

New Moodle Module for Charging Course Materials Download Process Using Prepaid Card Technique

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ABSTRACT

This work describes a new Moodle module, CFdownload, developed to set up e-commerce system which allows charging the process of downloading files using Prepaid Card Technique. This new module adds two features to Moodle, the first is allowing the student to pay per file of course material download and not to pay to enroll in the entire course as the existing Moodle system do, While the second allows the student to pay using prepaid card technique (which is similar to the Cell Phone prepaid card method) and not by credit cards (which are rarely used in the developing counties) as the existing Moodle system do.

Keywords: e-learning, Moodle module, prepaid card payment, e-cash, payment methods.

وحدة جديدة لبرنامج موودل لتحميل رسم مالي على عملية تنزيل فيلات المحاضرات باستخدام تقنية بطاقات الدفع المسبق

الخلاصة

يشرح هذا العمل وحدة جديدة لبرنامج موودل اسمها CFDownload, تم تطويرها من اجل صنع برنامج تجارة الكترونية تمكن من تحميل رسم مالي على عملية تنزيل الفيلات باستخدام تقنية بطاقات الدفع المسبق. ان هذه الوحدة الجديدة تضيف خاصيتين جديدتين الى برنامج موودل, الاولى هي تمكين الطلاب من دفع رسم مالي لتنزيل فايل المحاضرة الاكاديمية بخلاف الطريقة الحالية لبرنامج موودل والتي توجب دفع الرسم المالي للاشتراك بالبرنامج الدراسي اكمله, في حين ان الخاصية الثانية تمكن الطلاب من دفع الرسوم المالية باستخدام تقنية بطاقات الدفع المسبق (والتي تكون مشابهه لبطاقات الدفع المسبق لشركات الهواتف المحموله) بخلاف عملية دفع الرسوم المالية باستخدام البطاقات الائتمانية (والتي تكون نادرة الاستعمال في البلدان النامية) والموجودة في برنامج موودل الحالي.

INTRODUCTION

E-Learning becomes more and more important. Reasons are the paramount importance of knowledge, life time learning, globalization and mobility. Not all providers of e-learning products succeed in closing the gap between production costs and revenues. Especially in the academic sector e-learning projects suffer more and more from decreasing funding. Generally realizing and performing tasks in an E-Learning context is an expensive matter. In order to compensate incurring costs, appropriate business models are required. A lot of various authors develop and describe different business models for E-Learning [1].

Gabriela Hoppe presents in [2] a framework for e-learning business models. According to that approach sustainable business models for e-learning integrate and consolidate strategic proposition concerning Market Model, Activity Model, and Asset Model. The Asset Model comprehends Cost and Revenue Model. Regarding the Revenue Model commercial providers of e-learning have to close the gap between costs of production and selling price themselves. Six revenue models have been observed to be common in the e-learning sector and are applicable to Web Based E-Learning, these revenue models are Selling E-Learning Products, Brokerage, Membership, Subscription, Advertising, and Sale of Customer Related Information [2]. In essence, the revenue model describes the sources of revenue of a business [3].

A discrepancy can be observed: some providers of e-learning components realize profits by offering e-learning products. They are likely to become key players of e-learning. Others developing with the same or even more effort does not succeed in supplying e-learning products successfully. A suitable business model and especially revenue model is crucial to put the work of the e-learning providers on a commercially exploited basis in order to fund actual and future e-learning projects [2].

Also whenever there is a flat hierarchy and foreign resources are provided for free, this might result in an abuse of resources, the so-called free-riding. To prevent from such like abuse, corresponding resources can be offered for purchase [1].

It is required to combine arbitrary functions of E-Learning Management Systems (LMS) with simple financial transaction, in order to implement and realize business models in E-Learning, to integrate business processes into the learning flow, to accomplish financial transactions, to assure quality in learning context, and to demand an economic behavior of involved participant [1].

The revenue sub-model of the business model of E-Learning which we depend on depends on delivering and selling lessons or course materials on-line. In essence it is a business to customer e-commerce and it is abbreviated as B2C e-commerce.

This paper is organized as follows: Section 2 presents the motivation of this work, section 3 gives an overview of the e-payment systems, section 4 presents the design and implementation of the CFdownload plug-in, and section 5 presents discussion about the result and the future work.

