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(54) **TRAFFIC INFORMATION GATHERING VIA CELLULAR PHONE NETWORKS FOR INTELLIGENT TRANSPORTATION SYSTEMS**

(57) **ABSTRACT**

Location information obtained and continuously updated from vehicular-based cellular phones is collected, processed and used as a basis for input to Intelligent Transportation Systems, in particular to Real Time Urban Traffic Guidance for Vehicular Congestion and Intelligent Traffic Control Systems. Location information that forms the basis of the present invention is obtainable from wireless location systems such as GSM in Europe, CDMA in the USA, or PDC in Japan, and depends on supporting technologies, which are in the process of perpetual improvement. Relying on cellular networks location system capabilities to provide moderately reliable position information, the records of vehicle phones coordinates, timing, etc., are collected, updated and stored in the Traffic Service Center database. Those records together with digital maps are fed into mathematical models and algorithms that construct lists of vehicles traveling on various road sections, traffic loads at particular road sections, real time travel times along all road sections resulting from traffic congestion in particular areas, turning loads for signal intersections, and other key parameters necessary for real time functioning of Intelligent Transportation Systems, in particular of Intelligent Traffic Control Systems, Route Guidance Systems, etc.

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**Traffic Information Gathering System via Cellular Networks for Automated Traffic Signal Control**

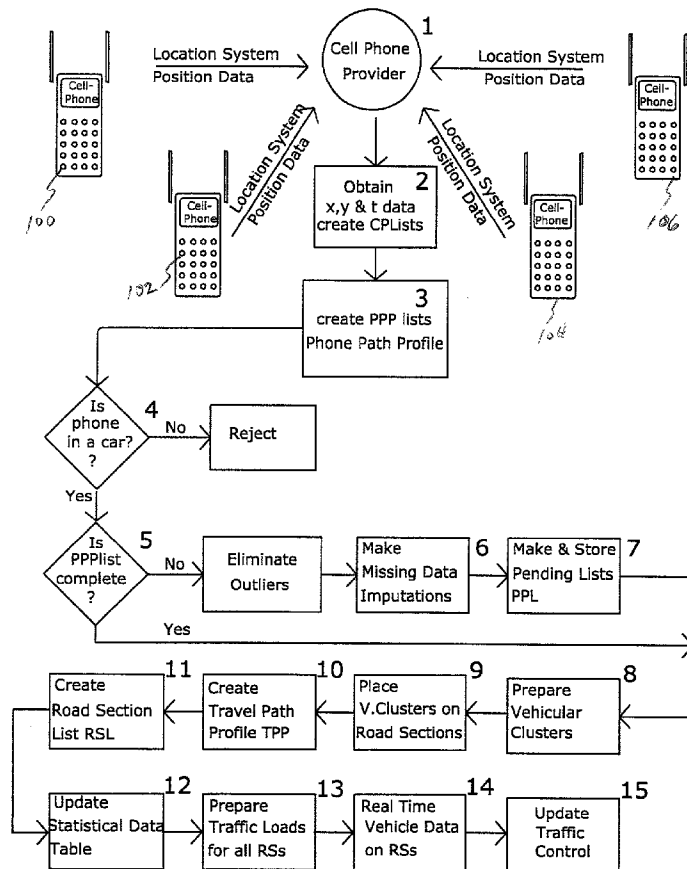


Fig. 1 Traffic Information Gathering System via Cellular Networks for Automated Traffic Signal Control

