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Implementation of Automatic Identification and Data Capture/Collection (AIDC) Systems in Monitoring the Actual Time of Production Data in Ready-made Garments Factories

Mostafa A. Badawy

Lecturer,
High Institute of Engineering, Mehalla Kobra

Hatem M. F. Idrees

Prof. of Production Management, Fac. of App.
Arts, Damietta Uni.

Ahmed M. El Shikh

Assoc. Prof. of Garment Technology, Fac. of
App. Arts, Banha Uni.

Tarek M. Zaghlol

Assist. Prof.,
Fac. of App. Arts, Damietta Uni.

Abstract

The ready-made garment industry faces many difficulties due to the lack of actual time production data, which can provide the necessary information to track product operations. There is no transparency for management in sharing information between departments. There is also a large gap between the actual production and the production plan established by the management. To overcome these difficulties, the use of automatic identification system and data capture (AIDC) is necessary to support management decision-making systems. (AIDC) is used to identify objects and collect data, as it helps provide direct data entry, without resorting to manual data entry methods. The various systems depend on (AIDC) technology are the Barcode, Quick Response (QR) and Radio Frequency Identification (RFID) systems. This study aims to create a system by collecting and monitoring actual-time product data using AIDC systems. This system was applied to one of the garments factories, and recording product data at the time of entry and exit of product materials automatically in each department and obtaining the necessary reports. Hence, a comparison was made between the actual time of product data in the various departments and the production plan prepared previously. The study reported that there was a significant difference between the production plan and the actual time of the product data. The application of this system helped the management to obtain product flow data in the different factory departments at the actual time. It also built a modern and efficient management to help for making appropriate decisions.

Keywords: Automatic Identification and Data Capture (AIDC), Actual Time, Production Data, Readymade Garments factories

Introduction:

The ready-made garment industry faces many difficulties due to the lack of actual time for production data, which can provide

the necessary information to track product operations as quickly as possible. Most factories depend on traditional systems to collect, follow-up and record product data.

So there is difficulty in obtaining production data on time, there is no transparency for management in sharing information between the different departments inside the factory. There is also a big gap between the actual production and the production plan that was put in place by the management. The difficulties faced by the management cannot be solved without obtaining correct data at the actual time. Therefore, management must depend on a system of real-time control of product data.

With the development of information in the garment industry, accuracy of information, and the timing and integration of information becomes more important to improve management. Therefore, real-time production and logistical information should be integrated into the enterprise information system, and the actual flow of materials and the flow of associated information should coincide.

Making decisions based on data requires management to trust the quality of the data collected. Obviously, to get that confidence in the data, the data must be accurate, timely and reliable. Unfortunately, employees assigned to fill in data entry roles are less skilled, and get lower salaries. In addition, the more complex the data entry task, the more likely that you will make a mistake. Hence, to eliminate the human element in data collection, an automatic identification and data capture system is necessary to ensure the level of accuracy needed to support decision-making systems.

AIDC systems are used to identify objects and collect data. It is called "automatic identification systems or automatic data capture, as it depends on the use of

technology to provide direct data entry, without resorting to manual methods of data entry, and among the various systems that depend (AIDC) technologies are the Barcode system, the Quick Response system (QR) and Radio Frequency Identification system (RFID).

The importance of using Automatic Identification and Data Capture (AIDC) technologies to demonstrate the requirements of collecting and transmitting data in an effective, fast and accurate, as it works to reduce or eliminate errors in data collection and entry, helps provide a reliable way not only to identify elements but also to track it. It encodes a wide range of information from the primary element or identifies a person to comprehensive details about the item or person, for example description, size, weight, color, etc., and helps reduce data entry costs, is able to collect tracking data and locate it exactly.

The aim of this paper is to use systems that depend on (AIDC) technologies such as the Barcode system, the (QR) system and (RFID) system in the control of the actual time of product data in garment factories and the extent to which the actual time of production data matches the production plan.

Automatic Identification and Data Capture / Collection

In the manufacturing industry, the tracking of a product and its status through the processes of a company. From the moment it arrives until the time of dispatch, can significantly reduce the lead time, increase the efficiency and visibility, increase the accuracy of production plans and also improve the efficiency of an ERP system. As the constant reader^(6: p 17).



Fig. (1) Barcode structure

Working of Barcode

The laser beam is located on a mirror / prism that are then directed to the bar code from left to right. The incident light is absorbed by the dark bars of the barcode but the light is reflected by light spaces. The reflected light is measured by the photodiode and gives an electrical signal. The analog electrical signal is then converted into digital one. And corresponding barcode is read. There are several weaknesses, among which it is easy to damage the barcode card in harsh environments, external factors such as rain / low temperatures. To read the barcode, the barcode scanner needs to be line of sight with the label. Therefore, manual movement of objects or scanner is necessary. The operator needs to open the

container and scan the objects one by one, thereby involving intensive labor. It is clear that the barcode is unable to fast processing (٧: p 3).

Quick Response Code (QR Code) System

The QR code (Quick Response) is a two-dimensional (2D) matrix code. It belongs to a larger group of machine-readable codes, which are often referred to as barcodes, whether they consist of bars, squares or other shape elements. The difference appears between (1D) codes and (2D) codes, as the 2-D codes can keep more data in a smaller space (Fig. 3). Thanks to the advanced error correction method and other unique features that allow the QR code to be read more reliably than other codes (٦: p 818).

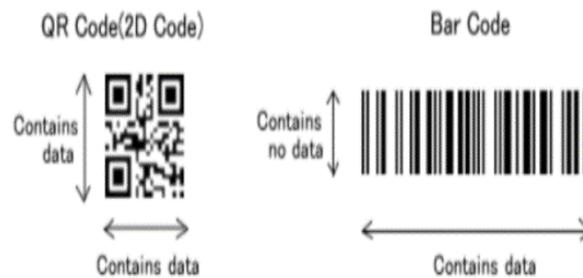


Fig. (2) QR code and Barcode

Structure of the QR Code

The elements contained in a QR code (Fig. 4) are: **Position Pattern:** are three large squares in the corners to reveal the position, size and angle of the QR code. **Alignment Pattern:** is a pattern used to correct distortion of the QR code. It can occur when you attach the codes on the curved surface. **Timing pattern:** Consists of white and black modules arranged alternately and placed between

two position patterns, used to determine the central coordinates of each cell in the QR code. **Quiet Zone:** is the margin space that facilitates detection of the QR code, needs at least four cells. **Data area:** is the area in the QR code, the data area contains data encoded in binary numbers (for example, a URL). It can be seen that the QR contains information to provide the ability to correct errors (٨: p 223).



Fig. (3) Structure of a QR Code

QR Code has many advanced features such as: **High data capacity**: The QR code can store 7,089 numeric characters, 4,296 alphanumeric characters and 1817 kanji characters. **High-speed scanning**: The QR code can be scanned using a mobile phone with the camera function, to get the content from the QR code quickly and easily. **Small print volume**: QR codes are better than 1D barcodes in data capacity, as data is loaded both horizontally and vertically into the QR Code ^(١: p 469).

