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(54) Title: METHOD AND APPARATUS FOR ALGORITHMIC CONTROL OF THE ACCEPTANCE OF ORDERS BY AN E-COMMERCE ENTERPRISE

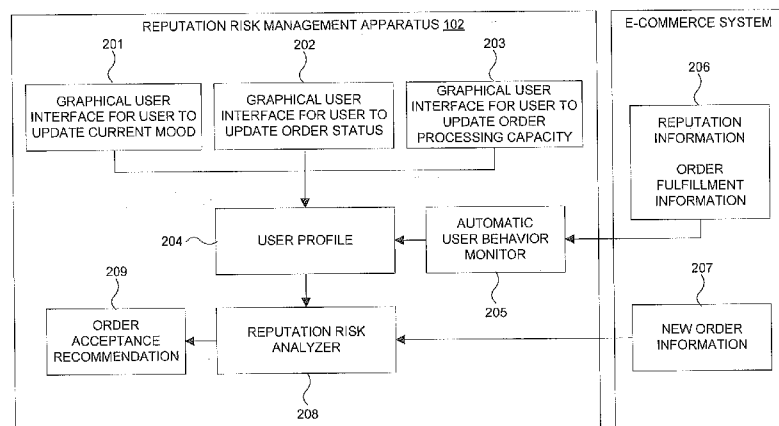


FIG. 2

(57) Abstract: This invention proposes an autonomous interaction decision support apparatus to provide the operator of an e-commerce business with a recommendation of which received orders to perform. The apparatus autonomously tracks situational information comprising the existing level of work of the e-business, for each of multiple products and/or services offered by the business, and also a desired level of work. In this way, the recommendation protects both the reputation of the business and achieves work-life balance for the business owner.

METHOD AND APPARATUS FOR ALGORITHMIC CONTROL OF THE ACCEPTANCE  
OF ORDERS BY AN E-COMMERCE ENTERPRISE

FIELD OF THE INVENTION

- 5 The present invention relates an algorithm for generating a recommendation of whether an e-Commerce business should accept a received request to perform a task (an "order").

BACKGROUND

10 In recent years, electronic commerce (e-Commerce) has grown at a rapid pace. Many customers purchase merchandise and services from online stores. This has created demand for an increasing number of online stores, which are typically small and medium enterprises (SMEs) owned by individuals or small partnerships. In an e-Commerce environment where customers and business owners do not know each other or meet up face-to-face, there is always the concern about the reliability of the online stores in fulfilling their contractual obligations. Many e-Commerce  
15 systems have implemented reputation mechanisms for customers to rate online stores based on their past transaction experience. The reputation of a store has now become an important social capital that can make or break an online store in an e-Commerce environment.

The majority of customers, who are not malicious, rate their experience with an e-Commerce online store according to two main categories of concerns: 1) the *quality* of the  
20 merchandise/service received, and 2) the *time* taken for the merchandise/service to be received. In general, the higher the quality and the shorter the delivery time, the better the customer rating for the online store will be. For the owner of an online store, the higher the reputation of the store, the more business he/she will likely receive over the long run. If these future orders can be fulfilled with high quality and in short periods of time, the reputation of the store will grow  
25 further, resulting in even more businesses, and vice versa.

Many methods for computing the reputation of an entity have been proposed (e.g., EP2365461A3, WO2007143314A3, US20120310831A1 and US8112515B2, the disclosure of which is incorporated herein by reference). Methods for assessing the reputation risk facing an

online entity (e.g., US20110106578A1 and US20060116898A1) have also been disclosed, but these take into account only some of the issues facing an online store owner.

One important challenge facing online store owners as a result of the use of reputation as a social capital has emerged: the difficulty for online store owners to achieve work-life balance during the process of managing their businesses. Typically, the online stores are short staffed (most stores are one-man operations). The store owners are often overly focused on maximizing their revenue. As the business volumes grow with their reputations, they have to sacrifice more of their personal time to fulfill the orders with good quality and as fast as possible. According to an online survey in 2012 (<http://www.inc.com/magazine/201203/data-bank/how-do-small-business-owners-measure-success.html>), “work out more” and “work less” ranked Number 4 and Number 5 respectively on the list of top goals for small business owners in the US. However, 33% of them did not achieve these goals in 2011 and 22% gained weight as a result. In China, the situation has resulted in tragic outcomes with reports of sellers on Taobao, China’s largest e-Commerce system, who died of exhaustion related illnesses (<http://english.cntv.cn/program/china24/20121104/104649.shtml>).