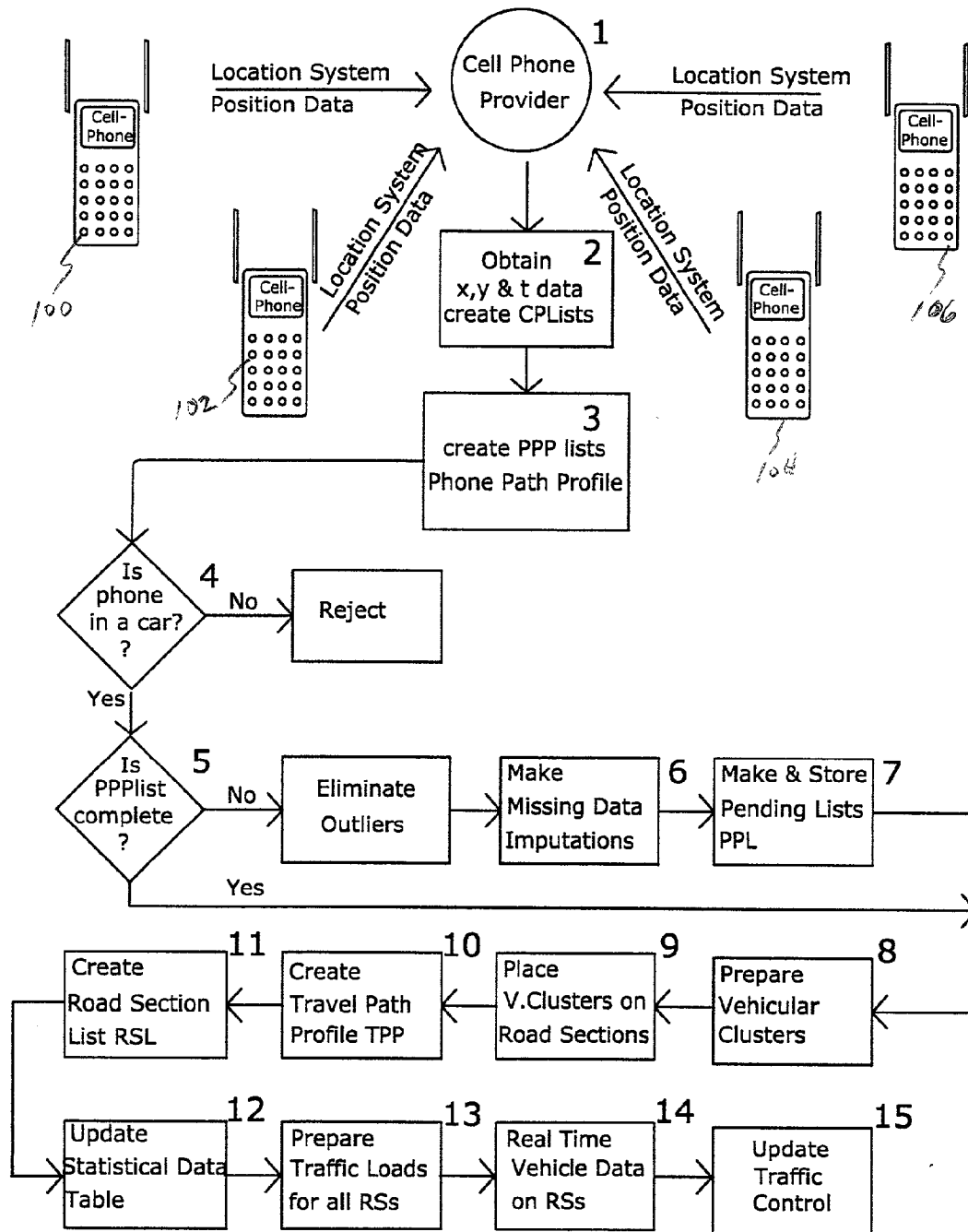


Fig. 2 Creating Current Cell Phone List

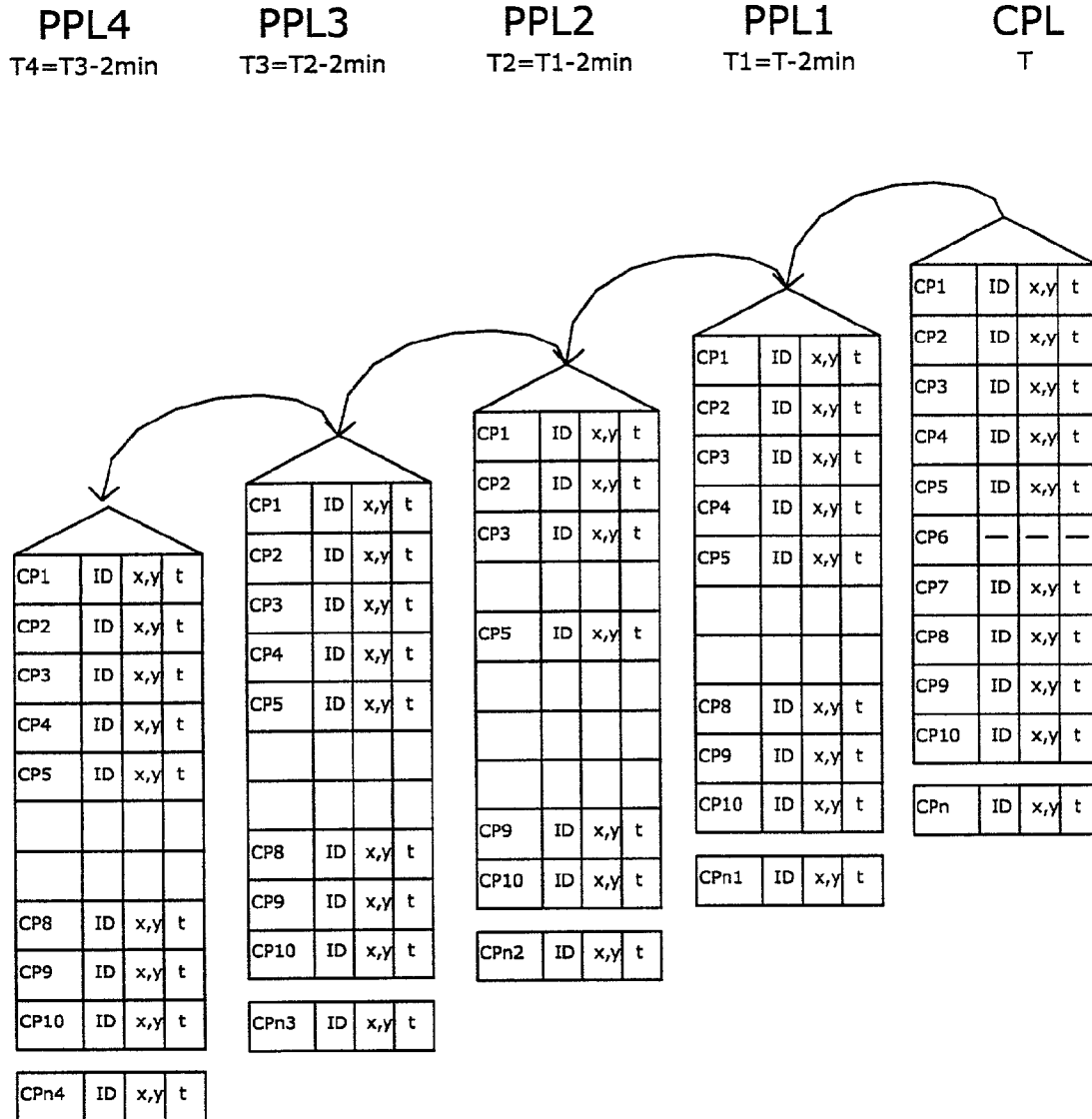


Fig. 3 Creating Cell Phone Path Profile List

PPP Table:

| Active Cell Phones | Time Interval         |                       |                       |                       |                       |       | T5<br>PEPL            |
|--------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-------|-----------------------|
|                    | T                     | T1                    | T2                    | T3                    | T4                    | SCORE |                       |
|                    | P                     | P1                    | P2                    | P3                    | P4                    |       |                       |
|                    |                       |                       |                       |                       |                       |       |                       |
| CP1                | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | ∅     | <input type="radio"/> |
| CP2                | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | ∅     | <input type="radio"/> |
| CP3                | <input type="radio"/> | <input type="radio"/> |                       | <input type="radio"/> | <input type="radio"/> | -1    | <input type="radio"/> |
| CP4                | <input type="radio"/> | <input type="radio"/> |                       | <input type="radio"/> | <input type="radio"/> | -1    | <input type="radio"/> |
| CP5                | <input type="radio"/> |                       | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | -1    | <input type="radio"/> |
| CP6                | <input type="radio"/> |                       |                       |                       |                       | -4    |                       |
| CP7                | <input type="radio"/> |                       |                       | <input type="radio"/> | <input type="radio"/> | -2    | <input type="radio"/> |
| CP8                |                       | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | -1    | <input type="radio"/> |
| CP9                |                       | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |                       | -2    | <input type="radio"/> |
| CP10               | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |                       | <input type="radio"/> | -1    | <input type="radio"/> |
| CPn                | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | ∅     | <input type="radio"/> |

PEPL Table:

| Active Cell Phones | Time Interval         |                       |                       |                       |                       |                       |       |
|--------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-------|
|                    | T                     | T1                    | T2                    | T3                    | T4                    | T5                    | SCORE |
