**Mini Project Report**

**on**

**Functional code development of existing data transformations for the retail data warehouse.**

**Submitted**

**BY**

**Ms. Ankita Ghule (Roll No: 04)**

**Ms.Annlip Gour (Roll No: 05)**

**Mr. Mayank Junankar (RollNo: 57)**

**Mr. S Akshansh (RollNo: 70)**

**Semester/Section: 7th/A**

**Roll No:**

**Under the Guidance of**

Ms. Archana S. Pimpalkar



**November 2022-23**

**Department of Computer Technology**

**YESHWANTRAO CHAVAN COLLEGE OF ENGINEERING, Nagpur**

(An Autonomous Institution Affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

**YESHWANTRAO CHAVAN COLLEGE OF ENGINEERING**

**NAGPUR**

(An Autonomous Institution Affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

**Department of Computer Technology**

**(2022-23)**

**Certificate**

**This is to certify that the Mini Project Report titled “Functional code development of existing data transformations for the retail data warehouse. " is submitted towards the partial fulfillment of the requirement of the Mini Project course in VII Semester, B.E.(Computer Technology).**

**Submitted by:**

**Ms . Ankita Ghule (RollNo: 04)**

**Ms .Annlip Gour (RollNo: 05)**

**Mr. Mayank Junankar (RollNo: 57)**

**Mr. S Akshansh (RollNo: 70)**

**is approved.**

**Project Guide**

**Ms. Archana S. Pimpalkar**



**Project Coordinator**

**Smita R. Kapse**



**Head, Department of Computer Technology**

**Dr. R.D.Wajgi**



Date:\_\_\_\_\_\_\_\_\_\_\_

Place:\_\_\_\_\_\_\_\_\_

**Certificate of collaboration (industry/research organization)**

**(To be printed on Industry letterhead)**

**Certificate of Completion**

This is to certify that the following students of the final year Computer Technology Department, Yeshwantrao Chavan College of Engineering, Nagpur, have completed the Live/Industry/Joint research mini-project titled "**Functional code development of existing data transformations for the retail data warehouse.** ” under the guidance of (Ms. Archana S. Pimpalkar*)* and Co-guide (Mr. Koustubh Laghate*)* with industry name InCredo Technologies for the session 2022-23.

**Name of student: Ankita Ghule Enrollment No: 19010345**

**Name of student: Annlip Gour Enrollment No: 20030123**

**Name of student: Mayank Junankar Enrollment No: 20030193**

**Name of student: S Akshansh Enrollment No: 19010927**

**Name and Signature of Industry Guide with Seal**

**ACKNOWLEDGEMENT**

We would like to thank our guide Ms. Archana S. Pimpalkar and industry mentor Koustubh Laghate for thorough guidance in the project. We are extremely grateful and indebted to them for their expert, sincere, valuable guidance and encouragement which was of immense help to us.

We would like to express our sincere gratitude to **Dr. R.D.Wajgi**, Head, Department of Computer Technology, for her constant encouragement towards the successful completion of our work.

We wish to express our sincere thanks to Dr. U.P. Waghe, the Principal of our college, for providing us with all the necessary facilities and the infrastructure without which we would not have been able to complete our project successfully.

We would also like to thank our Project Coordinator Prof. S. R. Kapse for their continuous guidance owing to which the project could take shape.

We would like to thank the technical assistant, Mrs. B. H. Kulkarni, for providing the necessary technological support. Last, but not least, we would like to thank all the faculty members and non-teaching staff members who helped us despite their busy schedule

**Abstract**

*ETL (Extract Transform Load) process is the industry standard term for data extraction, transformation, and loading into the Data Warehouse (DW). The ETL process is the most resource-demanding in DW implementation and typically has to be evolved and maintained for the duration of the DW. To facilitate the development and maintenance of ETL processes many ETL tools have been developed featuring Graphical User Interfaces and various built-in functionalities (parallelism, logging, rich transformation libraries, documentation generation, etc.). The downside of such GUI ETL tools is that development is carried out heavily using mouse operations and less by writing programming code, which feels unnatural for some developers, especially with many similar, repetitive tasks. In this paper, we present an alternative approach - an ETL framework "ETLator" based on Python scripting language where ETL tasks are defined by writing Python code. ETLator implements various typical ETL transformations and allows the user to simply and efficiently define complex ETL tasks with multiple sources and parallel tasks whilst leveraging the full flexibility of Python. ETLator also provides logging and can document ETL tasks by generating data flow images. In a test case, we show that ETLator simplifies ETL development and rivals the GUI approach.*

