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IT Framework for Verifying International Academic Transcripts in a Shared Repository

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Abstract:- As labor mobility and pursuit of international recognition upsurges, demand for international certificates grows astronomically while institutions of higher learning, especially those in developing countries are jam-packed with transcript-related issues on daily basis. This situation elucidates the need to put an efficient system of validating international transcript documents in place. This paper describes a framework that will provide a system of sharing academic transcripts among recognized institutions of higher learning seamlessly, leveraging existing cloud technologies. Consequently, glitches such as delay, undue charges and fraud associated with traditional methods of transcripts verification are minimized drastically.

Keywords:- *Academic Transcript, Cloud, Database Design, System Analysis and Design.*

I. INTRODUCTION

Academic transcripts are valuable, highly in-demand and veritable method of human capital appraisal, planning and development [1], [2]. As such, concerted effort towards an efficient system of validating such documents, to determine their genuineness is incontestable. Of equal importance is a viable system of preserving such documents for future reference, as physical documents could be defaced due to susceptibility to extreme weather [3]. Digitalization is the way to go! [4].

In an international setting involving underdeveloped countries, excessive delay in processing and delivering transcripts to requesting institution is common. Transcripts are physically conveyed from one location to another via standard postal services. This is mostly due to administrative challenges, lack of adequate funding [5] and difficulties associated with seeking international academic accreditation [6]. In India, private couriers have apparently taken the lead due to their competitive edge over standard postal service as a result of their proficiency in contemporary marketing strategies in the industry [7]. In the case of Nigeria Postal Services, parcels are often exposed to defacement or loss-in-transit as a result of exposure to extreme conditions or human errors owing to manual operations though the system is improving with the introduction of tracking system [8]. However, private courier operators seem to offer better contract but for relatively high postage and other inherent costs [9].

However, contemporary technologies have emerged as fundamental factor for driving processes in a cost-effective manner [10]. This paper takes advantage of such technologies to derive relevant theoretical guides and methodologies appropriate for the support or the development of an efficient system of international transcripts attestation.

II. SIMILAR WORK

A. Transcript Xpress (TX)

TX is a service that links alumni, transcripts issuers and requesters of transcripts. The process is such that scanned transcript documents are pre-stored in an integrated database with a sub-system through which an alumnus can apply online. Upon application confirmation, the applicant gets notification while the requested transcript is being downloaded and posted directly to the requester via courier. Then the initiator (the alumnus) of the request receives a final "success" notification [11]. This method can be costly and error-prone due to too much manual intervention. The pre-stored documents are not accessible to other international institutions.

B. E-Transcript Web Services System Supporting Dynamic Conversion between XML and EDI

Transcripts are sent in XML (Extensible Markup Language) or EDI (Electronic Data Interchange) format via web service or FTP (File Transfer Protocol) server respectively. Its main components are: workflow engine, XML-To-EDI adaptor and security subsystem. Transcript orders are initiated when the workflow engine starts, while the transmission mode (XML or EDI; web service or FTP server) for the workflow engine is selected at an instance of the requester. A transcript handler object is then generated to send transcript to requester immediately [12].

C. Apply Alberta

When an application is initiated, transcripts are automatically transferred from the applicant's secondary school to prospective undergraduate post-secondary institutions. Though, this is closely related to the framework described in this paper in the sense that process of transcripts verification is apparently seamless and does not involve courier service but its limited to only institutions within Alberta [13].

D. World Education Service Canada

World Education Service (WES) Canada provides a system for evaluating local educational certificate in order to determine its foreign degree equivalence. It is required that copies of credentials under review are posted directly to WES by the issuing institution. This is 100% manual process. However, like the proposed system, WES stores electronic copies of successfully verified and evaluated transcripts for future use [14]. WES' transcripts repository is internal and not directly accessible to other institutions.

E. The Proposed Framework

The process of transcript verification is a one-off transaction and once it is successfully initiated, its stored in the virtual repository for future use. No currier involvement, as transcripts are digitally transferred to requesters Fig. 1. This will be more ideal if implemented.

