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**Nelken**

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(54) **SYSTEM AND METHOD FOR AUTOMATIC TASK PRIORITIZATION**

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(52) **U.S. Cl.** ..... **705/9; 705/7; 705/8; 709/100; 709/102; 709/103**

(58) **Field of Search** ..... **705/7, 8, 9; 709/100, 709/102, 103**

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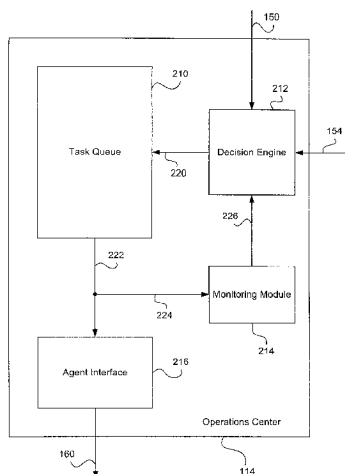
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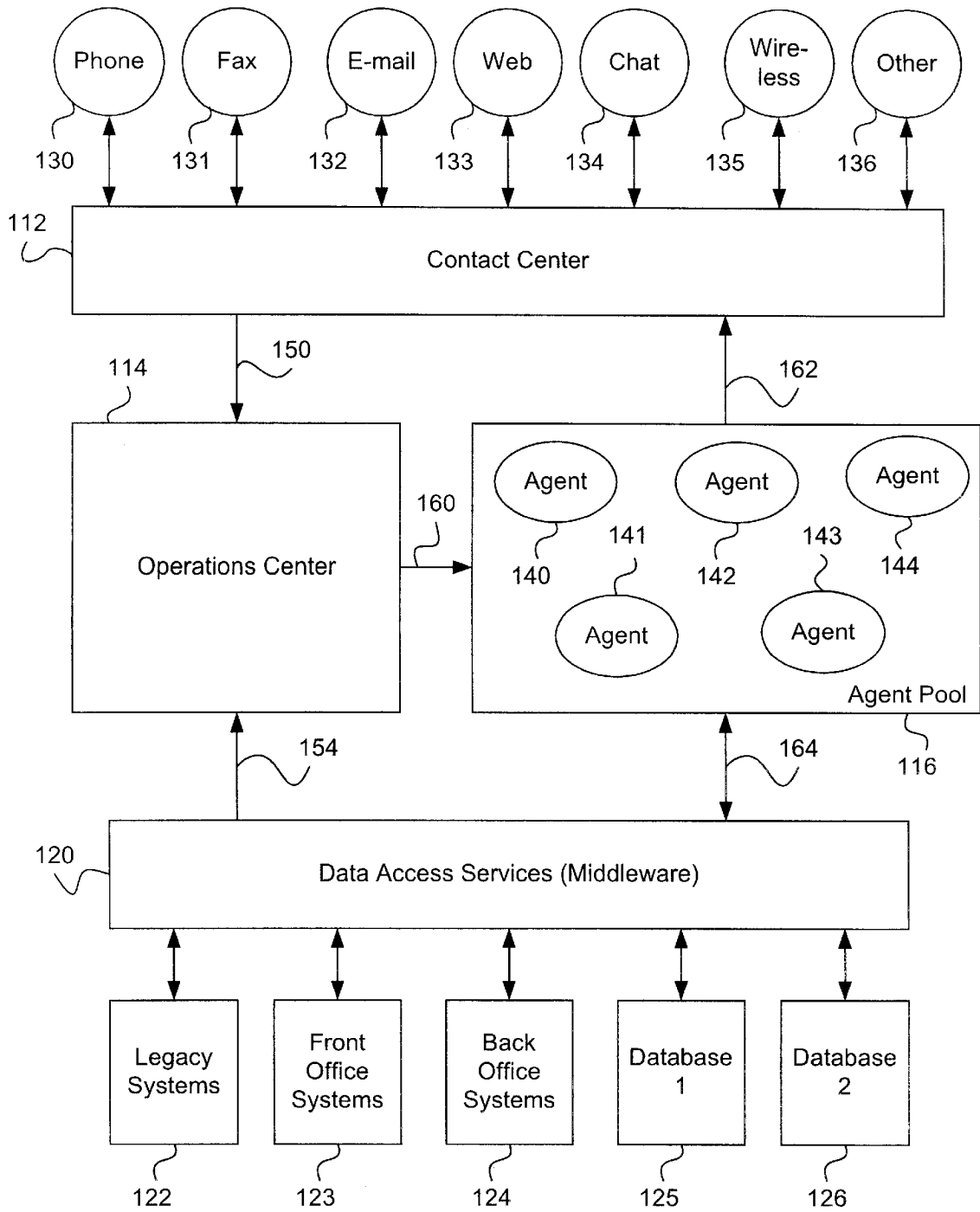
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(57) **ABSTRACT**

