Development of an Intelligent Customised Service System for Contact Centres

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Abstract: - This paper describes the research and development of a methodology through which Intelligent Support can be provided at contact centres (CC). The authors provide the methodology to develop a fuzzy expert system which assigns a new customer or advisor to the pre-defined categories. The paper presents the need of intelligent information support in contact centres and the strategic framework for intelligent customised support within contact centres. The authors have illustrated their understanding through the help of case study analysis carried out at five different contact centre locations (complaints / reporting/service) within UK. The issues and problems encountered within the CC are discussed which identifies the need for customised information support within contact centres. An intelligent decision support system framework is also presented which focuses on the development and methodology for framework. This mainly focuses on three main areas (1) customer and service advisor (CSA) categorisation (2) design of fuzzy expert system to assign the categories and (3) information requirement modelling which identifies the minimum amount of information required by the advisor to serve the customer.

Key-Words: - Soft Computing, Contact Centres, Customised Service, Intelligent Systems, Customer and Advisor Modelling, Telecommunications.

1 Introduction

For a fast growing technology and communication systems, it is important for any organisations to develop new ways for managing the customer relationships within contact centres (CC). It is critical for companies to identify the need to offer a superior service in order to ensure business survival in a service sector economy [1]. There are three features of contact centre operations that customers feel are crucial to quality service, namely convenience in fast call handling, cordiality of the advisor, and consistency in advisors providing a reliable and accurate service [2]. Customer contact centres afford the companies the potential to manage customer relations more effectively, thus providing some competitive advantage while saving costs [3] [4]. Customer satisfaction may in addition be based on another three dimensions: access, including the advisors communication skills; timeliness, including advisors resolution of queries; and quality, which includes the accuracy, consistency and comprehensiveness of the advisors advice, in addition to the knowledge and politeness of the advisors [5]. Business and customers are not necessarily ready for some of the more sophisticated applications (web chat, videoconferencing, etc). Although organisations have developed a better understanding of their customer needs, they must evaluate their customer's capabilities more accurately. There is also a shortage of skilled staff due to retention problems within the current contact centres. The use of internet, and internet based technologies have rapidly changed how business is conducted around the world. The new business environment requires organisations to rethink their approach to dealing with their customers. The main aim of the paper is to present a framework for intelligent support to service advisors (CSA) within contact centre environment. The framework provides means for better customer satisfaction and more business opportunities to be created. There is a need to identify the right amount of information to be displayed on the screen considering both the customer and the assigned advisor background [6]. The paper describes the development of fuzzy expert system for assigning any customer and advisor to the pre-defined category.

2 Intelligent Customised Information Support in Contact Centres

Currently, business decisions are made mainly by humans based on available information. Intelligent decision making is to a large extent an exclusive characteristic of humans. The advancement of communications and information technology is altering the ways customers interface with service providers and, therefore, may influence customer's perceptions of the service experience. Organisations have realised the benefits of certain contact centre technologies and their use to manage customer relationships. However organisations make technological investments before their organisation is fully ready to effectively integrate it [7]. Most of the customer contact with the company is through back office which is mediated by technology (e.g., via telephone, fax, chat, instant messaging, or email). Service organisations are finding the interaction with their customers through new technologies as a challenge [8]. The future CC must include the integration of information which provides full access to all customer information through all departments. This will enable them to develop businesses and retention programs which are customer specific. Customer service interactions, preferences and behaviours which are captured at customer points can be analysed and transformed into customer intelligence. [9]. Behaviour based modelling is a continual dynamic process of collecting and analyzing data on customers and their behaviour, and learning how best to influence them to enhance business returns [10]. Latest developments in artificial intelligence (AI) technology have brought us much closer to modelling human reasoning and learning from examples [11]. A new branch of artificial intelligence known as Soft Computing recognises that human reasoning is based on imprecise and uncertain information, an ability that has been difficult to incorporate into computer programmes [12]. Soft computing is a consortium of methodologies that works synergistically and provides a flexible information processing capability for handling real-life ambiguous situations. Its aim is to exploit the tolerance for imprecision, uncertainty, approximate reasoning, and partial truth in order to achieve tractability, robustness, and low-cost solutions [13]. The guiding principle is to find an acceptable solution at low cost by seeking for an approximate solution to an imprecisely/precisely formulated problem [14]. Business needs to assign any available advisor to a customer and provide consistent and good quality of service. The authors have focussed here some of the market opportunities where intelligent customised information can be used and its advantages are as shown below [15]:

- For an understanding of how customers behave and Continue to enhance this by learning service levels, communication methods and channels effect different customers
- The framework builds a depth of market and customer knowledge that will provide a link to corporate survival and market dominance.
- The challenge for service providers is to maximize the use of information about the customer and to exploit opportunities to sell other products.
- To resolve the problem that service advisors are forced to limit their call duration for the reason of attending the next call in queue; and therefore it is vital importance that they try to resolve the customer query as efficiently as possible.

