

Designing 'IE Solution' App for Calculation and Monitoring of Garments Production

Sadman Sakib Rashad¹, Hriday Paul², Most. Setara Begum^{3*}

Abstract

Industrial Engineering (IE) is one of the important departments in apparel industry. The aim of this study is to minimize the production time and enhance the efficiency of the work to obtain the actual results monitored by the IE department. In this study, the 'IE Solution' app was developed using a mobile and web application development platform named 'Firebase'. This app can be installed on android based mobile devices. It was designed in such a way that the IE experts can solve their necessary calculations rapidly and can monitor the production status in the right time. The user application of 'IE Solution' consists of the steps as – signing up to create an individual profile of users; logging-in app that redirects users to the calculation and hourly production. Here, target, efficiency and Standard Minute Value (SMV) calculation options. The hourly production form stores the daily production details per hour as well as daily efficiency. Through this app, the users not only can do the calculation, but also can monitor the time-to-time hourly production status and show the line efficiency per day. All the information can be stored in this app and can be accessed conveniently at any time, from anywhere; however, an internet connection is mandatory.

Keywords: *IE solution app, Apparel industries production calculation, Hourly production monitoring, Data store, Production efficiency.*

1. Introduction

Nowadays the popularity of mobile devices in getting higher day by day. As the mobile devices are increasing, the number of mobile applications is also growing rapidly. The IT experts put effort on mobile applications and people enjoy the convenience of those mobile applications (A. Vitor Monte., et al., 2015).

At present Industrial Engineering (IE) is one of the important departments for each apparel industry. The job responsibilities of the department are always beneficial for managing and monitoring on floor. IE officers have to inform the top-level management about the hourly production report of the floor for achieving the target. Also, the IE officers have to do different calculation related to the production such as SMV calculation, efficiency, target etc.

Nowadays, in the apparel industry focus on technological adaptation (Hoque, M.A., et al., 2021) through different type of software (I. W. R. Taifa, S. G. Hayes and I. D. Stalker, 2020) (Y. Li, L. Yang and Y. Li 2009). However, most of the garment's factories are still using the manual method for doing those tasks which is more time consuming. Hence, they often can't get their actual production and the management can't take the proper steps to fulfill the gap instantly as they check the production report at the end of the day

To monitoring the production properly we need new technology for the adaption (S. Ahmad, S. Miskon, R. Alabdan and I. Tlili, 2021) (H. Ruile and P. Wunderlin, 2011) in our apparel industry (M. MobinHossain., et al., 2022) which can be share the real time data in IE department that might be reduced nonproductive time (NPT) and also increase the effective works to get the actual data.

¹⁻² Department of Textile Engineering, BGMEA University of Fashion & Technology, Dhaka, Bangladesh

³ Faculty of Mechanical Engineering and Design, Kaunas University of Technology, Lithuania

* Corresponding Author E-mail: setara.begum@buft.edu.bd, most.setara@ktu.edu

The study attempts to develop an apps for “IE solution” which will expedite to formulate production efficiency at any time and will assist the stakeholders to monitor the production capacity (R. Tanaka., et.al, 2018).

By using this mobile apps, we will easily calculate the target unit per day, efficiency of the production and the Standard Minute Value (SMV). Also, the higher management will easily monitor the production report in every hour not at the end of the day. They will also communicate with each other by giving their opinion on the comment box in the apps and immediately take the necessary steps when the hourly production would hamper.

2. Methodology

2.1 Firebase

Firebase [10] is a mobile and web application development platform. It can be categorized as an internet based soft machinery and this technology shows real-time data. Our mobile app has been developed by using this platform. Besides this web development platform, -Personal Computer, Android Mobile and Internet Connection had used [11].

2.2 Experimental Works (App Development)

The “sign up” form was created first to create individual profile for each user. To entry in a specific profile to run the app, the “log in” form was created which come after completing the sign-up form. Then the “My Profile” form was created which represents the calculation and hourly production options.