A system and method for automatic task prioritization comprises one or more task queues, a monitoring module, and a decision engine. The decision engine receives tasks and assigns a priority code to each task. Each task is inserted into one of the task queues according to its priority code and the priority codes of other tasks which may be present in the task queues. Agents select tasks to perform from the task queue according to priority guidelines established by a system user. The monitoring module may monitor the order of the tasks selected by the agents and each task's priority code. The monitoring module feeds this information back to the decision module. In one embodiment, the decision module is a learning system that updates stored data using feedback from the monitoring module to determine priority of each task.

**1 Claim, 5 Drawing Sheets**





100 ↗

Fig. 1

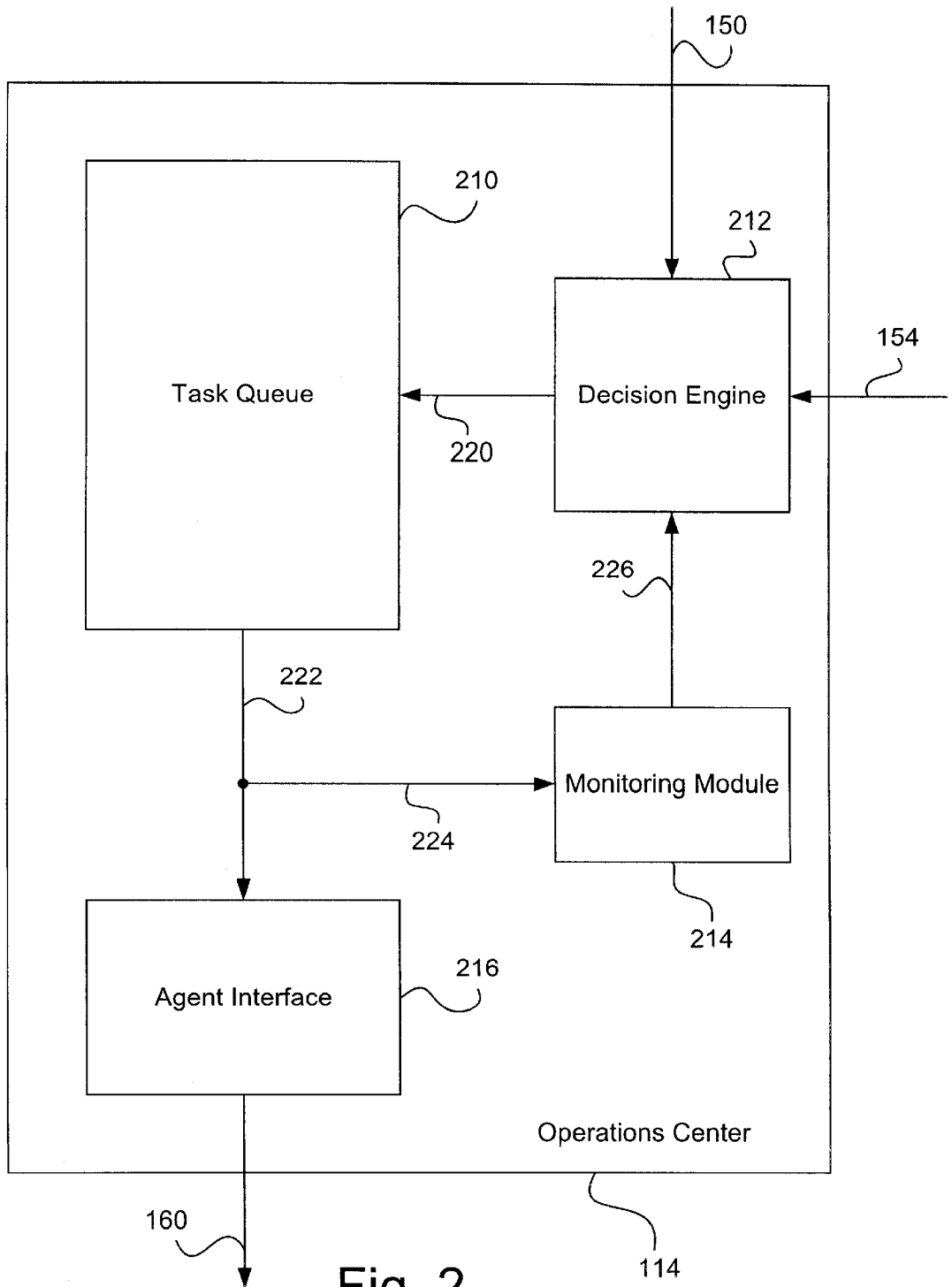


Fig. 2

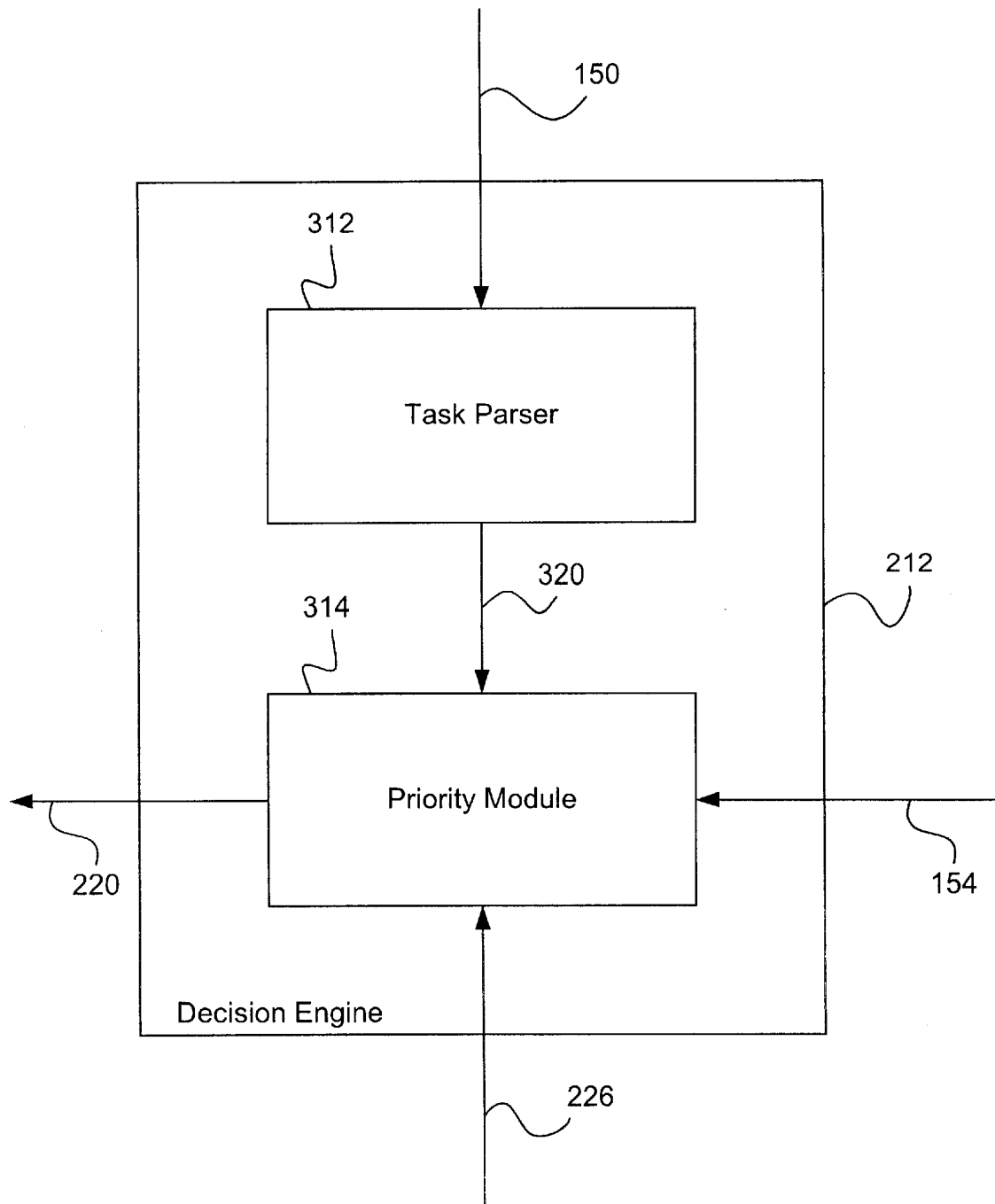


Fig. 3

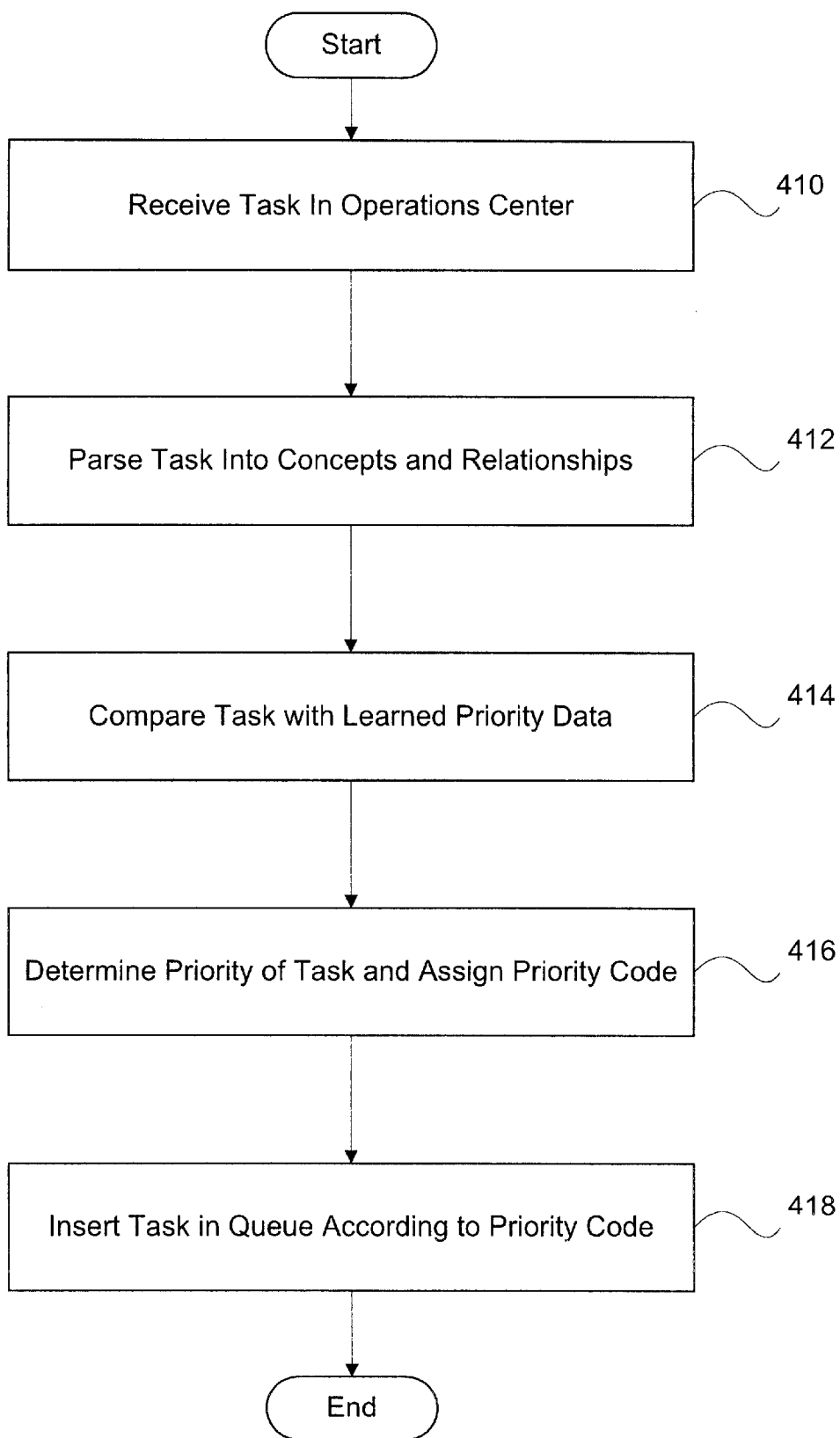


Fig. 4

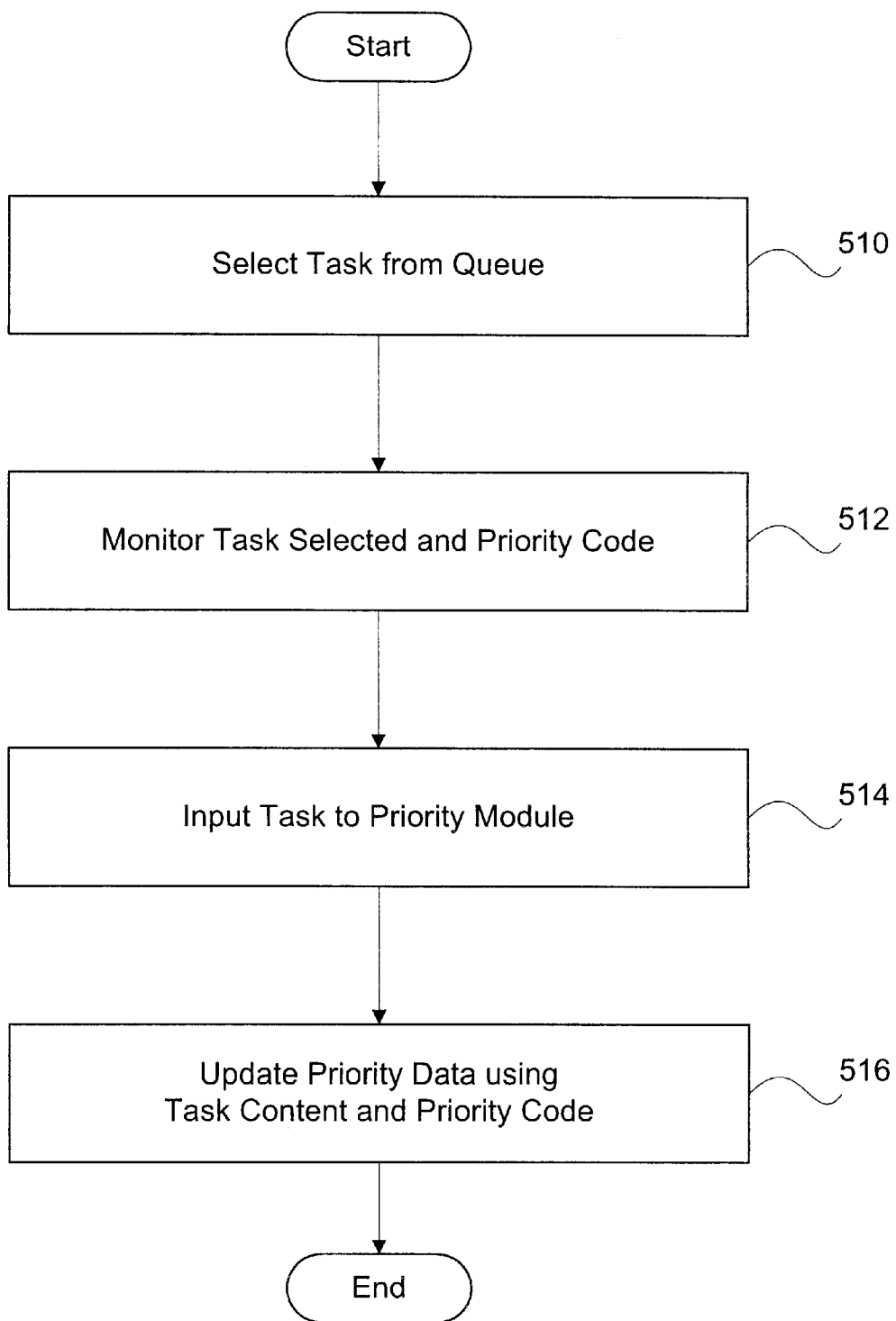


Fig. 5

## SYSTEM AND METHOD FOR AUTOMATIC TASK PRIORITIZATION

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

This invention relates generally to electronic systems, and relates more particularly to a system and method for automatic task prioritization.

#### 2. Description of the Background Art

Many organizations are under a constant barrage of interactions with customers, suppliers, partners, and others. These organizations typically have a limited number of resources to process all of the incoming information and tasks in a timely manner. This problem is exacerbated when the interactions occur via multiple channels and over a wide geographic area. An organization may receive and send information via telephone, facsimile, electronic mail, and other electronic communication forms.

Incoming interactions may be processed on a first-come, first-served basis. This approach may be adequate for some organizations, when the quantity of interactions is relatively small. However, for organizations that process a large number of interactions, an interaction that requires an immediate resolution or response may be delayed due to the number of interactions ahead of it in the system. This and other limitations may prevent the organization from providing excellent service.