III. METHODOLOGY

An approach of SSADM (structured system analysis and design methodology) adopted in this paper is a modified version of SDLC (system development life cycle). The methodology imposes a disciplined approach to designing systems. SSADM involves six distinct processes [15]:

- System Survey: First step in SSADAM is to evaluate the current system ("As Is") in order to identify its deficiencies as related to users' needs. Outcome of these exercise will determine the goal and constraints of the proposed system ("To Be").
- Structured Analysis: This involves the illustration of the system in graphics such as data flow diagrams and data dictionary for better understanding of users and other relevant stakeholders.
- Structured Design: At this stage, the input/output, database, program and control all-together are specified. As a result, the system is transformed from logical design to physical design. Hardware specification, interface engineering and UAT (user acceptance test) script design can run concurrently with this process.
- Hardware Specification: To achieve an optimum system performance, it is imperative to specify suitable hardware configuration based on the outcome of the structured design while considering cost and benefit implications.
- Implementation: Implementation commences as soon as the new project gets duly approved. This process of implementation runs through system acquisition, programming, testing, conversion and documentation.
- System Maintenance: Method of maintaining the system can be corrective i.e. errors or bugs are being rectified as they are detected. System maintenance can be adaptive. This is synonymous with customizing the system to accommodate changing user's requirements. Lastly, maintenance can be perfective which means, fine-tuning the system for better performance.

IV. THE SYSTEM ARCHITECTURE

Fig. 1 shows an overview of the four main components involved: *payment, initiation of transcript order, confirmation and execution of order* and *transcript delivery*. This is further illustrated by the flow diagram in Fig. 2.

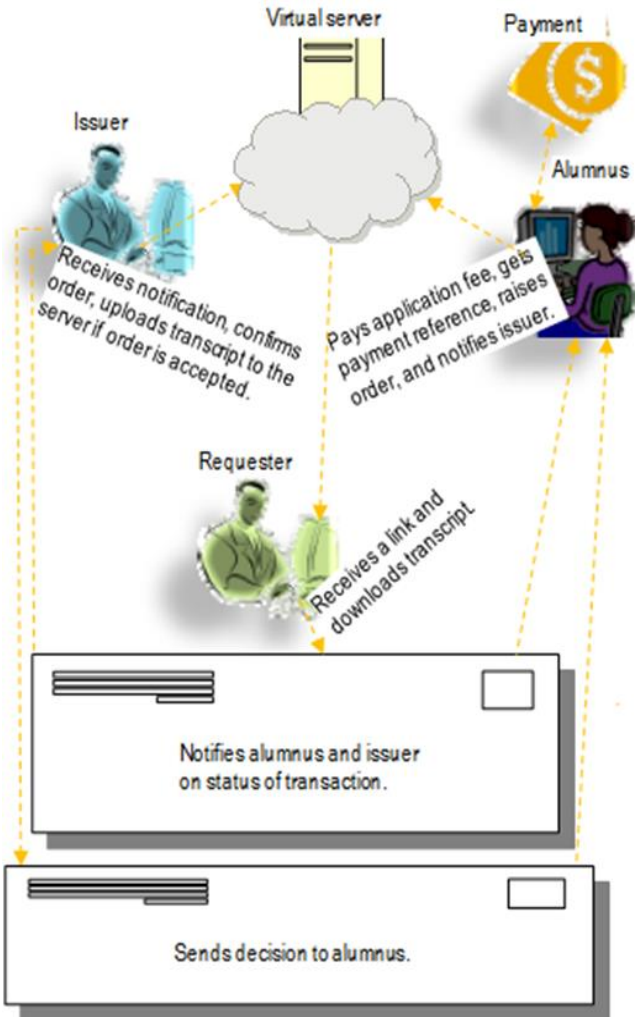


Fig 1:- An overview of a typical system.

A. Alumni Setup

This is the first step and a one-off process of migrating primary data of alumni and corresponding institutions into the database.

B. Payment

Next is an electronic payment of necessary fees as required by the initiator's (alumni's) institution [16].