## SUMMARY OF THE INVENTION

The present invention relates methods and apparatus which address at least some of the problems described above.

This invention proposes an autonomous interaction decision support apparatus for an e-commerce business. The apparatus autonomously tracks situational information affecting the risk of reputation damage in multiple products or services offered by an e-commerce business owner, and also takes into account a desired level of work by the operator of the business, and uses them to provide a reputation risk metric. Specially, the apparatus provides recommendations and explanations of the type and number of product/service orders the business should accept in order to protect the reputation of the business and achieve work-life balance for the business owner.

The invention makes it possible to help the business owners estimate their own resource constraints and manage the risk of damaging the reputation of their stores by failing to fulfil orders with high quality on time.

The invention can be expressed as an apparatus or as a method. The method is preferably performed automatically, that is substantially without human involvement, save possibly for initiation of the method. The invention may also be expressed as a computer program product, such as a tangible data storage device, storing (e.g. non-transitory) computer program instructions for performance by a computer system to cause the computer system to carry out the method.

#### BRIEF DESCRIPTION OF THE DRAWINGS

A non-limiting embodiment of the invention is described below with reference to the following drawings, in which:

FIG. 1 is a diagram of the concept of how the proposed apparatus works in an e-Commerce environment.

FIG. 2 is a block diagram of the reputation risk management apparatus 102 according to various embodiments.

FIG. 3 is the data structure of the user profile 204 according to various embodiments.

FIG. 4 is a flowchart of the working process of the reputation risk management apparatus 102 according to various embodiments.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring firstly to FIG. 1, an embodiment of the invention is shown which is an e-Commerce business 1. FIG. 1 illustrates, as the contents of the rectangle marked 1, a block diagram of the processing flow of the e-Commerce business.

The business 1 receives a plurality of orders from e-Commerce customers 101. The customers 101 submit orders using a computing device, such as a personal computer, a mobile phone, a personal digital assistant, a telephone, or the like. The customer is anyone who submits orders to

an e-Commerce system for an online store owner and may be, for example, a person, someone acting on behalf of an entity, or a group of people. The plurality of customers **101** and the e-business **1** are configured to communicate over via a communication network **2** provided by the e-Commerce system. An order includes at least one task attribute that identifies the type the order belongs to, a stipulated deadline for completion, and an associated payoff the customer is willing to pay for its successful fulfilment.

The e-business **1** comprises a reputation risk management apparatus **102**, for selecting, from among the received orders, a sub-set **103** of the orders which the apparatus **102** recommends that the business should accept. The other orders are rejected, and a rejection message is sent to the corresponding customers **101** to explain the situation to them.

In this document, the operator of the business is referred to as the “user”, typically the e-business owner. Typically, the business **1** will be operated only by a single person, but the embodiment is also applicable to a business **1** which is operated by multiple people collectively (for example, including the e-business owner), and in this case in the following discussion the set of people is regarded as one “user”.

The reputation risk management apparatus **102** provides a graphical user interface (GUI) **104** which presents the recommended orders **103** to the user and receives input encoding the user’s decision, which is to accept some or all of the recommended orders. Note that in certain embodiments of the invention, this step is omitted, and the recommended orders are put directly into workflows for processing without waiting for the user to explicitly accept them. As described below, during the initialization of the reputation risk management apparatus **102**, it presents further interfaces to the user which are not shown in Fig. 1).

The reputation risk management apparatus **102** sends rejection messages to the customers **101** corresponding to the recommended orders **103** which the user did not accept. The business **1** further includes a number of working order queues **106** each dedicated to one type of orders only. The reputation risk management apparatus **101** places the accepted orders **105** as tasks **107** in the appropriate working order queue **106**, for further processing **108**. Over a given period of time, the user can process the orders **105** of various types based on limitations caused by a range of internal and external factors.

