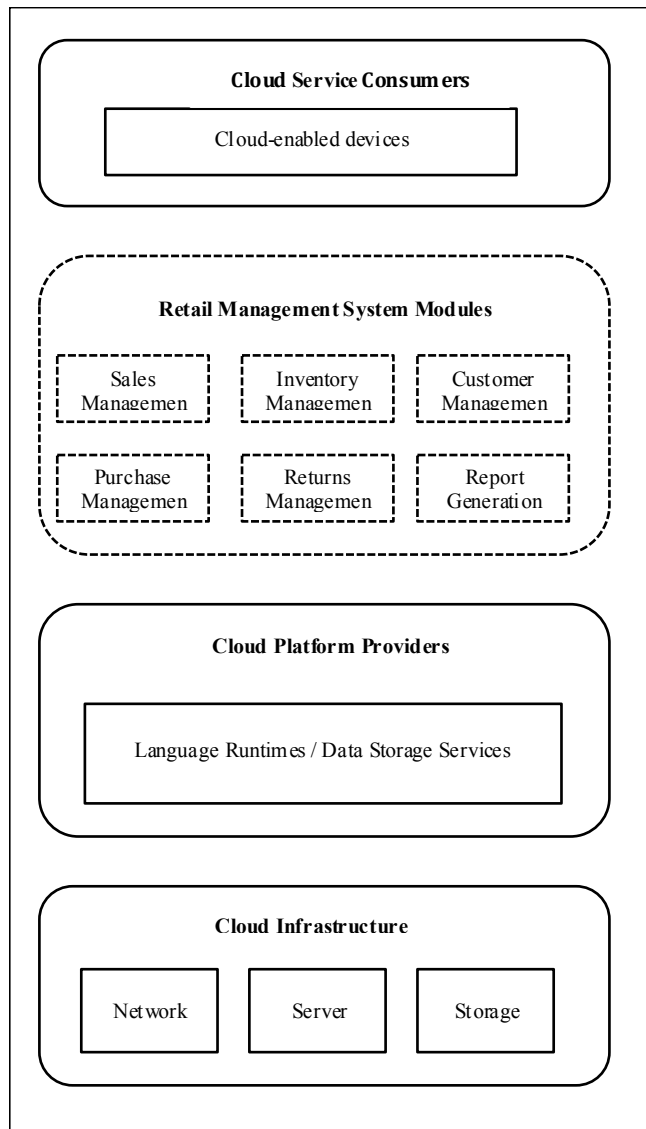


Fig. 1. Framework of the proposed retail management system

3.1 Cloud Service Consumers

This refers to devices that will be used to access and use the retail management system. Such devices should be cloud-enabled and include: laptops, tablet computers and smartphones.

3.2 Retail Management System Modules

The proposed retail management system (shown with dashed lines in Fig. 1) will have the following key features: inventory management that makes it easy to add and track retail items; customer management that helps to keep record of customers thus building relationship with them; purchase management to help manage the purchase of supplies; sales management to provide a complete point of sale solution integrated to help deliver sales efficiently; and report generation.

3.3 Cloud Platform Providers

Quite a number of platform providers exist depending on the preference and choice of retail organizations. They generally provide language runtimes and data storage services for their platform. Notable among these cloud platform providers are Microsoft – with their Windows Azure cloud platform [14] [15] and Google – with its Google App Engine platform [16] [17]. With Windows Azure, applications can be built using any language, framework or tool particularly Python, Java, Ruby, Node.js and PHP. SQL Azure is a service for managing Microsoft SQL databases. The Google App Engine platform provides language runtimes for Python, Java, PHP and Go programming languages. Google Cloud SQL is the service provided for maintaining and administering MySQL databases.

3.4 Cloud Infrastructure

Cloud platform providers leverage their platforms with their own cloud infrastructure. So Microsoft and Google as well as other platform providers support their respective platforms through their cloud infrastructure, which includes: networks, servers and storage.

4 Implementation of the Proposed System

We implemented a cloud-based retail management solution called SkyRetail based in the design in Section 3. The cloud platform provider used was Microsoft with its Windows Azure platform. In order to realize the retail management system modules, we leveraged on Open Source Point of Sale – an open source POS solution developed in PHP and hosted on SourceForge repository and the Web address is given as -

<http://sourceforge.net/projects/opensourcepos/>. The modules of the retail management system are discussed in the sub-sections that follow:

4.1 Home Page

This is the first page the user is redirected to after logging into the system. It displays a list of available modules to that particular user. It is shown in Fig. 2.