C. Initiation of Transcript Order

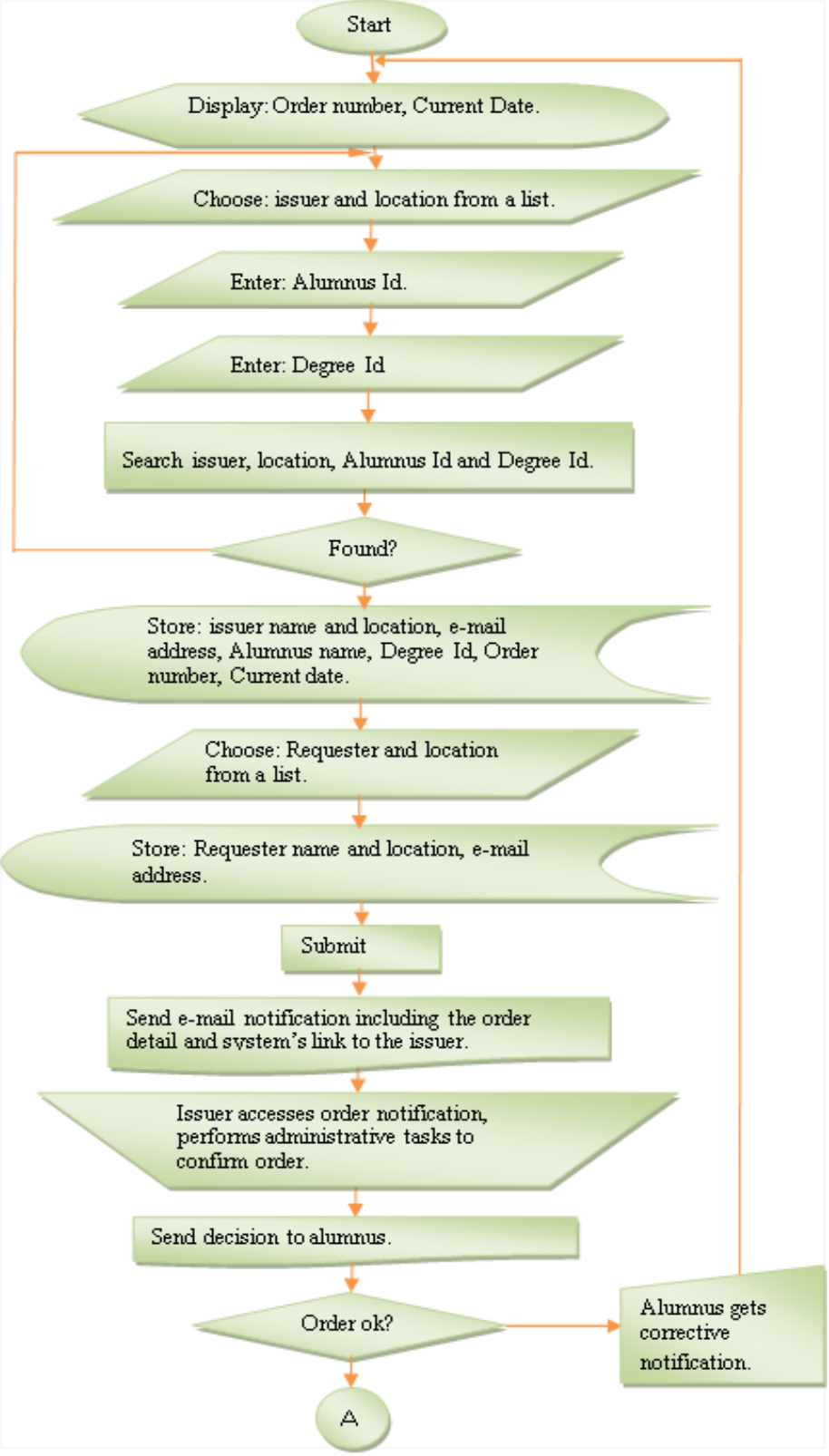
An alumnus is able to apply for transcript online upon confirmation of required payment by transcript issuing institution. This process triggers a mail notification to the transcript issuer including the application link.

D. Confirmation and Execution of Transcript Order

The issuer accesses the link to view the order and performs necessary internal administrative routine to confirm order. The requestor (initiator) gets an e-mail notification of application status Fig. 2.

E. Transcript Delivery

If order is approved, issuer uploads electronic format of the transcript into the *cloud* which is a virtual server and global repository for transcripts. At this point, both issuer and initiator are automatically alerted of successful or unsuccessful transaction. Fig. 2.