Radio Frequency Identification

RFID (radio frequency identification) was proposed to collect real-time manufacturing data easily, as well as a real-time synchronization of the material flow and flow of information associated with it. In recent years, RFID technology has emerged as an important automatic identity technology that has many advantages over barcodes because it has a longer reading distance and greater data storage capacity. The first use of RFID technology was to capture data repair work in the car production lined. It has been applied in production management, supply chain management (SCM) and warehouse management (WM), due to its strong ability to collect and capture real-time data. ^(١: p 100)

Components of RFID System

RFID is a method of automatic identification of objects, which is based on a basic component such as: **RFID Tag** (attached with an object, unique identification), **Antenna** (tag detector, creates magnetic field), **RFID Reader** (transceiver or interrogator or a read/write device), **Communication infrastructure** (enable reader/RFID to work through IT infrastructure) and **Application software** (user database/application/ interface) ^(١: p175).

RFID is applied in many fields as high and new technology. There are eight application fields which can be differentiated: public services; sports, leisure and household; health care; smart cards with customer, membership and payment functionalities; access control and tracking & tracing of people and animals; product safety, quality and information; production, monitoring and maintenance; as well as logistical tracking & tracing ^(١٧: p 3). RFID technology was adopted in the textile and garment industry in particular early. The reasons for this are obvious: RFID is revolutionizing all parts of fashion logistics, from manufacturing through distribution and retailing, where it depends on determining a simple and effective element level of textiles and garments ^(١٧: p 5).

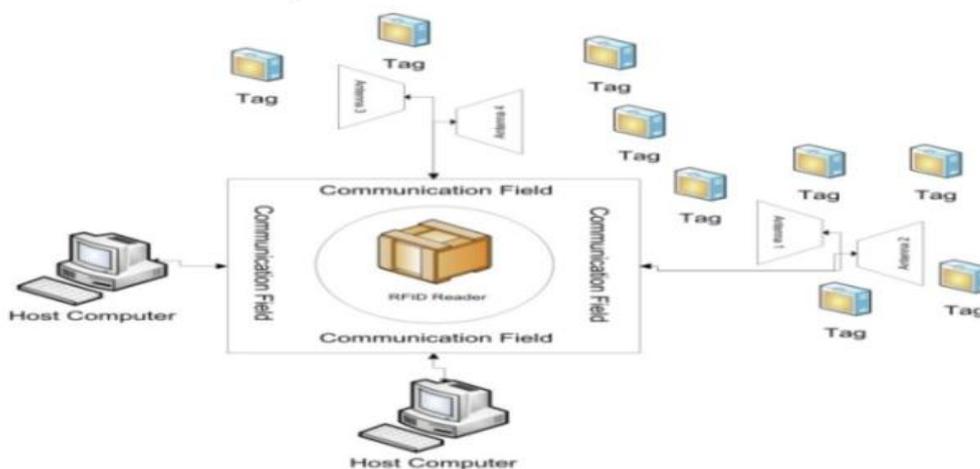


Fig. (4) Components of RFID System

Experimental Work

The experimental study was conducted in one of the ready-made garment factories that manufacture children's clothing. A system based on AIDC technology has been established that includes both: Bar code system, QR code system, RFID system, in order to track the actual time of production data. **The system is based on:**

1- Create tables for factory departments, by studying the traditional paper worksheets in the factory departments and converting them into tables to save data that is read on system.

- 2- Create Bar code, QR code, RFID code through the system, print it, and attach it with the product parts.
- 3- Reading the bar code, QR code, and RFID code Attached with the parts of the product at the time of entry and exit from each department.
- 4- Record and save the product data inside the table after reading the codes.
- 5- Create, save and print product-specific reports.

Create Tables in the System

To create tables in the system, the following steps are taken:

- 1- Entering the system and entering its username and password.

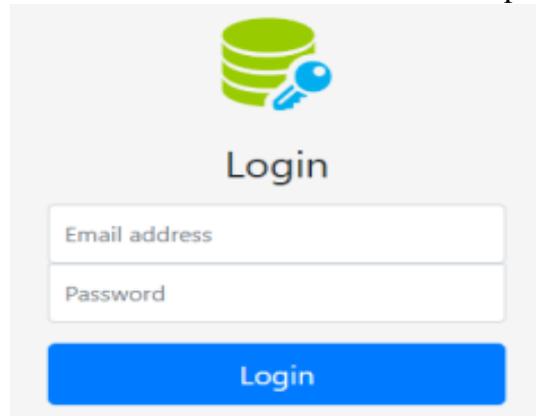


Fig. (5) Entering the user name and password on the system

- 2- After entering the system, click on the (Create Table) icon to display the window for creating the table.

All Table

Remove Table

Create Table

Type something in the input field to search the Table:

Fig. (6) Create a new table on the system

- 3- Enter the table name and click on the icon (Create New Column) to add table.

Table Name

Table Name

Name

id auto Generation

Create

Create New Columns

Fig. (7) Specify the name of the table to be created

4- Entering the name of the column and its type (number, text, date). After completing entering the columns for the table, click on the icon (Create). After completing the work of the table, a message will appear stating that the table was created correctly.

Fig. (8) Enter and select columns

5- To delete a table from the system, click on the icon (Remove Table), then select the table to be removed.

Fig. (9) how to remove the table

6- A message appears to ask (Do you want to remove the table?) Then press OK. After completing the deletion of the table, a message appears, stating that the schedule was correctly removed.

Fig. (10) message indicating that the table was removed correctly

Creating codes

Three types of AIDC technology were used: Bar code, QR code, Radio frequency identification (RFID) card.

To create a Bar code, QR code the following steps are followed

1- Click on the (Create Code) icon, then specify the Number of codes to be printed, and select the type of the code (Barcode, QR Code, RFID card), then click on "Submit".

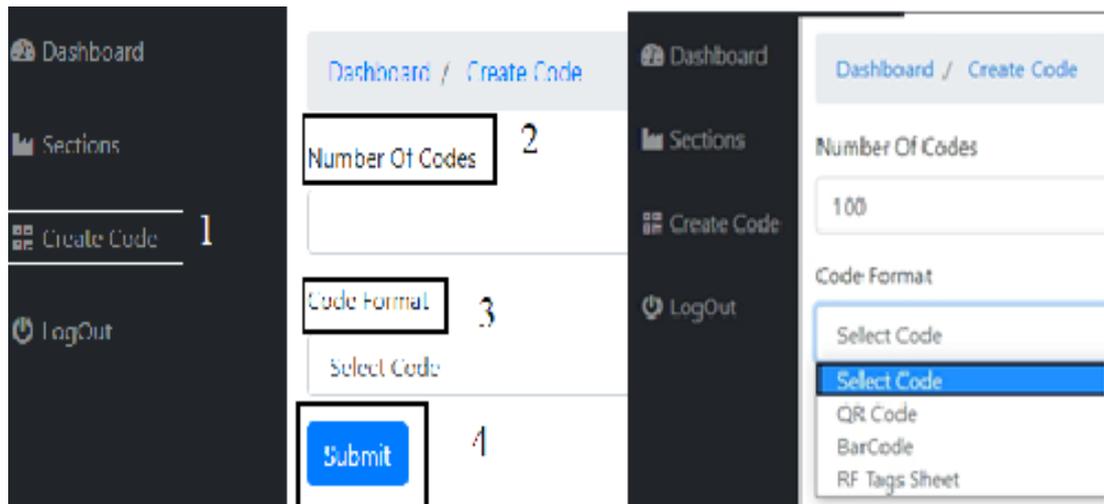


Fig. (11) how to create codes in the system

2- The bar code and QR code forms that have been created appear. The codes are printed using any printer.