The reputation risk management apparatus **102** may comprise a computer system including a data storage device (computer readable media), a processor, and/or logic. For example, the reputation risk management apparatus **102** may comprise a processor configured to execute computing instructions stored in the computer readable medium. These instructions may be embodied in software. In some embodiments, the computer readable medium comprises an IC memory chip, such as, for example, static random access memory (SRAM), dynamic random access memory (DRAM), synchronized dynamic random access memory (SDRAM), non-volatile random access memory (NVRAM), and read-only memory (ROM), such as erasable programmable read only memory (EPROM), electrically erasable programmable read only memory (EEPROM), solid state drive (SSD) and flash memory. Alternatively, the reputation risk management apparatus **102** may comprise one or more chips with logic circuitry, such as, for example, a processor, a microprocessor, a microcontroller, an application specific integrated circuit (ASIC), a field programmable gate array (FPGA), a programmable logic device (PLD), a complex programmable logic device (CPLD), or other logic device.

FIG. **2** is a block diagram of the reputation risk management apparatus **102**. The reputation risk management apparatus **102** generates a graphical user interface (GUI) **201** for the user to update a preference variable indicating his/her current mood; a GUI **202** for the user to update the status of orders in his/her working order queues **106** (the status information may include the position of an order in a queue, whether an order has been fulfilled, and changes in the payoff of an order, etc.); and a GUI **203** for the user to update changes in the processing capacity of his/her online store (such information may include hiring of new staff, retrenchment of existing staff, changes in the competence level of staff with regard to each type of orders, and changes in working hours, etc.).

The risk management apparatus **102** includes a user profile **204** describing the online store. The user profile **204** contains a plurality of variables describing various factors related to the reputation risk of the store; and an automatic user behavior monitor module **205** which receives statistics reflecting the current reputation of the online store for various types of orders and variations in the order processing capacity reflected from the actual order fulfillment statistics. The automatic user behavior monitor module **205** then uses this information to update related variables in the user profile **204**. The risk management apparatus further includes a reputation risk analyzer **208** which produces numerical values for the reputation risk facing each type of

order the online store can serve; and an order acceptance recommendation module **209** which produces recommendations on which incoming orders should be accepted, explanatory texts for the user, and rejection messages for customers whose orders are to be rejected for the user's approval. The modules may be implemented in the reputation risk management apparatus **102** as software and/or hardware.

The reputation risk management apparatus **102** is configured to receive new orders **207**. Upon receiving new orders, the reputation risk management apparatus **102** is configured to access the user profile **204** to determine the number and type of new orders to be admitted into the online store owner's working order queues in order to minimize his/her reputation risk and achieve efficient utilization of the processing capacity of the online store.

FIG. 3 shows the data structure of the user profile **204**. The user profile **204** may include separate profile sections **301**, **302** for  $N$  respective business types, corresponding to the working order queues **106** of Fig. 1. The profile sections **301**, **302** include information about the reputation, the number and deadline of each working order, and the general effort required to complete a unit item for the each working order queue **106**. The user profile may also contain a numerical preference variable **303** representing the current mood of the user, and in particular indicative of the desire of the user to perform work, and a numerical variable **304** representing the current processing capacity. This variable is called  $q^c$  below, and may take a different value for each of the workflows

FIG. 4 is a flowchart of the working process of the reputation risk management apparatus **102**. The apparatus is started in step **401**. During the initialization process (step **402**), the online store owner can set the values for the variables in the user profile **204** through the GUIs provided by the reputation risk management apparatus **102**. The user profile **204** will then be initialized (step **403**) with these values. In subsequent interactions, the values of the variables in the user profile **204** will be automatically updated (step **404**) with statistics obtained from monitoring the actual behavior of the user over time. External information including reputation values and order fulfillment information will also be automatically obtained (step **405**) to update the user profile **204**.

Upon receiving new orders from the e-Commerce system, the reputation risk management apparatus **102** calculates the reputation risk facing the online store based on information

contained in the user profile 204 and the new order information 406. In one embodiment, the formula for calculating the reputation risk facing an online store  $i$  for order type  $c$  at time  $t$  is:

$$risk_i^c(t) = q_i^c(t) - \rho \cdot \gamma_i^c(t) \cdot m_i(t) \cdot p(c)$$

where  $q_i^c(t)$  is the current working order queue size for order type  $c$  under online store  $i$ ;  $m_i(t)$  is the preference variable indicating the current mood of the user;  $p(c)$  is the payoff for successfully fulfilling a unit order of type  $c$ ;  $\gamma_i^c(t)$  is the current reputation score for the online store  $i$  in serving order of type  $c$ ; and  $\rho$  is a non-negative control parameter to allow the user to specify the relative importance given to quality and timeliness when estimating the reputation risk (the larger the value of  $\rho$ , the more importance is given to the quality aspect). Note that in this embodiment the principal risk is considered to be producing an unsatisfactory service to a customer. Tasks for which the business has a good reputation are generally ones the business is good at (for example, the business is well equipped and/or has competent staff), so the risk of producing an unsatisfactory result is low. Thus, the expression above for  $risk_i^c(t)$  was chosen to give a low value for such tasks.