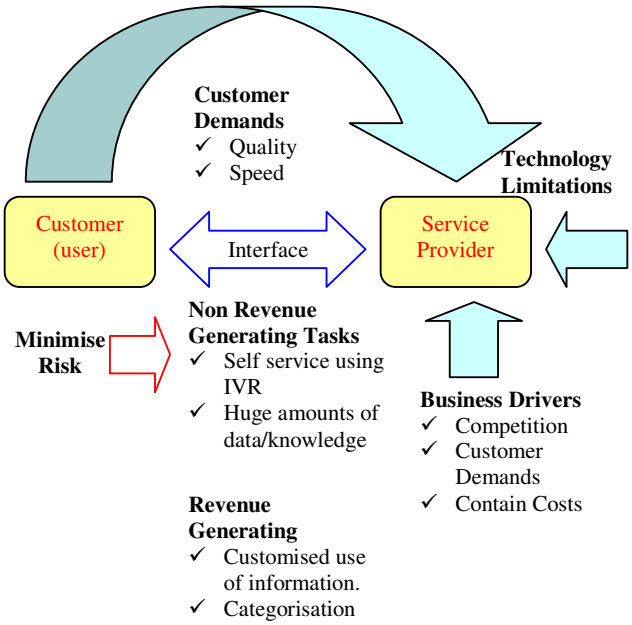


Fig.1 Drivers for Change in CC (Business, Information, CSA and Technology)

These factors also have significant impact on the full exploitation of software tools for CRM and the use of data mining, itself dependent on customer data. From figure (1), the main key elements in the drivers for change in contact centre as noticed were the business information, customer service advisors and technology use and its limitations [16].

3 Need for Intelligent Customised Information Support

Information requirement analysis was done on the basis of the set of categories for customer and advisors derived from the clustering and fuzzy expert system model. The main objective was to identify the minimum amount of information which is required to be displayed on the screen of advisor to help the customer more efficiently. The strategic framework for intelligent customised support is as shown in figure (2).

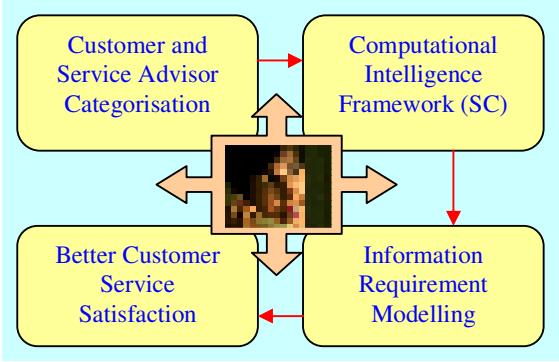


Fig.2 Strategic Framework for Intelligent Support

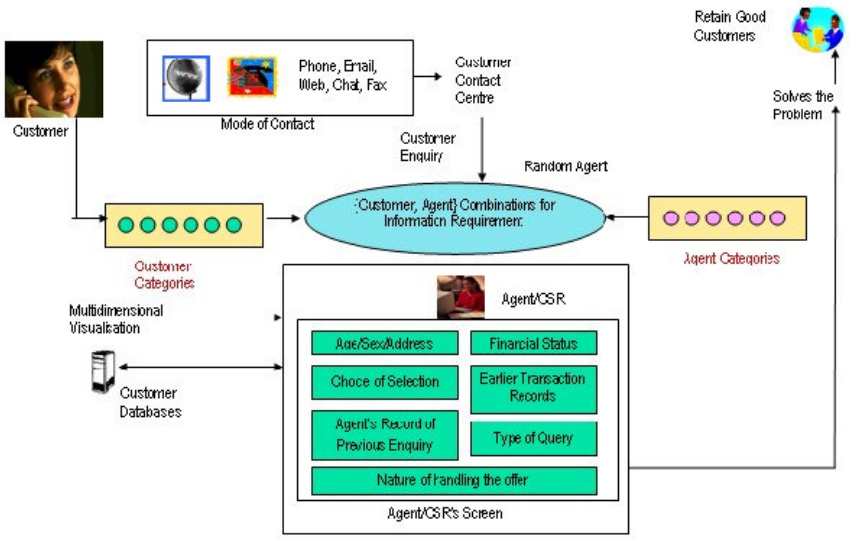
This information should always satisfy the three important business aspects of customer contact mainly (i) Customer Satisfaction, (2) Resolving the conflict and (3) Cross Sell – Up Sell opportunities. The strategic framework for intelligent customised support in CC is as shown in figure 2. Information Requirement framework was developed to overcome the *information overload* within the contact centres. From customer satisfaction point *speed of response* was crucial and the *right amount of information* required to be displayed to advisor for customer – advisor situation was important [17]. The use of qualitative information within customer contact centres is very useful for any company to provide an efficient service towards customer and also helping their service advisor. The authors represent analysis of the need of intelligent information support from a case study of a large telecommunications fault contact centre. The centre mainly deals with customer queries and complaints regarding any faults to their telephone (ISDN), fax services. There are mainly three types of customers calling at the centre:

- Residential Customers.
- Business Customer (1-2 single telephone/fax lines).
- Business Gold / Platinum Customers (more than 5 business telephone/fax lines).

The main process followed at the centre is similar to any basic call operation at contact centre. Customer calls with their problem; the service advisor answers the call, tries to resolve the query, if the fault is found within the customer line, reports it to the service engineers on the site, and updates the customer about the problem. There is no customised service available within the system where the system would display the information on the basis of the type of customer and advisor during that particular situation [17]. The company does have the differentiation of their customers calling the centre, but there are no means of customising the information. It was noticed during the observation that the advisor spends lot of time finding the right kind of information and the necessary forms which are required to be processed for resolving the customer problem. Because of this problem, the call duration time is high which in turn increases the call waiting with the queues.

Data was collected with help of semi-structured questionnaires for advisors (CSA) and team leaders/managers with respect to their demographic variables, experience and behavioural variables. A total of 24 advisors were interviewed and assessed, 20 customer calls were monitored, and total of 5 team leaders and managers were interviewed through the questionnaires. Please refer to reference [18] for full list of the criteria's used for customer and advisor data collection. The framework was validated with 5 team leaders and managers at the contact centres and the results were acceptable for 80 % of the cases applied. A summary of the results are discussed below:

- Customer and advisor categorisation carried out on the basis of demographic, experience and behavioural attributes. Development of fuzzy expert system to assign each customer / advisor with a pre-defined category.
- Proper use of information which the service provider has about the customer and which enables the advisor to efficiently use this information and provide better customer service.
- With the help of proposed SC methodology levels of customer handling can be improved where customers are provided with the service they expect from their service provider.
- Any advisor is able to provide the same level of service to any customer regardless of the knowledge that exists in database.



Fig, 3 Overview of the System Development [15, 17]

4 System Developments: I - CONTACT

I-CONTACT is a systems development framework that uses computational intelligence for identifying intelligent customised service information in contact centre. It supports:

- customer and service advisor categorisation based on demographic, experience and behavioural attributes.
- method selection,
- system creation,
- system evaluation, and
- system validation (simulation)

Figure (3) shows an overview of the system development for intelligent customised information framework. The systems development starts out with identification of the type of data to be used to categorise customer and advisor within contact centre. Once the data was analysed, expert judgement was used to identify the use of the data based on experience, demographic and behavioural variables. They are grouped into set of categories which are derived from clustering analysis. Fuzzy expert system is designed to assign each customer or advisor to that of the pre-defined category [18].

4.1 Customer and Advisor Categorisation

Data was collected with the help of semi-structured questionnaires for advisors (CSA) and team leaders/managers. The authors further carried out five different case studies focusing on fault and sales from single to multi profile business.

Based on clustering analysis of the database six customers (C1 – C6) and advisor categories (A1-A6) were derived for customer and advisors.

The development of the fuzzy expert system was derived to assign any customer and advisor to that of pre-defined category. The critical factors were the input variables of the fuzzy ES which were as age, education, financial background, time with the company, business value and behaviour from the customer side which would identify the type of category they belong to. The fuzzy membership function for age and category is shown in figure (4).