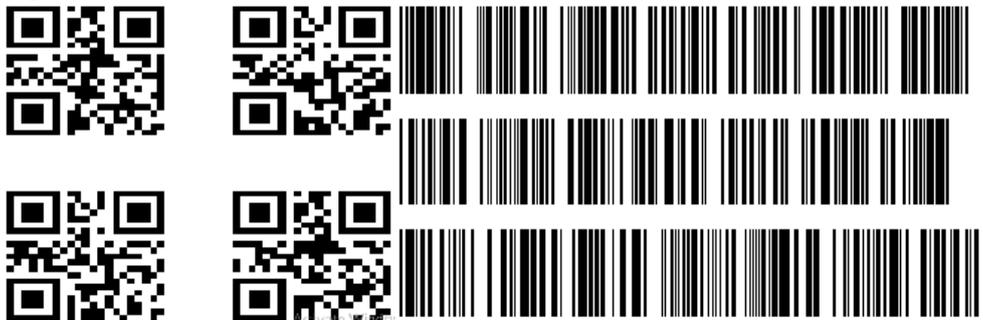


Fig. (12) the forms of Bar code, QR codes that were created in the system

To create Radio frequency identification code, follow these steps:

1- Click on the "Create Code" icon, then specify the number of codes to be printed, specify the type of the code (RF tag sheet), then click on "Submit".

2- Copy (the code and the link through which the system is opened) on the RFID card.

3- Using a phone with a feature NFC (Near field communication), and installing an application to read and copy the codes on the RFID card, such as the application (NFC Tools).

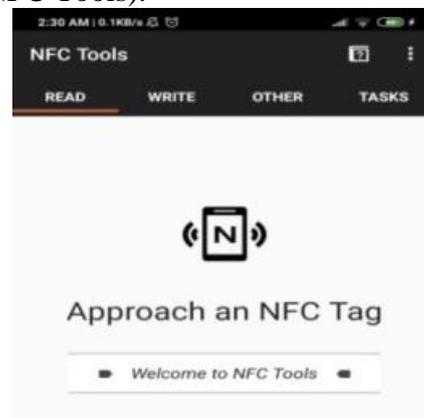


Fig. (13) the application (NFC Tools)

4- Open the application from the phone, activate its (NFC) feature, then place the RFID card near the phone, then read the data for the RFID card

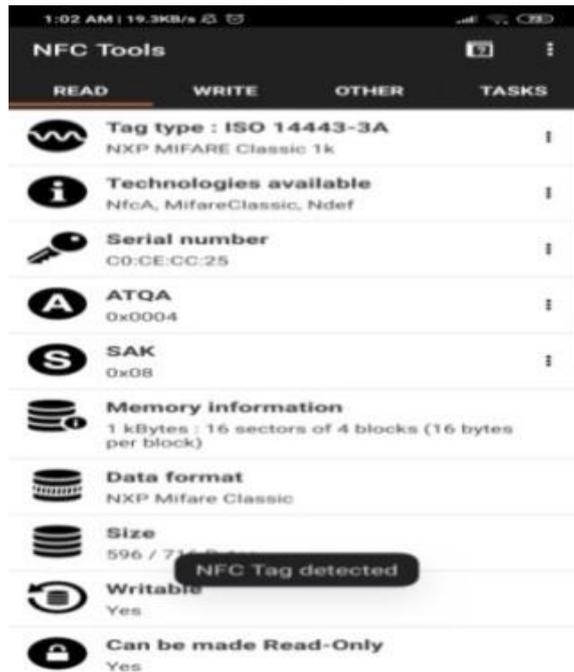


Fig. (14) Reading the data of the RFID card.

5- To write on the RFID card, the code and link are copied to accompany the RFID card, click on the (write) icon in the application, and choose (Add record). Then

choosing the type of record to write on the RFID card, then (Add URL Record) is selected.

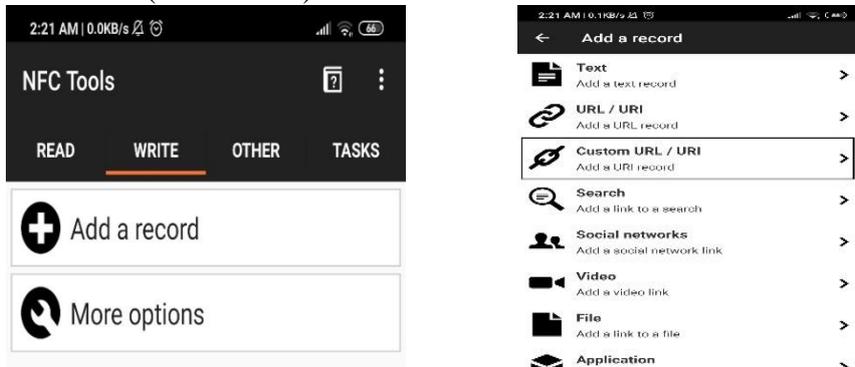


Fig. (15) the types of records for typing the data of the RFID card.

6- The link for the system and the data we want to save is copied to the L card, then, and choose (Write).

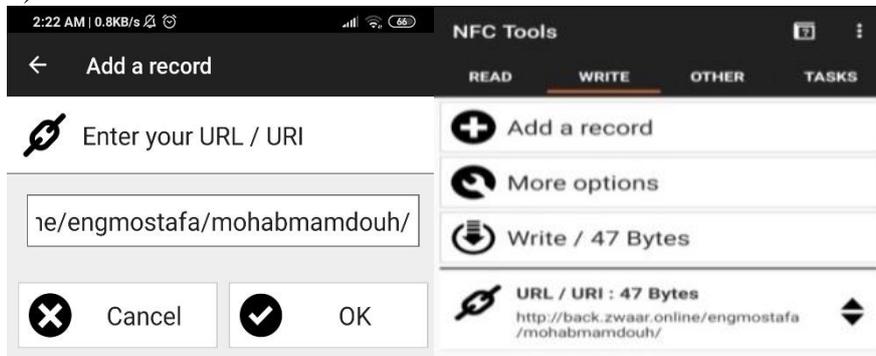


Fig. (16) how to record data on the RFID card

7- A message (Approach NFC Tag) appears, to bring the RFID card closer to the phone. If the writing process is done correctly, another message will appear stating that (write Complete) then the RFID

card is ready and loaded with the link of the system, and it can be read from any RFID reader or any phone that has the feature (NFC).