MOTIVATION

While the credit card payments are more common in the developed countries [4], they are rarely being used in the developing countries and they have high transaction cost. It is required to find a new solution which can be used in the developing countries and has a very low transaction cost because the proposed system is intended to sell course materials with a low transaction value per one course material download operation.

That was the reason which makes me develop a Prepaid Card payment Technique and integrate it in Moodle LMS, In contrast to PayPal payment gateway technique which is already available in Moodle LMS as [5] shows. The choice of Moodle is motivated by its modular organization based on free software like PHP and MySQL, from the developer point of view; this allows adding new modules using well-known interfaces [6].

REVIEW OF E-PAYMENT SYSTEMS

The E-Payment systems are the process of transferring the money between two separated parties over an electronic mean in the E-Commerce. There are three types of E-Commerce: business to customer (B2C), business to business (B2B), and customer to customer (C2C), each of these types has specific requirements and requires a specific method for transferring the money. Some of the e-payment methods are major and some are minor. A brief description of each of these methods is described below [4], and [7].

The Major Methods

As V.Rajaraman in [4] shows each of these methods has a unique algorithm for the payment process.

- **Credit Card Payment**

In this type, payment is made later a billing time. The transaction cost is high. The transaction value is up to credit limit in card. It is most popular in B2C e-commerce. If SET protocol is used, it can ensure anonymity.

- **Electronic Checks Payment**

In this type, payment is made when check is realized. The transaction cost is medium. The transaction value is up to balance in account. It is used in B2B e-commerce. No anonymity can be ensured.

- **Electronic Cash**

These types payment is prepaid. They are preferable for small value transactions, less than ten dollars. These systems mimic the physical cash payment using the Internet to allow low transaction cost and partial anonymity. The transaction value is limited by the prepaid limit. It is not implemented worldwide. There are three types of Electronic Cash (Generic E-Cash, Anonymous E-Cash, and Smart Card-Based Cash Payment). It is popular in C2C e-commerce.

The Minor Methods

As V.Rajaraman in [4], and ZHU Junxuan in [7] show, these methods are built on top of the major methods

- **Micro-Payment for Information Goods**

This system permits small payments of a few dollars. Information goods are materials such as e-books, e-papers, audio files, video entertainment clips and software files. It has been implemented in USA by a company named Net Bill. The customer deposits in advance an amount in the Net Bill's bank account. The payment is made when information goods is delivered. This method has low transaction cost.

- **Mobile Payment Systems**

These systems may be defines as "Any payments which uses a mobile hand-held device to initiate, authorize, and confirm payment in return for goods and services". There are several types of these systems like SIM Card-Enabled Payment, payment Based on SMS, payment using WAP-enabled Mobile Hand-held Device, and smart card along with the mobile hand-held device.

- **Financial Service Kiosks**

These kiosks are fixed stations with phone connections where the customer usually uses a keyboard and television-like screen to make the transaction or to access information. Located at convenient location such as bus or subway stations,

these kiosks enable electronic payments by individuals who may not have regular access to the internet or mobile phones.

- **Television Set-Top Boxes and Satellite Receiver**

Specialized boxes attached to a television can also be used for payments. The customer can make the purchase by viewing items on television. Payment is made electronically using a credit card or other account.

- **Biometric Payment**

These systems use biometrics such as fingerprints, voice recognition, and retina as the identification to access tools. A biometric identifier could replace the plastic card. The electronic payment is still charged to a credit card or other account, with the biometric identifier replacing the card, check or other transaction mechanism.

- **Electronic Payment Networks**

Various countries have electronic payment networks that consumer can use to make payment electronically like ACH in the USA, domestic EFTPOS networks in Australia and Singapore. The customer can go online, to a financial service kiosk or use other front end device to access their account and make payments to businesses or other individual.

- **Person-to-Person (P2P) Payments Gateways**

These systems enable an individual to pay another using an account, a prepaid card or another mechanism that stores value. PayPal in the USA is one of the most frequently used P2P payments. The primary use of PayPal is in C2C e-commerce among its members. It can also be used in B2C e-commerce if merchants maintain PayPal account. PayPal provide an alternative to those who do not have credit card.