The “Calculation” form has a calculator tab inside there. We can calculate line target, efficiency, and SMV according to the formula.

The “Hourly Production” form was developed which can save data by “line production” and date-wise. This production form was developed to store the details production per hour and the daily efficiency.

All the process of the development of this app is sequentially described below:

2.2.1 Sign up Form

The first step was to create a personal profile before using this app. The personal information which is needed are the email address, password, name, designation, mobile no. and the company name of that user.

2.2.2 Log in

After completing the “sign up” from, the user has to “log in” to use this app. The user was put in an email address and password to enter inside the app. The user who has no account in this app is not able to “log in”.

2.2.3 My Profile

My profile contains the user information or user details. The information that the user gave in the “sign up” form during account creation is shown on his individual profile. This is the main page of this app from where the user can execute the calculation and the hourly production.

2.2.4 Calculation Page

If the user wants to calculate the target, efficiency and SMV, then the user has to enter in the calculation page from My Profile.

2.2.5 Target Calculation

For calculating target unit per day, the user has to give input of manpower, working hour, SMV, efficiency %. The following formula was used for doing the target calculation:

$$\text{Target/Day} = (\text{Manpower} \times \text{working hour} \times 60 \times \text{Efficiency \%}) \div (\text{SMV}) \dots\dots\dots (1)$$

2.2.6 Efficiency Calculator

When the user needs to calculate the efficiency % per day, the user needs to enter in the “efficiency” option from the calculation page. For calculating the efficiency, the user has to give input day production, SMV, manpower and the working hour. The following formula was used to do the Efficiency % calculation

$$\text{Efficiency (\%)/Day} = (\text{Day production} \times \text{SMV}) \div (\text{Manpower} \times \text{Working hour} \times 60) \times 100 \dots\dots (2)$$

2.2.7 SMV Calculator

When the user needs to tab the “SMV” option from the calculation page to calculate “SMV”. Here the user needs to give input of “basic time” and “allowance”. The following formula was used for doing the calculation of SMV:

$$\text{SMV} = \text{Basic Time} + (\text{Basic Time} \times \text{Allowance}) \dots\dots\dots (3)$$

2.2.8 Hourly Production

When the user needs to monitor the hourly production data, the user has to tab the “hourly production” icon from “My Profile” option. After entering hourly production from there have two options. First option: “Create a new line” if you want to create a new line you click on that. Second option: “Lines” which are represented by previously created lines.

2.2.9 Line Creation Form

To create a production line name, the user had to tab a “Create new line” option from hourly production page. The user can give a specific line name for each line

2.2.10 Line Date

The user can enter specific line such as line no. 1, line no. 2, line no. 3 and also can see all the date which are previously updated. Here the user can also update data according to date-wise. In this page to add a new date the user has to click on the “Add option”.

2.2.11 Line Information

In the line dates page, when the user press on a specific date, the details information of a specific line of that specific date is visible to the user. The line information page contains the details information, production and efficiency of each specific line.

2.2.11.1 Details Form

From the line information page, to see the details information about a line the user has to press on the details option. The details option page contains the information of buyer name, style, order quantity, running date, manpower, operator, helper, ironman, SMV and balance. The user can able to update all these above data manually.

2.2.11.2 Production Form

The user has to press on the production option from the line information page to see the production information of a line. The production form contains the information of target

production unit, assembly, output, remaining production and remark.

where the “Target” represents the daily production goals, “Remaining” production shown by deduction from output to target goals, “Remark” can used by user for write down comments which can see all the responsible person. Every hour all data can be updated by user. If need to see the previous hour data just slide left “Hour” option.

2.2.11.3 Efficiency Form

The “Efficiency” information of a line, the user has to press on the efficiency from option from the line information page. The efficiency form contains the hour (h/r) and the manpower out. The efficiency of the day was calculated at the end of the working hour (8-13).

3. Results and discussions:

3.1 Result for “Sign up”

The developed “sign up” form layout is given below [Figure 1].

Fig. 1. “Sign up from” page.

