Title: A SIGN FOR INDICATING SPACE AVAILABILITY INFORMATION

Abstract: A sign for indicating availability of space in a zone, comprising an availability indicator which indicates a level of space availability in the zone and a receiver which receives data relating to availability for display by the availability indicator and wherein the availability indicator upon receipt of new data relating to space availability from the receiver indicates a new level of availability of space in the zone.
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.
A SIGN FOR INDICATING SPACE AVAILABILITY INFORMATION

Field of the Invention

The present invention relates to signs and in particular signs which are active in the respect they provide information which changes.

In a particular application the invention relates to signage used for providing parking availability information.

Background of the Invention

Typical car parks fall into either a managed or unmanaged category. In a managed car park, available car parking spaces are monitored and new vehicles are only allowed into the car park while spaces exist.

In contrast in the unmanaged car parks, for example in some shopping centres, it is up to the vehicle driver to find a car space even if no spaces are immediately available.

Studies have shown that the average distance travelled to find a car park can be reduced by up to 30% through the introduction of a parking guidance system. The consequential benefits from this reduction in circulating traffic include:

(a) reduced atmospheric and noise pollution;

(b) improved road safety; and

(c) lower fuel consumption.

In addition to the above participating car parks benefit through increased use of their facilities. Studies have shown that guidance systems can increase car park occupancies by 15%. Customer satisfaction as a whole improves, providing a high rate of repeat business.

Furthermore motorists benefit through a reduction in time to find a suitable parking space.

The present invention provides an alternative type of system for controlling parking availability and includes a novel sign for indicating parking availability.

Summary of the Invention
According to a first aspect of the present invention there is provided a sign for indicating availability of space in a zone, comprising an availability indicator which indicates a level of space availability in the zone and a receiver which receives data relating to availability for display by the availability indicator and wherein the availability indicator upon receipt of new data relating to space availability from the receiver indicates a new level of availability of space in the zone.

It is preferred that the sign indicates a level of availability for space in a parking zone.

The zone preferably includes a car park, area, building, road, space inside a building etc.

Although in its preferred form the sign relates to car parking space, the invention is equally applicable to indicating traffic congestion on a road or seating space available in a sporting or entertainment stadium.

The receiver preferably periodically receives new parking data.

The availability indicator may periodically show a new level of availability.

Preferably the availability indicator is periodically updated by data being parking data received by the receiver.

The availability indicator may comprise a gauge or bar indicator with the height of the bar indicating the level of parking availability.

It is preferred that the availability indicator indicates a level of vacant space and at the same time a level of occupied space.

The availability indicator preferably shows a comparison of vacant space to occupied space.

According to one embodiment the availability indicator shows only the level of occupied space in the zone.

According to another embodiment of the invention
the availability indicator includes a flashing display when the level of availability falls below a predetermined threshold value.

According to another embodiment the availability indicator displays a third colour when availability of space falls below the predetermined threshold value.

According to a further embodiment the availability indicator comprises a display which flashes at a predetermined rate to represent an indication of the level of traffic congestion from the sign to the zone.

According to another aspect of the present invention the availability indicator includes an indicator means to indicate if the level of availability is increasing or decreasing.

The indicator means may comprise any one of an arrow facing up or down, flashing of the display or a colour indication.

Alternatively the availability indicator may be in the form of a pointer which is able to move between different zones indicating different levels of availability.

Preferably the bar indicator comprises at least one colour representing the availability level of parking spaces.

Preferably the bar indicator comprises at least one colour representing the occupancy level of the parking area.

The bar indicator may comprise two colours, a first colour indicating a level/percentage of availability of parking spaces and a second colour indicating a level/percentage of occupancy of car spaces.

The first colour may be green and the second colour may be red.

The bar indicator may be of a first colour when parking availability is 100% and may be of the second colour if the parking availability is 0%.

It is preferred that the bar indicator fills in
with the second colour from bottom to top like a filling
glass as availability drops.

According to one embodiment of the invention the
availability indicator may present data in the form of a
lack of availability of spaces in the parking area.
The bar indicator may comprise a light emitting
portion.