DESIGN AND IMPLEMENTATION OF CFdownload PAYMENT MOODLE PLUG-IN

This project's e-business consists of three parties the CFdownload plug-in, the administrator, and the customer. The system is intended primarily for dealing with small cash transactions (about ten dollars per each transaction) and for allowing charging the process of file download (course materials).

Method

The CFdownload plug-in has currency PHP logic software which provides four functions create e-cash coins, insert e-cash, download charged files, and view log details. The procedure is as follows as figure 1 depicts:-

- 1) A customer (student) asks to buy an e-cash coin by an amount of about ten dollars in cash. He or she requests the administrator to issue e-cash coin.
- 2) The administrator uses the create e-cash function of the CFdownload plug-in to issue e-cash coins for an amount of around ten dollars which permits to download a limited amount (around ten) of files of course materials. The currency PHP logic software assigns to each coin a unique number as ID, and a random number consists of nine digits as key number to be entered when electronic payment is made.
- 3) The administrator sells the e-cash coin to the customer by hand or by an intermediary shop.
- 4) The customer inserts the e-cash coin key number using the "Insert Card" function of the CFdownload plug-in after signing in into his account, by doing this

his credits is increased by about ten credits which allow him to download about ten files.

5) The customer clicks on any file of course material to download it, by doing this his credits is decreased by one credit.

6) The administrator can view the log details of each file which had been downloaded to monitor the business.

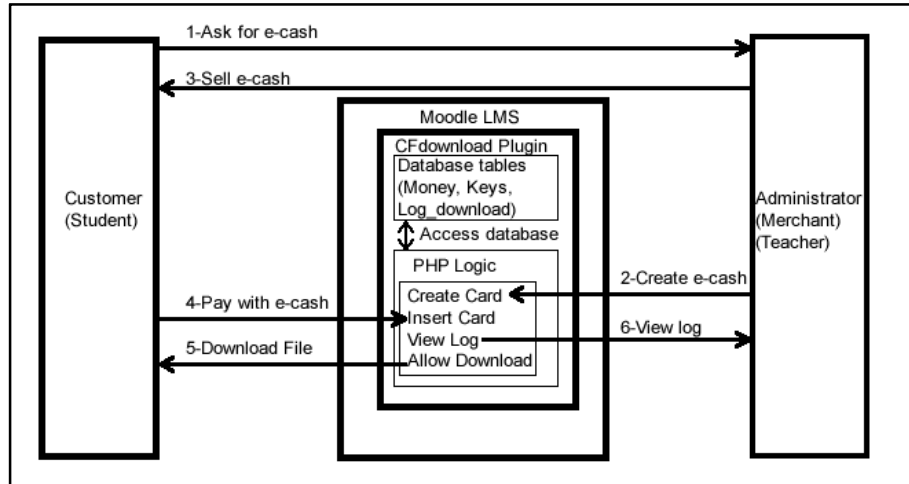


Figure (1) CFdownload method.

Development Tools

The following are the tools which are used to develop the CFdownload Moodle plug-in:

- 1) The integrated development environment (IDE) is NetBeans.
- 2) The web programming language is PHP.
- 3) The database server is MySQL, and the database is created using the XMLDB technique.
- 4) The interactive programming language is JavaScript.
- 5) The web server is Apache.
- 6) The operating system is Windows 7.

Development Parts

The development procedure consists of three parts which are logic, database design, blocks, and forms.

a) Logic

The CFdownload plug-in functions can be depicted by four flowcharts of its logical algorithms. They are downloading file flowchart, insert card flowchart, create new cards flowchart, and display log download flowchart. The CFdownload plug-in has access control system which gives the privileges of creating new cards and view log download only to the administrator. The four flowcharts are depicted in figures 2, 3, and 4, as follows:-

