Food Catering Prediction (FCP) System using Association Mining

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***Abstract*— The Food catering services is the business to provide qualitative food in varying quantity to their customers. But due to uncertain number of customers and lack of knowledge for planning, the business can lead to chaos and account huge loss. According to studies, the improper planning and under optimized use of resources affect the business profit. Secondly this leads to wastage of resources and food. The problem lies with unavailability of the mechanism which can accurately predict the situation and suggests the profitable decisions. We propose the Food Catering Prediction (FCP) system which will accurately analyze the parameters which affects the food preparation and utilization and recommend profit making decisions. This project work provides the software tool which will help the food managers to make decisions in their business and increase profit.**

Keywords: Food Catering System (FCP), prediction, association mining

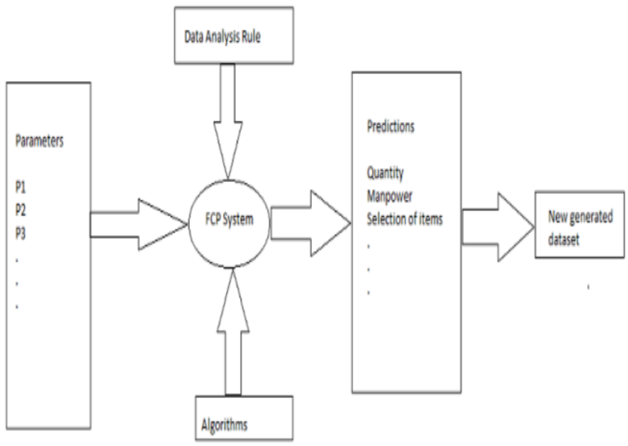
I. INTRODUCTION

The food provider faces problem in planning due to the uncertain number of customers and also due to under optimized use of resource which affect the total profit. The resource optimization of food provision system provides the prediction of schedule, planning by considering certain parameters will result an increase of total revenue of provider. The resource optimization for food provisioning system provides access to different user to find patterns in different sections like (planning, purchase of items, etc), predict number of customers, predict the period of purchase, plan schedule accordingly which affects overall profit and reduces wastage of materials and food.

II. RELATED WORK

The proposed FCP System relies on prediction for making decisions. Erick [2] demonstrates why prediction works, areas where prediction can be applied, factors affecting prediction along with its shortcomings. Generation of rules for prediction makes use of association mining technique. Zahid [3] provides overview of how association rules can be generated, its important attributes, i.e. support and confidentiality computation along with the different algorithms used for association mining like Apriori. Sotiris [4] illustrates the various association mining rules, how the access to a database can be minimized and constraints apply to the association rules. Jyoti [6] discusses the k means algorithm and its shortcomings. This paper also eliminates the drawbacks for improving efficiency of the algorithm. Nguyen [5] demonstrates how selection of 'k' i.e. number of clusters affects the performance, various available methods of choosing 'k' and a new approach to select 'k'.

III. PROPOSED SYSTEM



The input to the FCP system are the various parameters like cost, time, manpower based on which the prediction results will be obtained.

Input:
Cost= {Cost of raw materials, cost of transportation, cost of expertise team}
Manpower= {Food preparation team, serving team, management team}

Time= {Time for preparing on site items, time for preparing off site items}.

The data analysis rule generator will consider the historical data to generate the rules. These rules, along with the prediction algorithms will work with input parameters which will produce prediction plans.
The newly generated prediction results will be based on objective function that aims at maximizing revenue of the caterer. These results will be recorded in the database for future references.

