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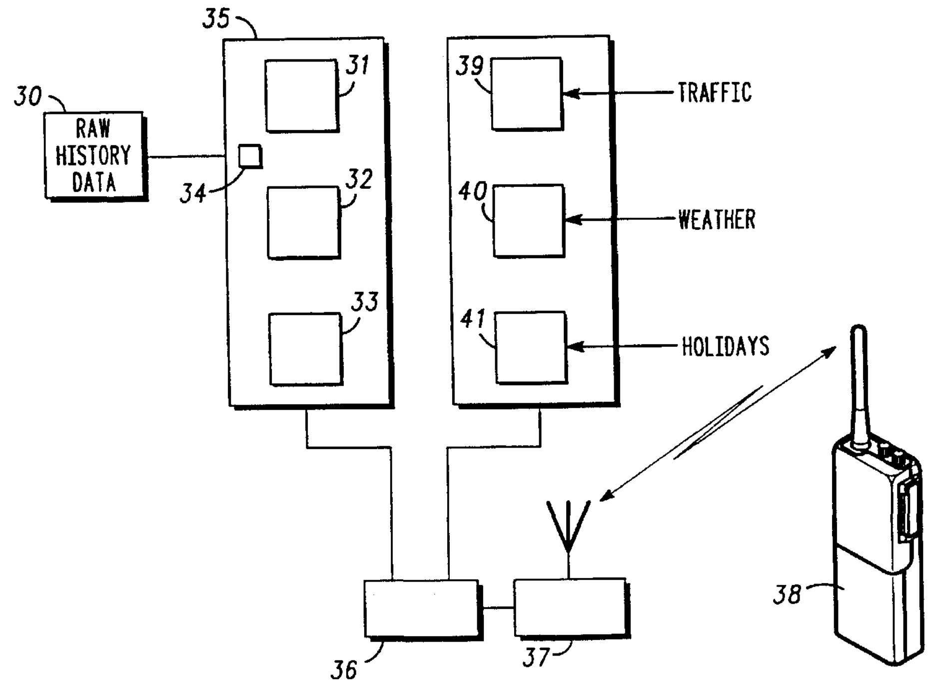

(57) Abstract: A method for utilising resources of a mobile telecommunications network, comprising monitoring historical or environmental data associated with a mobile terminal associated with the network, its users or environment and, at the time service is required, configuring the grade of service in accordance with said monitored data.

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RESOURCE UTILISATION OF MOBILE TELECOMMUNICATIONS NETWORKS

Background of the Invention

This invention relates to resource utilisation of mobile telecommunications networks. In particular, but not exclusively, it relates to cellular mobile telephone networks.

A cellular telephone network is configured, as is well known, by a number of cells distributed over the coverage area of the network. Within each of these cells is a base station which transmits and receives signals to and from a mobile station (ie a mobile telephone) as that station passes through the cell. As the station passes from cell to cell, a handover process ensures constant communication. The quality of service which a user can expect as he passes from cell to cell can, however, vary quite dramatically. The quality of service in a given cell depends upon the physical environment, the power, type and efficiency of the base station, the number of concurrent users, receiving service within the cell and other factors.

When a user requires service, a registration process occurs and during this process various algorithms are used to determine the quality and grade of service which is offered to the user at that time. This is dependent, inter alia, upon the quality of service which is possible in the particular cell in which the mobile station is situated, and upon the type of service which is required, ie voice, data, internet protocol and so on. Once a call is set up, however, a user will often travel onwards to and through other cells. If a quality of service Q1 has been established, then a subsequent cell through which the user passes may not, for various reasons, be able to offer this level; it may only be able to offer a second level of service Q2. This can result in a noticeable deterioration of quality, signal strength, etc and could result in premature loss of calls, or loss of data. On the other hand, if a terminal first requests service in an area having a low capacity, then the quality of service allocated to that call may be low since the system has to try to allocate resources which it considers will suffice for the duration of the call, even though the length of the call is of course unknown.

If the user is only in the first cell for a very small period, however, and then passes to a subsequent cell in which the potential quality of service which could be offered is much higher, then he will not be able to take advantage of this since the quality of service has already been determined. Thus, the user may have to suffer a lower quality of service than he might have been able to have, and this is not conducive to maximum possible customer satisfaction.

The present invention arose in an attempt to provide an improved mobile telecommunications network, and method for utilising resources of a mobile telecommunications network, with a view to overcoming the above problems.