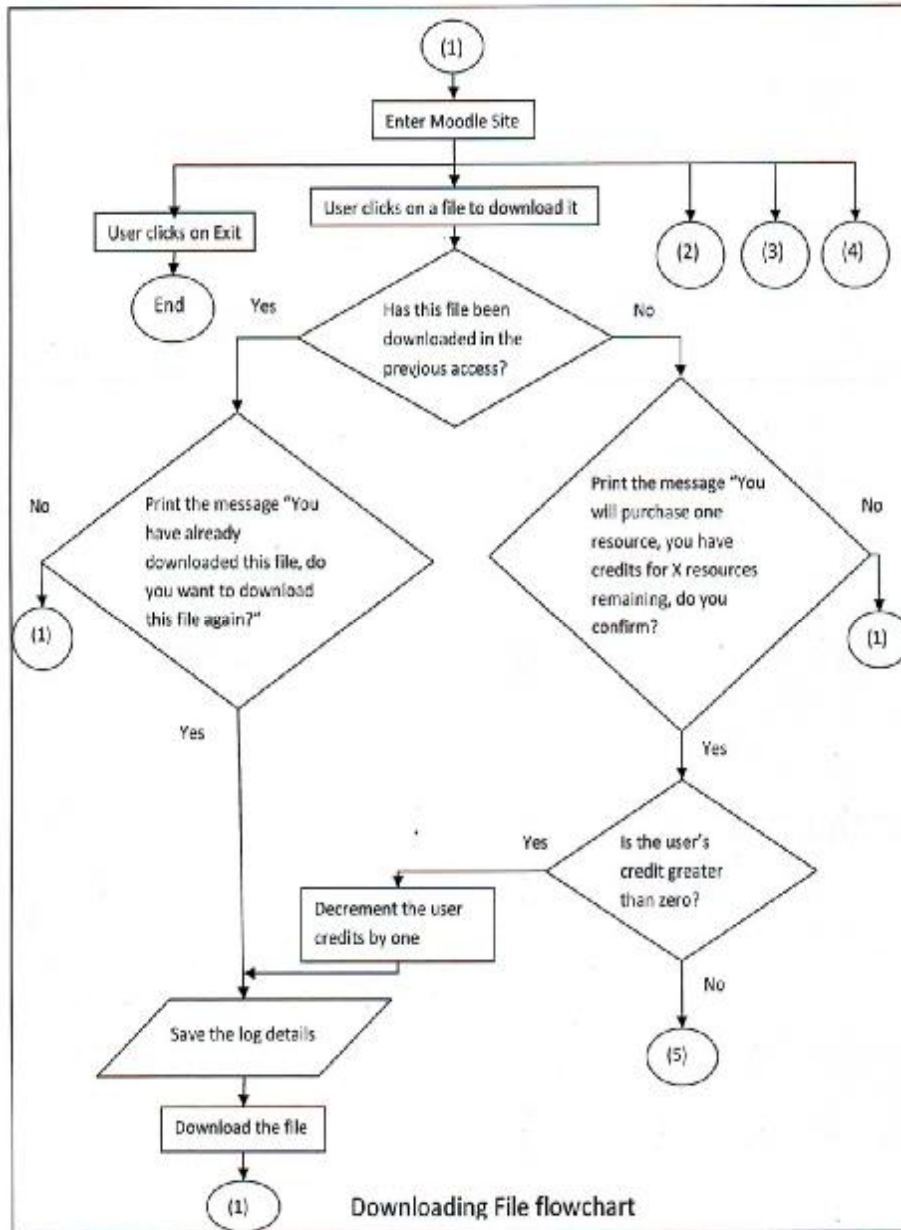


Figure (2) Downloading File flowchart.

