CROWD MANAGEMENT SYSTEM

This application claims priority benefit of Singapore Patent Application No. 10201502042S, filed on 17 March 2015.

FIELD OF THE INVENTION

[0001] This invention relates to crowd management systems, and more particularly to improved methods of managing crowds by providing real time updates of information about capacity constrained resources.

BACKGROUND OF THE INVENTION

[0002] There are many defined spaces where large crowds gather regularly, for example, theme parks, museums, transport hubs, concerts, marathons, exhibitions etc. Many of these venues, especially larger venues, want as many people as possible to use their services and facilities, but that can lead to long queues, which make for an unpleasant customer experience. Further, congestion at one venue can affect congestion (and length of queue) of other venues within such a defined space. The venues could be in the form of a restaurant, a theatre, a convention centre, a transport hub, a ride within a theme park and etc. that each visitor or group of visitors is interested to visit.

[0003] Known solutions for crowd control typically merely provide guidance to the crowd based on assumptions about pre-determined crowd movement or crowd

control plan, and can entail markings and signage placed around the venue, for example. Also marshals and security personnel may be deployed to direct the crowd in the event that signage is insufficient. The highly autonomous nature of the individuals and groups that make up the crowd along with their varying intents usually limits the effectiveness of these plans. Furthermore, poor communication to the crowd on these plans may result in discontent among the crowd and in extreme cases, could lead to scuffles among the people in the crowd or even between the crowd and the security personnel. The discontent and scuffles not only result in poor experience for the crowd but may also result in negative image or reputation to the venue operator and event organizer.

[0004] Other attempts to resolve the issue of congestion involve implementing a form of a booking/reservation system similar to those used by hotels, theatres and theme parks, etc. These efforts are suitable in situations where the likelihood of walk-in guests (i.e. those that did not book or purchase in advance) is relatively low and either the impact of not satisfying these guest is low or alternatives are readily available, e.g. an alternate show time, an alternate venue, etc. Also known is an attempt to generate a schedule or itinerary for the crowd to help with crowd flow within the venue. However, such system may not factor in environmental factors such as current and historical congestion and queue states, projected congestion and queue states and etc. Moreover, such known systems do not handle non-compliance well and do not provide real-time feedback or offer continuous planning/re-planning capabilities. This can result in the generated schedule/itinerary be rendered sub-optimal as soon as it is generated due to ever-changing environmental factors.

[0005] US Patent 8,082,186 to Shuchman et al. describes a method for generating a custom itinerary which takes into consideration a user's travel preferences, but is merely directed to a trip planner and only uses historical data for assumptions. US Patent Publication No. 2012/0226532 to Prabhakar et al. discloses treating a venue as a single capacity-constrained resource or as in the form of an Origin-Destination (OD) routing problem. However, such an approach is limited to a single capacity-constrained resource and does not factor in other resources (both with and without capacity constraints) in the vicinity that may be affected by the congestion and queue state of this resource. Essentially, Prabhakar et al. teaches an approach which is concerned with only a single capacity-constrained resource and the ability of this resource to control visitors' entry and exit to ensure smooth movement flow within itself.

[0006] It would be desirable to provide a method and system for crowd management that enhances crowd movement where there are multiple capacity-constrained resources, and thereby increases user enjoyment of such resources.

SUMMARY OF THE INVENTION

[0007] In accordance with a first aspect, a method for managing a crowd attending a plurality of capacity constrained resources comprises operatively connecting an operator via an internet connection to a plurality of users of the crowd to form a network, determining a status of each of the capacity constrained resources, presenting information to the users or to the operator, wherein the information

comprises the status of the capacity constrained resources, and delivering a real time update of information to at least one of the users in the crowd. The capacity constrained resources can be events at a shopping mall, rides and attractions at an amusement park, events at a stadium or sports complex, sessions or presentations at a convention centre, and restaurants operatively connected to the network.

[0008] From the foregoing disclosure and the following more detailed description of various embodiments, it will be apparent to those skilled in the art that the present invention provides a significant advance in the technology of crowd management systems. Particularly significant in this regard is the potential the invention affords for providing an elegant crowd management system adapted to handle a crowds in an environment with many capacity constrained resources. Additional features and advantages of various embodiments will be better understood in view of the detailed description provided below.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] Fig. 1 shows a schematic representation of a series of queues for events which a crowd may wish to attend.

[0010] Fig. 2 is a schematic block diagram of a crowd management system connecting operators via a server to a plurality of users.

[0011] Fig. 3 is a flow chart outlining steps in the method of managing a crowd in accordance with an embodiment where incentives are used.