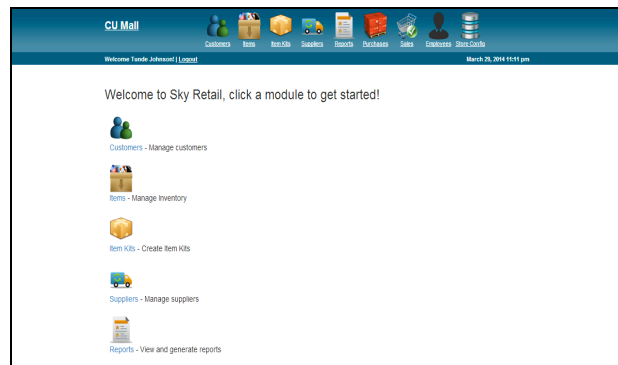


Fig. 2. Sky Retail Home Page

4.2 Customer Management Module

This administers the customer relationship management of the system. Here, the user can add new customers; view customers' details and also make changes. The Customers link on the application homepage or menu bar launches this module. The page lists out existing customers associated with the retail store. The tick box on the first column is to select customer(s) so that operations such as deleting and emailing can be carried out. Customer information can be updated by clicking the edit link on the last column. A new customer is added by filling the form displayed after pressing "New Customer" button. The search box allows the operator to search for a customer by typing a string, which could be part of the customer's name. Multiple customer information can be added to the system by clicking excel import button. The module's interface is shown in Fig. 3.

List of Customers				New Customer	Excel Import
<input type="checkbox"/>	Last Name	First Name	E-Mail	Phone Number	
<input type="checkbox"/>	Alima	Chinedu	almachinedu@gmail.com	051-8096-5436	edit
<input type="checkbox"/>	Aminu	Femi	Femiaminu@outlook.com	081-8003-6430	edit
<input type="checkbox"/>	Fola	Kola	kfolia@yahoo.com	081-8096-5430	edit
<input type="checkbox"/>	Ibukun	Otundeko	ibk@gmail.com	070-2657-2121	edit
<input type="checkbox"/>	Ogbuchi	Stanley	stanleyogbuchi@gmail.com	081-8096-6334	edit
<input type="checkbox"/>	Timi	Bukola	bukot@gmail.com	080-2096-5430	edit
<input type="checkbox"/>	Toia	Loko	lokoT@yahoo.com	070-5245-5430	edit

You are using Sly Retail.

Fig. 3. Overview of the Customer Management Module

4.3 Inventory Management Module

This controls the inventory of the retail store. It provides options to add items, view the inventory details of a particular item and also make updates or changes to items. The user can group similar items into item kits. The module is depicted in Fig. 4.

List of Items							New Item	Excel Import
<input type="checkbox"/>	Item Name	Category	Cost Price	Unit Price	Tax Percent(s)	Quantity	Inventory	
<input type="checkbox"/>	Amazing Deodorant	Body Spray	N220.00	N450.00		48.00	edit	inv details
<input type="checkbox"/>	Bellini Crackers	Snacks	N10.00	N20.00		500.00	edit	inv details
<input type="checkbox"/>	Black Deodorant	Body Spray	N170.00	N300.00		50.00	edit	inv details
<input type="checkbox"/>	Bottle Groundnut	Provisions	N200.00	N350.00		34.00	edit	inv details
<input type="checkbox"/>	Bran Flakes	Cereal	N350.00	N600.00		62.00	edit	inv details
<input type="checkbox"/>	Chesea Bread	Bread	N35.00	N70.00		68.00	edit	inv details
<input type="checkbox"/>	Coco Pops	Cereal	N500.00	N750.00		50.00	edit	inv details
<input type="checkbox"/>	Digestive Biscuit	Snacks	N70.00	N100.00		230.00	edit	inv details
<input type="checkbox"/>	Hydron Bread	Bread	N125.00	N180.00		89.00	edit	inv details
<input type="checkbox"/>	Hungry Man Bread	Bread	N100.00	N150.00		124.00	edit	inv details
<input type="checkbox"/>	Indomie Carlton	Provisions	N1200.00	N1800.00		150.00	edit	inv details
<input type="checkbox"/>	Kelloggs Corn Flakes	Cereal	N550.00	N800.00		50.00	edit	inv details
<input type="checkbox"/>	Kelloggs fruit and fibre	Cereal	N480.00	N750.00		50.00	edit	inv details
<input type="checkbox"/>	Nasco Corn flakes	Cereal	N300.00	N600.00		50.00	edit	inv details
<input type="checkbox"/>	Rice Croquettes	Cereal	N550.00	N800.00		50.00	edit	inv details

Fig. 4. Overview of the Inventory Management Module

4.4 Supplier Management Module

This provides an interface for managing the retail vendors associated with the store. The Suppliers hyperlink on the application home page or menu bar directs the user to this module. A list of existing store suppliers is displayed. Provided are different links and buttons to conduct varying operations. The tick box on the first column is used to select customer(s) for performing operations such as deleting and emailing. A supplier detail can be updated by clicking the Edit link on the last column. A new supplier is added by filling the form displayed after pressing “New Supplier” button in Fig. 5.