Fig. (17) message to approach the RFID card from the phone and stating (Write Complete)

The Bar code and QR code can also be combined with the RFID Card, by pasting the Bar code, QR code on the RFID Card.



Fig. (18) Combine the Bar code, QR code with the RFID Card

the product parts Reading the Bar code, QR code, and RFID Card attached with

- The Barcode, QR code attached with the parts of the product is scanned, using the phone scanner, and then it goes to the system link automatically.



the phone scanner for Barcode, QR code Fig. (19)

- As for the RFID card, the phone with the NFC feature is placed near the RFID card to move to the system link automatically.



Fig. (20) The phone reading the RFID card

Record and save the product data inside the table after reading the codes

After reading the codes associated with the parts of the product, whether it is Bar code, QR code, or RFID card, then the process of entering data into the tables assigned to each section of the system. Within each department there are two tables for entering

data in it, the first table is for the supplying movement of material to the department, and the other table is devoted to the Issuing movement of materials from one section to another.

To enter the product data into the table, click on the icon (add new record)



Fig. (21) The data entry screen on the system

Then a data entry window appears, the data is filled in with it and then click on the icon (Save Record).

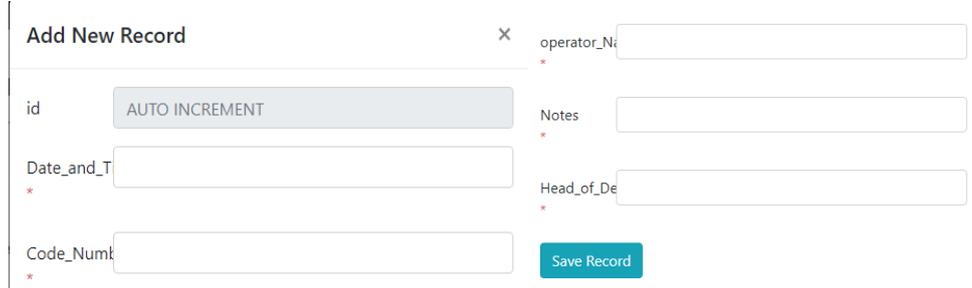


Fig. (22) how to save data on the system

To modify or deleted the entry that was saved, click on the icon at the end of the row in the table as in the following figure,

after which the entry window appears again to modify again and save these adjustments.

without Needle	Mixing Ratio	Notes	Head of Department	Action
Open Width	95% cotton – 5% Lvcra			 

Fig. (23) the icon for modifying or deleting data saved in the table

You can also search in the table; by entering what we want to search for in the table within the search box, and the result of the search appears in the table, you can

also save a copy of the table on the device, and you can choose the type of copy (Copy, Excel, CSV or PDF).

Issuing Movement From Final Inspection Department Report Table



Fig. (24) method of searching in the table

As for the cost of this system, this system only needs a global server to create and save databases, and we also reduced the

cost by using a mobile phone to read the code, instead of using the reader.

Result and discussion:

The system was applied in a ready-made garment factory on a product, in order to monitor the actual time of product data, and to compare the product production plan and the actual time of product data through the system. The movement of the product inside the factory was tracked in its different departments and the actual time of the product data was recorded on the system. These records are in the form of

tables, the first table (Supplying of movement materials to the Department), and the second table is (Issuing of movement materials from one department to another).

Raw Materials Warehouse (Yarn)

The yarn is received from the supplier companies. The Warehouse disburses the yarn to the knitting department.

Table (1) Movement materials in Raw Materials Warehouse (Yarn)

Issuing Movement for Yarn Report Table	
id	3
Date / Time	25/1/2020
Customer	D. H
Product Number	6302 (1)
Product Image	N/A

P. O Number	638027
Fabric Type	S. Lycra
Color	Lactic - Cream
Color Code	45
Description	Jcnbg Lay Ette S.Suit & Hat
Quantity	4300
Issuing Order Number	3180
Issuing To	Knitting Department
Issuing Reason	Dyeing the product
Knitting Order Number	1954
LOT Number	850
Kone Weight	2.5
Residual Yarn weight	N/A
Fabric Weight kg	731
Fabric Weight gm	00
Fabric Description	Single Jersey Lycra, Strip, Lactic Cream
Woven structure	30/1 * 20/1
Diam	30"
Needle / without Needle	Open Width
Mixing Ratio	95% cotton – 5% Lycra
Notes	N/A
Head of Department	N/A

Knitting Department

yarn is received from the raw materials warehouse (yarn) and data is recorded in (Supplying Movement to Knitting Department Report Table). After the

knitting process, the raw fabric is sent to the raw fabric warehouse for storage, and the data is recorded in (Issuing Movement from Knitting Department Report Table).

Table (2) Movement materials in Knitting Department

Supplying Movement to Knitting Department Report Tab		Issuing Movement From Knitting Department Report Table	
id	1	id	1
Date / Time	02/02/2020	Date / Time	2/2/2020
Customer	D. H	Customer	D. H
Product Number	6302 (1)	Product Number	6302 (1)
Fabric Type	S. Lycra	Fabric Type	S. Lycra
Color	Lactic - Cream	Color	Lactic - Cream
Description	Jcnbg Lay Ette S.Suit & Hat	Description	Jcnbg Lay Ette S.Suit & Hat
Quantity	4300	Quantity	4300
Supplying From	Raw Materials Warehouse (Yarn)	Issuing Order Number	8761
Supplying Reason	N/A	Issuing TO	Raw Materials Warehouse (Fabric)
LOT Number	850	Issuing Reason	N/A
Net weight of raw fabric Kg	830	Knitting Order Number	1954
Net weight of raw fabric gm	00	LOT Number	850
Net weight of Prepared fabric Kg	850	Gm / m square	198

Supplying Movement to Knitting Department Report Tab		Issuing Movement From Knitting Department Report Table	
Net weight of Prepared fabric gm	00	Fabric Rolls Numbers	28
Metric	N/A	weight kg	830
Cones Numbers	152	weight gm	00
Cone weight	2.5	Machine Number	2
Boxes Number	N/A	Operator Name	N/A
Boxes weight	N/A	Inspection Result	A1
Notes	N/A	Fabric Description	Single Jersey Lycra, Strip, Lactic Cream
Head of Department	N/A	Woven structure	30/1 * 20/1
Action	Edit / Delete	Diam	30"
		Needle / without Needle	Open Width
		Mixing Ratio	95% cotton – 5% Lycra
		Head of Department	N/A

Raw Materials Warehouse (Fabric)

Raw fabrics are received from the knitting department and stored inside the raw materials warehouse (fabric), and the data is recorded in (Supplying Movement for

Raw Fabrics Report Table). The raw fabrics are sent to the external dye-houses for the fabrics to be dyed, and the data is recorded in (Issuing Movement for Raw Fabrics Report Table).

