Scheduler - Flexible Scheduling Method, Interface with Planning and Production

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Abstract

This paper presents a probabilistic scheduling control system based on different order interval time and limited number of machine capacity that will perform flexible scheduling and schedule execution. The major features of the proposed system include (1) the allocation of the styles among the limited capacity machines, (2) the development of an interface between planning and production and 3) the use of shop floor scheduling techniques to dynamically use the optimum resources and the different levels of state of the system to the management decision making support. The paper sketches the framework, design and logical issues for the proposed scheduling system.

Keywords
Probabilistic Scheduling, Virtual group, Forecasting

1. Introduction
The textile industry in Bangladesh and comparable low cost economies has been in long –term decline for many years now. The total production of textiles and clothing in the Bangladesh fell by 30% from the first quarter of 1997 to the second quarter of 2001 while the export of garments rose by 104.5% between 2002 and 2006. In order to survive, manufacturers need to find competitive advantage from their offering based on their added value service performance combined with high quality product manufacture and this can be attainable by applying proper flexible scheduling method to make a link between production, planning. The textile and denim industry has recently undergone a great deal of change, with a move towards high levels of production, price competition and quick response with high quality product and this situation can be effectively handled by re-configuration of existing scheduling. Traditional scheduling technique follows one machine, n' types of products or two machines, n' types of products where denim productions follow one type, n'number of machines and limited types of products. Most of the factories follow separate scheduling techniques in production and planning where schedule of production department which is based on their allocated machines and resources does not concur with that of planning and as a result it delays the overall delivery dates. This proposed model is much flexible to match the schedule between planning and production considering allocated machines, capacity, delivery dates and optimum resources.

2. Methodology
The modeled scheduling system is characterized by the system dynamics: probabilistic arrival of work orders, limited machine capacity, zero machine breakdowns and limited type of orders. Such a dynamic environment may frequently require not only adaptive control of the scheduling or dispatching rules, but also a change in the operational objective criterion for which the scheduling rules are selected. Interface with planning to production, optimum capacity for weaving process has been recorded and used. Shop floor status or nature of order receipts affects the selection of the best scheduling policy out of the relevant policies by using the forecasting procedure. According to fabric type and denim styles, nine different categories have been classified and have been proceed for different virtual group reflecting two criterions- percentage of every style against the total order volume and percentage of group of machine to be allocated against the total capacity of machine on the basis of each style percentage. Since the orders arrive by maintaining a probabilistic rule, the orders are allocated and distributed according to the percentage of total machine capacity. Interval time between different orders also have been examined which had been followed a regular interval or regression model. The research has been proposed a scheduling model where denim styles have been classified into nine categories and estimated virtual machine group have been allocated for each style according to the order percentage and inters order arrival time. The logic of the proposed system has been converted into software algorithm which is termed here as scheduler where virtual group has been allocated for each style and management and planning department can negotiate to buyers for any new

coming style considering control management, tentative order delivery date and continuous data update for every style.

3. Data Analysis

Based on the collected data, we have analyzed the order placing quantity and time interval of each style, then statistical distribution of orders which have been identified by a forecasting technique have been plotted into graphs and have been allocated the anticipated styles in particular machines which are grouped using forecasting booking allocation and finally monitor, planning and control the weaving floor scheduling by a customized scheduling software termed as scheduler. According to the Pareto rule, maximum effort must be centered to the weaving department because it adds 90% value of the total production floor.

3.1 Weaving capacity

Weaving section maintains two type of new advanced machines-one is Rapier machine with a total quantity of 30 machines and capacity of 620m/day/machine and another is Air jet machine with a total quantity of 35 machines and capacity of 600m/day/machine. For the simplicity of calculation, we have limited the capacity to 600m/day and maximum capacity is 39000m/day with a total 65 number of machines.

3.2 Order Types and Classify Category

We have examined the order sheet for the month of May where different styles follow probabilistic orders with almost repetitive time intervals as each style has been maintained regression model of regular interval. The order sheet which is given below contains amount of orders in yard and meter against each buyer. The right most column shows different categories for each style as we have used capital letter 'A' for the style of 1250-01, 'B' for style 1200-BB and so on which is given in the table.

Table 1: Sample order sheet for the month of May and different categories of orders for each style