Here the user given his personal information in sign up for to create account in “IE SOLUTION” app which is shown in the [Figure 2].

Fig. 2. Result of “Sign up” page.

3.2 Result for “Log in”

The “log in” to this app was done by giving the email and password which was used in “sign up” form [Figure 3].

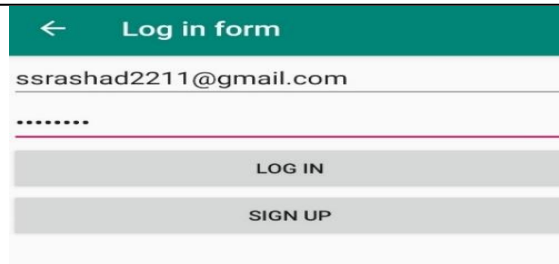


Fig. 3. Result for “log in” page.

3.3 Result for “My Profile”

After “logged in” successfully in IE apps, user could see personal information of that user and also allow to execute the calculation and hourly production [Figure 4].



Fig. 4. Result for “My Profile” page.

3.3.1 Result for “Calculation Page”

The calculation page layout is given below [Figure 5].

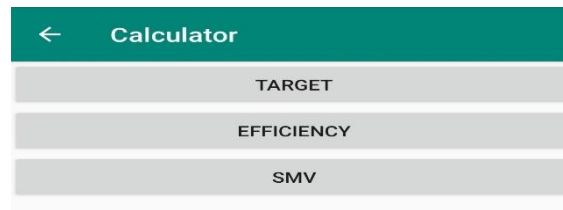


Fig. 5. “Calculator” page.

3.3.1.1 Result for “Target”

The target calculation page layout is given below [Figure 6].

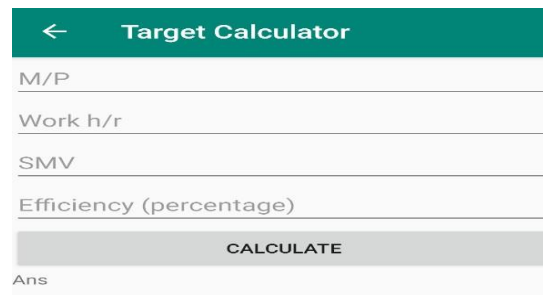


Fig. 6. “Target Calculator” page.

Here, the data was given, such as: manpower-55, working hour-8, SMV-20.5, efficiency (%) -77. After giving this input, the result was generated in the 'IE solution' app. The target was calculated by (Eq 1) that shown in [Figure 7].

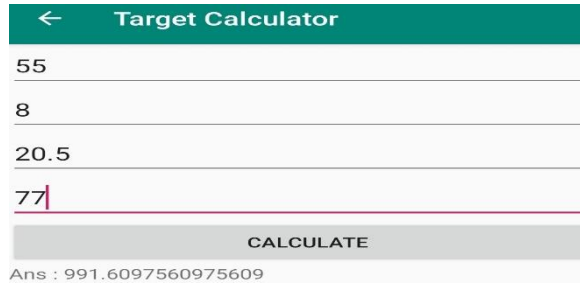


Fig. 7. Result in “Target Calculator”

3.3.1.2 Result for “Efficiency”

The efficiency calculation page layout is given below [Figure 8].

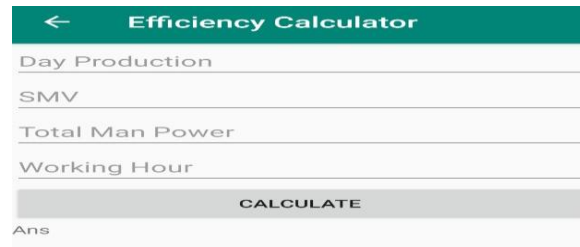


Fig. 8. “Efficiency Calculator” page.

Here, given data: - Manpower-55, Working hour-8, SMV-20.5, Target-992. After giving this input, the result was generated in the 'IE solution' app. The efficiency was calculated by (Eq 2) that shown in [Figure 9].