Once the  $risk_i^c(t)$  values for all types of orders a given online store can serve have been calculated, the order acceptance recommendation module 209 ranks the  $N$  working order queues in the online store in ascending order of their respective  $risk_i^c(t)$  values. If the  $risk_i^c(t)$  values for all working order queues are positive, it implies that the online store is currently too busy or a large number of past orders have not been fulfilled with high quality. In this case, no new orders should be accepted to allow the reputation risk to be worked off over a period of time. As long as there are new orders not yet accepted and the  $risk_i^c(t)$  value associated with a working order queue  $q_i^c(t)$  is less than 0, the new orders of type  $c$  are admitted into  $q_i^c(t)$  subject to the following constraints:

$$0 \leq A_i^c(t) \leq \lambda_i^c(t)$$

$$\sum_c A_i^c(t) \cdot e^c \leq e_i^{max}$$

$A_i^c(t)$  denotes the number of new orders of type  $c$  admitted into the online store  $i$  at time  $t$ ;  $\lambda_i^c(t)$  represents the number of new orders of type  $c$  which have been received by the online store  $i$  at time  $t$ ;  $e^c$  denotes the general amount of effort required to fulfill a unit order of type  $c$ ;  $e_i^{max}$  is



the maximum amount of effort the online store *i* can use to process orders over a unit time period (e.g., a day). Note that the embodiment accepts orders one-by-one when forming the recommended list. Once an order is recommended for a certain queue, the embodiment recalculates the risk for that queue before looking at the next incoming order. Once the  
5 constraints have been met, the remaining new orders are to be rejected.

Thus, the sequence in which the order acceptance recommendation module **209** processes orders can influence which orders are accepted. In one form, the embodiment processes incoming orders in a first-come-first-served basis (i.e. there is a queue of incoming orders, and that queue is a first-in-first-out queue). Alternatively, a mechanism may exist for changing the sequence in  
10 which the order acceptance recommendation module **209** processes orders. For example a special business arrangement may exist, such that orders from certain customers are put into specific positions in the incoming order queue. However, this does not change the method which the order acceptance recommendation module **209** uses to process the queue.

The reputation risk management apparatus **102** then generates the recommendations and  
15 explanatory texts to be displayed to the user in the GUI **104** for approval **407**. Once approved, the reputation risk management apparatus **102** sends messages to the customers whose orders are to be rejected via communication networks provided by the e-Commerce system using a computing device, a mobile phone, a telephone, a personal digital assistant, or the like.

Although only a single embodiment of the invention has been described, it will be appreciated  
20 that many modification and variations of the above teachings are possible within the scope of the appended claims without departing from the spirit and intended scope thereof.

CLAIMS

1. A computer system comprising:

a computer processor;

an interface between the computer system and a communication network; and

a data storage device, the data storage device storing:

(a) a profile describing an e-commerce business;

(b) program instructions operative by the computer processor, to cause the computer processor automatically:

(i) to receive, from the interface, a set of one or more orders for the e-commerce business, each order specifying a good or service to be provided by the e-commerce business;

(ii) to use the profile to select from the one or more received orders, a subset of orders which are recommended for performance;

wherein the profile comprises at least one data value indicative of at least one level of existing workload by the e-commerce business, and at least one modifiable preference variable indicating a desired level of work;

whereby the selection takes into account both existing workload and desired workload.

2. A computer system according to claim 1 in which e-business operates according to a plurality of processing workflows, and the profile contains for each of the workflows at least one respective said data value indicative of the level of existing work in the corresponding workflow,

the selection comprising calculating for each workflow a corresponding risk value using the corresponding at least one said data value, and selecting received orders such that the risk value for each workflow remains within a pre-determined range.

