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COURIER MANAGEMENT SYSTEM USING CLOUD COMPUTING

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ABSTRACT

Courier Management Softwares of various types are widely used by Courier Companies to efficiently track and process their delivery orders. This goal of this project is to develop a courier management software to help businesses and its customers to locate the movement of couriers. This aims to make efficient the pickup, delivery and transit of goods. Automation will be a key feature of it. This reduces any delays in delivery without causing any losses due to follow ups. Rapid repair of damaged equipment and optimizing the utilization of them along with improved parcel security has been the focus. As a result of this, losses will be lowered and costs can be cut, thereby making the operations as efficient as possible. Cloud Computing will serve as a cost effective solution to deploy this. Global Positioning System (GPS) technology has been the pillar of the system which is responsible for sharing the exact geographical location. This information can improve quality of the service. GPS also leaves a trail of the package and helps the customer get alerts and track it.

KEYWORDS - *Courier management system, Package, GPS, Tracking, Cloud Computing, Elastic Beanstalk, Automation.*

I. INTRODUCTION

With the advent of e-commerce, the scope of logistics grew exponentially. With the arrival of the pandemic, the world realised the potential of this as personal movement was restricted and work from homes were encouraged. However these operations are not immune from the consequences of the pandemic. It caused severe disruptions on the supply chains and logistics. This therefore affected businesses in their B2B operations and reduced productivity. Delays and losses were the two primary troubles which both – the businesses and customers faced.

This is where an efficient model of courier management system comes into play. Following the model followed by the Austrian parcel delivery service [1]; this project developed a system to implement an effective solution. Cloud computing i.e. Amazon Web Services was used to deploy the application into. The application would have a front end with PHP and HTML while the backend would be SQL to support the database function. It would be deployed on the Elastic Beanstalk service of AWS [2] [3] [4]. The other option available is to host it on IIS of an EC2 instance [5].

Cloud based applications enjoy many benefits than the traditional systems. This will be an application which is fully hosted on the cloud i.e. following the public cloud deployment model. As an Elastic cloud application, it will be scalable and hosted in a specific environment designed especially for it [4] [6].

II. PROBLEM STATEMENT

The courier management system is supposed to be effective and utilise the resources in an optimum manner to ensure timely service with least cost. Every aspect of the operation from pickup/receipt must be logged properly. The movement of goods between hubs or zones will have a time limit set under which it must be completed. The last mile delivery will also be important as a lot of delays happen here due to time taken to locate the receiver. Any packages which remain undelivered or unclaimed will be notified to the receiver first and then the sender. The receiver will be sent a tracking ID by the courier service company through

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SMS/email. This can be used to track its movement. The design and implementation of this system will be the goal of this project [7].

III. EXISTING SYSTEM

The traditional courier management system relies on a single centralized database and system to operate [8]. This has many disadvantages such as higher rate of failure, corruption of data, single point of failure etc. These factors can cause severe damages in showing the right picture which is used for taking correct decisions.

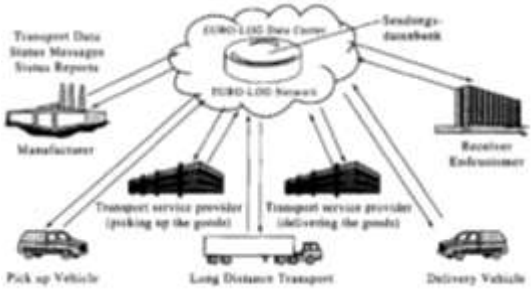

Figure 1: Traditional Courier Management System

The other drawback of it was the need to manually update the progress of an order. This sometimes caused delays and confusions in case of a dispute.

IV. PROPOSED SYSTEM

The proposed system will ensure that the application will be decentralized with proper checks and balances to give the right picture. Due to its automated nature, there won't be any loss due to manual intervention [1] [7].

Once the application is developed and tested, it would be deployed on the cloud thereby eliminating all chances for any failures or disruptions which maybe caused in normal course of business.

Auto scaling and load balancing would ensure Fault Tolerance and High Availability. This will make the application more resilient to ensure business continuity [9].