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**1.0 INTRODUCTION**

Data Transformations are used for mapping that represents the operations that you want to perform on data. We will define the functionality of data transformation using the Python programming language. ETL (Extract Transform Load) process is the term for data extraction, transformation, and loading into the Data Warehouse (DW). Here, we’ll focus on transformations. To perform the development and maintenance of transformations, many tools have been developed with the basis of Graphical User Interfaces and various built-in functionalities (transformation libraries, documentation generation, etc.). The disadvantage of such GUI tools is that development is carried out using mouse operations and less by writing programming code, which feels unnatural for some developers, especially with many similar, repetitive tasks. Here, transformation tasks are defined by writing Python code. This implements various ETL transformations and allows the user to simply and efficiently define complex ETL tasks while leveraging the full flexibility of Python.

**1.0 AIM & OBJECTIVES**

**Aim:** Functional code development of existing data transformations for the retail data warehouse.

**Objectives:**

* Define transformation tasks by writing functional code.
* To simply and efficiently define complex ETL tasks with multiple sources while leveraging the full flexibility of functional codes.
* In place of GUI, developing a functional code to provide better understanding and customizability of tasks.
* There is a cost involved to use the existing ETL tools, but by using the functional code we can perform the required tasks at a very low cost or free of cost.

**2.0 LITERATURE REVIEW**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Reference**  **No.** | **Title** | **Authors** | **P Published**  **in** | **Major**  **Findings** |
| **1** | ETLator - a scripting ETL framework | Miran Radonić; Igor Mekterović | 2017 40th International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO) | The authors presented an alternative approach - an ETL framework "ETLator" based on Python scripting language where ETL tasks are defined by writing Python code. ETLator implements various typical ETL transformations and allows the user to simply and efficiently define complex ETL tasks with multiple sources and parallel tasks whilst leveraging the full flexibility of Python. ETLator also provides logging and can document ETL tasks by generating data flow images. In a test case, they show that ETLator simplifies ETL development and rivals the GUI approach. |

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| **2** | pygrametl: A Powerful Programming Framework for Easy Creation and Testing of ETL Flows | Søren Kejser Jensen, Christian Thomsen, Torben Bach Pedersen & Ove Andersen | CHI '11: Proceedings of the SIGCHI Conference on Huma Factors in Computing Systems -- May 2011 Pages 3363–3372 | They propose to develop ETL flows by writing code. To make the programming easy, they proposed the Python-based ETL framework pygrametl in 2009. They have extended pygrametl significantly since the original release, and in this paper, They present an up-to-date overview of the framework. pygrametl offers commonly used functionality for programmatic ETL development and enables the user to efficiently create effective ETL flows with the full power of programming. Each dimension is represented by a dimension object that manages the underlying table or tables in the case of a snowflake dimension. Thus, filling a slowly changing or snowflaked dimension only requires a single method call per row as pygrametl performs all of the required lookups, insertions, and assignment of surrogate keys. |
| **3** | Empirical Analysis of Programmable ETL Tools | Neepa Biswas, Anamitra Sarkar & Kartick Chandra Mondal | 26 June 2019 Springer, Singapore | This paper focuses on an alternative ETL developmental approach taken by hand coding. In some contexts, it is appropriate to custom-develop an ETL code that can be cheaper, faster, and maintainable. Some well-known code-based open-source ETL tools (Pygrametl, Petl, Scriptella, R\_etl) developed by the academic world have been studied in this article. Their architecture and implementation details are addressed here. This paper aims to present a comparative evaluation of these code-based ETL tools. Not to acclaim that code-based ETL is superior to the GUI-based approach. It depends on the particular requirement, data strategy, and infrastructure of any organization to choose the path between Code based and GUI-based approaches. |

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| 4 | A Transformation System for Developing Recursive Programs | R. M. Burstall  And John Darlington | Journal of the Assooat~on for Computing Machinery, Vol 24, No 1, January 1977, pp 44-67 | A system of rules for transforming programs is described, with the programs in the form of recursion equations. An initially very simple, lucid, and hopefully, correct program is transformed into a more efficient one by altering the recursion structure Illustrative examples of program transformations are given, and a tentative implementation is described Alternative structures for programs are shown, and a possible initial phase for an automatic or semiautomatic program manipulation system is indicated They start with programs having extremely simple structures and only later introduce the complications which they usually take for granted even in high-level language programs. These complications arise by introducing useful interactions between what were originally separate parts of the program, benefiting from what might be called "economies of interaction." They proceed in quite an empirical manner, showing examples of various kinds. |