Table (3) Movement materials in Knitting Department

Supplying Movement to Knitting Department Report Table		Issuing Movement for Raw Fabrics Report Table	
Date / Time	02/02/2020	Date / Time	18/02/2020
Customer	D. H	Customer	D. H
Product Number	6302 (1)	Product Number	6302 (1)
Fabric Type	S. Lycra	Fabric Type	S. Lycra
Color	Lactic - Cream	Color	Lactic - Cream
Color Code	45	Color Code	45
Description	Jcnbg Lay Ette S.Suit & Hat	Description	Jcnbg Lay Ette S.Suit & Hat
Quantity	4300	Quantity	4300
Supplying From	Raw Materials Warehouse (Yarn)	Issuing Order Number	172
Supplying Reason	N/A	Issuing To	El Giza Dye House
LOT Number	850	Knitting Order Number	1954
Net weight of raw fabric Kg	830	Dyeing Order Number	504
Net weight of raw fabric gm	00	Loading Order Number	3066
Net weight of Prepared fabric Kg	850	LOT Number	850
Net weight of Prepared fabric gm	00	Fabric Rolls Numbers	28
Metric	N/A	weight Kg	731
Cones Numbers	152	weight gm	00
Cone weight	2.5	Net weight of Finished Fabric kg	830
Boxes Number	N/A	Net weight of Finished Fabric gm	00
Boxes weight	N/A	Fabric Description	Single Jersey Lycra, Strip, Lactic Cream
Notes	N/A	Woven structure	30/1 * 20/1
Head of Department	N/A	Diam	30"
Action	Edit / Delete	Needle / without Needle	Open Width
		Mixing Ratio	95% cotton – 5% Lycra

Finished Fabric Warehouse

Finished fabrics coming from external dye-houses are received and stored in the finished fabrics warehouse, and this data is recorded in (Supplying Movement for

Finished Fabrics Report Table). Finished fabrics are sent to the Spreading and Cutting Department and the data is recorded in (Issuing Movement Form Finished Fabrics Warehouse Report Table).

Table (4) Movement materials in Finished Fabric Warehouse

Supplying Movement for Finished Fabrics Report Table		Issuing Movement form Finished Fabrics Warehouse Report					
id	1	id	4	5	6	7	8
Date / Time	02/03/2020	Date / Time	9/3/2020	13/3/2020	13/3/2020	7/3/2020	8/3/2020
Customer	D. H	Lay Number	3	4	5	1	2
Product Number	6302 (1)	Customer	D. H				
P. O Number	638027	Product Number	6302 (1)				
Fabric Type	S. Lycra	P. O Number	638027				
Color	Lactic - Cream	Fabric Type	S. Lycra				
Color Code	45	Color	Lactic-Cream				
Description	Jcnbg Lay Ette S.Suit & Hat	Color Code	45				
Quantity	4300	Description	Jcnbg Lay Ette S.Suit & Hat				
Supplying Order	148	Product Quantity	945	945	945	945	945
Supplying From	El Giza Dye House	GM / m square	197	197	197	197	197
Supplying Reason	Receive the Finished Fabric	Issuing Order Number	4456				
Knitting Order	1954	Issuing To	Cutting Department				
Dyeing Order	504	Issuing Reason	N/A				
Loading Order	3066	Lay Width CM	170	170	170	170	170

Supplying Movement for Finished Fabrics Report Table		Issuing Movement form Finished Fabrics Warehouse Report					
LOT Number	850	Marker Length M	7.75	7.75	6.02	7.75	7.75
Fabric Rolls Num	20	Metric	348.75	348.75	240.8	348.75	348.75
Net weight of Finished Fabric kg	968	weight kg	115	117	70	115	117
Net weight of Finished Fabric gm	00	Weight gm	0	0	0	0	0
Inspection Result	A1	Average Length	0.369	0.369	0.388	٠.٣٦٩	٠.٣٦٩
Notes	N/A	Average Weight	0.122	0.124	0.113	0.122	0.124
Head of Dept	N/A	Lay Efficiency	72.76	72.76	72.76	72.76	72.76
Action	Edit / Delete	Lay Direction	One Side				
		Lay Method	Saw				
		Head of Department	N/A				

Spreading and Cutting Department

Fabrics are received in this Department, and data are recorded in (Supplying Movement to Spreading and Cutting Department Table). After the cutting

process, the product pieces are sent to the Primary inspection department, and the data is recorded in (Issuing Movement from Spreading / Cutting Department Report Table).

Table (5) Supplying Movement to Spreading and Cutting Department Table

Supplying Movement to Spreading and Cutting Department Table					
id	4	5	6	7	8
Date / Time	8/3/2020	9/3/2020	10/3/2020	14/3/2020	14/3/2020
Lay Number	3	4	5	1	2
Customer	D. H				
Product Number	6302 (1)				
P. O Number	638027				
Fabric Type	S. Lycra				
Color	Lactic-Cream				
Color Code	45				
Description	Jcnbg Lay Ette S.Suit & Hat				
Product Size	(T.B) - (N.B) - (0.3) - (3.6) - (6.9) - (9.12)				
Product Quantity	45 - 135 - 315 - 315 - 90 - 45	45 - 135 - 315 - 315 - 90 - 45	45 - 135 - 315 - 315 - 90 - 45	45 - 135 - 315 - 315 - 90 - 45	20 - 40 - 280 - 120 - 40 - 120
Total Quantity	945	945	945	945	620
GM / m square	197	197	197	197	197
Cutting Order Number	2072	2072	2072	2072	2072
Supplying From	Finished Fabric Warehouse				
Supplying Reason	N/A				
Lay Width CM	170	170	170	170	170
Marker Length M	7.75	7.75	6.02	7.75	7.75
Metric	348.75	348.75	240.8	348.75	348.75
weight kg	115	117	70	115	117
weight gm	0	0	0	0	0
Average Length	0.369	0.369	0.388	٠.٣٦٩	٠.٣٦٩
Average Weight	0.122	0.124	0.113	0.122	0.124
Lay Efficiency	72.76	72.76	72.76	72.76	72.76
Lay Direction	One Side				
Lay Method	Saw				
Head of Department	N/A				

Table (6) Issuing Movement from Spreading / Cutting Department Report

Issuing Movement From Spreading / Cutting Department Report					
id	4	5	6	7	8
Date / Time	8/3/2020	9/3/2020	10/3/2020	14/3/2020	14/3/2020
Lay Number	3	4	5	1	2
Customer	D. H				
Product Number	6302 (1)				
P. O Number	638027				
Fabric Type	S. Lycra				
Color	Lactic-Cream				
Color Code	45				
Description	Jcnbg Lay Ette S.Suit & Hat				
Product Size	(T.B) - (N.B) - (0.3) - (3.6) - (6.9) - (9.12)				
Product Quantity	45 - 135 - 315 - 315 - 90 - 45	45 - 135 - 315 - 315 - 90 - 45	45 - 135 - 315 - 315 - 90 - 45	45 - 135 - 315 - 315 - 90 - 45	20 - 40 - 280 - 120 - 40 - 120
Total Quantity	945	945	945	945	620
GM / m square	197	197	197	197	197
Cutting Order Num	2072	2072	2072	2072	2072
Issuing Order Num	3229	3242	3249	4760	4767
Issuing To	Primary Inspection Department				
Issuing Reason	N/A	N/A	N/A	N/A	N/A
Lay Width CM	170	170	170	170	170
Marker Length M	7.75	7.75	6.02	7.75	7.75
Metric	348.75	348.75	240.8	348.75	348.75