List of Suppliers						New Supplier
Company Name	Last Name	First Name	E-Mail	Phone Number		
<input type="checkbox"/>	Orange Goods	Anthony	James	anthony@orangegoods.com	00-6343-7676	edit
<input type="checkbox"/>	M&H Distributors	Henries	Major	m.henries@mhb.com	081-0763-0998	edit
<input type="checkbox"/>	McVities	Vlaser	Mark	mark@mcvities.com	070-3465-7689	edit

You are using Sly Retail.

Fig. 5. Overview of the Supplier Management Module

4.5 Reports

This module makes it possible to generate various reports based on a retail store's transactions. The interface is depicted in Fig. 6. Sample reports generated by the system are shown in Figs. 7 – 8

Detailed Sales Report										
01/01/1970-03/30/2014										
Sale ID	Date	Items Purchased	Sold By	Sold To	Subtotal	Total	Tax	Profit	Payment Type	Comments
+ POS 1	2014-03-10	3.00	Tunde Johnson		N1800.00	N1800.00	N0.00	N750.00	Cash	72000.00 0
+ POS 2	2014-03-26	2.00	Tunde Johnson		N650.00	N650.00	N0.00	N460.00	Cash	7990.00 0
+ POS 3	2014-03-26	1.00	Tunde Johnson		N250.00	N250.00	N0.00	N150.00	Cash	7850.00 0
+ POS 4	2014-03-27	3.00	Tunde Johnson		N320.00	N320.00	N0.00	N125.00	Cash	7420.00 0
+ POS 5	2014-03-28	1.00	Tunde Johnson	Femi Aminu	N150.00	N150.00	N0.00	N50.00	Cash	7150.00 0
					Subtotal	N3020.00				
					Total	N3200.00				
					Tax	N0.00				
					Profit	N1535.00				

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Fig. 6. This figure shows the view of detailed sales report

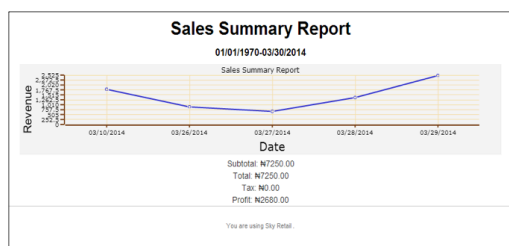


Fig. 7. This figure shows the graphical view of sales summary report.

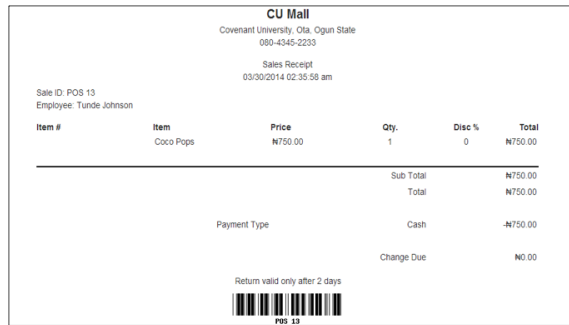


Fig. 8. This figure shows the view of Sales receipt.

4.6 Purchases Module

This module manages the purchase of items from the suppliers. Clicking the “Purchase” link on the application menu bar or home page directs the user to this module. Items are added by simply searching for the item in the Find/Scan Item search box and selecting from the search dropdown. More items can be added by repeating this procedure. The sales detail for each item can be added in the text boxes provided. The supplier involved can be optionally added if the supplier exists in the system by typing the supplier’s name into Select Supplier text box. The user then selects the payment type and inputs the payment amount tendered. The Finish button is clicked to complete the purchase order. The purchase is completed and the receipt is displayed. The purchase module is depicted in Fig. 9.

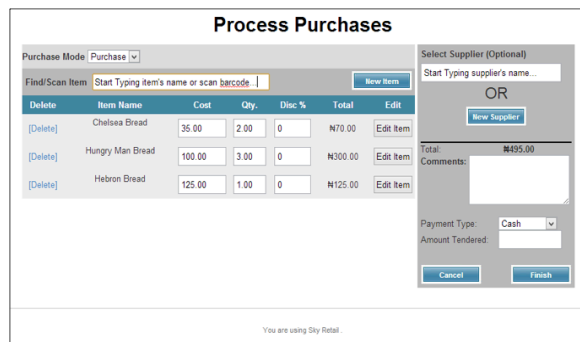


Fig. 9. This figure shows the overview of purchase module.