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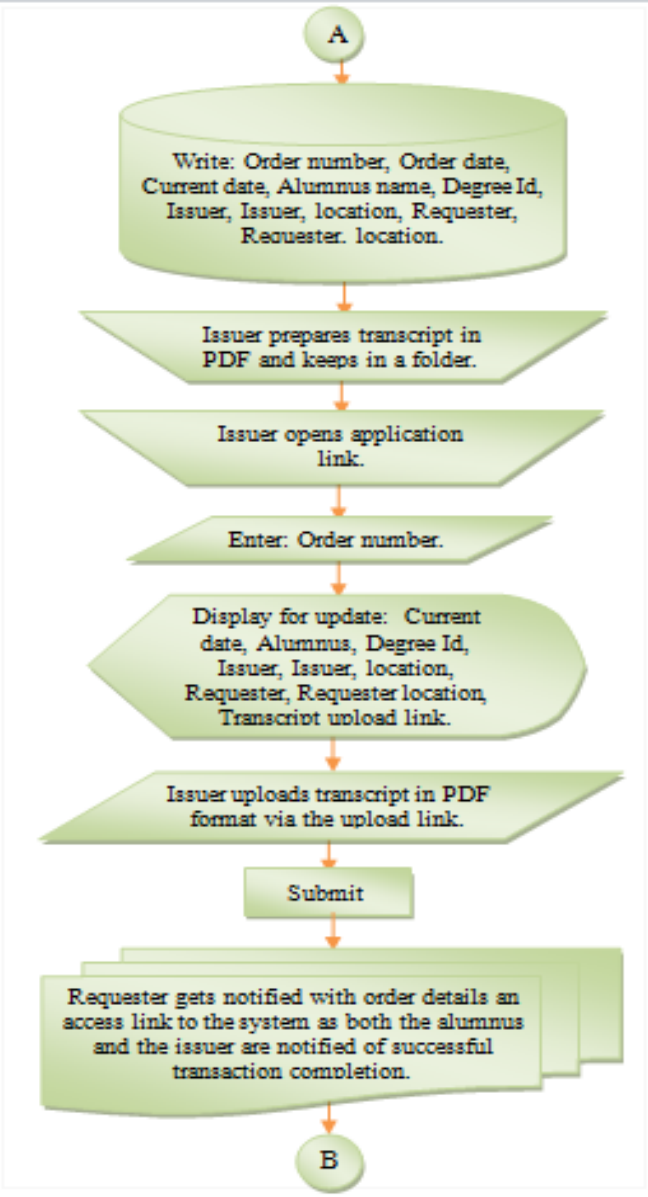