Issuing Movement From Spreading / Cutting Department Report					
weight kg	115	117	70	115	117
weight gm	0	0	0	0	0
Average Length	0.369	0.369	0.388	0.369	0.369
Average Weight	0.122	0.124	0.113	0.122	0.124
Lay Efficiency	72.76	72.76	72.76	72.76	72.76
Lay Direction	One Side				
Lay Method	Saw				
Head of Department	N/A				

Primary inspection Department

The product pieces that were cut from the cutting department are received, and the product pieces are received from external print-houses if the product has prints in the design, and also the product pieces that were embroidered from the embroidery department are received until the product pieces are inspected, and that data is recorded in a (Supplying Movement to Primary Inspection Department Report

Table). After the inspection process, the product pieces are sent to the embroidery department If the design needs to be embroidery, and the product pieces are sent to the external print-houses If the design needs to be print, then the product pieces are sent to the sewing department to start operation process, the data is recorded in (Issuing Movement from Final Inspection Department Report Table).

Table (7) Supplying Movement to Primary Inspection Department Report Table

Supplying Movement to Primary Inspection Department from Spreading / Cutting Department					
id	4	5	7	13	14
Date / Time	8/3/2020	9/3/2020	10/3/2020	14/3/2020	14/3/2020
Lay Number	3	4	5	1	2
Customer	D. H				
Product Number	6302 (1)				
Product Image	N/A				
P. O Number	638027				
Fabric Type	S. Lycra				
Color	Lactic-Cream				
Color Code	45				
Description	Jcnbg Lay Ette S.Suit & Hat				
Cutting Order Num	2072				
Supplying From	Spreading / Cutting Department				
Product Size	(T.B) - (N.B) - (0.3) - (3.6) - (6.9) - (9.12)				
Product Quantity	45 - 135 - 315 - 315 - 90 - 45	45 - 135 - 315 - 315 - 90 - 45	45 - 135 - 315 - 315 - 90 - 45	45 - 135 - 315 - 315 - 90 - 45	20 - 40 - 280 - 120 - 40 - 120
Total Quantity	945	945	945	945	620
Total Defective Pieces	N/A				
Defects Types	N/A				
Head of Department	N/A				

Table (8) Issuing Movement from Primary Inspection Department Report

Issuing Movement from Primary Inspection Department Report						
id	٣	٤	٥	٦	٧	٨
Date / Time	9/3/2020	10/3/2020	11/3/2020	14/3/2020	15/3/2020	17/3/2020
Customer	D. H					
Product Number	6302 (1)					
Product Image	N/A					
P. O Num	638027					
Fabric Type	S. Lycra					
Color	Lactic-Cream					
Color Code	45					
Description	Jcnbg Lay Ette S.Suit & Hat					
Cutting Order Num	2072	2072	2072	2072	2072	2072
Issuing Order Num	3129	3132	3141	3147	3149	3152
Issuing To	Embroidery Department					Sewing Department
Product Size	(T.B) - (N.B) - (0.3) - (3.6) - (6.9) - (9.12)					
Product Quantity	45 - 135 - 315 - 315 - 90 - 45	45 - 135 - 315 - 315 - 90 - 45	45 - 135 - 315 - 315 - 90 - 45	45 - 135 - 315 - 315 - 90 - 45	20 - 40 - 280 - 120 - 40 - 120	210 - 590 - 1550 - 1075 - 320 - 255
Total Quantity	940	940	940	940	910	4300
Head of Department	N/A					

Accessory Warehouse

Accessories for the product are received from suppliers, stored in the accessory

Warehouse. The accessories for the product

are sent to the different departments

Table (9) Movement materials in Accessories Department

Supplying Movement to the Accessories Department				Issuing Movement from the Accessories Department Report			
id	1	4	5	id	1	3	4
Date / Time	14/12/2019	15/12/2019	24/12/2019	Date / Time	4/3/2020	14/3/2020	14/3/2020
Customer	D. H			Customer	D. H		
Product Number	6302 (1)			Product Number	6302 (1)		
P. O Num	638027			P. O Number	638027		
Fabric Type	S. Lycra			Fabric Type	S. Lycra		
Color	Lactic-Cream			Color	Lactic-Cream		
Color Code	45			Color Code	45		
Description	Jcnbg Lay Ette S.Suit & Hat			Description	Jcnbg Lay Ette S.Suit & Hat		
Quantity	4300			Quantity	4300		
Supplying From	Britannia Turkey	Rudholm	Rudholm	Issuing To	Sewing Department		
Item Name	Ticket	Rectangle Junior Badge	(J) Letter	Item Name	Ticket	Rectangle Junior Badge	(J) Letter
Product Size	(T.B) - (N.B) - (0.3) - (3.6) - (6.9) - (9.12)			Product Size	(T.B) - (N.B) - (0.3) - (3.6) - (6.9) - (9.12)		
Item Quantity	200 - 575 - 1475 - 1325 - 400 - 300	200 - 575 - 1475 - 1325 - 400 - 300	200 - 575 - 1475 - 1325 - 400 - 300	Item Quantity	200 - 575 - 1475 - 1325 - 400 - 300	200 - 575 - 1475 - 1325 - 400 - 300	200 - 575 - 1475 - 1325 - 400 - 300
Head of Dpt	N/A			Head of Department	N/A		

Embroidery Department

The product pieces are received from Primary inspection, After the embroidery

process, the product pieces are sent to the

Primary inspection department.

