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Professional paper

STREAMLINING POSTAL SERVICES IN NORTH MACEDONIA: A CASE STUDY

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Abstract

The COVID-19 pandemic has indeed been an extraordinary situation that has required adaptation to new circumstances and forced all market players, including postal operators, to adjust to new challenges. It is important to note that the postal industry has faced challenges in the past decade, including declining mail volumes and revenue. However, many postal operators have implemented various strategies to adapt to changing market conditions and remain profitable, including the adoption of modern technologies such as Postal Management Systems. These systems provide a centralized platform to manage and track various postal operations, which can help postal operators optimize their operations and reduce costs. By automating several tasks involved in managing postal services, these systems can reduce manual labor and increase efficiency, enabling postal operators to offer better customer service and improve their bottom line. Overall, implementing a Postal Management System can be an effective strategy for postal operators to overcome the challenges faced by the postal industry and improve their performance in the long run.
This paper aims to introduce the benefits of a Postal Management System to the postal services in North Macedonia.

Keywords: postal management system, digitalization of postal services

1. Introduction

In recent years, technology has undergone remarkable advancements, revolutionizing our daily lives, work environments, and social interactions. The advent of smartphones, artificial intelligence, and the Internet of Things (IoT) has transformed industries and opened up new possibilities. Virtual reality and augmented reality have gained popularity, promising to revolutionize the entertainment, education, and healthcare sectors. As technology continues to advance at an accelerated pace, the future holds even more rapid developments and innovations, bringing forth new opportunities for humanity.

However, amid the digital transformation, certain industries have encountered significant challenges, particularly postal services. The digitization of communication channels has exposed the limitations of traditional postal systems, leading to delays in delivering packages and letters to recipients' homes. In many cases, these delays can have serious consequences, especially when time-sensitive or crucial items need to be promptly received. To address this issue, a comprehensive digitization of the postal operations nationwide is crucial. By embracing digital solutions, the entire postal system can be streamlined, reducing delays and ensuring efficient delivery to recipients. This transformation will significantly enhance the reliability and effectiveness of postal services, aligning them with the advancements seen in other industries.

2. Problem definition

North Macedonia, as a country, has been relatively slow in embracing and integrating technology into various aspects of daily life. Despite some recent progress, the country still lags behind other European nations in terms of digital infrastructure and technology adoption. This lack of investment in technology has hindered the growth of the country's economy, and the education system also faces challenges due to limited access to technology. To catch up with other countries, North Macedonia requires substantial investment and improvements in its digital infrastructure.

One significant area that has been overlooked in terms of technology adoption is the post office system in North Macedonia. Currently, post offices in the country rely heavily on manual processes, which are inefficient and ineffective in today's digital era. Our research has revealed that technology is not utilized at all in these post offices, leading to delays and inconveniences for both postal workers and citizens. This situation calls for the development of a system that can streamline operations and benefit both postal workers and citizens. Therefore, the purpose of this paper is to propose a solution that will address these challenges and help modernize the post office system in North Macedonia. The envisioned system aims to digitalize the entire operation process of post offices in the country. By implementing this system, citizens will no longer have to wait for days for packages or letters to reach their homes. Instead, as soon as a package or letter arrives at one of the post offices, it will be registered in the system. The intended recipient will then have immediate access to this information through the system, allowing them to decide whether they want to collect the item or not.

This digitalization effort will bring several benefits. Firstly, postmen will save time by not having to deliver unnecessary letters or packages to citizens' homes. Secondly, citizens will have faster and more convenient access to information about incoming mail, enabling them to stay informed without unnecessary delays. By leveraging technology to streamline postal operations, North Macedonia can enhance the efficiency and effectiveness of its post office system, aligning it with modern standards and improving overall customer satisfaction.

3. State of the art

Recent studies and authors have highlighted the transformative impact of digitalization on the postal sector, as traditional mail volumes decline while parcel volumes continue to grow [1]. In the UK, for instance, mail volumes have been steadily decreasing, albeit at a slower rate in recent years, with a slight increase in revenues primarily driven by price adjustments. In this changing landscape, the digitization of post offices is becoming increasingly crucial as technology reshapes communication and business practices.