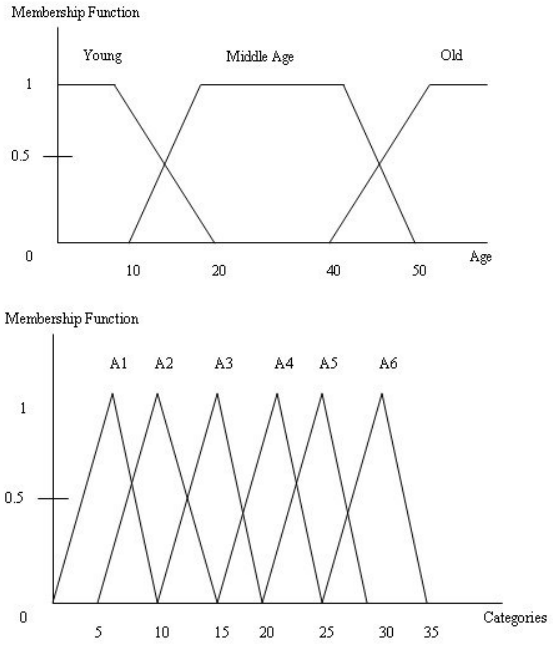


Fig. 4 Sample Membership Functions for Input (Age) and Output (Categories) of the System [17]

Age	Education	Experience	Previous Experience	IT Speed	Positive Behaviour	Negative Behaviour	Output	Category	CC Validation
28	24.6	0	1.5	3	8	4	5	A2	A2
51	27	8.6	5	2.8	5	1.2	25	A5	A4
43	16.5	7	5.1	4.2	6	0	20	A4	A4
22.8	18	2	2.1	2.5	3.2	1	26.1	A6	A2

Table1 Experimental Results for Advisor Expert System Model Summary

Age	Education	Financial Status	Time with Company	Business Value	Positive Behaviour	Negative Behaviour	Output Value	Category	CC Validation
28	10.7	0	0	5	10	2.1	15	C3	C3
40	25	5	10	8.5	9	0.4	20	C4	C6
50	10	4.3	6.5	0	7	3	30	C6	C4
18	1.2	1.5	3	1.2	1.2	8	5	C1	C1

Table 2 Experimental Results for Customer Expert System Model Summary

For customer rules; **IF** age is young, education is school, financial status is poor, time with company is low, business value is low, positive behaviour is none and negative behaviour is aggressive **THEN** the category selected is C1 and so on. Experiments were carried out to validate the fuzzy expert system within the contact centres [16].For advisor rules; **IF** age is young, education is school, experience is novice, previous exp is low, IT speed is slow, positive behaviour as friendly and negative behaviour as unaware **THEN** the selected category is A1 and so on.

4.2 Validation of the Fuzzy Expert System

For validation of the expert system, the authors carried out experiments within the fuzzy expert system by changing the input variable values and monitoring the change in the output which showed the change in the category for customer and advisors. The results which we analysed are the set of new data points from sampling for customer and advisors [Table 1 and 2]. The results derived from the experiments carried out within the expert system were validated with team leaders and managers at contact centres.

4.2.1 Advisors Experimental Examples

This section highlights the experimental examples which were carried out within the fuzzy expert system to assign the customer and advisor to that of the pre-defined category from the clustering analysis. Experiments shown above are the ones which were different during the validation process.

Ex. 2 - If Age = 51, Education = 27, Experience = 8.6, IT Speed = 2.8, Previous Exp = 5, Positive Behaviour = 5, Negative Behaviour = 1.2. Then Advisor Category output is 25 which determines that the category for advisor is A5

Ex. 4 - If Age = 22.8, Education = 18, Experience = 2, IT Speed = 2.5, Previous Exp = 2.1, Positive Behaviour = 3.2, Negative Behaviour = 1. Then Advisor Category output is 26.1 which determine that the category for advisor is A6. As shown above in table (1) the CC validation shows the results from the validation carried out with the team leader's expert judgment at the contact centre.

4.2.2 Customer Experimental Examples

The customer experimental results from the expert system, which differ during the validation process, are discussed as below and shown in table (2).

Ex. 2 - If Age = 40, Education = 25, Financial Status = 5, Time with company = 10, Business Value = 8.5, Positive Behaviour = 9, Negative Behaviour = 0.4. Then Customer Category output is 20 and category is C4.

Ex.3 – If Age = 50, Education = 10, Financial Status = 4.3, Time with company = 6.5, Business Value = 0, Positive Behaviour = 7, Negative Behaviour = 3. Then Customer Category output is 30 and category is C6.Based on the model, the authors identified that the results derived from the model, assigned a customer with the pre-determined category which were derived from the clustering. These results were also validated with the team leaders at the contact centre to verify that the given selection of the pre-determined categories for customer was properly justified.