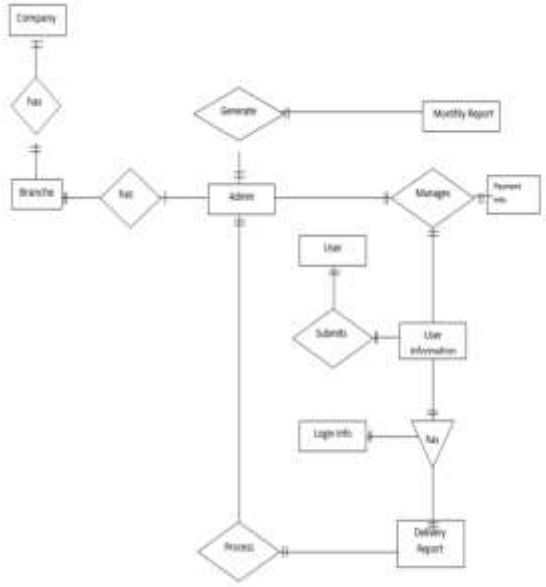

Figure 2: ER Diagram of the Proposed System

As the ER diagram shows, there will be the option for the business to generate data for measuring the performance and visualizing it using tools. [10] [7]

V. DATAFLOW DIAGRAM

The dataflow diagram gives a rough idea of the proposed system. There are three main parties in this transaction:

- Administrator and his agents
- Customer or users.

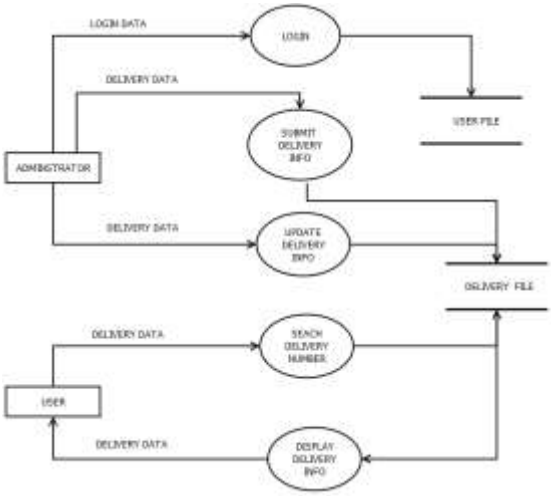

Figure 3: Data flow Diagram

The administrator or the other business IDs can be used to book a courier request that generates a unique ID for tracking till delivery. The user is also notified of all the movements by the package along the system.

On the scheduled delivery time the user is notified and put in touch with the last mile delivery agent to

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ease the delivery. They have also been given an opportunity to raise complaints [11] [12].

VI. SYSTEM ANALYSIS AND DESIGN

The application will rely on the frontend developed by PHP and HTML. These are the two suitable scripting languages for making the interface of the application. The backend of it will be SQL [13] [14]. This is to maintain and process the databases used for various purposes. PHP's compatibility with the SQL database is an added advantage here [15].

This will be hosted on an Elastic Beanstalk [2] or in an IIS server [16] of an EC2 instance.

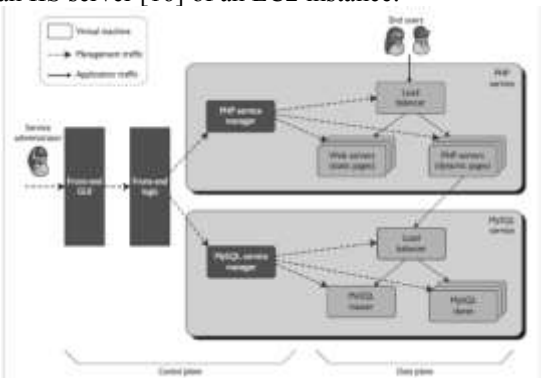

Figure 4: System Architecture and Design

The customers will be able to access the information from the application while the administrator will be able to control and segregate the information fed to the servers [1]. The updates made are always by administration authorisation. This is to ensure that the customer gets access only to the right information [17]. The end users consist of both, senders and receivers. The updates in transit will be made available to the customer on a provisional basis thereby reducing any scope for error.

Since this will be hosted on a Cloud, there will be provisions for auto-scaling and load balancing. This is to ensure that the application performs without any hiccups depending upon the fluctuations in loads [6].