By embracing digitalization, post offices can enhance their operational efficiency and provide customers with more convenient and personalized experiences [2]. Various digital tools, such as online tracking, self-service kiosks, and digital printing and scanning services, can reduce waiting times and streamline post office operations [2]. Furthermore, digitization enables post offices to expand their online presence, reaching a broader audience and offering new services tailored to the needs of modern customers [3]. To remain competitive in the digital age, post offices need to adapt and cater to the evolving demands of their customer base [4].

The advantages of digitalizing post offices extend beyond operational efficiency. Accurate record-keeping and the mitigation of errors can significantly reduce the risk of delays or lost packages, improving overall service

quality [5]. In an era marked by increasingly sophisticated cybersecurity threats, digitalization can contribute to the safety and security of postal transactions, safeguarding both customers and postal employees [5].
Notably, digitalization brings about cost savings, increased efficiency, and improved customer satisfaction within postal services [6]. Customers can enjoy the convenience of tracking their packages and accessing services online from the comfort of their own homes, resulting in heightened satisfaction [7]. By leveraging technology, post offices can adapt to changing customer preferences, streamline processes, and deliver more value to their customers. In light of these developments, North Macedonia must embrace digitalization and leverage technological advancements to modernize its post office system. By implementing digital solutions and incorporating best practices observed in other countries, North Macedonia's post offices can enhance their efficiency, improve customer satisfaction, and adapt to the demands of the digital age.

4. System design and development

When developing a new system for an institution, it is crucial to carefully consider all aspects to ensure a comprehensive and effective solution. To ensure nothing is overlooked, we begin by creating an activity diagram, fig. 1, that outlines the system's functionalities and workflow.

Activity Diagram-The activity diagram for our system is divided into two main parts: the user section and the administrator section, with both parts converging at the end of the diagram.

User - The users of the system are citizens of North Macedonia, excluding those below 18 years old. Individuals under 18 will be able to see packages and letters addressed to them under their parents' accounts. The activities that users can perform in the system include:

Log in to the system: Users will authenticate themselves using their credentials to access the system.

View packages/letters: Users can see a list of packages and letters that have arrived for them.

Manage packages/letters: Users can manage their packages and letters by making decisions about their delivery. They can choose whether they want the package to be sent to their home or take alternative actions.

Administrator-The administrators of the system are employees of the Post Offices in North Macedonia. The activities that administrators can perform in the system include:

Log in to the system: Administrators will log in to the system using their authorized credentials.

View packages/letters: Administrators can view a list of all packages and letters that have arrived at the post office.

- If a package needs to be sent to the recipient's home, the administrator can send it for shipping.
- If a package does not require home delivery, the administrator can send it to the archive.

Manage packages/letters: Administrators have the authority to add, edit, and delete packages and letters in the system. This allows them to maintain accurate records and update information as needed.

By dividing the system into user and administrator sections, we can ensure that each user group has access to the necessary functions and activities relevant to their role. Users can easily manage their packages and make delivery decisions, while administrators have full control over package management and system administration.

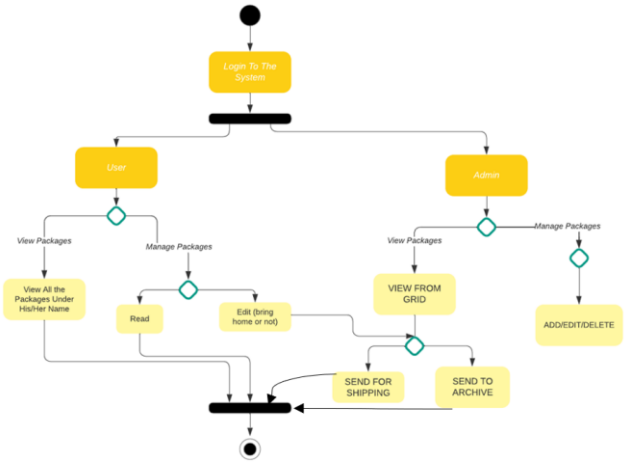

Figure 1. "All functions" Activity Diagram

A database ER (Entity-Relationship) diagram is a visual representation of entities and their relationships within a database. In our system, the database is designed with simplicity in mind, consisting of three tables: 'AdminLogin', 'UserLogin', and 'PackagesLetters'.