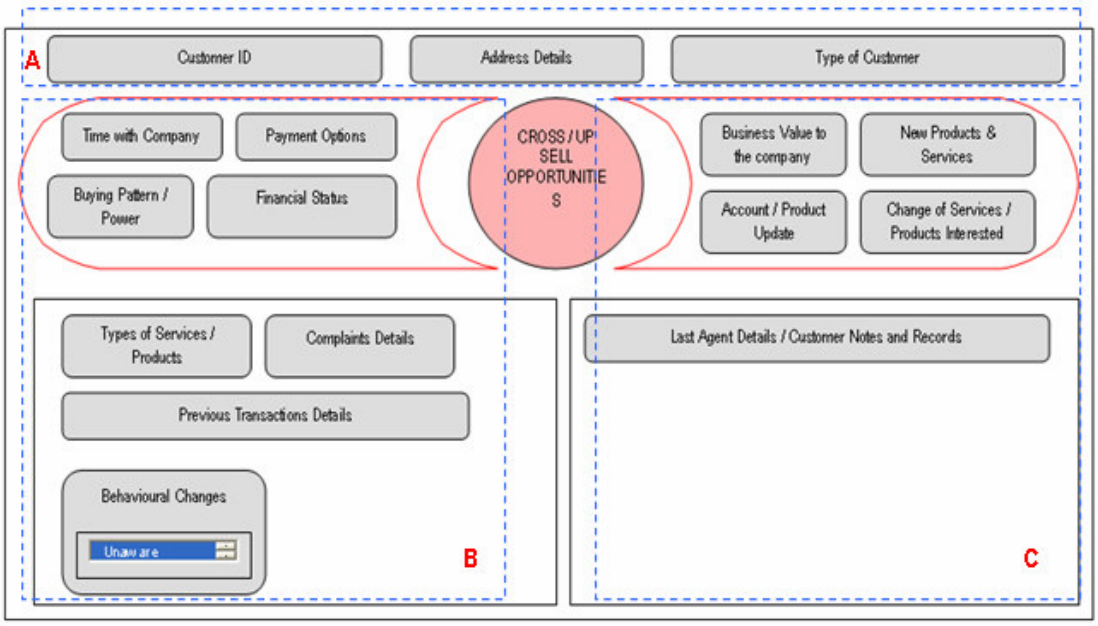


Fig. 5 Information Requirement Master Screen Layout

4.3 Intelligent Information Requirement Analysis

The information to be used for the framework can be grouped from the possible combinations of {customer, advisor} [15]. Thirty six scenarios were considered identifying the best case and worst case of customer and advisor contact. It identifies the type of customer and advisor; and selects the required information based on the customer and advisor attributes from the categorisation [18]. The complete set of information required to be displayed in any given {customer, advisor} situation is as shown below in figure (5). Further analysis on the framework through expert judgment from contact centre experts was carried out and discussed below.

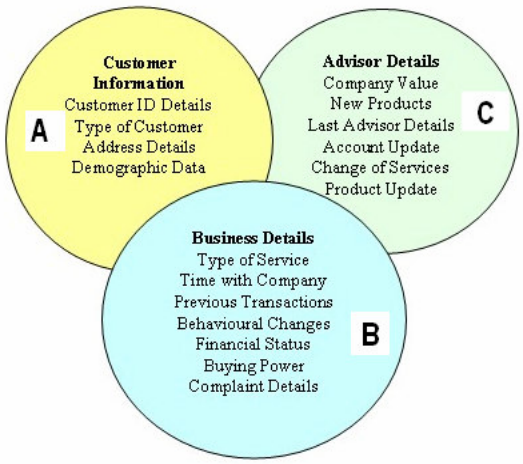


Fig. 6 Information List

Once the type of customer and advisor are categorised and assigned a category from the expert system the information screen will vary accordingly. Figure 6 derives the information requirement master screen in detail [17]. The authors have represented a sample of the results from the expert judgment carried out the contact centre with team leaders and managers. The sample represents two scenarios for customer and advisor combination which are discussed as below.

Scenario A - Advisor A1 and Customer C4

A1 –18-25, School (education), >1yrs Experience, Slow (IT speed), None Previous experience, Angry and Unaware (behaviour) C4 – 40+ (age), Professional (education), Average (financial status), 10-12 yrs (time with company), High (business value), Joyful (behaviour)

Information Display - Customer ID, address details, type of customer, time with company, buying pattern/power, financial status, CROSS/UP Sell, type of services, business value to company, behavioral changes.