Brief Summary of the Invention

According to the present invention in a first aspect there is provided a method for utilising resources of a mobile telecommunications network, comprising monitoring historical or environmental data associated with a mobile station, its users or environment and, at the time service is required, configuring the grade of service offered to the user in accordance with said data.

Most preferably, the method comprises monitoring and determining a historical pattern of movement of a mobile station through a network and, at a time when service is required, determining whether the users situation is a match with the historical pattern and using the historical pattern to configure the grade of service which is offered.

Advantageously, additional data is monitored, preferably real-time data, which data is associated with the environment in which the mobile station is used, or which can influence the behaviour or movements of a user. This data may comprise, for example, real-time traffic data, ie automobile traffic, train movements, etc. This data may relate to traffic in the immediate vicinity of the mobile stations current position and/or data relating to traffic flow in regions determined by the historical pattern of movement of the mobile station. Other types of data which may alternatively or additionally be monitored include weather data, including real time and projected data, and; data relating to civil movements, such as national holidays, and other data useful in analysing and determining whether a user will follow a normal historical pattern or is likely to divert from this.

Where historical data is required, this need not necessarily be done by tracking the pattern of cells through which a user historically passes. Alternative methods, such as GPS (Global Positioning System) technology may be used.

According to the present invention in a second aspect, there is provided a mobile telecommunications system comprising a network of cells; at least one mobile station requiring service; a network including means for receiving and transmitting signals from and to the mobile station, to enable the station to communicate with third parties, means for determining historical or environmental data associated with the mobile station, its users or environment and means for configuring, at a time when service is required, the grade of service to be accorded to the mobile station in accordance with said monitored data.

Description of the Drawings

Embodiments of the invention will now be described, by way of example only, with reference to the accompanying schematic drawings, in which:

Figure 1 shows movements of a user of a mobile telephone during a typical workday;

Figure 2 shows a network; and

Figure 3 shows how data can be used in embodiments of the invention.

Description of the Preferred Embodiments of the Invention

Most users of mobile telephones tend to have one or more set patterns of behaviour relating to their movements in any period. Thus, a person who travels from his home to a place of work five days a week may have a fairly set routine of movements during the working week. Figure 1 shows very schematically movements of a hypothetical user of a mobile telephone during a workday. The user generally leaves his home H at a particular time and travels on a route 1 to his usual workplace W. He generally travels at an average speed of 50 km per hour and passes through several cells C1, C2, C3 of the cellular radio network from which he receives service. He may then stay at his workplace W for a couple of hours. Subsequently, he regularly travels along a route 2 to visit, say, a customer 3. He usually travels at a known average speed on this route. After spending a certain time at this customers, the user may travel on a route 4 to another site of his employer, say a factory 5.

He subsequently travels back to his original workplace W along a route 6. At 7pm, the user travels home along the same route as he travelled to workplace W but, since the road has generally less traffic, may travel at a faster average speed of 70 km per hour. See route 8 on Figure 1.

After dinner, the user may customarily take his dog for a walk and travels by foot on a route 7 at a walking speed through cells C_8, C_6, C_2 and C_1.

Figure 1 also shows a further cell C_9. Generally, the network will comprise many more cells, which are not shown for clarity.

During all this time, the user carries his mobile telephone and requires service thereon.

It is seen that as he travels around, the user passes through various cells at various speed and also moves between and across cells. It is important that the network knows in which cell he is at any time, in order be able to provide service, and so it becomes possible to know the average length of time the user generally stays at each leg of his journey and therefore within each cell in which he requires service. Thus, on his initial journey 1, the user may turn on his telephone at home H and spend two minutes in cell C1 before leaving home along route 1. If he travels at average speed of 50 km per hour through cell C2 and cell C2 is of diameter of around 1 km, then he, on average, spends a little over one minute within cell C2 at, say, 8.15 am. Similar information can be derived for the whole of his day.

Referring to Figure 2, this information can be stored in a central database 20 which receives information, directly or indirectly, via the base stations 21 of each individual cell. By storing a users movements over an extended time period, then one or more historical patterns will become evident. The database 20 maybe stored in any convenient location, such as at the server which holds the home location register (HLR) of that network.