3. A computer system according to claim 2 in which each of the workflows is associated with a respective payoff value indicative of the reward to the e-business of performing the

corresponding workflow, the selection comprising reducing the risk values by an amount dependent on the corresponding payoff value.

4. A computer system according to claim 2 or claim 3, wherein the interface is operative to receive at least one quality value indicative of a quality of service of the e-business for each of the workflows, the selection comprising reducing the risk values by an amount dependent on the corresponding quality values.

5. A computer system according to any of claims 2 to 4, in which the selection comprises selecting a received order for which the risk value of the corresponding workflow is lowest.

6. A computer system according to any preceding claim, further including:

a display device, the computer system being arranged to display on the display device the one or more recommended orders; and

an input device to receive input from a user defining a sub-set of the recommended orders which are accepted for performance;

the computer system being arranged to send a rejection message to those of the orders which are not in the sub-set of accepted orders.

7. A method for performance by a computer system comprising a computer processor, an interface between the computer system and a communication network, and a data storage device, the storing profile describing an e-commerce business;

the method comprising automatically:

(i) receiving, from the interface, a set of one or more orders for the e-commerce business, each order specifying a good or service to be provided by the e-commerce business;

(ii) using the profile to select from the one or more received orders, a sub-set of orders which are recommended for performance;

wherein the profile comprises at least one data value indicative of at least one level of existing workload by the e-commerce business, and at least one modifiable preference variable indicating a presently desired level of work;

whereby the selection takes into account both existing workload and desired workload.

8. A method according to claim 7 in which e-business operates according to a plurality of processing workflows, and the profile contains for each of the workflows at least one respective said data value indicative of the level of existing work in the corresponding workflow,

5 the selection comprising calculating for each workflow a corresponding risk value using the corresponding at least one said data value, and selecting received orders such that the risk value for each workflow remains within a pre-determined range.

9. A method according to claim 8 in which each of the workflows is associated with a respective payoff value indicative of the reward to the e-business of performing the  
10 corresponding workflow, the selection comprising reducing the risk values by an amount dependent on the corresponding payoff value.

10. A method according to claim 8 or claim 9, wherein the interface is operative to receive at least one quality value indicative of a quality of service of the e-business for each of the workflows, the selection comprising reducing the risk values by an amount dependent on the  
15 corresponding quality values.

11. A method according to any of claims 8 to 10, in which the selection comprises selecting a received order for which the risk value of the corresponding workflow is lowest.

12. A method according to any of claims 7 to 11, further including the computer system:  
displaying to a user the one or more recommended orders;

20 receiving input from the user which defines a sub-set of the recommended orders which are accepted for performance; and

sending a rejection message to those of the orders which are not in the sub-set of accepted orders.

13. A computer program product comprising program instructions to be performed by the  
25 computer processor of a computer system further comprising an interface between the computer system and a communication network;

the program instructions being operative by the computer processor, to cause the computer processor automatically:

- (i) to receive, from the interface, a set of one or more orders for the e-commerce business, each order specifying a good or service to be provided by the e-commerce business; and
  - 5 (ii) to use a profile describing an e-commerce business to select from the one or more received orders, a sub-set of orders which are recommended for performance by the e-business;
- wherein the profile comprises at least one data value indicative of at least one level of existing workload by the e-commerce business, and at least one modifiable preference variable indicating a desired level of work;
- 10 whereby the selection takes into account both existing workload and desired workload.