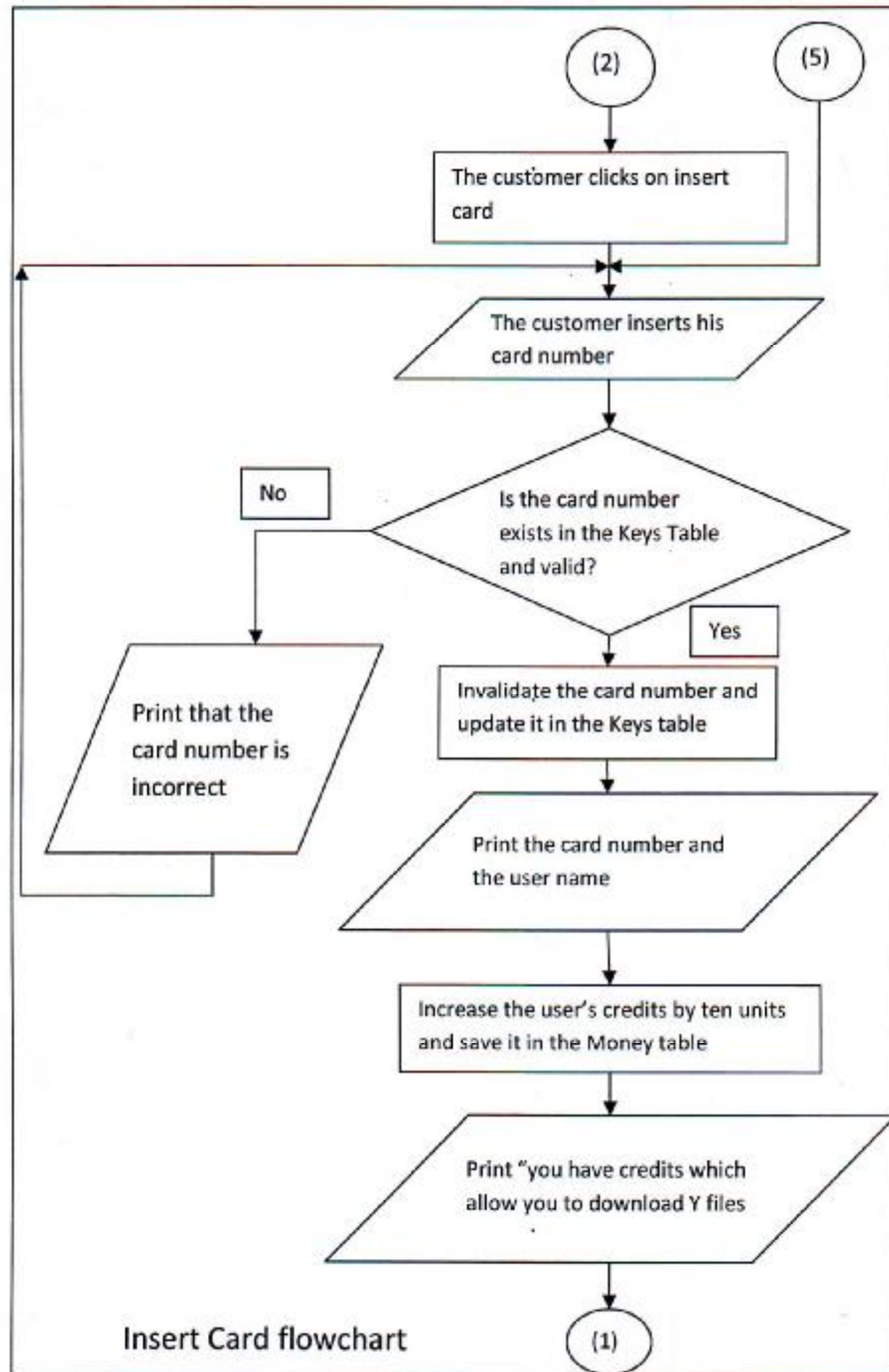


Figure (3) Insert Card flowchart.