It is unfortunately not the case that all cells can always offer the same quality and grade of service to a user. In any cellular network, some of the cells may be able to provide greater service than others. This can be dependent upon the nature, efficiency and power of the base station in that cell and is also dependent upon the physical environment (ie whether the cell is in a built up area or other terrain which prevent obstacles to radio signals). The quality of service possible for each call is also dependent upon the number of users requiring service from that cell at any time. If only one or a few users require service, then each of them can receive the best possible quality of service. If, however, there are many users competing for resources, then the resources which can be allocated to each user will be lower in order to ensure that as many users as possible obtain some sort of service.

By generating historical patterns, for example the pattern illustrated by Figure 1, then, when a user seeks to request service from the network, the network can make an attempt to predict whether his movements are likely to fit in with a historical pattern. If the network believes that this is so, then it will have an idea of the pattern of use which the user is to take that day and, in particular, as to the pattern of cells through which he is to pass and the duration he is likely to spend in each one. Thus, when a user requests service by originating a call, if he is at home and is only to be there for two minutes before passing through cell C2 and onto cell C3, where he is to stay for a few hours, the network can allocate a grade of service to him which takes into account not only the service possible at the present time from cell C1 but also the service which he is likely to be able to receive from cell C2 and C3. If the projected quality of service from one of these cells is low, then the quality of service which may be accorded to him originally may be set slightly lower in order to ensure that there is no degradation of reduction in quality as he passes along his journey. Thus, the resources of the network can be more efficiently used. Clearly, there will be some instances where a user unexpectedly deviates from his normal routine but these do not significantly affect the efficiency of the present invention.

A typical user will commonly have more than one pattern of movement which he often repeats. It can therefore be desirable to store several sets of historical movement patterns so that at any particular time the system can select which of the historical patterns it considers a user is mostly likely to follow. For example, on two days a week a user may work at a particular workplace and on three days he may work at a different work place, necessitating a different journey to work and a different daily routine. By storing historical data for both of these circumstances and determining when a user requests service it is possible to recognise which of these routes he is likely to be taking, and the grade of service can be configured accordingly.

Figure 3 shows how raw "historical data" is collected and a store 30. This comprises data representative of the cells through which a user passes and the time and duration of his time of passing through that cell. From this, a number of identity patterns 31, 32, 33 can be ascertained. This is determined by analysing the raw history data over an extended period and attempting to determine patterns of use therefrom. This may be done by, for example, a processing means 34. This can be part of the overall processing capability of the network, such as its home location register, or may be a separate unit. Software can be used to determine patterns as is well known in the art. For example, fuzzy logic, neural networks or other systems or software concepts may be used. Although three patterns 31 to 33 are shown, in practice there may be many more patterns and the general box 35 is indicative of these.

When a user requests service, the network, as part of the service setting procedure, tries to determine whether the user's present location, and perhaps movement while setting up the call, seems to fit in with any of the previously determined historical patterns 31-33 with a good or reasonable degree of confidence. If so, then it allocates or configures the grade of service, or quality of service which can be offered, bearing in mind the limitations and resources of the cells which it believes the user will pass through when making a call. The required grade of service is established via one or more transmitters/receivers 37 in contact with a user's mobile station 38.

There may of course be some instances where a user's progress through his normal route is slower, or faster, than normal. This may be because of traffic conditions, weather conditions, or many other conditions. In preferred embodiments of the invention, further data, preferably real time data, is also accumulated, which data is relevant to the users progress through his usual routes.

Accordingly, Figure 3 also shows several sets of real time data which can be collected, such as traffic data 39, weather data 40, data relating to public holidays 41, etc. Traffic data may be obtained from services which are currently commercially available and which can be passed in real time to store 39. Weather data can be obtained from various sources or direct from weather sensors and detectors. Dates, public holidays and other similar information can be obtained from many different databases. The system processor 36, when it is allocating a grade of service, can therefore also study the relevant real time data such as traffic data.

So, if traffic data indicates that a particular route, eg route 8, is particularly congested and traffic is moving very slowly on this route, much slower than the user's average speed of 70 km per hour, then the system is able to make a better judgement as to the correct quality of service which can be allocated, since the user is likely to stay in cell C2 longer and, the likelihood is that more users will be requiring service in that particular cell than would normally be the case. Similarly, information about particularly bad weather which is currently occurring or is projected is useful, as is information about public holidays or any other information concerning civil or population movements. If, for example, a major public demonstration is to occur in a part of a town through which a user normally travels, then it is likely that that user will either be delayed upon his normal route, or will attempt to divert. Data indicative of local events, eg sports events, which may affect the user's movements may be monitored, in addition to, or as an alternative to, national events. Many other types of data, which may influence a user's behaviour or movements can be recorded or monitored and used to configure a grade of service for a user.