Table (10) Supplying Movement to Embroidery Department

Supplying Movement to Embroidery Department Report					
Id	1	2	3	4	5
Date / Time	9/3/2020	10/3/2020	11/3/2020	14/3/2020	15/3/2020
Lay Number	1	2	3	4	5
Customer	D. H				
Product Number	6302 (1)				
P. O Number	638027				
Fabric Type	S. Lycra				
Color	Lactic-Cream				
Color Code	45				
Description	Jcnbg Lay Ette S.Suit & Hat				
Cutting Order Number	2072				
Supplying From	Primary Inspection Department				
Supplying Reason	N/A	N/A	N/A	N/A	N/A
Product Size	(T.B) - (N.B) - (0.3) - (3.6) - (6.9) - (9.12)				
Product Quantity	45 - 135 - 315 - 315 - 90 - 45	45 - 135 - 315 - 315 - 90 - 45	45 - 135 - 315 - 315 - 90 - 45	45 - 135 - 315 - 315 - 90 - 45	20 - 40 - 280 - 120 - 40 - 120
Total Quantity	940	940	940	940	910
Head of Department	N/A				

Table (11) Issuing Movement from the Embroidery Department Report

Issuing Movement from the Embroidery Department Report													
id	1	2	3	4	5	6	7	8	9	10	11	12	13
Date / Time	10/3/2020	10/3/2020	11/3/2020	11/3/2020	12/3/2020	14/3/2020	14/3/2020	15/3/2020	15/3/2020	16/3/2020	16/3/2020	17/3/2020	17/3/2020
Customer	D. H												
Product Num	6302 (1)												
P. O Number	638027												
Fabric Type	S. Lycra												
Color	Lactic - Cream												
Color Code	45												
Description	Jcnbg Lay Ette S.Suit & Hat												
Issuing Order	3401	3402	3403	3404	3405	3406	3407	3408	3409	3410	3411	3412	3413
Issuing To	Primary Inspection Department												
Quantity	375	375	210	٣٧٥	٣٧٥	٣٧٥	٣٧٥	300	375	375	375	375	150
Shift	A	B	A	B	A	A	B	A	B	A	B	A	B
Machine Num	6	6	6	6	6	6	6	6	6	6	6	6	6
Stitches Num	2800	2800	2800	2800	2800	2800	2800	2800	2800	2800	2800	2800	2800
Needle Num	6	6	6	6	6	6	6	6	6	6	6	6	6
Applique Num	1	1	1	1	1	1	1	1	1	1	1	1	1
Frame Num	25	25	14	25	25	25	25	20	25	25	25	25	10
Heads Num	15	15	15	15	15	15	15	15	15	15	15	15	15
Worker Name	N/A												
Head Of Dpt	N/A												

Sewing Department

The product pieces are received from the Primary inspection department, to start the operation process, and the data is recorded in (Supplying Movement for Product Pieces Report Table). After the sewing

process, the product is sent to the final inspection department to complete the inspection process, and the data is recorded in (Issuing Movement from Sewing Department Report Table).

Table (12) Movement materials in Sewing Department

Supplying Movement for Product Pieces Report		Issuing Movement from Sewing Department Report												
id	4	id	10	11	12	13	14	15	16	17	18	19	20	
Date / Time	4/4/2020	Date / Time	18/3/2020	19/3/2020	21/3/2020	22/3/2020	23/3/2020	29/3/2020	30/3/2020	31/3/2020	1/4/2020	2/4/2020	3/4/2020	
Customer	D. H	Customer	D. H											
Product Num	6302 (1)	Product Num	6302 (1)											
P. O Num	638027	P. O Num	638027											
Fabric Type	S. Lycra	Fabric Type	S. Lycra											
Color	Lactic – Cream	Color	Lactic-Cream											
Color Code	45	Color Code	45											
Description	Jcnbg Lay Ette S.Suit & Hat	Description	Jcnbg Lay Ette S.Suit & Hat											
Supplying From	Primary Inspection Dept	Cutting Order	2072											
Supplying Reason	Receive the Fabrics	Issuing To	Final Inspection Department											
Product Size	(T.B) - (N.B) - (0.3) - (3.6) - (6.9) - (9.12)	Product Operating Time	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	
Product Quantity	210 - 590 - 1550 - 1075 - 320 - 255	Pieces Numbers per day	130	465	435	625	545	475	425	610	410	25	155	
Total Quantity	4300	production hours Num	22.1	79.05	73.95	106.2	92.65	80.75	72.25	103.7	69.7	4.25	26.35	
Notes	N/A	Machines Num	3	26	28	25	25	25	25	26	25	10	4	
Head of Dpt	N/A	Machines Hours Numbers Per Day	24	208	224	200	200	200	200	208	200	80	32	
		Production Efficiency	92.0	38.0	33.01	53.1	46.3	40.3	36.1	49.8	34.8	5.3	82.3	
		Total pieces	130	595	1030	1655	2200	2675	3100	3710	4120	4145	4300	
		Operating method	N/A											
		Machines Types	N/A											
		operator Names	N/A											
		Head of Dpt	N/A											

Final Inspection Department

The product is received from the sewing department, in order to complete the final inspection process, and data is recorded in (Supplying Movement to Final Inspection

Department Report Table). After the final inspection process, the data is recorded in (Issuing Movement from Final Inspection Department Report Table).

Table (13) Supplying Movement to Final Inspection Department Report

Supplying Movement to Final Inspection Department Report											
id	1	2	3	4	5	6	7	8	9	10	11
Date / Time	18/3/2020	19/3/2020	21/3/2020	22/3/2020	23/3/2020	29/3/2020	30/3/2020	31/3/2020	1/4/2020	2/4/2020	3/4/2020
Customer	D. H										
Product Num	6302 (1)										
Product Image	N/A										
P. O Number	638027										
Fabric Type	S. Lycra										
Color	Lactic-Cream										
Color Code	45										
Description	Jcnbg Lay Ette S.Suit & Hat										
Quantity	4300										
Supplying From	Sewing Department										
Product Quantity	130	465	435	625	545	475	425	610	410	25	155
Total Quantity	130	595	1030	1655	2200	2675	3100	3710	4120	4145	4300
Notes	N/A										
Head of Dpt	N/A										

Table (14) Issuing Movement from Final Inspection Department Report

Issuing Movement from Final Inspection Department Report											
id	1	2	3	4	5	6	7	8	9	10	11
Date / Time	18/3/2020	19/3/2020	20/3/2020	21/3/2020	23/3/2020	24/12/2020	25/3/2020	31/3/2020	1/4/2020	6/4/2020	9/4/2020
Customer	D. H										
Product Numb	6302 (1)										

Issuing Movement from Final Inspection Department Report											
Product Image	N/A										
P. O Number	638027										
Fabric Type	S. Lycra										
Color	Lactic-Cream										
Color Code	45										
Description	Jcnbg Lay Ette S.Suit & Hat										
Quantity	4300										
Issuing Order Num	4109	4110	4111	4112	4113	4113	4114	4115	4115	4116	4117
Issuing To	Finishing Department										

Issuing Reason	N/A										
Total inspected pieces Num	131	468	437	632	550	478	429	617	414	25	17
Accepted pieces Num	131	468	435	631	547	475	427	609	409	23	17
Rejected pieces Numbers	0	0	2	1	3	0	0	0	0	0	0
Repairing pieces Num	1	3	2	7	5	3	4	7	4	0	0
Total Defects	0	3	2	1	3	3	2	3	5	2	0
Defects Types	Repair					Textile - Ravel					
Inspector Name	N/A										
Notes	N/A										
Head of Dept	N/A										

After collecting the real-time product data on the system, the Supplying Movement Date and Issuing Movement Date were put together with the production plan that was previously prepared by the Production Planning Department, for comparison between them through the following table:

Table (15): Comparison between real-time production data and factory production plan