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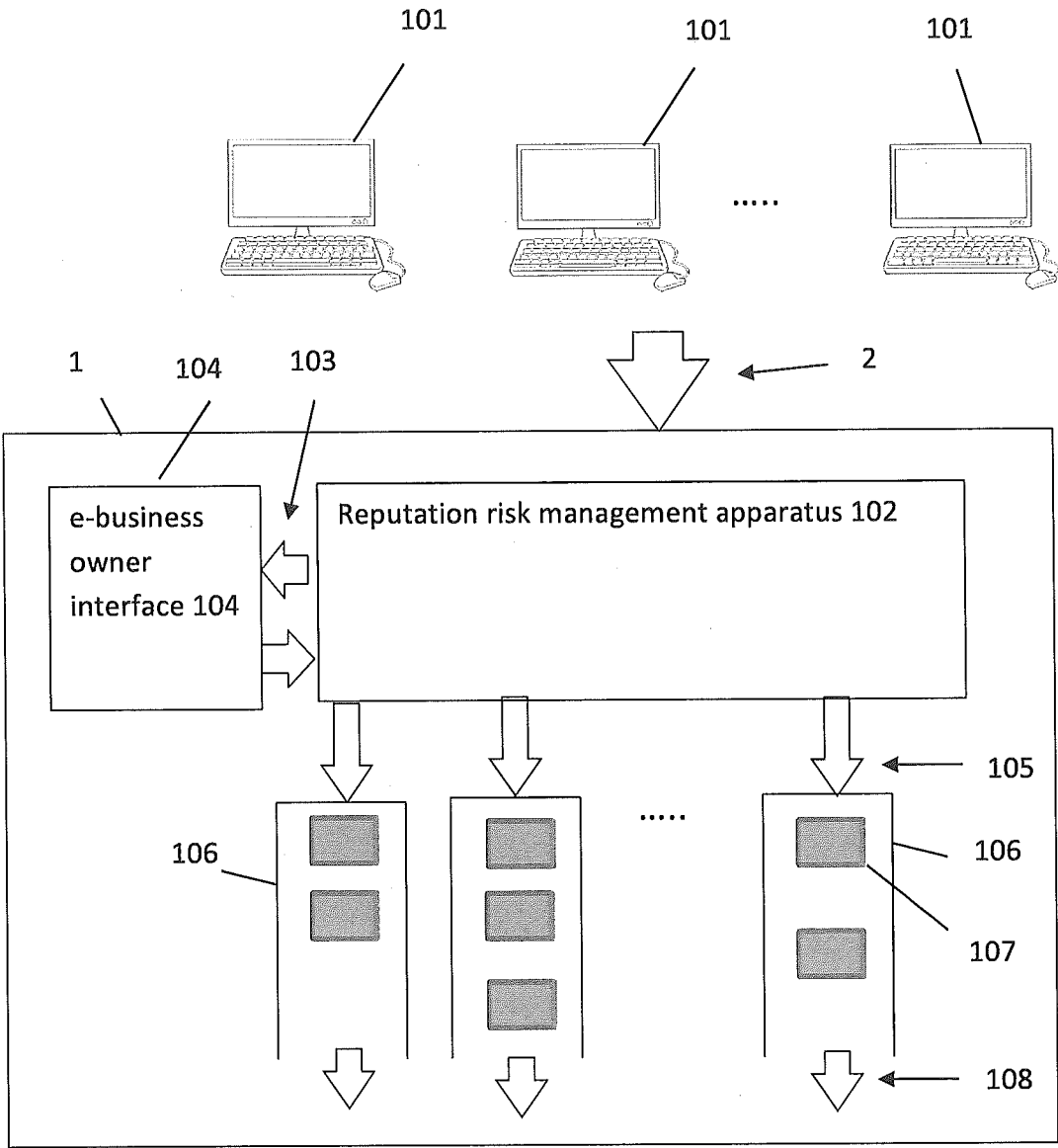