Similar to a hospital emergency room, incoming information and tasks may be triaged, whereby items having higher priorities than the others are processed first. Typically, an agent determines which information and tasks are more important and prioritizes them accordingly. When an organization processes hundreds, and perhaps thousands, of interactions a day, efficiently prioritizing the information and tasks at hand likely requires a large number of agents. However, a large number of agents is no assurance that information and tasks will be prioritized efficiently and accurately. Thus, a system and method for automatic task prioritization is needed.

### SUMMARY OF THE INVENTION

The present invention provides a system and method to automatically prioritize tasks. The invention includes one or more task queues, a monitoring module, and a decision engine. The decision engine receives tasks and assigns a priority code to each task. A task may be an action that is to be performed by an agent or an electronic system. Alternatively, a task may be a piece of data that must be acted upon in some fashion, for example a news item received by a news service or a piece of intelligence data received by an intelligence gathering organization.

In one embodiment, the decision engine includes a task parser that analyzes and parses each task into concepts and relationships between the concepts. In one embodiment, the task parser includes a natural language processor for parsing text-based tasks expressed in natural language.

Each task is inserted into the task queue or queues according to its priority code and the priority codes of other tasks which may be present in the task queue. Agents select tasks to perform from the task queues according to priority guidelines established by a system user. The monitoring module monitors the order of the tasks selected by the agents and each task's priority code. The monitoring module feeds back this information to the decision module.

In one embodiment, the decision module is a learning system that uses feedback from the monitoring module to

update stored priority data. The decision module learns the priority guidelines of the system user by learning from the order in which agents select tasks from the task queue. Thus, a system user may adjust its priority guidelines and, based on the selections of the agents, the decision engine will automatically update its priority data.

In another embodiment, the decision engine may be a rule-based system that prioritizes tasks according to a pre-determined set of rules. In this embodiment, a change in the system user's priority guidelines requires changes to the rules of the decision engine. In a further embodiment of the invention, the decision engine may include a rule-based system that is supplemented by a learning system. In this embodiment, rules may be used to determine priorities of tasks until the learning system has received sufficient feedback to make priority decisions, or the rules may establish general guidelines that are further reined by feedback.

### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of one embodiment of an electronic interaction system, in accordance with the present invention;

FIG. 2 is a block diagram of one embodiment of the operations center of FIG. 1, in accordance with the invention;

FIG. 3 is a block diagram of one embodiment of the decision engine of FIG. 2, in accordance with the invention;

FIG. 4 is a flowchart of method steps for performing automatic task prioritization, in accordance with one embodiment of the invention; and

FIG. 5 is a flowchart of method steps for updating the operations center of FIG. 1, in accordance with one embodiment of the invention.

### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention relates to an improvement in task prioritization in electronic devices.

FIG. 1 is a block diagram of one embodiment of an electronic interaction system **100** which includes, but is not limited to, a contact center **112**, an operations center **114**, and an agent pool **116**. System **100** may also include data access services **120** (middleware), legacy systems **122**, front office systems **123**, back office systems **124**, and databases **125**, **126**. Contact center **112** may interact with other parties via various communication channels. The channels include, but are not limited to, a telephone (phone) **130** channel, a facsimile (fax) **131** channel, an E-mail **132** channel, a web-based communication (web) **133** channel, a chat communication (chat) **134** channel, and a wireless **135** channel. Other **136** forms of communication channels, for example, a news wire service, are within the scope of the invention.

Communications received by contact center **112** may be in the form of tasks. Although tasks in particular are discussed here, other types of text-based communications, for example remote employees' reports, are within the scope of the invention. Contact center **112** may also receive voice communications that require some action by an agent. Contact center **112** may include a speech recognition module that converts a voice communication into a text communication.

A task may be an action that is to be performed by an agent or an electronic system. Alternatively, a task may be a piece of data that must be acted upon in some fashion, for example a news item. A skilled person typically determines

whether each received news item should be disseminated, archived, or otherwise processed. In another embodiment of the invention, system **100** may be utilized by an intelligence gathering organization, and a task may be an intelligence item. A skilled person typically determines whether each received intelligence item should be immediately forwarded to supervisory personnel or routed through routine channels.

Contact center **112** forwards tasks to operations center **114**. Agents **140–144** in agent pool **116** select via path **160** tasks that are received by operations center **114**. Each agent **140–144** is preferably a skilled person trained to perform the types of tasks typically received by system **100**. Although only five agents are shown in FIG. 1, agent pool **116** may include any number of agents.