A. Association Mapping

Let I=I_1, I_2, … , I_m being a set of m distinct parameters on which results of prediction will be derived, T be transaction that contains a set of items such that T ⊆ I, D be a database with different transaction records Ts. An association rule is an implication in the form of X⇒Y, where X, Y ⊂ I are sets of items called item sets, and X ∩Y =Ø X is called the antecedent while Y is called consequent, i.e. X implies Y.
Association algorithm can potentially find many rules within a dataset. The algorithm uses two parameters:

1.) Support 2) Confidence

Sr No	Name	Parameters identified
1.	C_count	Number of customers
2.	Item_req	Required items
3.	Item_InStore	Items present in store
4.	Live_Items	Items to be prepared on sight of event
5.	Backend_Items	Items that can be prepared before the event

n= Total numbers of record

Transaction ID	Items
T1	Item1, Item2, Item3
T2	Item5, Item6, Item9, Item8
T3	Item11, Item12
T4	Item15

Table: Transaction Database

$$support = \frac{(XUY).count}{n}$$

Items	Support s
Item1	60%
Item6	40%
Item3	95%
Item12	35%
Item15	80%

Table : Support for items

$$confidence = \frac{(XUY).count}{X}$$

Rule	Confidence	Rule Holds
Item1⇒Item3	50%	NO
Item6⇒Item12	50%	NO
Item6⇒Item15	100%	YES
Item15⇒Item3	50%	NO

Table : Confidence Of Association Rule

B. K-means algorithm

It is a process of dividing a dataset into small groups or clusters based on the nearest mean. The **k-means algorithm** is an algorithm in which '*n*' objects forms *k* partitions, where $k < n$.
For the new details i.e. parameters that will be entered by the user, making an entry into the dataset to the relevant section is important. So clustering will be helpful in classifying the parameters in related sections.

Cluster	Cluster Size	Performance
1	15	50.08
2	24	65.97
3	19	34.54
4	30	75.23

Table: K=4

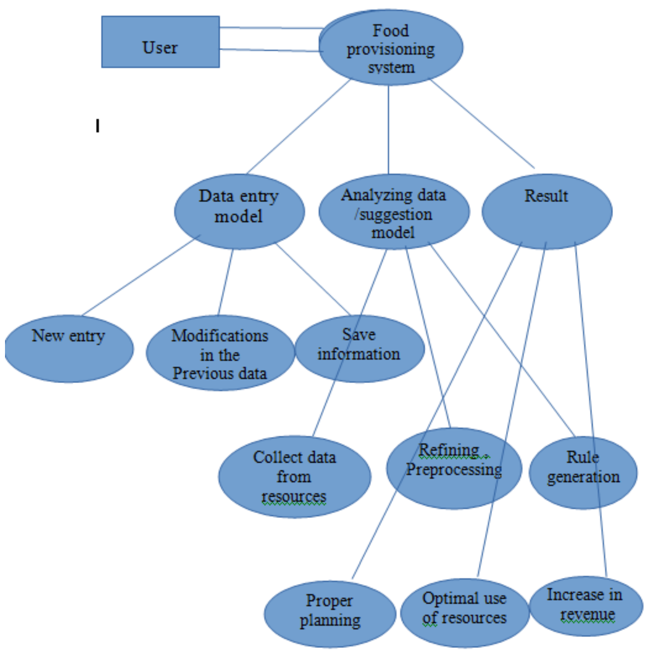
Based on the various number of items in a cluster the performance of each cluster is evaluated.

75 and above	Excellent
65-74	Very good
55-65	Good
40-50	Satisfactory
Below 40	Poor

Table : Decision Index

Decision Index will be helpful for the FCP system in deciding whether to consider the generated prediction or to discard it.

IV. Analysis Model



V. Mathematical Model

S={R, d, D, Fun}
Where
Rule R= {R1, R2 ...Rn}
Dataset d= {d1, d2, d3....dn}
Decision D= {D1, D2, D3.....Dn}
Function F= {F1, F2, F3}

Where
F1=Rule generation
F2=Clustering
F3=Mapping Rules to datasets.

VI. FUTURE WORK

The scope of the proposed FCP system is restricted to the small catering enterprise. Future work will be extending the use of the FCP system to larger clusters of food provisioning systems. Also for these enterprises, more efficient algorithms and data mining techniques will be used for prediction. The FCP system will be designed to operate on various platforms and operating systems.

VII. CONCLUSION

The proposed prediction system will take into consideration different parameters and map the data to the rules generated from previous dataset. The outcome will be decisions that will be help caterers in planning thus resulting in an increase in revenue and optimal use of resources.

VIII. References

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