The use of Elastic Block Storage will create a separate environment for the application to run. It can also be run on containers like Dockers to achieve the same results. In the case of an IIS deployment, it will require the creation of autoscaling groups and load balancers [2] [16] [6].

Though the application is decentralized and data is redundant, there must not be an issue of data corruption. This is taken care of by introducing strict checks. The primary such responsibility is that of the administrator to approve all changes which occur along the passage of the shipment across hubs and the destinations.

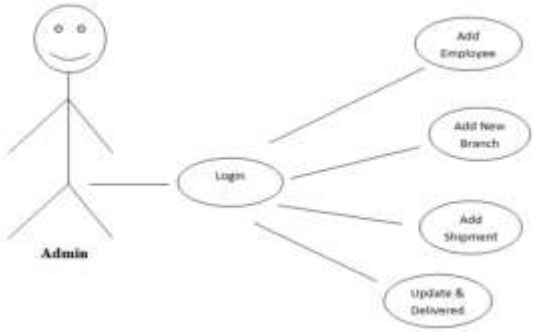

Figure 5: Admin Roles

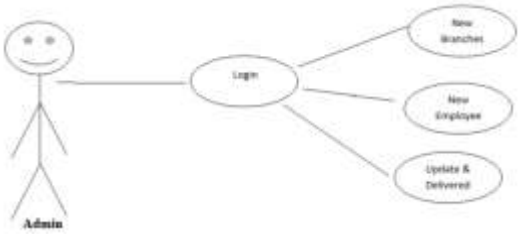

Figure 6: Admin Roles

Some changes to the application are restricted only to the administrator. They are as follows:

1. Adding new employee
2. Deleting or updating existing employee
3. Adding new branches
4. Deleting or updating new branches

These are functions which alter the structure and shape of the organisation and come after major approvals [18]. Therefore this cannot be done without the knowledge of the administrator [1].

In the case of the normal day to day operations the administrator does not need to keep an eye for every movement [8]. The other functions which can be updated on the website and need to be just notified to the administrator are:

1. Pickup or receipt of a package
2. Transit updates
3. Returned packages
4. Delivery confirmations

The information must be entered by authorised employees who are allotted the respective task and it must be ensured that they have done it from the specified ID and location. These transactions need to be verified by a supervisory authority [8].

The reports on these operations are constantly updated in a Power BI dashboard which is summarised and accessed by higher authorities who can check their business performance [10] [19].

There are other tools for data visualization as well. They can be implemented based on the features and requirements.

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	Open Source	Integration with popular sources	Interactive Visualization	Desktop Client	Online Client
Tableau	N	Y	Y	Y	Y
Power BI	N	Y	Y	Y	Y
Plotly	Y	N	Y	N	Y
Gephi	Y	N	Y	Y	N
Excel 2016	N	Y	Y	Y	Y

Figure 7: Comparison of Data Visualization Tools

In this case Power BI stands out as an appropriate choice due to its interactive visualization and online client. Tableau is another viable choice which is more sophisticated [10] [19].

VII. FUTURE SCOPE

This concept can be developed into an android mobile application [11] [12] and enable remote working with co-ordination. The mobile application can be devised in two ways –

- Customers
- Business

The business app will be restricted to the employees of the company and will be used to update the data on the application. There will be a separate API for this app and it will contain much more advanced features than the customers' API [12].

For the customers, a user friendly app can be developed to help them approach the business for their needs. The main features offered will be:

- Schedule pickups
- Get Transit alerts
- Raise complaints
- Mark delivery confirmation

Another aspect would be to take the best advantage of the cloud technology available. The organisation can opt for Hybrid Cloud deployment model so as to take the best advantages of Public and Private Deployment models. This can secure the business data by letting it remain on premise [20] [9].

CONCLUSION

This project has solved the problems caused due to centralization and inefficient updating of a traditional courier management system and has additionally used the help of Cloud Computing to enable scaling and load balancing to enable High Availability and Fault Tolerance. Proper checks and balances have been incorporated into this and have reduced the scope of errors to near zero.

Deploying it in the cloud can be done through two services and the company can chose one which suits their purpose. The use of public cloud deployment has been made under the assumption that it will be used for a big scale.

The use of data visualization by taking data from the application can be used to measure performances and plan better approaches to achieving the target.

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