Buyer	Fabric Type	Delivery Date	Order Quantity/Yards	Order Quantity/Meter	Category
Month (May)					
KIA	1250-01	10	45000	41148	A
KIA	1250-01	20	30000	27432	A
KIA	1250-01	30	30000	27432	A
SL THREE APPARELS	1250-01	10	33000	30175	A
JAMUNA APPARELS	1250-01	10	79100	72329	A
IMESSIVE GMTS	1200-BB-02SB	25	5000	4572	B
IMESSIVE GMTS	1200-BB-302	25	5150	4709	B
NAFI GMTS	1375-RR-01	22	25910	2369	C
Buyer	Fabric Type	Delivery Date	Order Quantity/Yards	Order Quantity/Meter	Category
S.I APPARELS	1375-01	20	80000	7315	C
J.L GMTS	1375-01	25	20000	18288	C
S.I APPARELS	1375-BK-01	15	103000	9418	C
LIZ APPARELS LTD	1375-BK-01	22	121900	11146	C
NAL-2 BARI	1450-01	25	64000	58522	D
NAL-2 BARI	1450-01	30	20000	18288	D
LIZ APPARELS SADAK	1450-01	30	60000	54864	D
IMESSIVE GMTS	1100-BB-412B	25	8000	7315	E
NAL WALL MART	1050-BB-12	30	34500	31547	F
LIE GROUP	1000-12A	15	100000	91440	G
SI DENIMS LTD	8500-12	10	4603	4209	H
E R GMTS	SLUB-93	15	3750	3429	I

3.3 Order percentage

Virtual group stands upon two basic criterions- one is percentage of every style against the total order volume and another is percentage of group of machine to be allocated against the total capacity of machine on the basis of each style percentage. So each category has been sorted in percentage against the total amount of orders for the month of May, June and July shown in Table. The figure-1 shows the order percentage as category A has been ordered by the amount of 577100 meter which is 23% of total amount of order, followed by category B of 12%, Category C, D, E, F, G, H, I , J and Others of 5%, 14%, 4%, 3.8%, 15%, 0.17%, 0.17%, 1.2% and 21.5%.

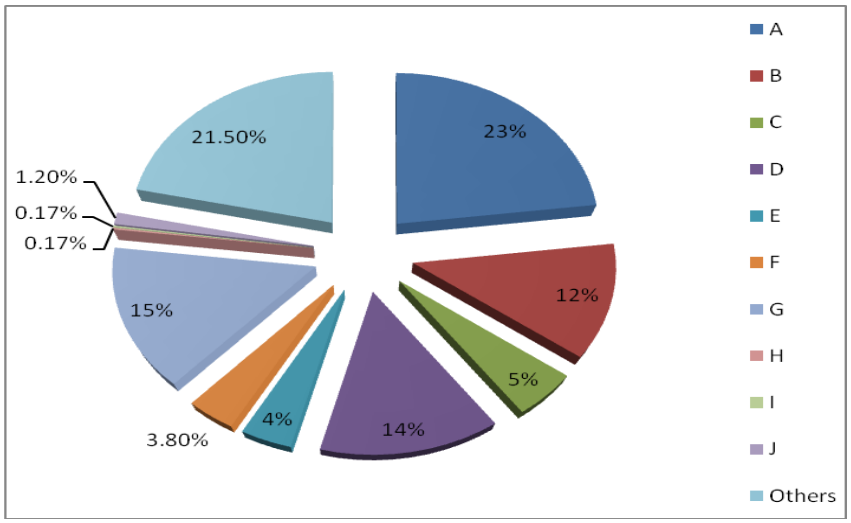

Figure 1: Percentage of order receipts for different categories

Table 2: Percentage of virtual group against each style category and Allocation of Machines

Category	Quantity/Month (May)	Quantity/Month (May, June, July)	Order Percentage	Allocated Number of Machines
A	198518	577100	23%	15
B	9282	301076	12%	8
C	48536	125456	5%	3
D	131674	351354	14%	9
E	7316	100320	4%	3
F	31547	97312	3.8%	3
G	91440	378256	15%	9
H	4209	4209	0.17%	Safety Machines of 15 for these rest of irregular categories against 23.2% order percentages
I	4209	4209	0.17%	
J	0	30359	1.2%	
Others	0	539488	21.5%	
Total	802407	2509130	99.84%	65

3.4 Virtual Group Allocation

Virtual group of machines have been allocated according to the percentage of each regular order which is shown in the right most column of the table. 23% of total orders have been booked for Category A and we have isolated 15 machines for this category which is generally 23% of total 65 machines. Similarly 8, 3, 9, 3, 3, 9 number of machines have been grouped for each category of B, C, D, E, F and G. We have isolated 15 machines (23% of total 65 machines) for the rest of the irregular categories of H, I, J and Others which in total of 23.2% of total order percentage.

4. Result and Discussion

4.1 Scheduler and Logic Diagram

We have used the virtual group of the machines as the main basis for the scheduler- the scheduling software which is the interface between planning and production and the logical language of the virtual group and order percentage has been converted into software working algorithm. The main basics for the virtual group which has been converted into scheduler later are:

- Allocation of the machines and machine group according to the order volume.
- Different order styles follow a regression model.
- Probabilistic order arrival time coincide with the machine group according to the order percentage.

