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| CO3201 Computer Science Project Interim Report |
| **Web-Based Inventory Management System for Small Business** |
| School of Computing and Mathematical Sciences, University of Leicester |

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| Choudhury, Arif  [Date] |

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Arif Choudhury

**Interim Report:**

1. **Introduction**
   1. **Aims**

The aim of this project is to develop a web-based inventory management system that is tailored for the needs of small businesses, allowing them to efficiently track and manage their stock levels, analyse sales trends, and generate insightful reports. Many small businesses face challenges in managing their inventory manually, which often leads to errors, discrepancies and stock shortages. This project aims to address these challenges by providing a digital solution that integrates real-time data updates, secure user authentication, and an intuitive user interface.

The project focuses on three main goals:

* To provide an easy-to-use solution that simplifies inventory tracking for non-technical users.
* To leverage cloud technologies for seamless data synchronization and remote access.
* To develop a scalable system that can grow alongside the business needs, adapting to larger inventories and more users as required,

By achieving these aims, the project will contribute to the digital transformation of small business operations, enabling owners and managers to make data-driven decisions that optimise their inventory processes.

* 1. **Objectives**

The objectives of this project have been defined to ensure that the aims are met in a concrete and measurable manner:

* Develop a user authentication system: Implements a secure login and registration process, allowing different user roles (Admin, Manager, and Staff) with varying levels of access.
* Design and implement a user-friendly interface: Create intuitive web pages for managing inventory, making it easy for users to add new products, update stock levels, and track inventory changes.
* Implement real-data updates: Use cloud-based storage to enable real-time synchronization of stock levels, ensuring that all users see up-to-date information without the need to refresh the page manually.
* Integrate data visualization tools: Provide graphical representation of stock levels, sales trends, and top-selling products using libraries like Chart.js, helping users analyse their business performance.
* Deploy the system on a scalable cloud platform: Host the application on a platform like Heroku to ensure that the system can handle increased traffic and data as the business grows.
* Implement reporting features: Allow users to generate customisable reports for inventory status, low-stock items, and sales data, which can be exported for further analysis.

By breaking down these objectives into specific tasks, the project will follow a structured approach, ensuring that each aspect is thoroughly developed and tested.

* 1. **Challenges and Originality**

Challenges:

Developing this project presents a range of technical and design challenges, such as:

* Real-Time Data Integration: Ensuring that changes in inventory are reflected immediately across all user interfaces can be challenging, especially when dealing with concurrent user access. This requires efficient database queries and the use of cloud-based synchronization tools.
* User Experience Design: Designing an interface that is easy for non-technical users to navigate requires careful consideration of UI/UX principles. The interface must balance simplicity with functionality, ensuring that users can perform tasks with minimal effort.
* Data Security: As the system handles sensitive business information, implementing secure authentication methods and protecting data from unauthorized access are critical challenges.

Originality:

The originality of this project lies in its focus on the specific needs of small businesses, which are often overlooked by larger inventory management systems. Unlike existing solutions that may be too complex or expensive for small business owners, this system offers a tailored approach, combining simplicity with key functionalities such as low-stock alerts and real-time updates. Additionally, the use of cloud technology allows the system to be accessible from anywhere in the world, providing a significant advantage for business owners who manage their operations remotely.

1. **Survey of Literature/ Information Sources**
   1. **Overview of Cloud-Based Solutions and Inventory Management**

Inventory management is a vital component of running a successful small business, ensuring that stock levels are managed, operational efficiency is maximized, and client expectations are satisfied. But conventional manual inventory management techniques are frequently insufficient, resulting in inaccurate stock, delays in operations, and monetary losses. To increase accuracy and expedite their procedures, a lot of small organisations are using computerised inventory management systems (Rushton, Croucher, & Baker, 2021).  
  
Cloud-based solutions have become a potent instrument for meeting small firms' inventory management requirements. With the benefits of scalability, remote accessibility, and real-time data synchronisation, cloud technology enables companies to manage their inventories from any place. Technology breakthroughs and falling cloud service prices have sped up this transition to cloud-based platforms, making it easier for small firms to implement these solutions (Hazen, Cegielski, & Hanna, 2011).  
  