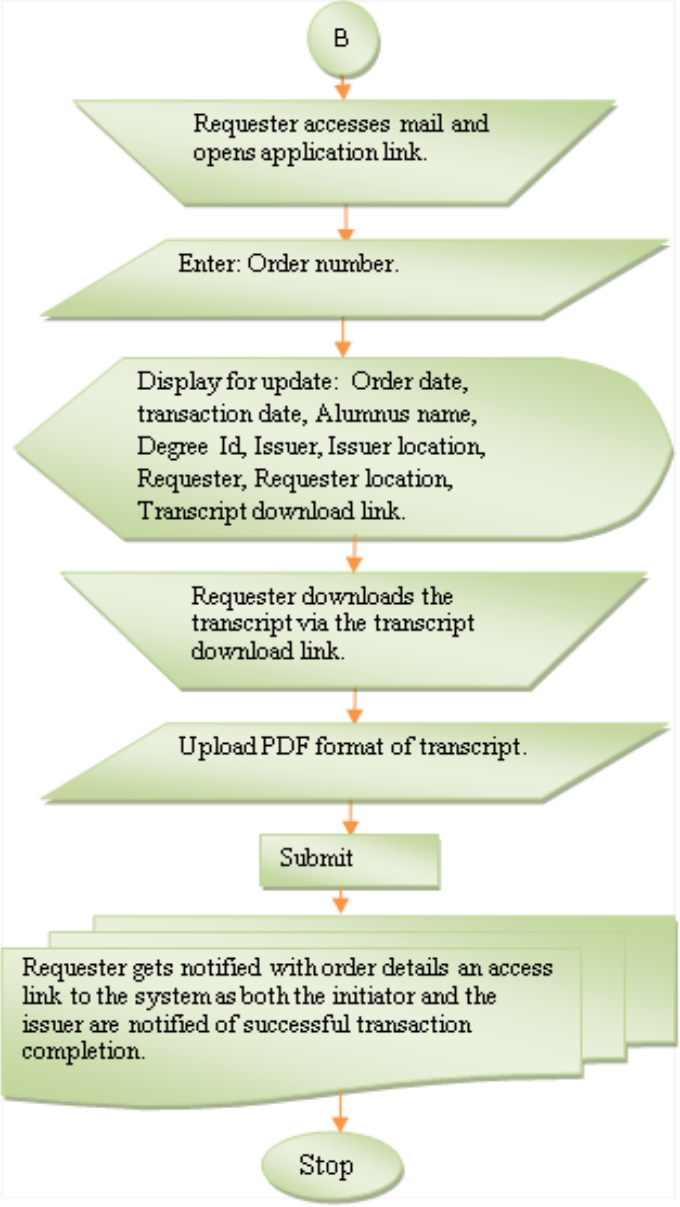

Fig 2:- A typical flow diagram illustrating the process from transcript order to delivery

V. IMPLEMENTATION

Implementing a shared service requires typically requires an integrated development environment (IDE), Database Design and User Interface Engineering.

A. IDE

An IDE is the combined software tools used to facilitate efficient codding, testing and production of software applications. e.g. WAMPserver. WAMPserver is an acronym for *Windows O/S* (operating system) *Apache MySQL PHP* (Hypertext Pre-processor) server [17],[18]. PHP is a server-side programming language of interaction with MySQL database.

B. User Interface Engineering

Modality web-based user interface (WUI) design technique is often recommended for a user-cantered design technique. Such technique can be facilitated based on tables relations fig. 3, fig 4, fig. 5, fig. 6 and fig. 7. A client-side programming language is essential for designing of a user interface with the database. Common programming languages include the combination of HTML (Hypertext Mark-up Language), CSS (cascading style sheets) and JavaScript. However, a text editor like "Atom" or "Sublime" will be needed for structured program editing.

Web browsers e.g. Google Chrome, Mozilla Firefox and Internet Explorer are very instrumental to web development as they are responsible for rendering HTML, CSS and JavaScript functions. However, cross-browser compatibility should be considered in course of implementing the system.

After the system has been tested okay locally, a web hosting service for live deployment of the system on a public IP (internet protocol) will be required.

C. Database Design

A well thought physical database design evolving from the SSADAM in section III above must be put in place using a relational database management system (RDBMS) e.g. the MySQL sub-system of the WAMPserver described in section V. Two major steps are involved:

➢ *Entity-Relationship Mode Design*

Ref. [3] The relational database schema diagram as demonstrated in Fig. 3 depicts the conceptualized design.

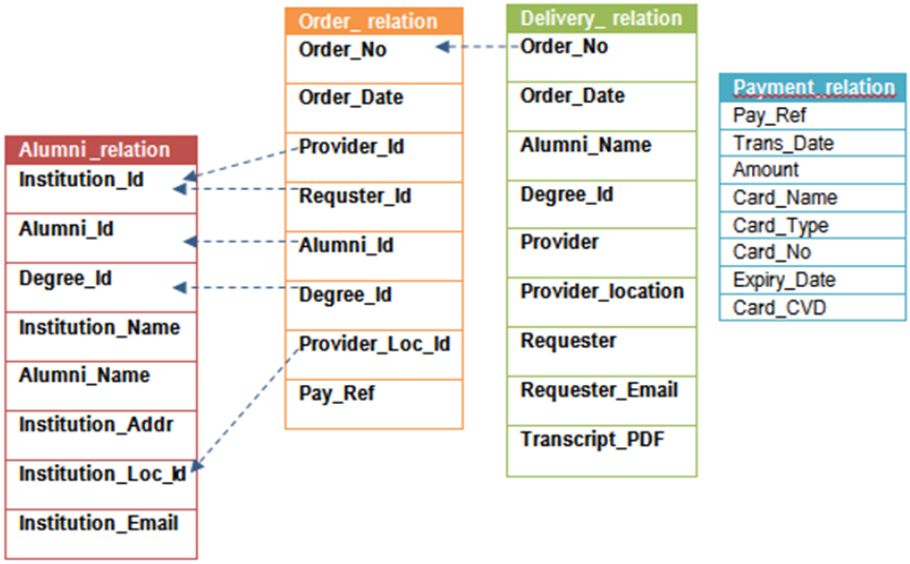

Fig 3:- E-R model

➢ *Table-Relation Design*

Fig. 4 – 5 shows an example of logical representation of conceptual design. Each table has an attached index file containing primary key properties.