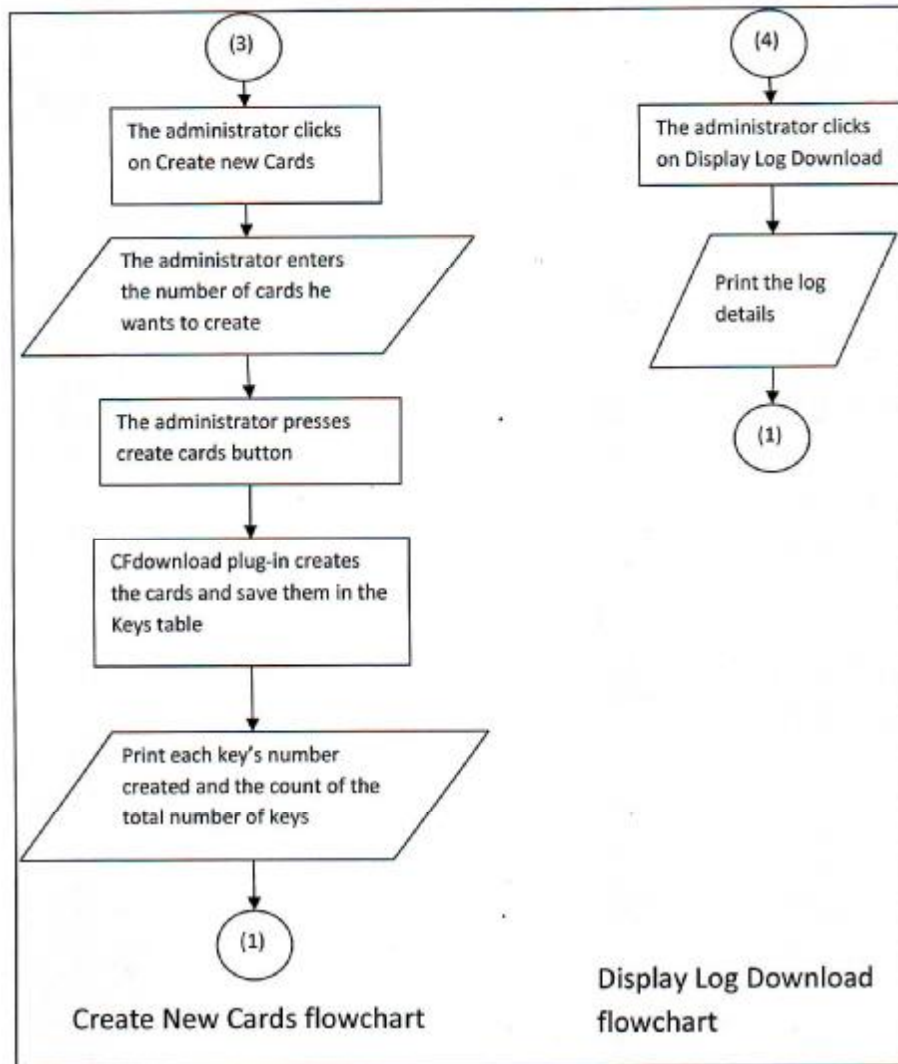


Figure (4) Create New Cards flowchart and Display Log Download flowchart.

b) Database Design

Moodle development procedure provide an easy steps to be followed to build the database required for the new plug-in, this process is controlled by three files within the new plug-in:- 1- version.php which contains the version number of the plugin, 2-db/install.xml which should be created using the XMLDB editor and should contain the definition of the database, 3-and db/upgrade.php, these steps are covered in the Moodle development documentation at [8]. Because these steps had been done in the right thing, Moodle automatically created the database tables for the CFdownload plug-in.

The CFdownload plug-in maintains a database of three tables as follows and as figure 5 depicts:

- 1) The first one is for issued e-coins and called “Keys” which contains a field of unique number as ID called “id”, a field called “keys” saves a random number consists of nine digits, and a last field called “Valid” which is used to invalidate the e-coin when it is used.
- 2) The second database table called “Money” contains a field of unique number called “id”, a field of unique customer ID called “id_user” and another field called “money” saves the customer credits and is used to know how many remaining files he can download.
- 3) The third table called “Log_download” which consists of ten fields and saves the details of each file which had been downloaded.

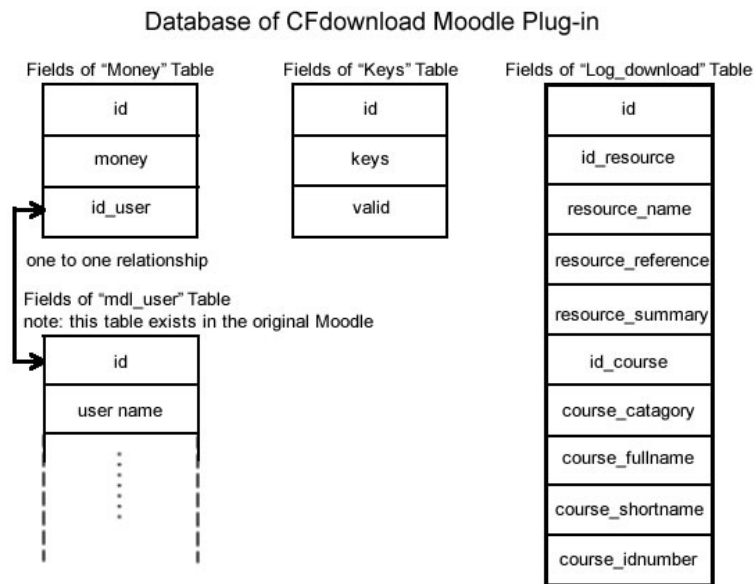


Figure (5) CFdownload Database Design.

c) Blocks

Blocks are items which may be added to the left, right or centre column (depending upon the selected theme) of any page in Moodle and may contain links to the designed forms of any new plug-in. A block has been developed for the CFdownload plug-in which contains the Create Cards, Insert Card, and Display Log download links.

d) Forms

The forms provide the user interfaces for the new plug-in. In CFdownload plug-in three forms has been developed Create Cards, Insert Card, and View Log Download to allow the functions of CFdownload plug-in to be implemented, figure 6,7,8, and 9 are screen shots of the CFdownload plug-in.