FIG. 1

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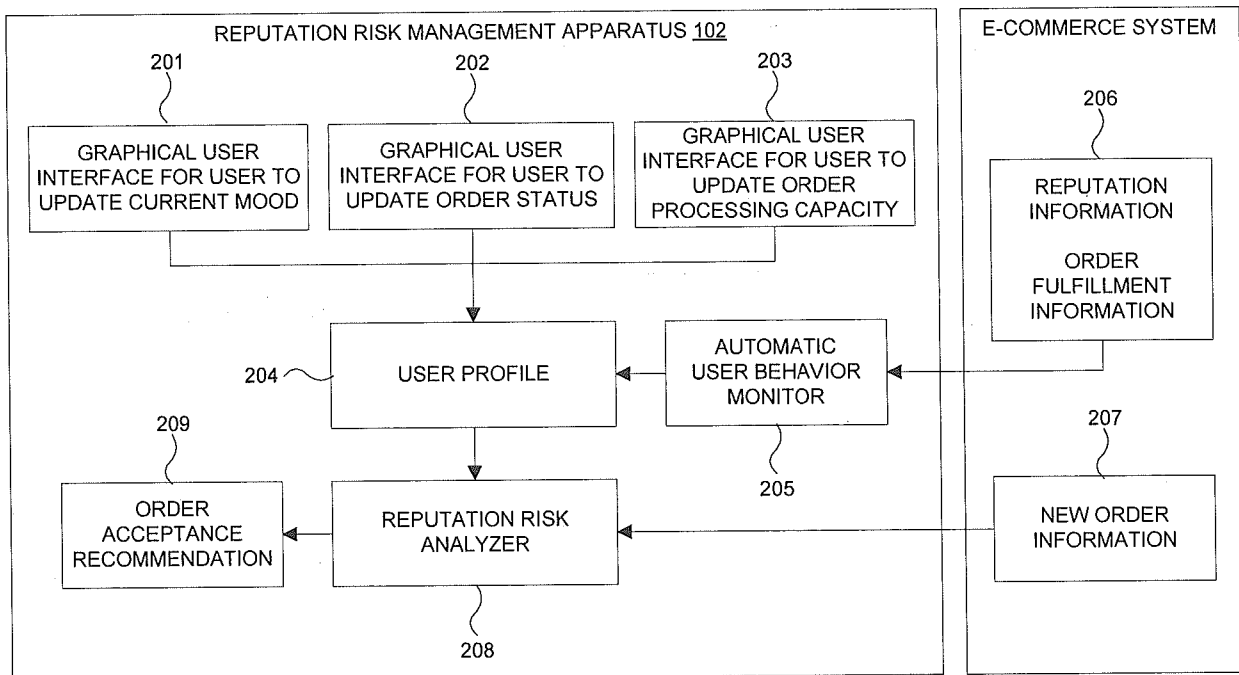


