Internet of Things (IoT)-Based Inventory Tracking System for Multi-Site Warehouse

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ABSTRACT – IoT-based smart environments are being explored in smart cities, smart homes, smart grid, smart buildings, smart transportation, smart health, and smart industry, to name a few. Scalability, energy consumption, and overcoming challenges are all seen as roadblocks to IoT adoption success. In Malaysia, inventory tracking systems are not technologically sophisticated, since most of them still rely on the conventional manner, with the operator performing most of the updates manually. The issue with the present inventory tracking system is the operator's delay in updating the system when a product arrives or is ready for distribution from the warehouse. After then, the owner may use a mobile device to check an app and predict the arrival time of the package, as well as plan the right delivery procedure. The project aims to develop a warehouse management system that will provide accurate arrival and departure time, date, and product type for the inventory system. The project also aims to provide an end user platform for tracking system as well as provide end users with end-to-end access to this information.

1. INTRODUCTION

In general, most inventory tracking systems in Malaysia are still conducted in semi-automatic or manual modes where most of the data input need to be done manually by the operator. The problem for current inventory tracking system is delay time update from the operator when the product arrives or out for delivery from the warehouse [1-3]. This problem will effect on the product expiry and storage space when holding for a period of time. Besides, the problem face by the supplier is to know every checkpoint reach by the shipping transport on time [3-4]. After that, the shipping process could be at ease when the owner could check through the mobile device on an app, they can estimate the time for arrival of the shipment and schedule the proper delivery process afterward through heuristic or metaheuristic approaches [5-6].
The objective of this study is to develop a tracking system for location checkpoint reach by the transport used to deliver the product. The outcome will be used by end users to monitor the parts and products movement.

2. METHODOLOGY

There are several components required to fulfill the objective. The IoT tracking system for inventory tracking consisting of RFID-Module (RC522) and Arduino Uno to act as the inventory tracking system. It also requires components such as NodeMCU ESP8266 and GPS Module (Ublox-Neo6M) to act as tracking system and Wi-Fi connection for the Blynk App. The proposed block diagram for the system is illustrated in Figure 1.

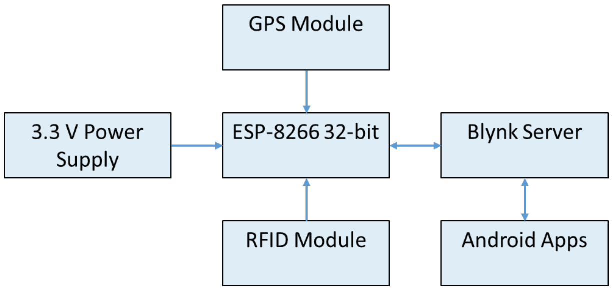

Figure 1 Proposed System Block Diagram

In order to increase system efficiency, the system is divided into two modules – outdoor and indoor tracking modules. The overall system flow is depicted in Figure 2.