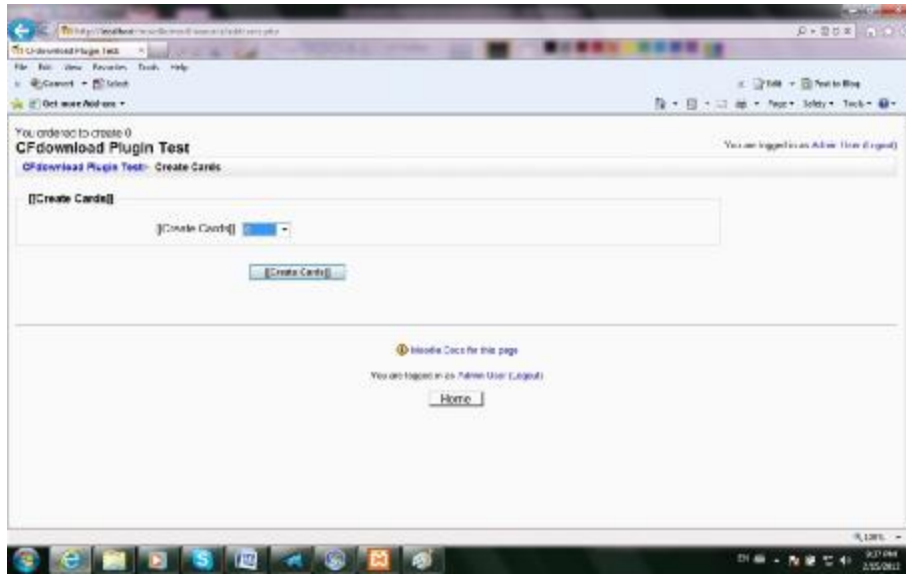


Figure (6) Create Cards form (before creating the cards).

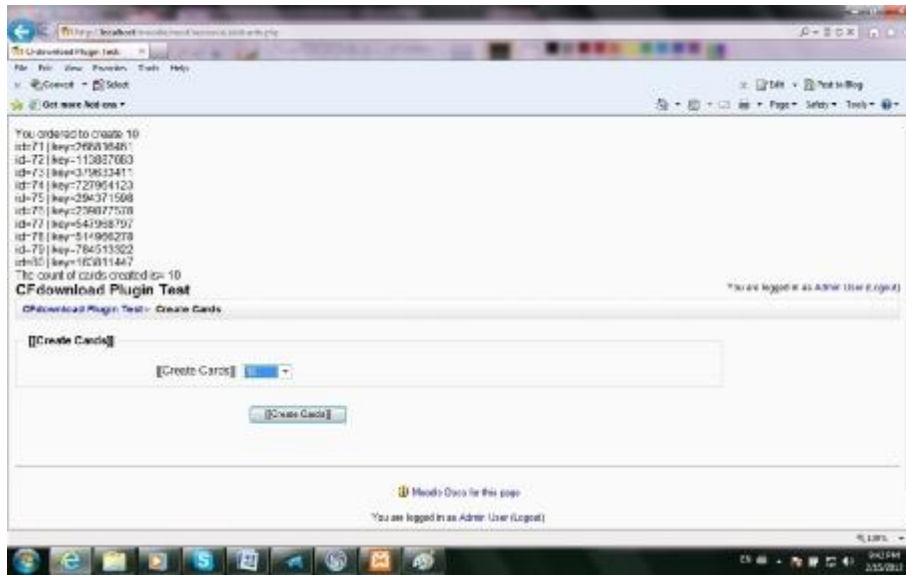


Figure (7) Create Cards Form (after creating the cards).