[0012] Fig. 4 is a schematic of an urban space showing several areas where the crowd management system disclosed herein may be deployed.

[0013] Fig. 5 is a schematic illustration of the shopping mall of Fig. 4.

[0014] Fig. 6 is a schematic of the convention centre/exhibition hall of Fig. 4.

[0015] Fig. 7 is a schematic of the theme park of Fig. 4.

[0016] Fig. 8 is a flow chart outlining steps in the method of managing a crowd where changes in status produce a real time update in the form of an updated schedule for the users in the crowd.

[0017] It should be understood that the appended drawings are not necessarily to scale, presenting a somewhat simplified representation of various features illustrative of the basic principles of the invention. The specific design features of the crowd management system as disclosed here, including, for example, the specific number of capacity constrained resources, will be determined in part by the particular intended application and use environment. Certain features of the illustrated embodiments have been enlarged or distorted relative to others to help provide clear understanding. In particular, thin features may be thickened, for example, for clarity of illustration. All references to direction and position, unless otherwise indicated, refer to the orientation illustrated in the drawings.

DETAILED DESCRIPTION OF CERTAIN EMBODIMENTS

[0018] It will be apparent to those skilled in the art, that is, to those who have knowledge or experience in this area of technology, that many uses and design variations are possible for the crowd management system disclosed here. The following detailed discussion of various alternate features and embodiments will illustrate the general principles of the invention with reference to a crowd management system for use with one or more of a theme park, shopping mall, convention centre and sports hub, and operatively connected restaurants, for example. Other embodiments suitable for other applications will be apparent to those skilled in the art given the benefit of this disclosure.

[0019] Large venues want as many visitors as possible, but that can lead to long queues, which can make for an unpleasant crowd experience. Crowd congestion in capacity constrained resources are seen particularly in urban spaces such as theme parks, shopping malls, convention centres and sports hubs/stadiums, for example, can advantageously be mitigated using real-time movement tracking and guidance provided to the individuals and groups within the crowd as described herein. Methods and systems are disclosed herein for crowd control, especially for reducing congestion, queues and other undesirable events within a given urban space that affects crowd experiences. The system works best in an urban space where a network of queues are used to access one or more resources (both capacity-constrained and non-capacity constrained resources). The methods disclosed herein help reduce the congestion, queues and other undesirable events in part by tracking the location of individuals or groups within the crowd, providing data to help

users select a personalized schedule or itinerary for each individual or group within the crowd based on preferences which they provided and information presented to the users, and providing guidance via real-time interaction with the individuals or groups based on the personalized schedule or itinerary which they generated. The crowd typically comprises a large group of people/users, wherein each person can access a computer network via an application downloaded onto their portable internet device. That is the users can access the network via the "app" on their portable internet device, normally their phone. Of course a portable or mobile internet device is understood here to mean any portable device with an internet connection, and can comprise phones, tablets, PDAs, etc. The crowd management system disclosed herein advantageously can help keep queues from becoming too long by reallocating users to different, less used capacity constrained resources.

[0020] The network or crowd management system comprises the server operatively connected via the internet to both the operators and the users (the individuals or groups of individuals in the crowd). The server can be remotely connected or positioned at the venue, and in addition to being operatively connected to the users in the crowd, is also operatively connected to one or more operators who advantageously have the ability to push information to the users in real time, either automatically or manually. The server receives user inputs such as preferred list of events to attend, and also receives real-time environmental factors such as congestion, length of queue for a given capacity constrained resource, traffic conditions, bus schedules, etc. Historical data may also be used, for example, it may be known that certain events become very crowded at certain times in the day. This allows for estimating a status of a capacity constrained resource at that certain

time of day. Notices can be sent to the users using such historical data to avoid heavily congested capacity constrained resources at those certain times. Estimates of capacity constrained resources can also be made manually, (such as when a sudden surge of the crowd makes a particular capacity constrained resource have a very high congestion state) and real time updates may be provided to a display of a portable internet device of the members of the crowd who have downloaded the application.

[0021] The individuals and groups (users) interact with the server using a front-end interface such as a display on a mobile phone application to provide the server with their preferences of resources that they wish to attend. One or more operators are also operatively connected to the users to send recommendations and guidance to the users. The operator can comprise a venue operator, event organizers, for example, and can also interact with the server using a separate front-end interface which provides command and control capabilities as well as abilities to perform intervention, including pre-emptive intervention where the intervention will be initiated in a later time. Users may advantageously be tracked in real-time to ensure that the status of the capacity constrained resources within the urban space is enhanced. Optionally, individuals and groups may be rewarded with incentives such as points, discount vouchers and the like. These actions may offer better value to the individuals or groups affected as well as positively contributing the overall experience of the crowd in the given urban space. Application domain of the methods and systems includes shopping malls, conventions, conferences, sport events, theme parks and related restaurants operatively connected to the network. The network

may also be enhanced by integration with a sensor network that provides a more comprehensive set of environmental factors in real-time.