|                    | P                     | P1                    | P2                    | P3                    | P4                    | P5                    |       |
|                    |                       |                       |                       |                       |                       |                       |       |
| CP1                | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | ∅     |
| CP2                | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | ∅     |
| CP3                | <input type="radio"/> | <input type="radio"/> |                       | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | ∅     |
| CP4                | <input type="radio"/> | <input type="radio"/> |                       | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | ∅     |
| CP5                | <input type="radio"/> |                       | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |                       | ∅     |
| CP6                | <input type="radio"/> |                       |                       |                       |                       |                       | —     |
| CP7                | <input type="radio"/> |                       |                       | <input type="radio"/> | <input type="radio"/> |                       | —     |
| CP8                | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |                       | ∅     |
| CP9                | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |                       | ∅     |
| CP10               | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |                       | <input type="radio"/> | <input type="radio"/> | ∅     |
| CPm                | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | ∅     |

Fig. 4  
Initial Discrimination Between Phones In Vehicles  
And Other Phones

|    | Vehicle Positions |    |    |    | Speeds |    |    |
|----|-------------------|----|----|----|--------|----|----|
|    | p1                | p2 | p3 | p4 | v2     | v3 | v4 |
| 1  |                   |    | LR | LR |        |    |    |
| 2  |                   | LR |    | LR |        |    |    |
| 3  | LR                |    |    | LR |        |    |    |
| 4  |                   | LR | LR |    |        |    |    |
| 5  | LR                |    | LR |    |        |    |    |
| 6  | LR                | LR |    |    |        |    |    |
| 7  |                   |    |    | LR |        |    | >  |
| 8  |                   |    | LR |    |        |    | >  |
| 9  |                   |    | LR |    |        | >  |    |
| 10 |                   | LR |    |    |        | >  |    |
| 11 |                   | LR |    |    | >      |    |    |
| 12 | LR                |    |    |    | >      |    |    |
| 13 |                   | SR | SR | SR |        | >  | >  |
| 14 | SR                | SR | SR |    | >      | >  |    |

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