According to another embodiment of the invention
the bar indicator includes a further colour such as
yellow, which indicates the level of reserved car spaces.
The bar indicator may comprise a plurality of
light emitting devices.
Preferably the bar indicator comprises a
rectangular bar of pixels.
The pixels may comprise different coloured LED’s.
The pixels may be arranged in an array.
Preferably the array comprises columns of pixels
of the first colour and second colour.
The columns of pixels of the first colour may be
arranged in alternate columns with pixels of the second
colour.
The array may comprise a plurality of rows, with
each row comprising alternating pixels of the first and
second colour.
According to one embodiment the array includes
pixels of another colour in spaces between the columns and
rows of pixels of first and second colour.
According to an alternative embodiment pixels are
arranged in alternative configurations of rows and columns
to that described above.
Preferably pixels have substantially the same
size.
Alternatively pixels of the first and second
colour are of one size and pixels of another colour are of
a different size.

It is preferred that parking availability is
calculated based on a plurality of parameters including
one or more of:

(1) the percentage of used car spaces;
(2) the capacity of the car park;
(3) the number of casual parking spaces;
(4) the number of reserved parking spaces; and
(5) the fill rate of the car park which is determined from the number of parking spaces being occupied per period of time.

According to one embodiment the sign includes a display module which activates the pixels according to data received from the receiver.

The sign may include light sensors for sensing ambient light levels in front of and/or behind the sign.

According to one embodiment the sign includes a plurality of availability indicators, each availability indicator providing an indication of parking availability for a different parking area.

According to a further embodiment of the present invention the sign includes directional data to one or more parking areas.

Preferably each parking area is identified.

According to another aspect of the present invention there is provided a system for displaying a level of availability of spaces in a zone, comprising a plurality of sensors including at least one item entry detector and at least one item exit detector, a control centre which receives data from the sensors and calculates the availability level of spaces in the area and outputs a vacancy update signal and a plurality of signs each including an availability indicator which indicates the level of availability of spaces in the area whenever a vacancy update signal is received from the control centre.

Preferably items include vehicles, persons, articles.

It is preferred that the system relates to the display of parking availability in a parking area.

Preferably the system relates to parking
availability or road congestion, stadium occupancy, hotel occupancy etc.

The control centre may include a processing module which calculates availability/vacancy from the number of vehicles detected to have entered and exited the parking area.

A module preferably includes software and/or hardware.

The processing module may include a fill rate calculation module which calculates the number of spaces being occupied per predetermined time period.

The processing module preferably uses the fill rate calculation module to forecast the fill rate at a predetermined future time.

The processing module may combine data relating to current availability of space with the forecast fill rate at a first future time and produce a forecast availability level for the first future time.

The processing module preferably outputs the forecast availability level at the first future time to at least one sign.

Preferably the first future time is dependent on the expected travel time from the one sign to the parking area.

The sign preferably shows the expected travel time to the parking area.

Preferably the sign shows the first future time.

The fill rate calculation module preferably forecasts the fill rate at the first future time based on the fill rate measured over a previous period of time.

The system may include a field processor which receives availability data for each sign from the central control and transmits availability data to each sign.

It should be understood that where reference is made to a sign having an availability indicator, any sign incorporating an indication of lack of availability is encompassed by such an availability indicator.
Preferred embodiments of the present invention will now be described by way of example only with reference to the accompanying drawings in which:

**Brief Description of the Drawings**

Figure 1 shows status by indicators according to a first embodiment of the present invention.

Figure 2 shows a sign according to a first embodiment of the present invention.

Figure 3 shows a sign according to a second embodiment of the present invention.

Figure 4 shows a schematic diagram of a parking guidance system according to a preferred embodiment of the present invention.

Figure 5 shows a light emitting device array for a status bar indicator according to a first embodiment of the present invention.

Figure 6 shows the status bar shown in Figure 5 in a first mode of operation.

Figure 7 shows a light emitting device array for a status bar indicator according to a second embodiment of the present invention.

**Detailed Description of the Drawings**

The preferred embodiment of the invention utilises the idea of a sign with a "barometer" or gauge to indicate the level of occupancy of a car park. The barometer is provided in the form of a status bar as shown in Figure 1. The status bar is a gauge symbol formed using light emitting diodes or similar technology.

Item 11 shows the status bar completely green and therefore indicating the car park has all spaces available.

Item 12 shows the lower half 15 of the status bar as being red and the upper half 16 as being green. This indicates that the car park has the percentage of spaces available indicated by green. The ratio of the green to red is the ratio of available spaces to used spaces.