AdminLogin Table - The 'AdminLogin' table is used for administrators to sign in to the system. It stores information related to their login credentials and access rights. This table may include fields such as:

AdminID: A unique identifier for each administrator.
Username: The username used for login authentication.
Password: The encrypted password associated with the username.
AccessLevel: Indicates the level of access and permissions granted to the administrator.

UserLogin Table- The 'UserLogin' table is utilized by users to sign in to the system. It stores information specific to user login credentials and access privileges. This table may include fields such as:

UserID: A unique identifier for each user.
Username: The username used for login authentication.
Password: The encrypted password associated with the username.
AccessLevel: Represents the level of access and permissions assigned to the user.

PackagesLetters Table- The 'PackagesLetters' table is responsible for storing all the relevant information about packages and letters, including details about the recipient and the package itself. This table may include fields such as:

PackageID: A unique identifier for each package or letter.
RecipientName: The name of the person to whom the package or letter is addressed.

RecipientAddress: The address where the package or letter should be delivered.
TrackingNumber: A unique number assigned to track the package's progress.
ArrivalDate: The date when the package or letter arrived at the post office.
Status: Indicates the current status of the package (e.g., in transit, delivered, archived).

These three tables form the foundation of the system's database, allowing for efficient storage and retrieval of information related to administrators, users, and packages/letters. The relationships between these tables, such as foreign key constraints, can be established based on the specific requirements of the system.
The database ER diagram, fig. 2, provides a visual representation of the data architecture, highlighting the entities and their relationships within the system. This diagram serves as a blueprint for implementing the database structure and facilitates efficient data management within the system.

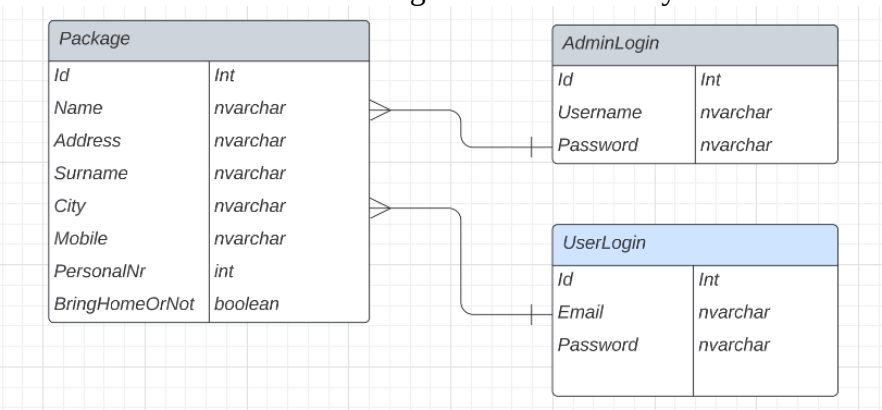

Figure 2. Database E-R Diagram

User Interface and Coding - The system is developed using the C# programming language for the backend, while the frontend and design are created using HTML, CSS, and Bootstrap. The MS SQL Server Management Studio is utilized to create and manage the database. Although the system encompasses various interfaces such as registration forms for users, login forms for users and administrators, and contact forms, this paper will focus on describing the pages that bring novel functionality to the Post Offices of North Macedonia, fig. 3, fig. 4, fig. 5, fig. 6.

Admin Panel-The Admin Panel serves as an interface for the system administrator, providing access to all registered packages and letters. The administrator can perform various actions, such as adding, editing, or deleting packages that have been entered into the system. Additionally, the administrator can determine whether a package should be sent to the addressee's home. The following functionalities are available within the Admin Panel:

Add- The administrator is redirected to a web form where they can input the necessary details of new packages or letters. This form captures information such as recipient name, address, tracking number, arrival date, and status.

Delete- The administrator is redirected to a web form where they can delete packages or letters based on their unique identifier (ID). This form provides a convenient way to remove packages that are no longer relevant or required.

Edit-The administrator is redirected to a web form where they can edit the details of packages or letters based on their ID. This form allows the administrator to modify any information related to the package, ensuring accurate and up-to-date records.

These pages within the Admin Panel provide the system administrator with comprehensive control over the packages and letters registered in the system. The ability to add, edit, and delete entries streamlines the management process, enabling efficient and accurate record-keeping within the post office system.