Scenario B - Advisor A5 and Customer C1

A5 – 50+ (age), Professional (education), 10+ yrs (experience), Medium (IT speed), Moderate (prev.exp.), Friendly (behaviour) C1 – 18-25, School (education), Poor (financial status), 1-5 yrs (Time), Low (business value), Angry and Aggressive (behaviour)

Information Display - Customer ID, address details, type of customer, financial status, type of services, business value to company, behavioral changes.

5 System Validation – Simulation

The validation of the framework is going to be carried out with help of discrete event simulation technique. It would simulate the type of caller, identify the customer category from the database and then automatically assign an advisor to that caller and will find category for the customer. Once the assigning of the group of customer and advisor is done; it would then look for the combination of the customer and advisors for the information to be displayed on the screen from the master information screen (figure 4). Based on the type of the information which is required to be displayed; it would then display this information to the advisor on the screen. For example:

If customer A calls, enter the details (customer id); automatically assigned an advisor for that customer, system model will find which category that customer belongs to, looks for possible combination of customer and advisors, and finally displaying the information to the advisor which would enable the advisor to deal with the customer.

Some of the ways in which call centre simulation can be carried out are as discussed below:

Scenario 1

In first case, the customer calls in; the ACD identifies the type of call, and the calls are placed in the queue, from where they are answered by the next available advisor.

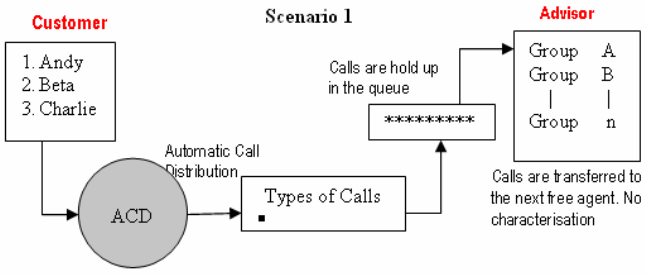


Fig. 7 Scenario 1 for Simulation Validation

Scenario 2

In second case, the same method is followed, but this time, the call of the customer from the queue is transferred to the advisor who is suitable for the customer to take the call.

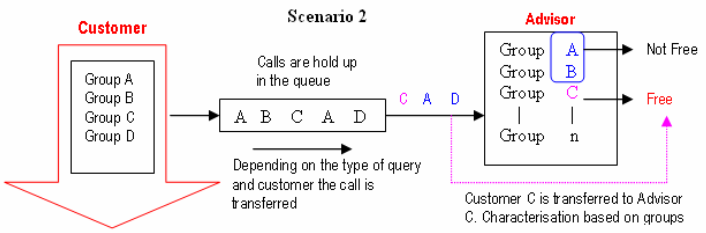


Fig. 8 Scenario 2 for Simulation Validation

Scenario 3

In the last case, intelligent customised service system tool to be used is shown. As mentioned in the previous two cases, no intelligent transfer or the use of information about the customer was used. In this case however, we do make use of both of them; from the point where the call is transferred to the advisor who answers the calls.

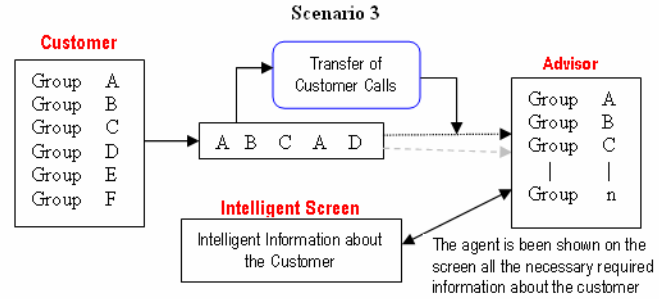


Fig. 9 Scenario 3 for Simulation Validation

6 Conclusions and Future Directions

A framework development of an intelligent customised service system for contact centres is discussed in this paper. Through the research the authors have identified the need for intelligent support to the advisors in contact centre environment to improve customer satisfaction and business opportunities. With the help of the framework described in this paper it is possible to identify the required information on the screen based on the customer – advisor combinations. The paper demonstrates that a soft computing based approach can provide the necessary framework for the intelligent support to the advisors. The authors represents a method through which the customised information is displayed on the screen of the customer service advisor (CSA) which enables them to serve the customer more efficiently thus providing better customer satisfaction. The research has shown that fuzzy expert system could be used to categorise customer and advisor effectively for better customer handling. Discrete event simulation is going to be used to validate the systems framework.

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