Item 13 shows the lower half of the status bar 15
as red and the upper half 17 as yellow. This indicates that the car park has only reserved spaces available. The ratio of the yellow to red is the ratio of reserved spaces to used spaces.

Item 14 indicates the status bar is completely red and therefore that the car park has no spaces available and is full.

Figure 2 shows a status bar 18 and 19 respectively indicating parking availability for different car parks. The first being a convention centre and the second being parklands. The letter P is located next to the status bar indicator 18, 19 to indicate that the status bar relates to parking.

The size of the status bar is determined by the size of the square or rectangle containing the capital P symbol.

If conventional 5mm high intensity LED's are used in the status bar, a number of layouts are possible. Each of these layouts has advantages and disadvantages in terms of appearance and cost.

Figure 5 shows an example of vertical columns of alternating colours of red 20 and green 21.

Figure 6 shows how the status bar would appear when displaying a 60% full indication for a car park. Thus as shown the upper 40% of the status bar 22 shows five parallel columns of green LED's. The lower 60% of the status bar shows five vertical columns of red LED's 23.

Although the array of LED's is the same as that shown in Figure 5 the red LED's in the upper 40% of the status bar and the green LED's in the lower 60% of the status bar are not illuminated and therefore would not appear to an observer driving a vehicle.

The disadvantage of the array shown in Figures 5 and 6 is that the green LED's illuminated and the red LED's illuminated do not line up and therefore may appear as being slightly offset with respect to each other.
An alternative arrangement which solves this problem is a pattern of LED's as shown in Figure 7. In this embodiment of the invention parallel rows of LED's 24 are provided and in each row LED's alternate between red 25 and green 26. Thus when an upper 40% of green LED's are illuminated LED's in the first and last columns are perfectly aligned with red LED's in the lower 60% of the bar indicator.

Another advantage of the embodiment shown in Figure 7 is that it enables yellow LED's 27 to be positioned in spaces between successive rows of red and green LED's. The yellow LED's can then be illuminated to indicate the percentage of reserved spaces available.

As an alternative it is possible to simulate yellow by illuminating both red and green in the appropriate section of the bar.

In addition to the above LED configurations, other configurations are contemplated in which alternating rows of red and green LED's are provided, as well as alternating diagonally aligned red and green LED's.

The number of LED's used in a status bar indicator can also be varied by changing the size of the LED.

According to one embodiment smaller yellow LED's may be used in combination with one of the arrays of red and green LED's.

Figure 4 shows an example of a parking guidance system for a car park having three external parking status indicator signs.

A central control 30 is connected by cabling or a wireless communication system to exit/entry detectors 31, 32, 33 which are positioned at different entrances to a car park. The central control 30 is connected to three signs 34, 35, 36.

Sign 34 is represented by an enlarged box which shows a field processor 37 inside which is connected by cabling to three status bar indicators 38, 39, 40.
It is preferred that each sign has a local microprocessor which interprets serial messages received by the receiver and activates a selection of red or green LED's according to the percentage of selection.

According to one embodiment the proportion of red-green LED's is set by the operator according to a manual interpretation of the available space. The state requirement is transferred as a serial data message from the controller which has a control program located in a remote PC to the display module. The display module microprocessor interprets the serial message and activates a selection of red LED's according to the percentage of selection. Selection increments are preferably in four percent steps from 0% to 100% (full) capacity. The display control module may also include two LDR's for sensing the ambient level behind the sign and in front of the sign. The control module may also have provision for sensing the temperature within the housing. An optional fan may be fitted if excessive heat is detected. The display module will adjust according to ambient light conditions with maximum light output occurring under circumstances of maximum ambience light. Accordingly the display control module includes a dimmer control so as to control the amount of light which is emitted from the LED's.

In operation the central control 30 periodically receives data from the detectors 31, 32, 33 regarding any vehicles which have entered or exited the car park. This data is collated to provide a count of the number of available car spaces in the car park. This information is then transmitted to the field processor 37 for each of the signs 34, 35, 36. The field processor than transmits this information to each status bar 38, 39, 40 which then illuminates its LED's to provide a portion of green to red LED's which matches the proportion of available car spaces to filled car spaces.

The different status bar indicators 38, 39, 40
would typically refer to different parking areas. Thus as an example referring to Figure 3 sign 34 would show an indication of the availability of car parks in a cultural centre, parklands and convention centre respectively.

Thus as shown in Figure 3 the status bar 38, 39, 40 shows different availability levels.