[0022] Turning now to the drawings, Fig. 1 shows a plurality of resources of a crowd management system or network. The resources may be capacity constrained or effectively non-capacity constrained, and may be interrelated so as to form a hierarchical network. Each box shown can comprise one or more queue(s) to access the capacity constrained resource indicated by a code. The congestion and queue states of the various resources within the urban space may affect the congestion and queue state each other which in turn affect the overall congestion and queue state of the urban space. Sometimes a resource can be considered as a child resource of a parent resource.

[0023] Fig. 2 shows a schematic block diagram of a crowd management system and related method where users of the crowd are represented as 203, 204, 205, and 206 and are operatively connected to server 201 via internet 202 with connections 211 and 213. Similarly, one or more operators 207, 208 may also be operatively connected to the server (optionally via an internal network 212) such that the operator is connected to the plurality of users to form the network. In addition to these connections, the server may be operatively connected to a plurality of sensors and devices which provide status of the capacity constrained resources and may also more broadly provide information about things of interest to users of the network. The system performs many functions. For example, selecting a schedule after entering the network (such as by downloading the app and logging in) comprises the users choosing a preferred order of attendance of the capacity

constrained resources, and making the preferred order available to the operator. Other functions of the system can comprise determining the status of the capacity constrained resources, that is, a congestion or queue status within the urban space; identifying the user(s) affected by the congestion or queue states; and computing a schedule or itinerary for the users based on preferences of the user. Data corresponding to historical schedule or itinerary of the user or of people with a similar profile may be stored; also current and historical (projected or estimated) congestion and queue states as well as other environmental factors that will affect the user's experiences may be taken into account.

[0024] A status of each of the capacity constrained resources can comprise, for example, at least one of the following of any of the capacity constrained resources: event availability, a congestion state (such as how long the line is or will be for the event), and a change in schedule for the capacity constrained resources. The congestion state is understood herein to be subject to real time updates based on data received by the server, or instructions from the operator, and the real time updates may be delivered manually (that is, by an operator manually overriding a status by, for example, rescheduling or cancelling an event, whitelisting, blacklisting, etc.), or automatically (for example, when a queue for a particular event gets too long, automatically inform users of this condition). Information presented to users and/or the operator can include not just status about the capacity constrained resources, but also can comprise data tangentially useful such as weather and environmental data, advertisements, promotions, schedule planner data, and award programs. Environmental data refers to factors that occur around or within the urban space which can affect the experience of the crowd both directly and indirectly.

Some examples of environmental data are surrounding vehicular or human congestion, queues, and bus or train schedules. These factors can be collected automatically through sensors or interface with external systems, or manually via internal interfaces with the network. Various sensors and/or inputs from external systems may be provided to the server, which the server uses to provide the information presented to the users and/or to the operator(s).

[0025] Promotions can be used in some instances to encourage some users to attend an event at a different time, thereby advantageously reducing congestion at particular events when they begin to suffer from long lines. Real time updates can be provided to both the operators and the users, and can also be created by the operators and delivered to the users. An operator display viewable by the operator may be provided, and information may be sent to the operator display which is not viewable by the users. Real time updates may take the form one or more of updating the schedule, and sending a notice of a change to the status of the capacity constrained resources to the users.

[0026] Receipt of information by the server regarding congestion and queue states of the various capacity constrained resources provides the system with the opportunity to reduce the congestion, queues and other undesirable events within the entire urban space through coordination of the schedules or itineraries (and hence movement) of the individual visitors over time and space via several mechanisms, including real time updates in the form of notices to the users, as well as the use of incentives for the users to modify their schedule. The incentives may be given in form of vouchers, gifts and etc., which the user may desire. The incentives may also

be given in form of credits or points which can be accumulated to redeem for rewards.

[0027] The system can advantageously continuously evaluate the schedules or itineraries of all the users with the current and expected congestion and queue states within the urban space in real-time and perform re-computation when necessary of the schedule or itinerary previously generated, which can then be delivered to the user in the form of a real time update. Any change to the schedule or itinerary may include previously excluded item(s) of interest or exclude previously included items(s) which are no longer desirable due to congestion, queues or other environmental factors, all of which helps enhance the experiences of the users.