**2.2 Cloud-Based Inventory Systems' Advantages**  
Numerous benefits for small firms are highlighted by research on cloud-based inventory systems. In their discussion of cloud computing's spread in the supply chain and inventory management industries, Hazen et al. (2011) highlight how cloud technology facilitates real-time data updates, increases accessibility, and fosters better departmental collaboration. The risk of stock inconsistencies is decreased by the cloud's capacity to deliver current stock levels, which guarantees that inventory data stays accurate across numerous locations and users.

The financial advantages of cloud-based inventory management, especially for small enterprises, are further discussed by Smith (2020). By eliminating the need for pricey on-premises servers and IT infrastructure, cloud storage enables small businesses to deploy inventory systems without having to make a significant upfront investment. Better scalability is also made possible since cloud solutions can be upgraded to meet the needs of growing businesses without incurring large additional costs. This research directly informs the project's usage of Firebase Firestore, a real-time NoSQL cloud database that provides instantaneous visibility across devices and real-time stock level updates (Firebase Documentation).

2.3 Issues with Current Inventory Management Systems  
Despite the many benefits of cloud-based inventory systems, research also identifies typical implementation issues that small firms encounter. The intricacy of many current systems is one of the most frequently mentioned problems. Steep learning curves and needless complexity result from the fact that many inventory management systems are made for large corporations and have many functions that small firms do not require (Scott, 2020). Small business owners, who might lack the technical know-how to handle complicated systems, are especially affected, which could lead to low user acceptance.

Norman (2013) highlights how crucial it is to consider the user when creating systems, particularly for non-technical users. According to his research, inventory management systems need to be easy to use, intuitive, and require little training in order for people to engage with them efficiently. Based on these observations, the project's user interface design prioritises simplicity by utilising Bootstrap to produce a responsive and user-friendly layout that reduces the number of steps needed for users to do necessary tasks, such adding goods or maintaining stock levels.

**2.4 Importance of Real-Time Data and Scalability**

It is impossible to overestimate the significance of real-time data synchronisation in inventory management. One of the main advantages of cloud-based inventory systems, according to Hazen et al. (2011), is their capacity to deliver real-time data updates, guaranteeing that companies always have the most up-to-date information on stock levels. Furthermore, Kavis (2014) talks about cloud systems' scalability, which is important for small firms trying to grow. Businesses may easily extend their inventory management systems without requiring major infrastructure upgrades by utilising cloud platforms such as Firebase. By integrating Firebase Firestore, this project offers scalability and consistency as the business expands while guaranteeing that real-time data modifications are visible to all users.

**2.5 Data Visualization and Reporting**

When it comes to using sales and inventory data to guide business choices, data visualisation is essential. Few (2012) asserts that well-designed graphs and charts enable users to swiftly analyse data, spot patterns, and base decisions on that knowledge. Effective inventory management for small enterprises requires having access to visual representations of stock levels and sales performance. A JavaScript data visualisation package called Chart.js is used in this project to allow users to view live graphs that show their sales patterns and inventory status. The use of interactive data visualisation is also encouraged by Murray (2013), who points out that people are more inclined to interact with data that is displayed graphically, which can result in better decision-making.

**2.6 Conclusion**

The study concludes by pointing out how important it is for small firms to use cloud-based inventory management systems in order to stay competitive in the current market. Even though current systems have many functions, they frequently don't have the simplicity and usability that small businesses need. Utilising real-time data synchronisation and emphasising user-centred design, this project overcomes the shortcomings of current systems and offers a scalable, reasonably priced system that is customised to meet the unique requirements of small business owners.

1. **Requirements**
   1. **Functional Requirements**
   2. **Non-Functional Requirements**
2. **Outline of Specification and Design**
   1. **System Architecture**
   2. **Important Algorithms and Data Structures**
3. **Planning and Timescales**
4. **References**

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