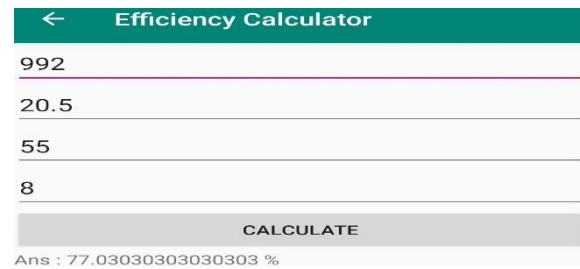


Fig. 9. Result in “Efficiency Calculator”

3.3.1.3 Result for “SMV”

The SMV calculation page layout is given below [Figure 10].

Fig. 10. “SMV Calculator” page.

Here, given data: - Basic Time- 33 second, Allowance- 15% or 0.15 After giving this input, the result was generated in the ‘IE solution’ app. The SMV was calculated by (Eq 3) that shown in [Figure 11].

Fig. 11. Result in “SMV Calculator”

3.3.2.1 Result for Hourly Production Monitoring

In this step, line 4 was created which was named as ‘C’ shown in [Figure 12].

Fig. 12. (a) is Line creation with specific name; (b) is the result for created line in Hourly Production form

Now, by pressing on the line C, date option was shown in [Figure 13].

Fig. 13. “Line Dates” page.

When press on the current date (07-07-2019), the line information page is appeared where there are three option- details, production and efficiency which is shown in the [Figure 14].



Fig. 14. “Line Information” page.

3.3.2.1.1 Details Form

Here the details option contains the information buyer name, style, order quantity, running date, M/P, operator, helper, iron man, SMV & Balance which is shown in the [Figure 15].

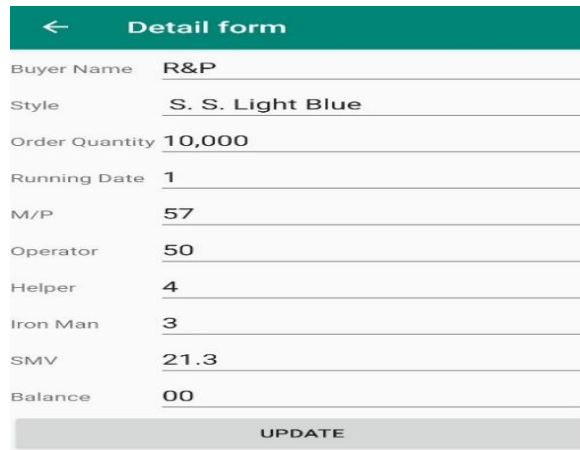


Fig. 15. “Details form” page.

3.3.2.1.2 Production Form

Target unit was fixed at 1000 pcs in the production form. For 1st hour, assembly unit pcs were given 90, output was given 75. Hence, the remaining production unit was automatically calculated which 925 pcs [Figure 16].



Fig. 16. “Production Form” page.

By scrolling left to right Hour-2, Hour-3 etc. are appeared continuously that shown in [Figure 17].

Production form	
Target	1000
Hour : 2	
Ass.	
O/P	
Rem.	925
Remark	
UPDATE	
Responsible by : Sadman sakib	

Fig.17. Production form for “Hour-2”.

In hour-6, a problem occurred during production which affected to achieve the targeted production unit. The user could give the explanation or add comments which is commented in the remark option [Figure 18].

Production form	
Target	1000
Hour : 6	
Ass.	100
O/P	70
Rem.	507
Remark	bottle neck on waist belt joining.
UPDATE	
Responsible by : Sadman sakib	

Fig. 18. Production form for “Hour-6”.

Similarly, every hour production data was updated by user until the production was closed for that day. After all updated data are saved in this app. Those data can be seen anytime.