[0028] As noted above, the system may intervene the schedules or itineraries of the various users based on automated thresholds configured or manually triggered by the operator. For example, delivering the real time update can comprise updating a schedule of the user after the user has attended one of the capacity constrained resources. Data about the user's attendance of a particular event is sent to the server, and the server can deliver a real time update to the display of that user. Optionally, movement tracking capability of the users of the crowd by the server 201 may be done by tracking the location of the user's portable internet device using one or more localization methods such as Global Positioning System (GPS), Wi-Fi network, Bluetooth.

[0029] Fig. 3 shows a flow chart with registration of users and use of an incentive program to encourage users to attend capacity constrained resources in an order

advantageous for relatively smooth flow of traffic. In Step 301, the user provides demographical information such as gender, nationality or etc. along with preferences information such as the period of visit, trip objectives and etc. using user interface such as mobile application, web portal or similar. The server will compute and provide the user with a recommendation based on the user provided information from Step 301 as well as environmental factors such as congestion and queue state and history in Step 302. The user reviews and finalizes his/her preferred schedule/itinerary of capacity constrained resources which can then be sent to the server. See Steps 303, 304, and 305. While the user is within the urban space, he/she will be rewarded for following the planned schedule/itinerary with promotion vouchers, points etc. Step 306. The amount of reward depends on the level of compliance to the planned schedule/itinerary and the impact of the move to the overall experience of all the users within the urban space. For example, if the user's action is viewed as one that result in positive enhancement of experiences of all users in the urban space, then he/she is likely to be reward with a better reward than another user whose action does not result in the any positive enhancement of experiences of all users in the urban space. Compliance with the requested change of behaviour allows the user to redeem products or services as shown in Step 307.

[0030] A representative urban space is shown in the schematic diagram of Fig. 4. The capacity constrained resources can be a shopping mall 401, a convention centre 402, a theme park 403, a sports hub, or similar structure with one or more buildings (including temporary structures such as tents and fenced-in areas). These buildings independently or as a whole or in part may comprise a capacity constrained resource. Fig. 6 shows a schematic example of a convention centre/exhibition hall

402 within an urban space with a plurality of booths in accordance with one embodiment. Fig. 7 shows a schematic example of a theme park 403 within an urban space in accordance with one embodiment.

[0031] In addition to basic login screens, the following information are examples of the kinds of data that may be presented to the each person in the crowd and/or to each operator on a screen of his portable internet device (or more typically in the case of the operator, onto a laptop or desktop screen) in accordance with the application or app used with the crowd management system disclosed herein. The information may be presented on separate screens, combined onto one screen, and not all of the information which can be presented need be displayed in all circumstances.

[0032] Fig. 8 is a representative flow chart 500 of a real time update in a method of managing a crowd as disclosed herein, presented in the form of a push notification presented to a user of the crowd. At step 501, a change in status of one or more of the capacity constrained resources occurs. Next, at step 502, the server receives data about the change and determines all affected user schedules. At step 503, the server calculates revised schedules, which can optionally include preferred events of the user which was not possible to include in the previous schedule. Assuming a better schedule is found, the server can provide a real time update. At step 504, a push notification (or other suitable notice such as a pop-up alert) is sent to the display of each affected user. Finally, at step 505, the mobile application on the user's portable internet device will inform the user of the change and update the schedule stored on the device accordingly.

[0033] Other optional elements can be included in the network. A screen showing a trip planner can show times, height and weight of persons, and preferred capacity constrained resources (such as preferred rides in an amusement park), for example. Next Attraction. A screen listing the upcoming capacity constrained resources, such as the next attraction or the next presentation at a conference, along with wait times. This screen may be presented to the users and/or to the operator(s). Selection Screen. A screen displaying options a list of capacity constrained resources/events the person(s) can attend, optionally with wait times for each event. Full Itinerary/Schedule. A list of events the person plans to attend along with operator recommended times to attend may be presented to the screen of the user's mobile device. Monitoring. A monitoring screen may be provided to a computer used by the operator showing real time usage of the plurality of capacity constrained resources. Intervention. A screen presented to the operator allowing them to change status of an event and/or send updates to the users. Update. A notification, optionally presented as a pop-up message on the user's mobile device, that the list of events a person plans to attend has been changed. Visited events. An updated screen presented after a person has attended an event indicating such. This can be done, for example by transmitting information to the user's mobile device that the person has entered or exited and event. Details. This is a screen which provides a detailed description of any of the events. Refresh Itinerary. This is a screen which allows the person to make changes to his preferred order of attending events. Attraction Status change. When an event is closed or full or rescheduled, for example, this information may be presented to the user in a pop up message and incorporated into screens showing the schedule of events and/or the Details screen.