In addition to the above the sign 34 shown in Figure 3 also includes a graphical representation of the direction of each of the car parks through lines 41, 42, 43.

The embodiment described with reference to Figures 4 and 3 represents a simplified system where each status bar indicates parking availability at a particular time. However each status bar can also be used to indicate an expected level of availability at a car park by the time a vehicle has travelled from the sign to the entrance of the car park. In such a situation the central control utilises software with a predictive algorithm to determine a prediction for the level of parking availability for a particular time in the future. Thus if a sign is located 5 minutes away from the entrance of a car park the predictive algorithm would determine the expected level of availability of car spaces five minutes in the future and this would be displayed by the status bar for the sign which is five minutes away.

In a typical scenario for an external managed car park the predicted casual spaces available (PCA) and predicted pre-paid/permanent spaces (PPA) would be given by the formula:

\[
PCA = CA - (CFR \times TT) \text{ and } PPA = PA - (PFR \times TT)
\]

where:  
CA = Car Park . Casual Spaces Available;  
CFR = Car Park . Casual Fill Rate;  
PA = Car Park . Pre/Perm Spaces Available  
PFR = Car Park . Pre/Perm Fill Rate  
TT = Travel Time
For an internal managed car park the predicted casual spaces available (PCA) would be given using the formula:

\[ \text{PCA} = \text{CPC} - \text{SU} - (\text{CFR} \times \text{TT}) \]

where:
- CPC = Car Park IntManaged Capacity\cdot Car Park IntManaged Capacity Adjustment
- SU = Car Park IntManaged Spaces Used
- CFR = Car Park Casual Fill Rate
- TT = Travel Time

Filling rates (CFR) can be estimated by determining the minute fill rate (R) for the last minute based on current and last minute number of spaces available. Thus R is given by the spaces available for the last minute minus spaces available for the current time.

The fill rate is calculated using an exponential smoothing of R calculated for the current minute and R calculated for the previous minute.

When the fill rate has been calculated for the previous minute then the fill rate is given by:

\[ \text{Fill Rate} = ((1 - \theta) \times R) + (\theta \times \text{Fill Rate}) \]

Otherwise
\[ \text{Fill Rate} = R \]

where: \( (1 - \theta) \) = Parking Guidance Parameters \cdot Smoothing Constant

A good default for \( \theta \) would be 0.40 - this value means that the fill rate is based on the last five minutes of operation. For other suggested values of \((1-\theta)\) refer to Table 1 on page 14.

The Smoothing Constant determines the degree of smoothing that is applied to the Car Park \cdot Fill Rate. Smoothing is used to reduce the variation in the raw data.
The smoothing constants must be greater than 0 and less than or equal to 1. For a given measurement, the smoothed value is defined recursively as follows:

\[ S_0 = X_0 \]
\[ S_t = (1 - \theta) \times X_t + \theta \times S_{t-1}; \quad t \geq 1 \]

where:
- \( S_t \) is the smoothest measurement at time \( t \).
- \( (1 - \theta) \) is the smoothing constant.
- \( X_t \) is the raw measurement at time \( t \).

It can be seen from the above equation that the smaller the value of the smoothing constant, the greater the degree of smoothing, and that a smoothing constant of 1 results in no smoothing at all.

Although the smoothing constant can theoretically take any value in the interval \([0,1]\), it has been restricted here to a number of preset values. This allows the operators to select the required degree of smoothing from the descriptions without needing to know the numerical value to assign to the smoothing constant.

The following table shows suggested values of the smoothing constant, along with the number of minutes of history each smoothing constant represents. The contribution of historical values older than the specified number of minutes is negligible.
Table 1

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<tr>
<th>Degree of Smoothing</th>
<th>Smoothing Constant</th>
<th>Minutes</th>
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<tbody>
<tr>
<td>None</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Low</td>
<td>0.40</td>
<td>5</td>
</tr>
<tr>
<td>Medium</td>
<td>0.27</td>
<td>15</td>
</tr>
<tr>
<td>High</td>
<td>0.14</td>
<td>30</td>
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</tbody>
</table>

Domain: Real Number, where 0 < Smoothing Constant <= 1
Default: 0.40
Role: Installation and Maintenance

Instead of having fixed travel times set for travelling from a parking sign to a car park entrance, the software may also utilise traffic congestion algorithms to periodically store data relating to traffic congestion levels for each road from a parking sign to an associated entrance. The traffic congestion level can then be reduced to a travel time which is then incorporated in the predicted algorithm for determining the predicted level of parking spaces available for the travel time required to travel from a parking sign to the entrance of a car park.