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| 5 | Program Transformation Mechanics | Jonne van Wijngaarden Eelco Visser | May 2003  UU-CS-2003-048 Institute of Information and Computing Sciences Utrecht University | Transformation techniques are spreading from application in compilers to general use in generative programming and document processing. Since transformation requires operations such as pattern matching, generic structure traversal, and querying, which are not normally provided by general-purpose programming languages, many tools have been developed to provide higher-level support for the implementation of transformations. These tools come in many flavors each with their own merits and based on different paradigms, which makes comparison difficult. In this paper, They consider transformation from the point of view of mechanics and develop a classification of transformation mechanisms that provides a reference for comparing tools developed for different applications, using different implementations, and in different programming paradigms. To do so They distinguish three fundamental aspects of transformation mechanisms: scope, direction, and stages. They apply this classification in a discussion of design patterns for transformation, characterization of several typical transformations, and a systematic comparison of eleven representative transformation tools. |

**Table No. 1 Literature Reviews**

**3.0 PROPOSED METHODOLOGY**

We propose to develop a similar retail data management system based on Python functional codes for performing the transformations. This will save the cost of the software for the retailer and provide more customizability and options for transformations to the managers.

The project will be based on SQL for storing data, and Python libraries like Pandas and Numpy for data transformations and analytics.

The system will offer various transformations like:

|  |  |
| --- | --- |
| **Transformation** | **Description** |
| Source | Reads data from a source. |
| Target | Writes data to a target. |
| Aggregator | An active transformation that performs aggregate calculations on groups of data. |
| Cleanse | Use a cleanse asset to standardize the form and content of your data. |
| Data Masking | A passive transformation that masks sensitive data as realistic test data for non-production environments. |

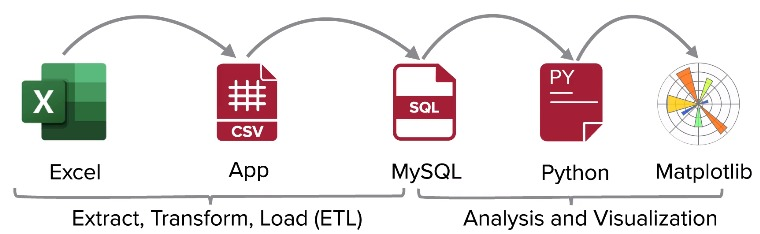
|  |  |
| --- | --- |
| Deduplicate | Use a deduplicate asset to find instances of duplicate identities in a data set and optionally to consolidate the duplicates into a single record. |
| Expression | A passive transformation that performs calculations on individual rows of data. |
| Filter | An active transformation that filters data from the data flow. |
| Joiner | An active transformation that joins data from two sources. |
| Labeler | Use a labeler to identify the types of information in an input field and to assign labels for each type to the data. |
| Lookup | Looks up data and defines the lookup condition and the return values. |
| Normalizer | An active transformation that processes data with multiple-occurring fields and returns a row for each instance of the multiple-occurring data. |
| Rank | An active transformation that limits records to a top or bottom range. |
| Sequence Generator | A passive transformation generates a sequence of values. |
| Sorter | A passive transformation that sorts data in ascending or descending order, according to a specified sort condition. |
| Union | An active transformation that merges data from multiple input groups into a single output group. |
| Web Services | An active transformation that connects to a web service as a web service client to access, transform, or deliver data. |

**Table no. 2 Data Transformations**

**4.0 RESULTS AND DISCUSSION**

After working on the development of this project, we got a deeper understanding of Python libraries. We built a function to extract data from Excel(xlsx) files as data can be easily manipulated on the excel sheet, and it isn't a safe storage for a database of important sales records. After fetching the data, we combine different databases and excel sheets like product details and transaction details into a single normalized database and store it in SQL completely using Python. This completes our ETL process.

The same task would take thousands of lines of code in SQL, but Python makes it easy.



**Fig No. 1 Flow of the system**

Then as an extension to this project, we can use the database to visualize data patterns which will come in handy to analysts and managers of the company. This can be done with the help of Python libraries like matplotlib.

**5.0 CONCLUSION AND FUTURE SCOPE**

**Conclusion:**

We have created platform-independent Python functional codes, with support for various data sources like product and transaction records for retail data. It will consist of writing short scripts in Python, with Python libraries at one's disposal, which results in expressive code, and overall an easier and faster experience of developing and maintaining projects.

**Future Scope:**

Future development of this will include built-in logging and documentation generation features (data flow charts included) which are traditional features found only in GUI-based ETL tools. Also, we plan to develop a rich data transformation and data quality library.

Other developers can use our project to build their projects too, as it is an open-source project.

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