Data access services **120** may access legacy systems **122**, front office systems **123**, back office systems **124**, and databases **125**, **126** to store and retrieve data. Data access services **120** also communicates via path **164** with agent pool **116** to provide information needed by agents **140–144** to act upon the incoming tasks. In addition, the tasks acted upon by agents **140–144** may result in changes to data stored in system **100**. Data access services **120** may also provide information to operations center **114**.

FIG. 2 is a block diagram of one embodiment of the operations center **114** of FIG. 1, in accordance with the invention. Operations center **114** includes, but is not limited to, a task queue **210**, a decision engine **212**, a monitoring module **214**, and an agent interface **216**. Although only one task queue **210** is shown in FIG. 2, operations center **114** may include a plurality of task queues, where each task queue is configured to store a certain type of task or kind of information. For example, in an intelligence gathering organization, operations center **114** may include a task queue **210** for each of several different geographical regions.

Decision engine **212** receives tasks via path **150** from contact center **112**. Decision engine **212** analyzes and assigns a priority code to each task. Decision engine **212** may also receive data via path **154** from data access services **120**. Data received via path **154** is preferably associated with a particular task. The contents and functionality of decision engine **212** are further discussed below in conjunction with FIG. 3.

Decision engine **212** sends each task, via path **220**, to task queue **210** which stores each task until the task is selected and acted upon by an agent **140–144**. The tasks in task queue **210** are ranked from highest priority to lowest priority according to the priority code assigned by decision engine **212**. Each incoming task is stored in task queue **210** according to the task's priority code, and how that priority code compares to priority codes of other tasks that may be present in task queue **210**. Thus, the order of tasks in task queue **210** may be rearranged with every incoming task.

Each agent **140–144**, via agent interface **216** and path **222**, selects tasks to perform according to a judgment of priority. Each agent's judgment of priority is based on and preferably in accordance with priority guidelines established by the system user. Variations among the selections of the various individual agents are averaged across the total number of agents. Thus, an individual agent's personal judgment of priority will not unduly skew the overall priority criteria of system **100**.

Monitoring module **214** monitors via path **224** the tasks selected by each agent **140–144**. Each selected task and its priority code are noted by monitoring module **214** and fed back via path **226** to decision engine **212**. Decision engine **212** analyzes the order in which the tasks were selected from task queue **210**.

By placing tasks in task queue **210** according to priorities, decision engine **212** advantageously allows agents **140–144** to more efficiently identify and process tasks having high priority. This advantage is especially apparent when task queue **210** contains a large number of tasks. In many instances, agents **140–144** will select tasks to act upon in an order which is consistent with decision engine's **212** determination of priority. However, the priority of each task in task queue **210** may be fine-tuned by an agent's personal judgment of priority. The impact of an agent's **140–144** judgment of priority is further discussed below in conjunction with FIG. 3.

FIG. 3 is a block diagram of one embodiment of the FIG. 2 decision engine **212** in accordance with the invention. The FIG. 3 embodiment of decision engine **212** includes, but is not limited to, a task parser **312** and a priority module **314**. Task parser **312** receives tasks via path **150** from contact center **112**.

In the FIG. 3 embodiment, task parser **312** analyzes content each task. Task parser **312** parses each task into concepts, and may also identify relationships between the concepts. Concepts may be as general as single words from e-mail texts, or may be as specific as field descriptors from a web-based form. Task parser **312** preferably includes a natural language processor that analyzes content of text communications expressed in natural language. In another embodiment, task parser **312** identifies keywords in each task to determine content of the task.

Task parser **312** may also include a voice communication processor (not shown) that analyzes tasks received via a voice-based channel, where these voice tasks were not converted to text by contact center **112**. The voice communication processor may be configured to detect emotional content of a voice task as well as to parse the task into concepts. Emotional content such as stress or anger may correspond to priority criteria that indicate a high priority.

Task parser **312** sends parsed tasks via path **320** to priority module **314**. Priority module **314** compares the parsed tasks with its priority data and assigns a priority code to each task. In one embodiment, the priority code may represent one of a limited number of priority levels, for example "very low," "low," "medium," "high," and "very high." In another embodiment, the priority code may be expressed as a percentage, for example 0% to indicate the lowest priority and 100% to indicate the highest priority. Other schemes for expressing priorities of tasks are within the scope of the present invention.

Priority of tasks may be determined based on the nature of the tasks received by system **100** and priority guidelines established by a system user. For example, if the system user is a financial institution, then the tasks received by system **100** may be fund transfers, loan applications, or other similar types of tasks. Priority for these types of tasks may be based on service level agreements with customers, dollar amounts mentioned in the tasks, and other similar criteria.