FIG. 2

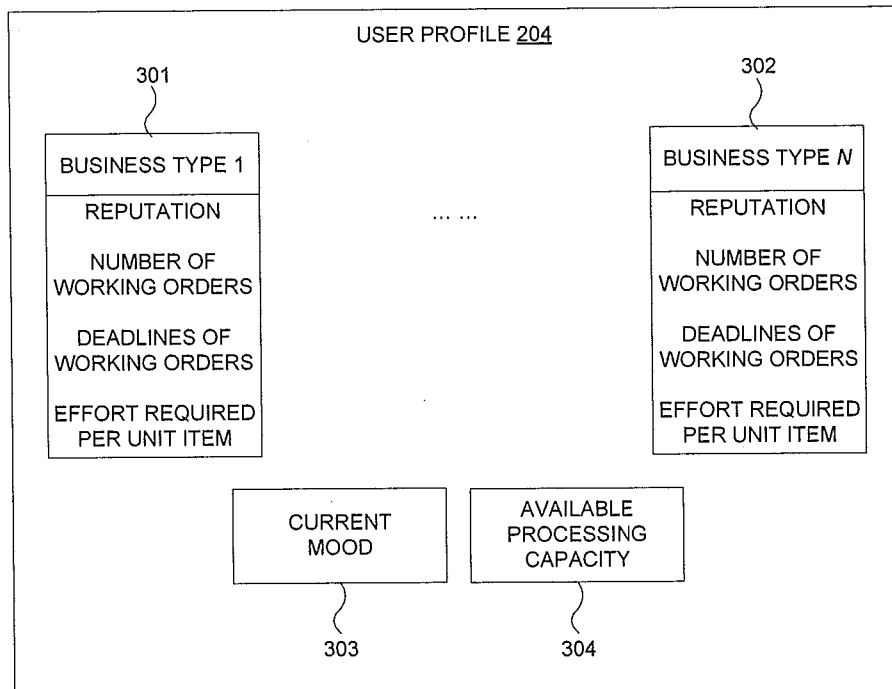


FIG. 3



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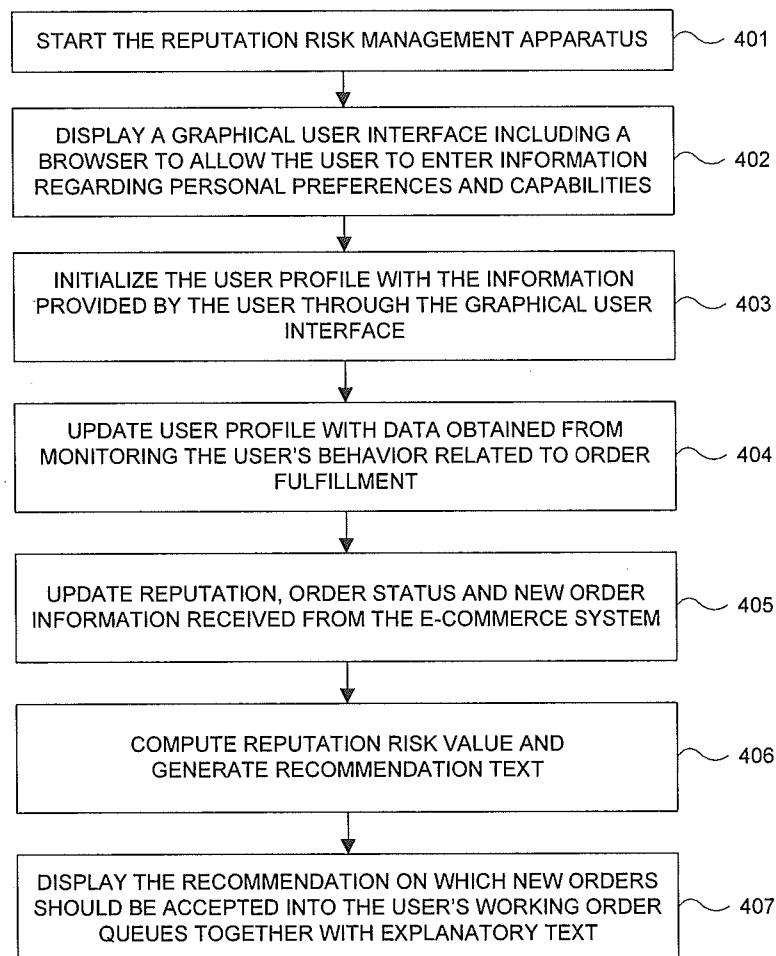


FIG. 4

## INTERNATIONAL SEARCH REPORT

 International application No.  
**PCT/SG2015/000074**

## A. CLASSIFICATION OF SUBJECT MATTER

**G06Q 30/06 (2012.01)**

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPIAP, EPODOC: IPC: G06F, G06Q; keywords: electronic, e, e-, digital, online, commerce, shop, market, business, retail, merchant, recommend, accept, select, choose, receive, filter, priority, reject, update, modify, manipulate, variable, order, job, work, task, profile, preference, variable, workload, level of work, set, subset, part, partial, portion and similar keywords.

Google / Google Patents / Google Scholar: keywords: ecommerce, online, shop, store, recommend, accept, receive, select, order, purchase, workload, level of work, balance, subset and similar keywords.

Espacenet: Applicant / Inventor

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	Documents are listed in the continuation of Box C	



Further documents are listed in the continuation of Box C



See patent family annex

* "A"	Special categories of cited documents: document defining the general state of the art which is not considered to be of particular relevance	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E"	earlier application or patent but published on or after the international filing date	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O"	document referring to an oral disclosure, use, exhibition or other means	"&"	document member of the same patent family
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 2 June 2015	Date of mailing of the international search report 02 June 2015
<b>Name and mailing address of the ISA/AU</b>  AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA Email address: pct@ipaustalia.gov.au	<b>Authorised officer</b>  Lili Eng AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No. +61 2 6283 2166

<b>INTERNATIONAL SEARCH REPORT</b> C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		International application No. <b>PCT/SG2015/000074</b>
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 7860730 B1 (GOODALL et al.) 28 December 2010 abstract, col 1 ln 46-47, 53-56, col 1 ln 66 to col 2 ln 9, col 3 ln 14-17, col 4 ln 35-36, col 4 ln 66 to col 5 ln 5, col 6 ln 4-34, col 7 ln 16-30, col 8 ln 30-33, figures [2, 3, 4]	1-13
X	US 2009/0198540 A1 (KIENZLE et al.) 06 August 2009 abstract, paragraphs [0013-0014, 0030-0031], figures [1, 4]	1-13
A	US 2012/0310831 A1 (HARRIS et al.) 06 December 2012	
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INTERNATIONAL SEARCH REPORT		International application No.	
Information on patent family members		PCT/SG2015/000074	
This Annex lists known patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.			
Patent Document/s Cited in Search Report		Patent Family Member/s	
Publication Number	Publication Date	Publication Number	Publication Date
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