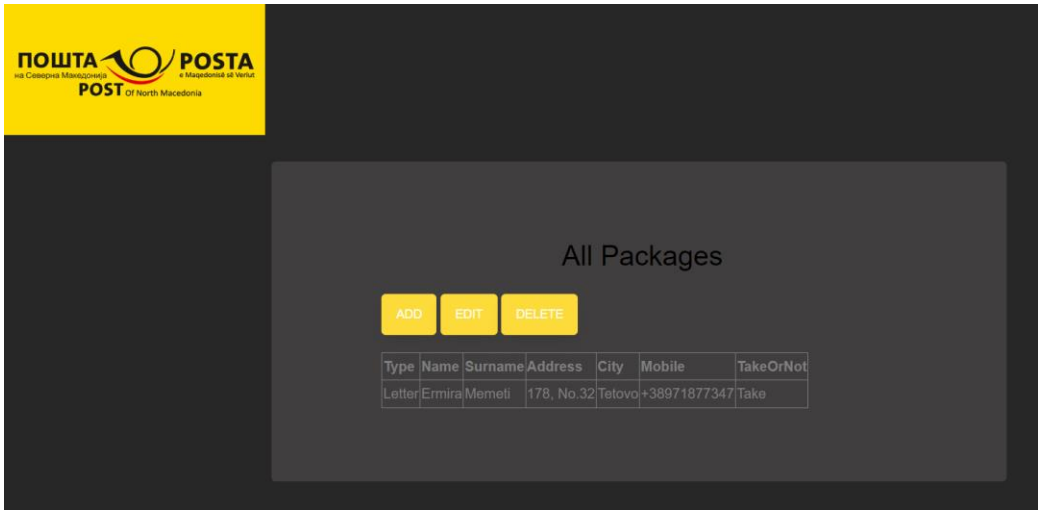

Figure 3. "Admin Panel" Web Form

```
public partial class AdminPanel : System.Web.UI.Page
{
    SqlConnection con= new SqlConnection("Data Source=DESKTOP-1OIQJOM;Initial Catalog=PostOfficeManagementSystem;Integrated Security=True");
    0 references
    protected void Page_Load(object sender, EventArgs e)
    {
        DataTable dt = new DataTable();
        SqlDataAdapter adapt = new SqlDataAdapter("select Type, Name, Surname, Address, City, Mobile, TakeOrNot from Packages", con);
        con.Open();
        adapt.Fill(dt);
        con.Close();
        if (dt.Rows.Count > 0)
        {
            GridView1.DataSource = dt;
            GridView1.DataBind();
        }

    }
}
```