According to one embodiment of the present invention it is preferred that the height of a status bar indicator such as 18 and 19 in Figure 2 directly translates to the percentage of the capacity of the car park that is used. Therefore central control determines the height of the used spaces indicator (percentage of use spaces) based on the percentage of used spaces being equal to the used spaces divided by capacity of the car park.

The controlling software sets the colour of used spaces to red and unused spaces to green. Accordingly red and green signals are sent to the display signs and the local microprocessor interprets these signals and lights up the applicable percentage of red and green LED's.

It is preferred that the central controller
includes a data processor with a screen which displays a bar style indicator for each of the signs which are controlled.

It is to be understood that, if any prior art publication is referred to herein, such reference does not constitute an admission that the publication forms a part of the common general knowledge in the art, in Australia or in any other country.

In the claims which follow and in the preceding description of the invention, except where the context requires otherwise due to express language or necessary implication, the word "comprise" or variations such as "comprises" or "comprising" is used in an inclusive sense, i.e. to specify the presence of the stated features but not to preclude the presence or addition of further features in various embodiments of the invention.
Claims

1. A sign for indicating availability of space in a zone, comprising an availability indicator which indicates a level of space availability in the zoned and a receiver which receives data relating to availability for display by the availability indicator and wherein the availability indicator upon receipt of new data relating to space availability from the receiver indicates a new level of availability of space in the zone.

2. The sign as claimed in claim 1 wherein the availability indicator indicates a level of parking space availability in a parking zone.

3. The sign as claimed in claim 1 or 2 wherein the availability indicator comprises a gauge with the height of the gauge indicating the level of space availability.

4. The sign as claimed in claim 1 wherein the availability indicator indicates a level of vacant space and at the same time indicates a level of occupied space.

5. The sign as claimed in claim 1 wherein the availability indicator shows a comparison of vacant space to occupied space.

6. The sign as claimed in claim 5 wherein the availability indicator includes a portion which emits light of a first colour to represent vacant space and a second portion which emits light of a second colour to represent occupied space.

7. The sign as claimed in claim 1 wherein the availability indicator includes a dynamic portion which represents a level of occupied space in the zone.

8. The sign as claimed in claim 1 wherein the availability indicator includes a flashing display wherein the level of availability falls below a predetermined threshold value.

9. The sign as claimed in claim 1 wherein the availability indicator displays a first colour to represent a level of vacant space, a second colour to
represent a level of occupied space and a third colour when availability of space falls below a predetermined threshold value.

10. The sign as claimed in claim 1 wherein the availability indicator comprises a display which flashes at a predetermined rate to represent an indication of the level of traffic congestion from the sign to the zone.

11. The sign as claimed in claim 1 wherein the availability indicator includes an indicator means to indicate if the level of availability is increasing or decreasing.

12. The sign as claimed in claim 1 wherein the availability indicator comprises a pointer which is configured to move between different zones indicating different levels of availability.

13. The sign as claimed in claim 1 comprising a plurality of light emitting portions, which are able to emit light of at least two different colours.

14. The sign as claimed in claim 13 wherein the light emitters are arranged in an upright rectangular shape.

15. The sign as claimed in claim 14 wherein the light emitting portions comprise light emitting devices.

16. The sign as claimed in claim 13 wherein the light emitting portions are configured in a column defining an array of pixels.

17. The sign as claimed in claim 16 wherein the availability indicator comprises an array of pixels comprising rows and columns.

18. The sign as claimed in claim 17 wherein the array comprises a plurality of rows with each row comprising alternating pixels of the first and second colour.

19. The sign as claimed in claim 18 wherein the array includes pixels of another colour in spaces between columns and rows of pixels of the first and second colour.

20. The sign as claimed in claim 13 including a
microprocessor for receiving parking availability data
from the receiver and controlling the light emitting
portions to emit light of a first and second colour in
accordance with the portion of available and unavailable
space in the zone.

21. The sign as claimed in claim 20 including a
plurality of availability indicators, each for indicating
space availability for a different zone.

22. The sign as claimed in claim 21 including
light sensors for sensing ambient light levels in front of
and/or behind the sign.