Departments	Factory Production Plan		Real Time Production Data System	
	Supplying Movement Date	Issuing Movement Date	Supplying Movement Date	Issuing Movement Date
Raw Materials Warehouse (Yarn)		2٦/1/2020		25/1/2020
Knitting Department	2٦/1/2020	٢/2/2020	25/1/2020	2/2/2020
Raw Materials Warehouse (Fabric)	٢/2/2020	٥/2/2020	2/2/2020	18/ 2/2020
Finished Fabric Warehouse	٥/3/2020	٦/3/2020	2/3/2020	٨/3/2020 ٩/3/2020 ١٠/3/2020 ١٤/3/2020 ١٤/3/2020
Spreading and Cutting Department	١٢/3/2020	١٣/3/2020	8/3/2020 9/3/2020 10/3/2020 14/3/2020 14/3/2020	8/3/2020 9/3/2020 10/3/2020 14/3/2020 14/3/2020
Primary Inspection Department	١٤/3/2020	١٥/3/2020	8/3/2020 9/3/2020 10/3/2020 10/3/2020 10/3/2020 11/3/2020 11/3/2020 12/3/2020 14/3/2020 14/3/2020 14/3/2020 15/3/2020 15/3/2020 16/3/2020 17/3/2020 17/3/2020	9/3/2020 10/3/2020 11/3/2020 14/3/2020 15/3/2020 17/3/2020
Accessory Warehouse	٣٠/1١/2019	١٥/3/2020	14/12/2019	14/3/2020 14/3/2020 14/3/2020
Embroidery Department	١٥/3/2020	١٧/3/2020	9/3/2020 10/3/2020 11/3/2020 14/3/2020 15/3/2020	10/3/2020 10/3/2020 11/3/2020 11/3/2020 12/3/2020 14/3/2020 14/3/2020 15/3/2020 15/3/2020 16/3/2020 17/3/2020

Departments	Factory Production Plan		Real Time Production Data System	
	Supplying Movement Date	Issuing Movement Date	Supplying Movement Date	Issuing Movement Date
				17/3/2020
Sewing Department	17/3/2020	٢٢/3/2020	17/3/2020	18/3/2020 19/3/2020 21/3/2020 22/3/2020 23/3/2020 29/3/2020 30/3/2020 31/3/2020 1/4/2020 2/4/2020
Final Inspection Department	١٨/3/2020	٢٣/3/2020	18/3/2020 19/3/2020 21/3/2020 22/3/2020 23/3/2020 29/3/2020 30/3/2020 31/3/2020 1/4/2020 2/4/2020	18/3/2020 19/3/2020 20/3/2020 21/3/2020 23/3/2020 24/3/2020 25/3/2020 31/3/2020 1/4/2020 6/4/2020 9/4/2020

Through comparison, we find that there is a difference between the actual time of product data that was previously monitored by the proposed system and the production plan prepared by the Production Planning Department.

Conclusions

- This system based on AIDC technology was used in one of the ready-made garments factories, as it was applied to the different sections of the factory, through this system the real time of the entry of product materials into the department, and the real time of the product leaving the department, A database of factory products can be created, various reports can be obtained, saved and printed, and easily accessible at anytime and anywhere, and this is what managers needed in the factory tracking process.
- One of the advantages of this system is that it was able to replace the (barcode) reader and (QR code) and the codes were read through a mobile application scanner, while the (RFID) reader was replaced by mobile phones with the feature (NFC - near field communication), which makes this system Easier to use, and it reduces cost.
- The actual time of the data of one of the products in the factory was monitored,

and that was compared to the production plan that was prepared by the production planning department in advance.

- From the results obtained after observing the actual time of one of the products of the factory in its different departments, which showed that there is a difference between the production plan and the actual time of the product data, the use of this technology-based (AIDC) helps the management in (Obtaining product flow data easily in different factory departments in real time, building a factory database based on product data in real time, creating various reports on product data and making it easy to access it anytime and anywhere, building a modern management method and a digital production environment in Real-time with high transparency, achieving effective management and taking appropriate decisions, and controlling the production schedule).

Recommendations

This paper recommends the following:

- Using this system based on AIDC technology can be applied in garment factories in all its departments, in order to obtain real-time product data.
- This system can also be developed to include various applications related to

apparel, textiles, knitting, manufacturing, retail and inventory management.

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استخدام تقنيات التعريف التلقائي والتقاط \ جمع البيانات (AIDC) في مراقبة الوقت الفعلي لبيانات الإنتاج بمصانع الملابس الجاهزة

الملخص:

تواجه صناعه الملابس الجاهزة صعوبات كثيرة لعدم وجود الوقت الفعلي لبيانات الإنتاج الذي يُمكنه توفير المعلومات الضرورية لتتبع عمليات المنتج، فلا توجد شفافية للإدارة في مشاركة المعلومات بين الأقسام. كما توجد فجوة كبيرة بين الإنتاج الفعلي والخطة الإنتاجية الموضعه من قبل الإدارة. فلا يمكن حل تلك الصعوبات دون الحصول على بيانات صحيحة في الوقت المناسب. لذا فيجب على الإدارة الاعتماد على نظام الوقت الفعلي في مراقبة بيانات المنتج. للتغلب على تلك الصعوبات فإن استخدام نظم تحديد الهوية التلقائي والتقاط البيانات (AIDC) ضروريه لضمان مستوى الدقة اللازمة لدعم أنظمة اتخاذ القرارات الإدارية. يتم استخدام (AIDC) في التعرف على الكائنات، وجمع البيانات عنها، حيث يعتمد (AIDC) على استخدام التكنولوجيا لتوفير إدخال مباشر للبيانات، دون اللجوء إلى الطرق اليدوية لإدخال البيانات، ومن الأنظمة المختلفة التي تعتمد على تكنولوجيا (AIDC) هي نظام الباركود ونظام الاستجابة السريعة ونظام تحديد الهوية باستخدام موجات الراديو.

تم تطبيق النظام على احد مصانع الملابس الجاهزة، عن طريق مراقبة الوقت الفعلي لبيانات المنتجات باستخدام انظمه (AIDC)، وتسجيل بيانات المنتج على النظام في وقت دخول وخروج مواد المنتج تلقائياً في كل قسم، والحصول على التقارير اللازمه لكل قسم. ومن ثم، تم عقد مقارنة بين الوقت الفعلي لبيانات المنتج في الأقسام المختلفة والخطة الإنتاجية المُعدة مسبقاً. وقد توصلت الدراسة الى وجود اختلاف بين الخطة الإنتاجية والوقت الفعلي لبيانات المنتج، وأن تطبيق هذا النظام يساعد الإدارة في سهوله الحصول على بيانات تدفق المنتج في أقسام المصنع المختلفة في الوقت الفعلي، وبناء نمط الإدارة الحديثة وبيئة إنتاج رقمية بشفافية عالية في الوقت الفعلي، وتحقيق الإدارة الفعالة وإتخاذ القرارات المناسبة.

الكلمات المفتاحية: تقنيات التعريف التلقائي، مراقبة الوقت الفعلي، بيانات الإنتاج، مصانع الملابس الجاهزة