In some embodiments, only the real-time type data above may be necessary; the user's historical data may not be necessary, or may be impractical to record or use.

CLAIMS

1. A method for utilising resources of a mobile telecommunications network, comprising monitoring historical or environmental data associated with a mobile station, its users or environment and, at a time when service is required, configuring a grade of service offered to a user in accordance with said data.

2. A method as claimed in claim 1, comprising monitoring and recording a historical pattern of movement of a mobile station through a network and, at a time when service is required, determining whether said user's situation appears to be a match with said historical pattern and using said historical pattern to configure said grade of service which is offered.

3. A method as claimed in claim 2, comprising monitoring and determining a plurality of historical patterns for a single mobile station and, at a time when service is required, determining whether said user's situation is a match with one of these historical patterns and using said one historical pattern to configure said grade of service which is offered.

4. A method as claimed in claim 1, including monitoring and/or recording data associated with an environment in which said mobile station is used, which data is of a type which may affect a person's movements or behaviour, and using said data to configure said grade of service to be offered to said user.

5. A method as claimed in Claim 4, wherein movement- or behaviour-influencing data comprises real-time data.

6. A method as claimed in claim 4, wherein movement- or behaviour- influencing data comprises any one or more of: traffic data; weather data; data relating to movements of the population; holiday data; and data relating to particular events or circumstances which may affect movement of said user of said mobile station.

7. A method as claimed in claim 1, wherein at least part of said data represents a historical pattern of movement of a mobile station through a network, said network being a cellular telephone network, and wherein said data is used to determine probable cells in which said user is likely to require service, and an estimated time within each cell when it will require such service, and to offer a grade of service in accordance with said grade of service which is likely to be achievable from a pattern of cells said user is likely to travel through.

8. A mobile telecommunications system comprising; at least one mobile station requiring service; a network including a receiver and a transmitter for transmitting signals from and to the mobile station, to enable said at least one mobile station to communicate with third parties, means for determining historical or environmental data associated with said at least one mobile station, its users or environment and means for configuring, at a time when service is required, a grade of service to be accorded to said at least one mobile station in accordance with said monitored data.

9. A mobile telecommunications system as claimed in claim 8, including means for determining and recording a historical pattern of movement of a mobile station through the network and, at a time when service is required, determining whether a user's situation appears to be a match with said historical pattern; and means for using said matched historical pattern to configure said grade of service which is offered.

10. A mobile telecommunications systems as claimed in Claim 9, including means for determining and recording a plurality of alternative historical patterns of movement of a single mobile station through said network; means for determining a time when service is required, determining whether said user's situation appears to be a match with any one of said historical patterns; and means for using said determined historical pattern to configure said grade of service which is offered.

11. A mobile telecommunications system as claimed in claim 8, including a processor for processing data to determine one or more historical patterns of movement, and a memory for storing said one or more historical patterns.

12. A mobile telecommunications system as claimed in claim 8, the said network including means for monitoring data associated with an environment in which said mobile station is used or data likely to affect movements or behaviour of a user of said mobile station.

13. A mobile telecommunications system as claimed in claim 12, including a processor and a memory for determining and storing said movement or behaviour influencing data.

14. A mobile telecommunications system as claimed in claim 12, including a receiver for receiving any one or more of the following types of data: real time traffic data; weather data; national holiday data; data relating to population movement; data likely to directly influence a behaviour and/or movement of a user; and a processor for using said data to configure a grade of service which is offered to a mobile station when service is required.

15. A mobile telecommunications system as claimed in claim 8, including a processor for determining regions of said network in which said user is likely to require service, and means for configuring a grade of service in accordance with capabilities of said regions.

16. A mobile telecommunications system as claimed in claim 15, wherein said regions comprise cells of a cellular telephone network.