Figure 4. C# code for binding packages/letters into the GridView

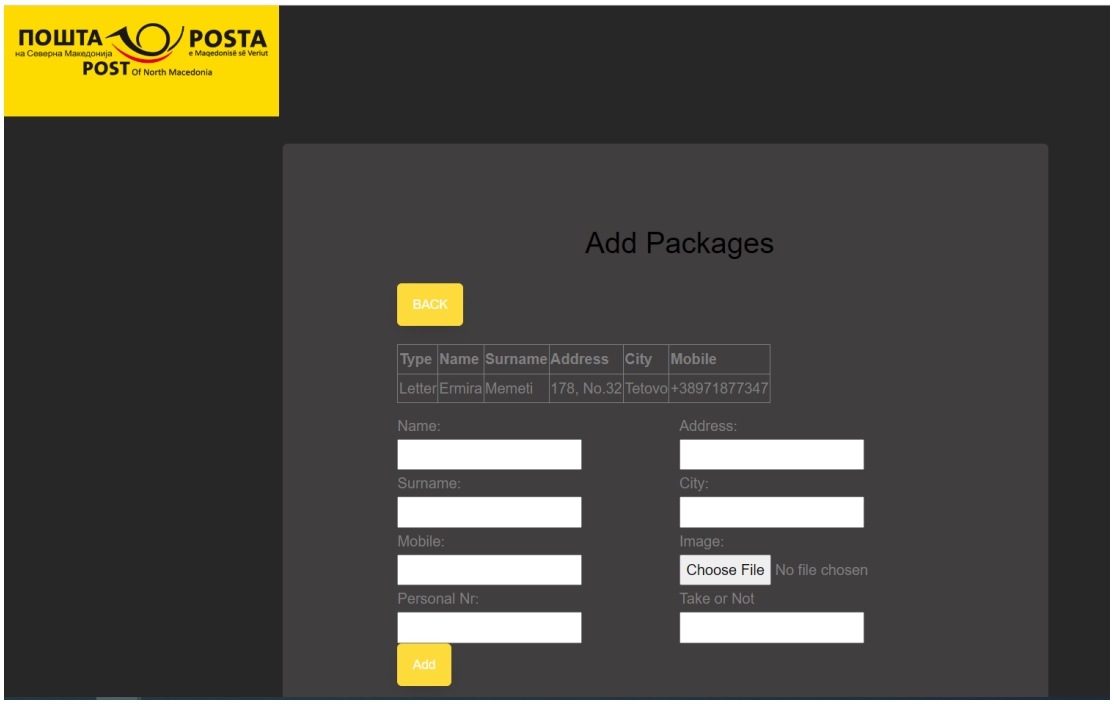

Figure 5. "Add Packages" Web Form

```
<body>
    <img src="images/posta-1210x642.png" style="height: 150px; width: 300px;" />
    <form id="form2" runat="server">
        <div style="margin-top: 2%; margin-left: 20%; margin-right: 25%; margin-bottom: 10%; background-color:#444242da; border-radius: 5px;">
            <div class="row" style="padding: 10% 15% 10% 15%">
                <div class="col-lg-12">
                <h2 style="margin-bottom: 20px; margin-left: 35%">All Packages</h2>
                </div>
                <div class="col-lg-12">
                    <a class="btn btn-primary" href="AddPackages.aspx" >ADD</a>
                    <a class="btn btn-primary" href="EditPackages.aspx" >EDIT</a>
                    <a class="btn btn-primary" href="DeletePackages.aspx" >DELETE</a>
                    <asp:GridView ID="GridView1" runat="server"></asp:GridView>
                </div>
            </div>
        </div>
    </form>
</body>
```

Figure 6. HTML code for switching between Web Forms

User Profile- Once a user logs into the system, they are presented with their user profile, which provides several features and information. The user profile interface includes the following components:

Contact Form- The user has access to a contact form where they can communicate with the post office if they have any inquiries or require assistance. This form allows users to submit their queries or concerns directly to the post office for prompt response and support.

Post Office Biography - A short biography of the post office is displayed, providing users with background information and details about the post office's services and operations. This section serves to familiarize users with the post office and create a sense of transparency and trust.

User Profile Information- The user's profile displays relevant details about the user, such as their name, contact information, and any other pertinent information associated with their account.

Packages and Letters- Within the user profile, the user can view a list or grid of all the packages and letters that have been sent in their name. This list includes relevant information about each package or letter, such as the sender's name, arrival date, and current status.

Package/Letter Photos- By clicking on the name or photo in the GridView, the user can view a photo of the package or a scanned image of the letter. This feature provides visual representation and verification of the items received, allowing users to easily identify their packages or letters.

Request for Home Delivery - In the GridView, there is a button that enables users to request home delivery for a specific package or letter. By clicking this button, the user can indicate their preference for having the item delivered to their home address.

No Need for Home Delivery- Similarly, another button is provided in the GridView for users to indicate that a particular package or letter does not need to be sent to their home. This option is useful when the user prefers to collect the item from the post office instead of having it delivered.

The user profile interface empowers users by providing access to their personal information, package and letter details, and options for managing home delivery preferences. This ensures a user-friendly experience and enables efficient communication and interaction with the post office.

```
public partial class Profile : System.Web.UI.Page
{
    SqlConnection con = new SqlConnection("Data Source=DESKTOP-1OIQJOM;Initial Catalog=PostOfficeManagementSystem;Integrated Security=True");
    0 references
    protected void Page_Load(object sender, EventArgs e)
    {
        DataTable dt = new DataTable();
        SqlDataAdapter adapt = new SqlDataAdapter("select Type, Name, Surname, Address, City, Mobile from Packages where PersonalNumber='Session['Personal
        con.Open();
        adapt.Fill(dt);
        con.Close();
        if (dt.Rows.Count > 0)
        {
            GridView1.DataSource = dt;
            GridView1.DataBind();
        }


    }
```