Typically such decisions would be driven by the operator or by the event itself relaying information about its status to the operator. Map. A display of your current location can be sent to the screen, along with directions on how to get to your next event. Other types of beneficial information which may be presented on display screens of both the operators and the users will be readily apparent to those skilled in the art given the benefit of this disclosure.

[0034] From the foregoing disclosure and detailed description of certain embodiments, it will be apparent that various modifications, additions and other alternative embodiments are possible without departing from the true scope of the invention. The embodiments discussed were chosen and described to provide the best illustration of the principles of the invention and its practical application to thereby enable one of ordinary skill in the art to use the invention in various embodiments and with various modifications as are suited to the particular use contemplated. All such modifications and variations are within the scope of the invention as determined by the appended claims when interpreted in accordance with the breadth to which they are fairly, legally, and equitably entitled.

CLAIMS

What is claimed is:

1. A method for managing a crowd attending a plurality of capacity constrained resources, comprising in combination, the steps of:

operatively connecting an operator via an internet connection to a plurality of users of the crowd to form a network;

determining a status of each of the plurality of capacity constrained resources;

receiving a preferred order of attendance from each of the plurality of users;

for each of the plurality of users, computing a schedule based on the preferred order of attendance of the user and the status of each of the plurality of capacity constrained resources, wherein computing a schedule includes coordinating the schedules of the plurality of users;

for each of the plurality of users, presenting the schedule of the user to the user, wherein the schedule comprises the status of the plurality of capacity constrained resources; and

for each of the plurality of users, providing an incentive to the user for following the schedule of the user; and

receiving real time updates on the status of each of the plurality of capacity constrained resources and for at least one of the plurality of users, performing a re-computation of the schedule of the at least one of the plurality of users in response to the real time updates, wherein re-computation of the schedule is automatically performed without prompting from the user, and pushing out a real time update to the schedule based on the re-computed schedule using a push notification and an incentive to the user to follow the modified schedule.

2. The method for managing the crowd of claim 1 further comprising the steps of:

for at least one of the plurality of users, performing a re-computation of the schedule of the at least one of the plurality of users in response to any change to the schedule of the at least one of the plurality of users; and

pushing out a real time update to the at least one of the plurality of users.

3. The method for managing the crowd of claim 1 wherein the status comprises at least one of the following of any of the plurality of capacity constrained resources: availability, a congestion state, and a change in schedule for at least one of the plurality of capacity constrained resources.

4. The method for managing the crowd of claim 3 wherein the schedule further comprises: weather data, advertisements, promotions, schedule planner data, and award programs.

5. The method for managing the crowd of claim 1 wherein the plurality of capacity constrained resources comprises at least one of: events at a shopping mall, rides and attractions at an amusement park, events at a stadium or sports complex, sessions or presentations at a convention centre, and restaurants operatively connected to the network.

6. The method for managing the crowd of claim 1 wherein the step of operatively connecting to the network comprises a user downloading an application to a portable internet device having a display.

7. The method for managing the crowd of claim 2 further comprising: presenting the schedule to an operator on an operator display viewable by the operator and not viewable by the users.

8. The method for managing the crowd of claim 2 further comprising the steps of: selecting the schedule by the at least one of the plurality of users comprising the preferred order of attendance of the plurality of capacity constrained resources, and making the preferred order available to the operator.

9. The method for managing the crowd of claim 7 or 8 wherein the step of pushing out the real time update comprises one or more of: updating the schedule, and sending a notice of a change to the status of the plurality of capacity constrained resources to the plurality of users.

10. The method for managing the crowd of claim 1 further comprising estimating the status of the plurality of capacity constrained resources using historical data.

11. The method for managing the crowd of claim 2 further comprising estimating the status of the plurality capacity constrained resources either automatically or manually, and pushing out the real time update automatically.

12. The method for managing the crowd of claim 2 wherein the step of pushing out the real time update comprises updating a schedule of the at least one of the

plurality of users after the at least one of the plurality of users has attended one of the plurality of capacity constrained resources.

13. The method for managing the crowd of claim 1 or 2 wherein providing an incentive to the user includes varying the amount of a reward depending on the level of compliance with the schedule of the user.

14. The method for managing the crowd of claim 1, wherein a mobile application on a user's portable internet device receives the push notification and updates the schedule stored on the device, and informs the user of the change.