3.3.2.1.3 Result for Efficiency

In line C, production/day 1000 pcs, SMV 21.3, Manpower 57 and working hour (at 10th hour they leave on 48 workers, at 11th hour leave on 5 workers and the remaining worker leave on at 12th hour). When we input this data, the result was generated in the ‘IE solution’ app. The Efficiency (%) is shown in [Figure 19].

Efficiency form	
H/R	Out
8	
9	
10	48
11	5
12	4
13	
UPDATE	
Line Effi.	60.891938250428815

Fig.19. Result for “Efficiency” form.

4. Conclusion:

In this study an android based mobile application was developed. This application can be installed and applicable in several devices at the same time. This application is applied in the android platform and made on the base of “firebase” web development platform. This android based mobile app can be used mainly for doing calculation related to Industrial Engineering department of ready-made garments factory and also for monitoring the hourly production in ‘time to time’. So that the ultimate productivity can be achieved. The information is stored in this app and can be accessed conveniently at any time, everywhere. However, internet connection is necessary to run this app.

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References

- A. Vitor Monte, M. Favero De Amorim, A. Ricardo Abed Grégio, G. Barroso Junquera and P. Lício De Geus, (2015). Identifying Android malware using dynamically obtained features, *Journal of Computer Virology and Hacking Techniques*, Vol. 11, No. 1, pp. 9-17,
- Hoque, M.A., Rasiah, R., Furuoka, F. and Kumar, S. "Technology adoption in the apparel industry: insight from literature review and research directions", *Research Journal of Textile and Apparel*, Vol. 25 No. 3, pp. 292-307(2021).
- H. Ruile and P. Wunderlin, "RFID application within product life cycle of industrial textile & apparels," *RFID SysTech 2011 7th European Workshop on Smart Objects: Systems, Technologies and Applications*, 2011, pp. 1-11.
- I. W. R. Taifa, S. G. Hayes and I. D. Stalker, "Computer modelling and simulation of an equitable order distribution in manufacturing through the Industry 4.0 framework," *2020 International Conference on Electrical, Communication, and Computer Engineering (ICECCE)*, 2020, pp. 1-6, doi: 10.1109/ICECCE49384.2020.9179275.
- M. Mobin Hossain, N. Mukta, N. Akter, T. Tazin, F. Soroni and M. M. Khan, "Microcontroller and Mobile App based Garments Environment Monitoring System for Workers," *2022 6th International Conference on Computing Methodologies and Communication (ICCMC)*, 2022, pp. 616-622, doi: 10.1109/ICCMC53470.2022.9754110.
- R. Tanaka, A. Ishigaki, T. Suzuki, M. Hamada and W. Kawai, "Shipping Plan for Apparel Products Using Shipping Record and Just-in-Time Inventory at a Logistics Warehouse," *2018 7th International Congress on Advanced Applied Informatics (IIAI-AAI)*, 2018, pp. 682-687, doi: 10.1109/IIAI-AAI.2018.00143.
- S. Ahmad, S. Miskon, R. Alabdan and I. Tlili, "Statistical Assessment of Business Intelligence System Adoption Model for Sustainable Textile and Apparel Industry," in *IEEE Access*, vol. 9, pp. 106560-106574, 2021, doi: 10.1109/ACCESS.2021.3100410.
- S. Sarkar, S. Gayen and S. Bilgaiyan, "Android Based Home Security Systems Using Internet of Things (IoT) and Firebase," *2018 International Conference on Inventive Research in Computing Applications (ICIRCA)*, 2018, pp. 102-105, doi: 10.1109/ICIRCA.2018.8597197.
- W. -J. Li, C. Yen, Y. -S. Lin, S. -C. Tung and S. Huang, "JustIoT Internet of Things based on the Firebase real-time database," *2018 IEEE International Conference on Smart Manufacturing, Industrial & Logistics Engineering (SMILE)*, 2018, pp. 43-47.
- Y. Li, L. Yang and Y. Li, "Research on Apparel CAD Pattern Data Interchange Format Based on XML," *2009 WRI World Congress on Software Engineering*, 2009, pp. 90-94, doi: 10.1109/WCSE.2009.38