Figure 7. C# code for binding the Packages into the GridView at the User Profile

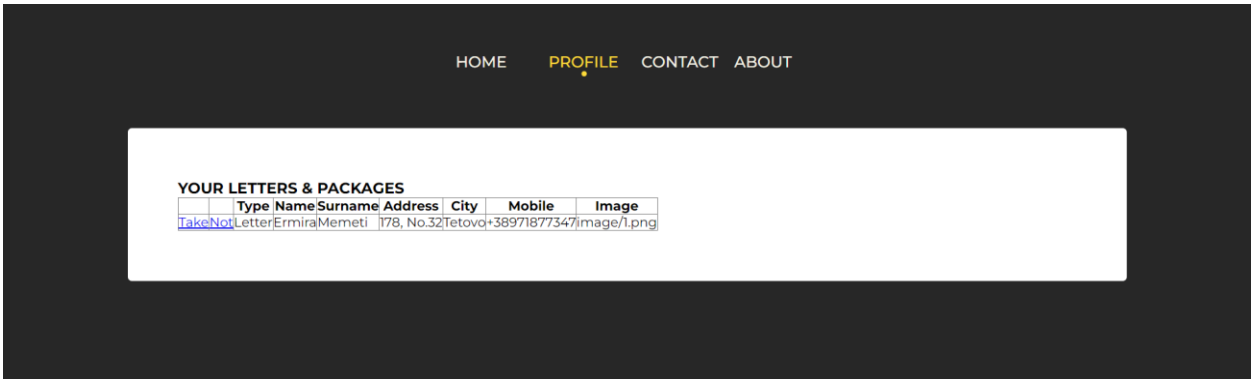

Figure 8. "User Profile" Web Form

```
protected void Button1_Click(object sender, EventArgs e)
{
    con.Open();
    string Id = GridView1.SelectedRow.ID.ToString();
    string update = "Update Package set TakeOrNot='Take' where Id=@Id";
    SqlCommand cmd = new SqlCommand(update, con);
    cmd.ExecuteNonQuery();
    con.Close();
    DataTable dt = new DataTable();
    SqlDataAdapter adapt = new SqlDataAdapter("select Type, Name, Surname, Address, City, Mobile, Image from Packages", con);
    con.Open();
    adapt.Fill(dt);
    con.Close();
    if (dt.Rows.Count > 0)
    {
        GridView1.DataSource = dt;
        GridView1.DataBind();
    }
}
0 references
protected void Button2_Click(object sender, EventArgs e)
{
    con.Open();
    string Id = GridView1.SelectedRow.ID.ToString();
    string update = "Update Package set TakeOrNot='Not' where Id=@Id";
    SqlCommand cmd = new SqlCommand(update, con);
    cmd.ExecuteNonQuery();
    con.Close();
    DataTable dt = new DataTable();
    SqlDataAdapter adapt = new SqlDataAdapter("select Type, Name, Surname, Address, City, Mobile, Image from Packages", con);
    con.Open();
    adapt.Fill(dt);
    con.Close();
    if (dt.Rows.Count > 0)
    {
        GridView1.DataSource = dt;
        GridView1.DataBind();
    }
}
```

Figure 9. C# code to update the package after the user decides to take it home or not

5. Conclusion

In conclusion, this paper addresses the need for technological advancement in the post offices of North Macedonia. Through our research, we identified the lack of a comprehensive package management system within the country's postal industry. To address this issue, we developed a system that aims to enhance the efficiency and effectiveness of post office operations.

By implementing our system, post offices can optimize their processes, saving valuable time and resources. The system eliminates the unnecessary delivery of letters and packages to citizens' homes by providing real-

time notifications when items arrive at the post office. This not only improves the overall customer experience but also streamlines the workflow of postal workers.

While our system is currently available only in English, we envision future developments to support additional languages, particularly Albanian and Macedonian, to cater to a broader user base. Furthermore, we recognize the potential for continuous improvement in the system's design. This could include incorporating a chat functionality to facilitate real-time communication between users and postal staff, further enhancing convenience and customer satisfaction.

In conclusion, the digitization of post office operations in North Macedonia is crucial for keeping pace with technological advancements and meeting the evolving needs of citizens. By embracing technology and implementing innovative solutions like our proposed system, the country's postal industry can experience significant improvements in efficiency, accuracy, and customer service.

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