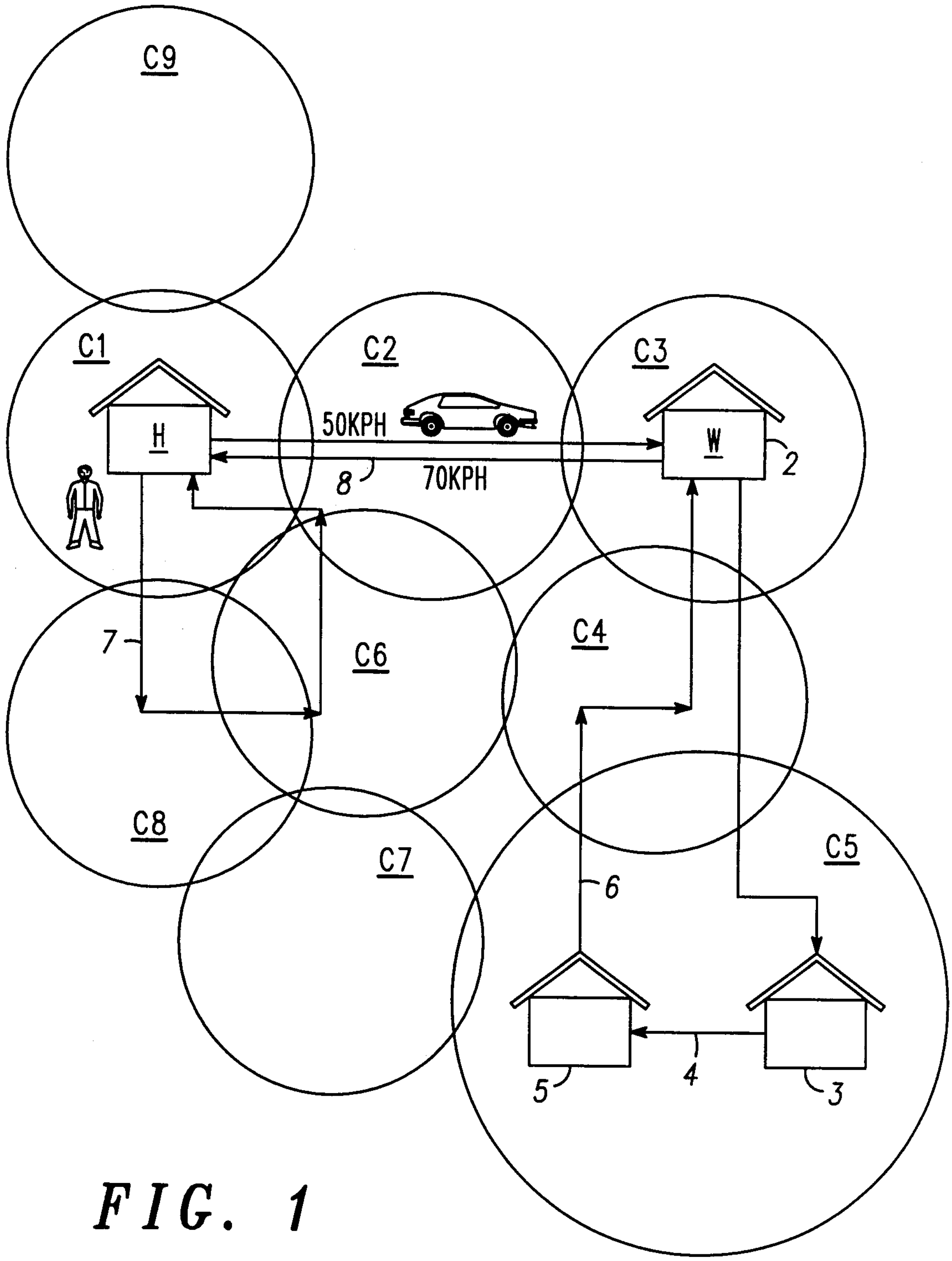

FIG. 1

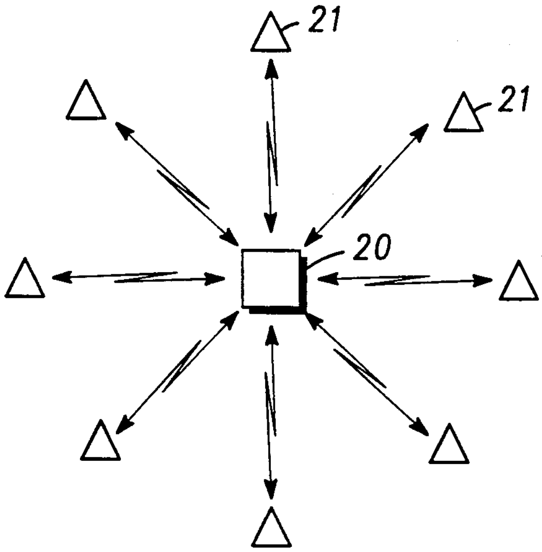
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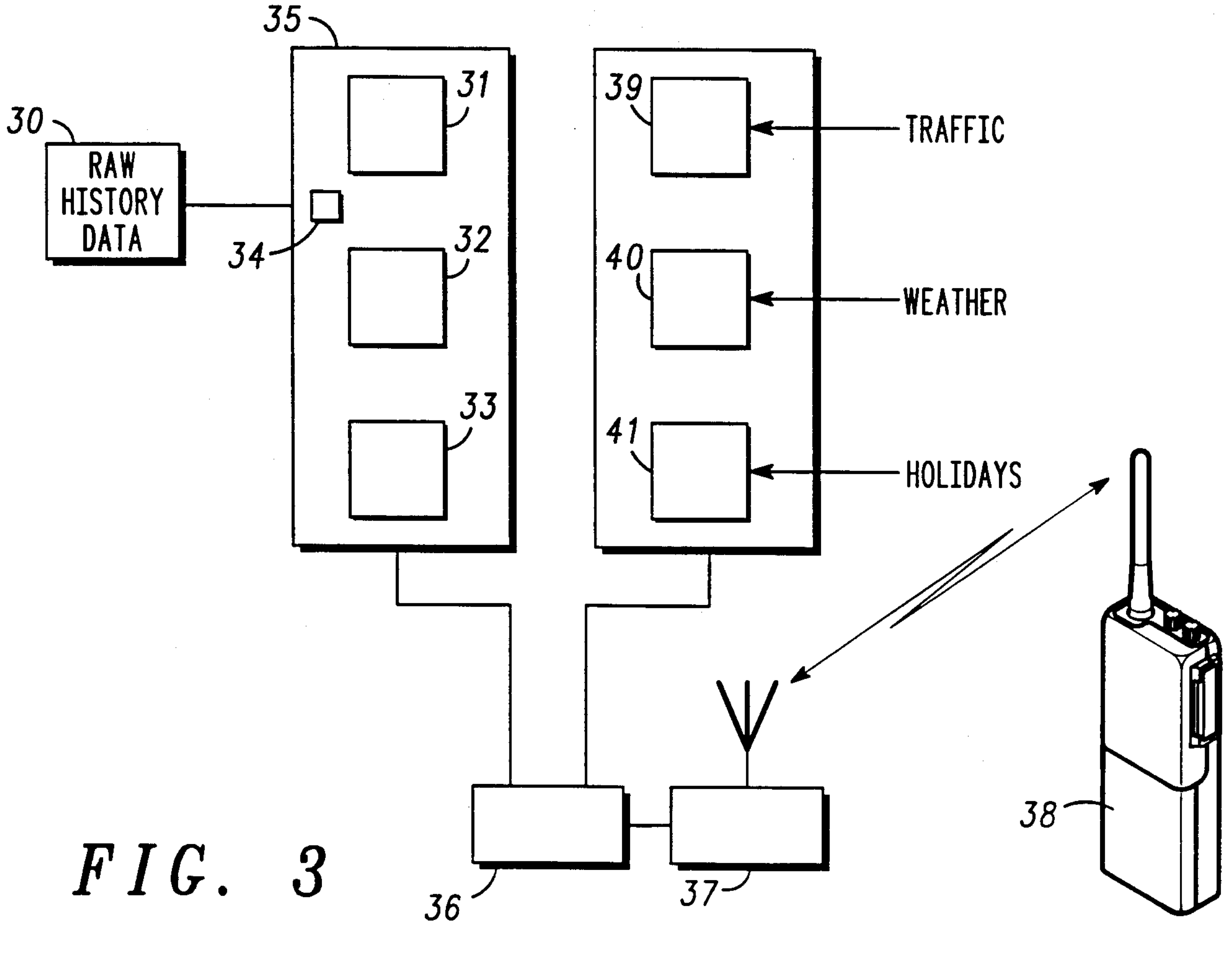
FIG. 2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RAW HISTORY DATA
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TRAFFIC
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WEATHER
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HOLIDAYS
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36
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FIG. 3