In another example, an interaction may have high priority if it contains a threat to initiate a legal action or a threat of violence. If the system user is a news service, priority may be based on geographic region, mention of a particular individual, or subject matter such as crime, politics, or lifestyle.

In the preferred embodiment, priority module **314** is a learning system. One such learning system is described in U.S. Provisional Application No. 60/176,411, filed Jan. 13, 2000, entitled "System and Method for Effective and Efficient Electronic Communication Management," which is

hereby incorporated by reference. Priority module 314 learns which tasks are considered more important than other tasks based on the order in which tasks are selected from task queue 210 by agents 140. Priority module 314 receives feedback via path 226 from monitoring module 214. The feedback may be positive or negative. Feedback may be considered positive if a selected task has a priority code that is lower than the priority codes of preceding selected tasks. Feedback may be considered negative if a selected task has a priority code that is higher than the priority codes of preceding selected tasks.

Priority module 314 utilizes the feedback to update stored priority data. In this embodiment, a system user need only indicate to agents 140–144 any changes in priority criteria, and priority module 314 learns the new criteria via feedback. In this way, agents' 140–144 judgments of priority adjust the priority criteria of priority module 314. Thus, when the system user indicates changes in priority criteria, system 100 may remain online with no interruptions in operation.

Since, in the preferred embodiment, priority module 314 is a learning system, new types of tasks may be received by system 100 and based on the selections of agents 140–144, priority module 314 learns how the priority of the new type of task compares to the priorities of other tasks. Thus, system 100 may receive and learn to prioritize new types of tasks with no interruptions in operation.

In another embodiment, priority module 314 is a rule-based system. Priority module 314 assigns a priority code to a task according to a predetermined set of rules. An exemplary rule may be that tasks associated with a dollar amount above five hundred dollars will have a higher priority than tasks associated with a lesser dollar amount. These rules typically remain unchanged until the system user affirmatively changes them. In the rule-based embodiment, priority module 314 may also receive feedback from monitoring module 214. The feedback may be periodically compared to the rules to determine if a rule may need to be modified. The rules may establish general guidelines that are refined by feedback.

FIG. 4 is a flowchart of method steps for performing automatic task prioritization in accordance with one embodiment of the invention. First, in step 410, operations center 114 receives a task from contact center 112. In step 412, decision engine 212 parses the task into concepts and the relationships between the concepts. Alternatively, decision engine 212 identifies keywords in the task. Then, in step 414, priority module 314 (FIG. 3) compares the parsed task with priority criteria. In the preferred embodiment, priority module 314 learns the priority criteria from feedback. In another

embodiment, priority module 314 compares the parsed task with a predetermined set of rules for assigning priority.

In step 416, priority module 314 determines the priority of the task and assigns it a priority code. Then, in step 418, priority module 314 sends the task and priority code to task queue 210, inserting the task in task queue 210 according to the priority code of the task and the priority codes of any other tasks that may be in task queue 210.

FIG. 5 is a flowchart of method steps for updating the FIG. 2 decision engine 212 in accordance with one embodiment of the invention. First, in step 510, agent 140 for example selects a task from task queue 210. Agent 140 selects the task based on priority as established by a user of system 100. The position of the task in task queue 210 preferably reflects the task's priority relative to the priorities of other tasks in task queue 210.

Next, in step 512, monitoring module 214 monitors the task selected and its priority code. In step 514, monitoring module 214 inputs the task and its priority code via path 226 to priority module 314. Then, in step 516, priority module 314 uses the task's content and priority code to update the priority data. The task's content includes concepts and their relationships.

The invention has been explained above with reference to a preferred embodiment. Other embodiments will be apparent to those skilled in the art in light of this disclosure. For example, the invention may readily be implemented using configurations other than those described in the preferred embodiment above. Additionally, the invention may effectively be used in conjunction with systems other than the one described above as the preferred embodiment. Therefore, these and other variations upon the preferred embodiment are intended to be covered by the invention, which is limited only by the appended claims.

What is claimed is:

1. A system for automatic task prioritization, comprising:
  - a decision engine configured to receive tasks and to determine a priority of each task;
  - at least one task queue configured to store said prioritized tasks in order of priority; and
  - a monitoring module configured to monitor tasks selected from said task queue by at least one agent and to forward said selected tasks and a priority code associated with each selected task as feedback to said decision engine such that said decision engine uses said feedback to update priority criteria, which include rules for prioritizing the tasks.

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