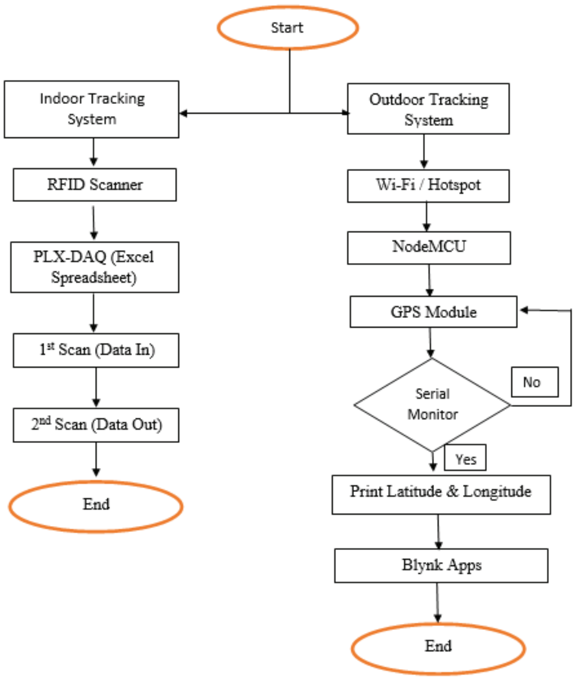

Figure 2 System flow

3. RESULTS AND DISCUSSION

A dedicated mobile application is developed to display the position tracked using the Blynk App on the owner mobile device. The coordinates of the transport, satellite response to the module, speed, and directions of the moving vehicle are the outputs obtained from the user's perspective in Figure 3. The system is capable to update the coordinate at a rate of less than 1 second. Instead of having the numerical information, particular vision may track the vehicle's movement using the map data so as to provide better user experience. Nevertheless, the coordinates information is included as well.

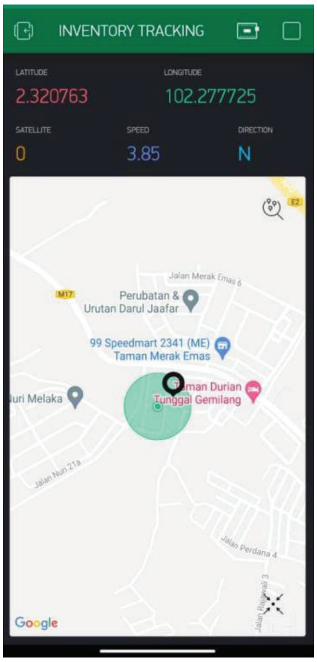

Figure 3 GPS Module Interface with Blynk

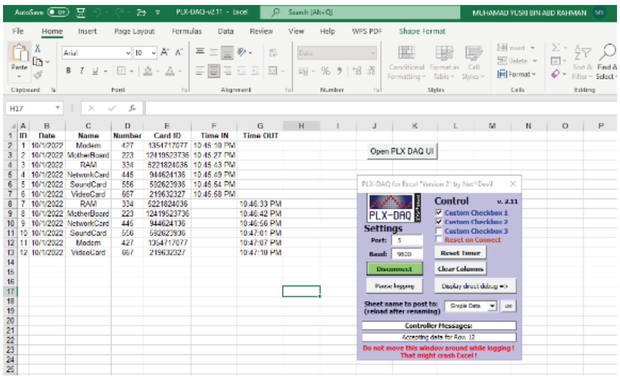

Figure 4 Excel Spreadsheet with RFID Module

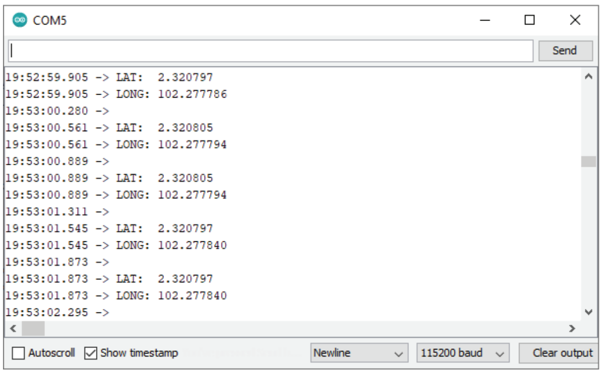

Figure 5 COMS Output

Related data including checked time, date, product name, product serial number, product tag ID, arrival time (In), and depart time (Out) are stored into a Microsoft Excel Spreadsheet file. The sample of the stored data is depicted in Figure 4.

In order to demonstrate the effectiveness of the communication, a test was conducted to assess the GPS Module's effectiveness. Arduino IDE serial monitor was used as the output console to represent the changes in latitude and longitude values. Figure 5 displays an example of a result on the serial monitor, demonstrating that the GPS Module able to communicate location data with satellites.

4. CONCLUSIONS

This project successfully produced a better range of product tracking by integrating RFID and GPS technologies into an IoT platform. It improves the product monitoring with high accuracy and user-friendly system. In the future, another aspects of the system such as data integrity and network security will be explored.

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