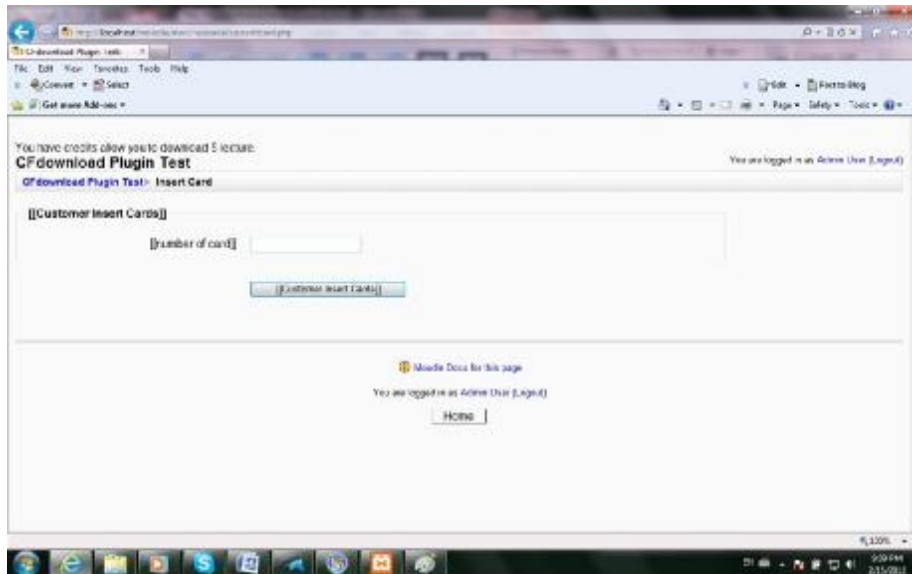


Figure (8) Insert Card form.

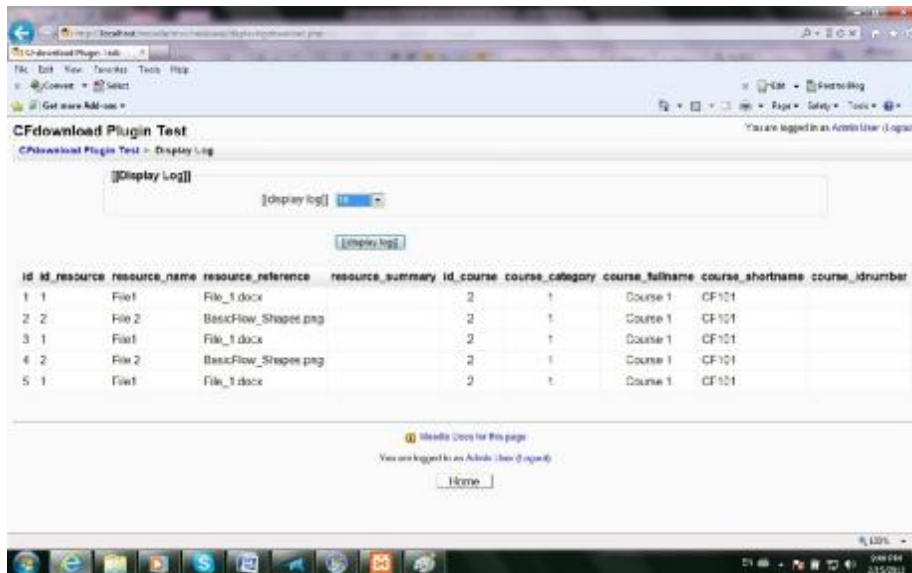


Figure (9) View Log Download form.

CONCLUSION AND FUTURE WORK

With this work a practical application, CFdownload plug-in, is developed, which is used for selling e-learning products (like course materials or any educational material electronic file), which represent one of the revenue models of the Asset model of the e-business model for e-learning. CFdownload plug-in can be used to charge the process of downloading file in Moodle LMS with a very low transaction cost and can be implemented easily in the developing and developed

countries in order to close the gap between the production cost and revenue and to fund actual and future e-learning projects. By this work Moodle moved from depending on PayPal to depend on itself for making the financial functions, and from being able to sell the whole course files by one transaction to being able to sell each file in the course by each transaction. By developing CFdownload plug-in, Moodle became having its own banking financial management system and became able to not require any external bank account for all of the e-business parties (merchant, customer, and the system itself). I suggest adding the security encryption algorithms to further enhance the security of the system in the future.

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