4.7 Sales Management Module

This module handles item sale processes. The Sales hyperlink on the application menu bar/home page launches the module. Items are added by simply searching for the item in the Find/Scan Item search box and selecting from the search drop down. More items can be added by repeating this procedure. The sales detail for each item can be added in the text boxes provided. The user can optionally choose to add the customer involved if the customer exists in the system. The user then selects the payment type and input the payment amount tendered. The Add Payment button is then clicked to submit payment. The user can decide to either complete the sale by clicking the Complete Sale button or suspend the sale by clicking the Suspend Sale button. If the sale is completed then the receipt will be displayed. Fig. 10 shows this module.

The screenshot displays the 'Sales Register' interface. At the top, there is a 'Register Mode' dropdown set to 'Sale' and a 'Transfered Sales' button. Below this is a search bar labeled 'Find/Scan Item' with the placeholder text 'Start Typing item's name or scan barcode' and a 'New Item' button. The main area contains a table with the following data:

Delete	Item #	Item Name	Price	Qty.	Disc %	Total	Edit
[Delete]		Coco Pops [49.00 in stock]	750.00	1.00	0	N750.00	Edit Item
Desc:	None						
[Delete]		Rice Crispies [50.00 in stock]	800.00	1.00	0	N800.00	Edit Item
Desc:	None						
[Delete]		Bran Flakes [62.00 in stock]	600.00	3	0	N1800.00	Edit Item
Desc:	None						
[Delete]		Kellogg's fruit and fibre [53.00 in stock]	750.00	2	0	N1500.00	Edit Item
Desc:	None						

On the right side, there is a 'Select Customer (Optional)' section with a search box 'Start Typing customer's name...' and a 'New Customer' button. Below this is a 'Sub Total' section showing 'Sub Total: N4850.00' and 'Total: N4850.00'. There is a 'Cancel Sale' button. A 'Comments:' section has a text area. At the bottom right, there are 'Complete Sale' and 'Suspend Sale' buttons. Below these, a 'Payments Total' section shows 'Payments Total: N4850.00' and 'Amount Due: N0.00'. There is a 'Payment Type' dropdown set to 'Cash' and an 'Amount Tendered' input field with '0.00'. An 'Add Payment' button is located below. At the very bottom right, there is a small table:

Delete	Type	Amount
[Delete]	Cash	N4850.00

Fig. 10. This figure shows the overview of the sales module.

4.8 Returns Management Module

This manages the return of the sold items of the retail store. For purchase returns, the Purchase link is clicked, then from the resulting page the user changes the mode to Returns by selecting returns from the purchase select dropdown. All necessary fields are filled and the Finish button is clicked to complete the purchase return. Clicking the Sales link and changing the register mode to returns can manage sales returns. The necessary fields are to be completed before the sales returns can be successful. This is depicted in Figs. 11 and 12.

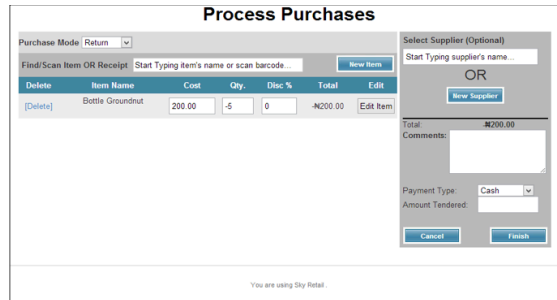


Fig. 11. This figure shows the Purchase Return module.

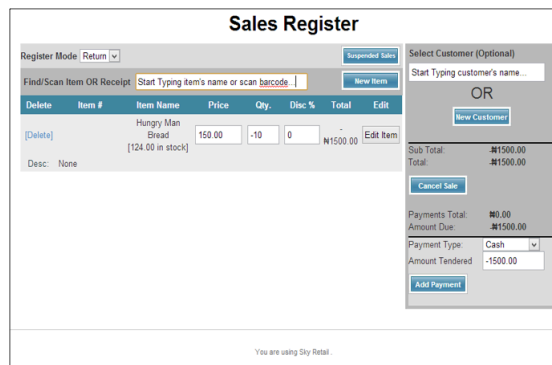


Fig. 12. This figure shows the Sales Return module

5 Conclusion

The cloud approach to implementing a retail management system adopted in this project offers massive benefits to retail organizations in managing retail operations. It will help them to overcome the high costs of running and maintaining technology infrastructure in-house. Also, the retailer can easily scale up or scale down compute resources effectively as the volume of the demand may be. Cloud computing will allow the retail organization to focus more attention on core activities of efficiency of workflow and business operations rather than maintaining servers or systems. Furthermore, Sky retail has demonstrated the viability of the framework on which it is developed.

The retail management solution developed in this paper needs to be tested and validated by would-be users and so usability studies of the system will be conducted as part of future work. Also, as a way of improving the core features of Sky Retail we

will be integrating third-party tools such as a payment gateway to process card payments and also SMS services to deliver instant messages or reports to the users.

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