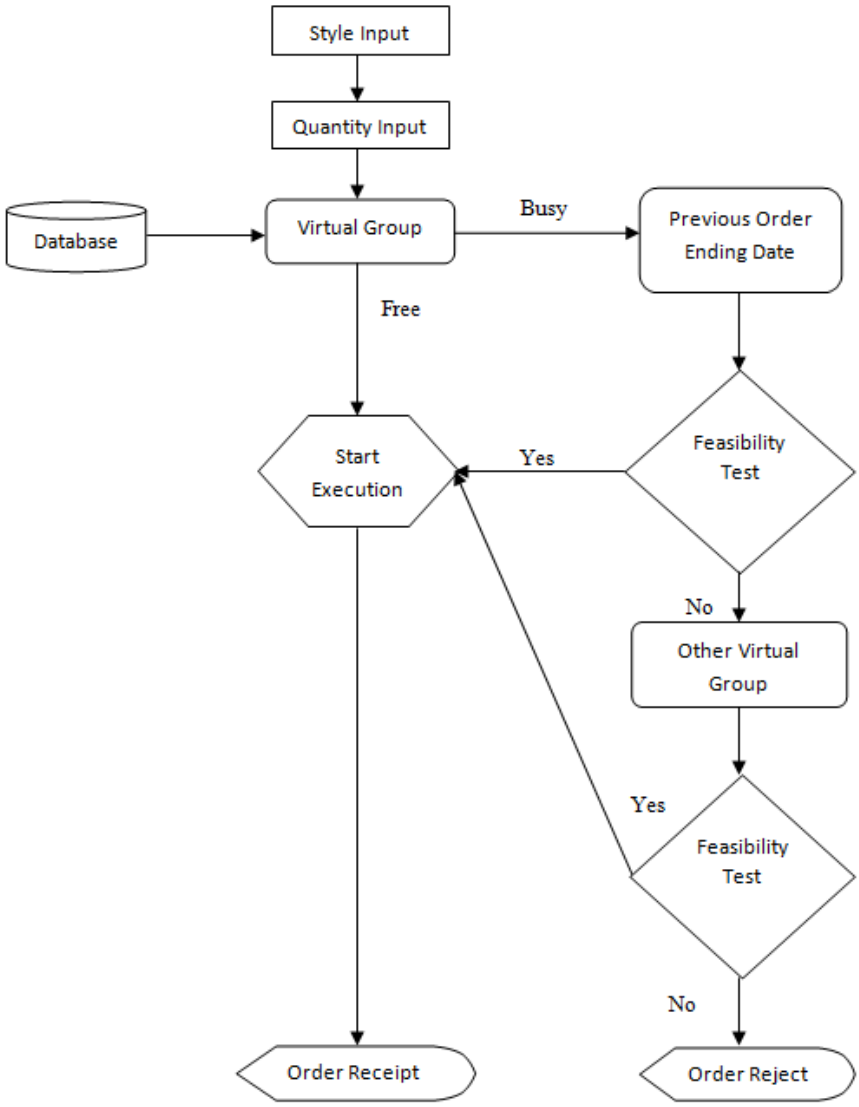

Figure 2: Scheduler logic diagram

4.2 Scheduler Control Management

Scheduler has been modeled as any new order or style initially will check whether it is into which category of the virtual group of the machines among A, B, C, D, E, F and G or for any irregular style it will controlled by other planning schedule with the rest of the 15 machines not by scheduler. Now for a coming style among the proposed virtual group, scheduler will reply the ending date for that style if the machine group is free. For the opposite

condition, the scheduler will reply whether the ending date after the completion of the previously working style or the style can be bypassed to another allocated machine group which is free. Since the scheduler is the flexible scheduling software, in this situation management can sorted out the style into two parts where some amount can be used in the proposed group and another in other group which is free since all machines are practically same. For large amount of orders, styles can be allocated to safety machine group where this machine group will be used for irregular styles or for any urgent or safety purpose. Then scheduler will negotiate the order showing the order start and completion date and allocated machines. If the order is confirmed by the buyer according to the order start and delivery date then this will save to the scheduler and planning will map the production according to the scheduler and allocated optimum machine capacity.

5. Conclusion

Shop floor scheduling software is based on the real time data base, probabilistic model of order arrival time, in house capacity, off line scheduling judgment. Consequently, the main objective of the thesis was to produce a scheduling package which would allow analysis of different order arrivals and their proposed shipment dates according to their current status against the limited styles. Although there are significant numbers of people involved in planning and scheduling activities across the company, we actually know little on the optimal level of human involvement in these roles or, then fundamentally it requires technical solutions and optimum scheduling process. So every denim and textile companies require manipulating an optimum shop floor scheduling techniques and software for proper planning, monitor and control the company for maximum profit and sound management activities.

6. Recommendations for Further Research

Scheduler has been converted for limited number of machines and orders. We have taken only weaving department as the production unit where other department can be utilized. The analysis of the system of the regression model is clearly based on the three month order sheets which are not very convenient and promising for creating shop floor scheduling techniques. The ultimate scheduling software would be generated by groping more large order data and forecasting may be more effective by applying more order interval time for better regression models. Scheduler can be applicable in the whole production area to schedule the whole factory into a frame and planning can be more effective to make interface with production and more upgraded by using Artificial intelligent, Decision support system.

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