23. The sign as claimed in claim 1 including a
directional indicator for indicating direction to one or
more zones with available space.

24. The sign as claimed in claim 1 wherein the
availability indicator indicates a predicted level of
availability of space in a zone having regard to the
expected travel time from the sign to the zone.

25. A system for displaying a level of
availability of spaces in a zone, comprising a level of
availability of spaces in a zone, comprising a plurality
of sensors including at least one item entry detector and
at least one item exit detector, a control centre which
receives data from the sensors and calculates the
availability level of spaces in the area and outputs a
vacancy update signal and a plurality of signs each
including an availability indicator which indicates the
level of availability of spaces in the area whenever a
vacancy update signal is received from the control centre.

26. The system as claimed in claim 25 wherein
the control centre includes a processing module which
calculates availability of space from the number of
vehicles detected to have entered and exited the area.

27. The system as claimed in claim 26 wherein
the processing module includes a fill rate calculation
module which calculates the number of spaces being
occupied per predetermined time period.
28. The system as claimed in claim 27 wherein the processing module uses the fill rate calculation module to forecast the fill rate at a predetermined future time.

29. The system as claimed in claim 28 wherein the processing module combines data relating to current availability of space with the forecast fill rate at a first future time and produces a forecast availability level for the first future time.

30. The system as claimed in claim 29 wherein the processing module outputs the forecast availability level at the first future time to at least one sign.

31. The system as claimed in claim 30 wherein the first future time is dependent upon the expected travel time from the one sign to the parking area.

32. The system as claimed in claim 31 wherein the sign shows the expected travel time to the area.

33. The system as claimed in claim 25 wherein the availability level indicator comprises a bar indicator formed from a plurality of light emitting portions which emit light of at least two different colours.

34. The system as claimed in claim 32 wherein the sign shows the first future time.

35. The system as claimed in claim 30 wherein the fill rate calculation module forecasts the fill rate at the first future time based on the fill rate measured over a previous period of time.

36. The system as claimed in claim 35 including a field processor which receives availability data for each sign from the central control and transmits availability data to each sign.

37. The system substantially as hereinbefore described with reference to the accompanying drawings.

38. A sign substantially as hereinbefore described with reference to the accompanying drawings.
Dated this 9th day of February 2006

INTELLIGENT TRANSPORT SYSTEMS QUEENSLAND

By their Patent Attorneys

GRIFFITH HACK

5 Fellows Institute of Patent and
Trade Mark Attorneys of Australia
Figure 1

Gauge Indication

11
16
12
15
17
13
15
14
Figure 2

P  Convention Centre
18

P  Parklands
19
Figure 5
# INTERNATIONAL SEARCH REPORT

**INTERNATIONAL SEARCH REPORT**

**International application No.**  
PCT/AU2006/000178

## A. CLASSIFICATION OF SUBJECT MATTER

**Int. Cl.**  
G08G 1/065 (2006.01)

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

## B. MINIMUM DOCUMENTS 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 database consulted during the international search (name of database and, where practicable, search terms used)**  
dwp (availability, empty, unoccupied, space, zone, park, sign, display, indication, receive, data, signal, management)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<td>US 6771185 B1 (YOO et al) 3 August 2004 Column 3, line 64 - column 4, line 19</td>
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* Further documents are listed in the continuation of Box C

**See patent family annex**

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<td>document which may throw doubts on priority claim(s)</td>
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<tr>
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<td>document referring to an oral disclosure, use, exhibition or other means</td>
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<tr>
<td>&quot;P&quot;</td>
<td>document published prior to the international filing date but later than the priority date claimed</td>
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| "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 |
| "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 |
| "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 |
| "&" | document member of the same patent family |

**Date of the actual completion of the international search**  
10 March 2006

**Date of mailing of the international search report**  
23 MAR 2006

**Name and mailing address of the ISA/AU**  
AUSTRALIAN PATENT OFFICE  
PO BOX 200, WODEN ACT 2606, AUSTRALIA  
E-mail address: pct@ipaustralia.gov.au  
Facsimile No. (02) 6285 3929

**Authorized officer**  
J. LAW  
Telephone No : (02) 6283 2179

Form PCT/ISA/210 (second sheet) (April 2005)
# INTERNATIONAL SEARCH REPORT

**C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT**

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Form PCT/ISA/210 (continuation of second sheet) (April 2005)
This Annex lists the known "A" publication level 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.

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Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

END OF ANNEX