

AWRSMS: An Approach to Enhance Apparel Warehousing and Retailing through IoT

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Abstract

When considering about the modern trends of the Information and technology field; Internet of Things (IoT) is one of the pivotal and emerging technology. In human dependent existing systems such analysis can be done only if someone runs a query and checks for it. When it comes to Warehousing and storage industry, manually collected data are sent to an Enterprise Resource Planning (ERP) system or to a warehouse management system. These systems have some limitations such as mismatches of issuing stock, problems in handling the inventory items and placing them in the warehouse. Warehouse management system manages all the functions in a warehouse but both the systems use manual methods to collect data, such as barcodes. So errors are occurred when entering large number of data into the system. Even a well trained staff member can fail due to common human failures such as fatigue. There's a very less number of systems which are fully automated, convert captured data into information in real time and these systems are not able to control both warehouse's and retail shop's functions. Moreover any of these are not using new methods to do customer promotion. To give a comprehensive solution to limitations of existing systems the above mentioned Apparel Warehouse and Retail Shop Management System (AWRSMS) is developed. The system manages the functions in both warehouse and retail shop in apparel industry. It involves organizing, automating and synchronizing the activities of these both places in effective and efficient manner, using the technology IoT. In this system, all the data about stocks, incoming goods, dispatching items, will be collected using Radio Frequency Identification (RFID) tags and readers and collected data will be sent to the system's database which stored in a web server. By using these data the system executes several functions such as providing details of returns, new arrivals and dispatched items, mismatch of dispatch, available items, details about stock updates and selected items with relevant reports. This system is implemented as three major modules; web application, data capturing module and customer promotion module. The promotion module enables the location based promotion process inside the retail shop and it is one of a newest and significant function included in AWRSMS. It is a combination of mobile application and a web application. In this module the marketing manager can add promotions into the database using web application. Through the mobile application customer receives the ongoing promotion details. In this process when a customer comes near to the particular sales area which has an ongoing sales promotion, system detects the customer's phone and send the promotion message to them, using IoT beacons. Mobile application installed in customer's phone continuously searches for beacon

ranges, connect with them and receives relevant promotion messages using Bluetooth Low Energy (BLE) signals transmitted by the beacons. Android studio, JAVA and XML are used as developing tools of the promotion module. Rest of the system is developed using spring framework, Java EE, Hibernate framework and MYSQL. Testing and evaluation was carried out in three procedures to verify whether the system has achieved the intended objectives. First one is the module testing, done by dividing each main function as a module and tested their functionalities, evaluated with intended results immediately after completing each module. White box testing methods were used to carry out the module testing. Test cases have been designed for each module and testing was carried out based on them. Statement coverage for all the test cases was within 85%-100%. All the modules of main web application got 100% accuracy level, Promotion module achieved 96% and data capturing module obtained 82% of accuracy level. After integrating each module, the final testing phase was carried out by using black box testing. All the modules of web application achieved 100%, promotion module 98% and data capturing module 76% of accuracy level. To ensure that the user requirements were achieved as intended, a questionnaire have been given to a selected sample which consist of 50 members, including AWRSMS's end customers, people who are knowledgeable of technology and management, and people who aren't. Questions of this questionnaire categorized under user friendliness, user experience, functionality, suggestion and recommendation. Questions made under user friendliness and user experiences mainly focused the end users who are not expert in technology to measure the usability of the system. The selected users had to comment by using the system without knowing the inside functions. Then the functionality section mainly focused the technological people who tested the overall system. The intention was to figure out the relevancy and compatibility of each and every function with user requirements. Suggestions and the recommendation sections were carried to explore the further improvements. The positive feedbacks which have been gained by user friendliness of AWRSMS is 80% and 78%, 84%, 76 % was obtained for recommendation, user experience, and functionality respectively. 64% of the sample gave suggestion to upgrade the functionalities. When comparing aims objectives and gathered outcomes of the system AWRSMS has been completed in intended and successful manner. By obtaining the required resources and doing further improvements such as using industry level RFIDs, and improving mobile application by adding more features and developing it also for IOS platform, the Apparel Warehouse and Retail shop management system will be an ultramodern and significant approach for the Apparel industry.

Keywords: *IoT, ERP, AWRSMS, RFID, IoT beacons*