Column	Type	Null	Related to	Relationship	Comments
Institution_Id	varchar(40)	No			Identification of requester / provider.
Alumni_Id	varchar(40)	No			Alumni identification.
Degree_Id	char(10)	No			drop-down list of Degrees e.g. BSc., MSc., PhD.
Institution_Name	text	No			Name of requester / provider.
Alumni_Name	text	No			Name of alumni.
Institution_Addr	text	No			Address of provider / requester.
Institution_Loc_Id	char(40)	No			Drop-down list of Countries in the world.
Institution_Email	text	No			Email address of provider / requester.

Keyname	Type	Unique	Packed	Column	Cardinality	Collation	Null	Comment
PRIMARY	BTREE	Yes	No	Institution_Id	0	A	No	
				Alumni_Id	0	A	No	
				Degree_Id	0	A	No	
				Institution_Loc_Id	0	A	No	

Fig 4:- Alumni relation and index table.

Column	Type	Null	Related to	Relationship	Comments
Order_No	int(12)	No			Auto generated serial number.
Order_Date	date	No			Current date.
Provider	char(40)	No	Table I	Institution_Id	Drop-down list of institutions.
Requester	char(40)	No	Table I	Institution_Id	Drop-down list of institutions.
Alumni	char(40)	No	Table I	Alumni_Id	Alumni identification.
Degree	char(10)	No	Table I	Degree_Id	Drop-down list of degrees.
Provider_Loc	char(30)	No	Table I	Institution_Loc_Id	Drop-down list of institutions.
Pay_Ref	text	No		Pay_Ref	For providers' use.

Keyname	Type	Unique	Packed	Column	Cardinality	Collation	Null	Comment
PRIMARY	BTREE	Yes	No	Order_No	0	A	No	

Fig 5:- Order relation and index table.

Column	Type	Null	Related to	Relationship	Comments
Pay_Ref	text	No	Table II	Pay_Ref	Payment Id, inserted from Table IV
Trans_Date	date	No			Date of transaction.
Amount	int(12)	No			Charge-out fee for transcript request.
Card_Name	text	No			Initiator's name as printed on credit card.
Card_Type	char(10)	No			Drop-down list of credit card types.
Card_No	int(40)	No			Credit card number as printed on card.
Expiry_Date	date	No			Card's expiry date.
Card_CVD	int(3)	No			Credit card CVD

Keyname	Type	Unique	Packed	Column	Cardinality	Collation	Null	Comment
PRIMARY	BTREE	Yes	No	Pay_Ref	0	A	No	text

Fig 6:- Payment relation and index table.

Column	Type	Null	Related to	Relationship	Comments
Order_No	int(12)	No	Table II	Order_No	Referencing Order_No. in Table II.
Order_Date	date	No	Table I	Order_Date	Inserted from Table I (Order_Date).
Alumni_Name	text	No	Table II Table I	Alumni_Id	Inserted from Table I; referencing Alumni_Id in Table II.
Degree_Id	char(10)	No	Table II	Degree_Id	inserted from Table II; referencing Degree_Id.
Provider	text	No	Table II Table I	Provider_Id	Inserted from Table I; referencing Provider_Id in Table II.
Provider_Location	text	No	Table II	Provider_Loc_Id	Inserted from Table II.
Requester	text	No	Table II Table I	Requester_Id	Inserted from Table I; referencing Requester_Id in Table II.
Requester_Email	text	No	Table II Table I	Requester_Id	Inserted from Table I; referencing Requester_Id in Table II.
Transcript	image	No			Inputted manually via application interface.

Keyname	Type	Unique	Packed	Column	Cardinality	Collation	Null	Comment
PRIMARY	BTREE	Yes	No	Order_No	0	A	No	int(12)

Fig 7:- Delivery relation and index table.

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