

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

UBER TECHNOLOGIES, INC. and UBER FREIGHT US LLC,
Petitioners

v.

CARMA TECHNOLOGY LTD.,
Patent Owner

Patent No. 7,840,427

DECLARATION OF PETROS IOANNOU, PH.D.

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I, Petros Ioannou, declare as follows:

I. INTRODUCTION

1. I have been retained by counsel for Uber Technologies, Inc. and Uber Freight US LLC (“Petitioners”) as an independent expert consultant in this proceeding before the United States Patent and Trademark Office (“PTO”) regarding U.S. Patent No. 7,840,427, (“the ’427 patent”) (EX1001). I have been asked to consider whether certain references alone or in combination disclose or suggest the limitations recited in claims 1-5, 11-12, and 15 (“the challenged claims”) of the ’427 patent. My opinions are set forth below.

2. I am being compensated at my rate of \$500 per hour for the time I spend on this matter. My compensation is in no way contingent on the nature of my findings, the presentation of my findings in testimony, or the outcome of this or any other proceeding. I have no other interest in this proceeding.

II. QUALIFICATIONS

3. I have summarized in this section my educational background, career history, publications, and other relevant qualifications. My full curriculum vitae is attached as Exhibit 1003 to this report.

A. Educational Background

4. I received a Bachelor of Science degree in Mechanical Engineering from the University London (University College) in 1978 with first class honors, a Master of Science degree in Mechanical Engineering from the University of Illinois at Urbana Champaign in 1980 and a PhD degree in Electrical Engineering from University of Illinois at Urbana Champaign in 1982. My PhD thesis was on the topic of Robust Adaptive Control with applications

B. Career History

5. In 1982 I became an assistant professor in Electrical Engineering and Systems at the University of Southern California (USC), Los Angeles, California. In 1987, I was promoted to associate professor at USC and in 1992 I was promoted to a Full Professor. I have courtesy appointments with the Departments of Aerospace and Mechanical Engineering and Industrial System Engineering and currently hold the A.V. “Bal” Balakrishnan Chair and the prestigious title of University Professor. I am the founder and Director of the Center for Advanced Transportation Technologies, an organized research unit at USC, and I am the co-founder of the University Transportation Center METRANS at USC where I hold

the position of associate research director. I am the founder and Director of the Master Degree program in Financial Engineering at USC and serve as the Director of the Center for Responsible AI in Decision Making in Finance supported by CapitalOne. Starting January 2026, I am the President of the IEEE Intelligent Transportation Systems Society (ITSS). Prior to 2026 I served as President Elect of the IEEE ITSS, Vice President (VP) for Membership, VP for Publications and served as Editor in Chief of the IEEE Transactions on Intelligent Transportation Systems. I have been a member of the National Academy of Engineering since 2022.

6. Vehicle Routing: I have over 30 years of experience in optimization applied to routing of passenger vehicles; trucks carrying and delivering containers; central coordination of schedules and routes of shuttles for airports using connectivity and central computers. My research team and I developed a centrally coordinated truck routing system where trucks send via communication links their origin and destination and desired time window to a central computer system which generates and communicates back their schedules and routes to reduce overall travel time. We also developed a centrally coordinated system for generating schedules and optimum routes for shuttles serving the Los Angeles international airport to reduce congestion at the curbside drop off and pick up points.

7. Intelligent Transportation Systems: These systems use vehicle-to-vehicle and vehicle-to-infrastructure communication together with control and

optimization techniques to perform lane change control, dynamic speed assignment, ramp metering and traffic light control. These systems involve active communication between vehicles and a central computer system where algorithms and protocols are executed in real time. These technologies involve active communication between users and a central computer system, optimization and decision making without requiring any private information from the users.

C. Publications and Patents

8. I am the author/co-author of 11 books and over 400 publications in Journals and Conference proceedings in the areas of controls, automated vehicles, vehicle routing and intelligent transportation systems.¹ I have close to 40,000 citations with h-index 78 and i10-index 290 on Google Scholar².

9. Some of my representative publications about vehicle routing include: Zheyu Wang, Maged Dessouky, Tom Van Woensel, Petros Ioannou, *Pickup and delivery problem with hard time windows considering stochastic and time-dependent travel times*, EURO Journal on Transportation and Logistics, Volume 12, 100099, ISSN 2192-4376.³

¹ <https://pioannou.usc.edu/>

² <https://scholar.google.com/citations?user=lvDGI2UAAAAJ&hl=en>

³ <https://doi.org/10.1016/j.ejtl.2022.100099>

Aristotelis-Angelos Papadopoulos; Ioannis Kordonis, Maged

Dessouky; Petros Ioannou, *Personalized Freight Route Recommendations with System Optimality Considerations: A Utility Learning Approach*, Oct. 2022.⁴

Ioannis Kordonis, Maged M. Dessouky, and Petros A. Ioannou, *Mechanisms for Cooperative Freight Routing: Incentivizing Individual Participation*, IEEE Transactions on Intelligent Transportation Systems, vol. 21, no. 5, May 2020.

Jie Shi, Yuanqi Gao, Wei Wang, Nanpeng Yu and Petros Ioannou, *Operating Electric Vehicle Fleet for Ride-Hailing Services with Reinforcement Learning*, IEEE Transactions on Intelligent Transportation Systems, November 2020, Vol. 21, Issue 11, pp. 4822-4834.⁵

10. I also have three issued patents and two pending patent applications in control and transportation.

⁴ <https://doi.org/10.1109/TITS.2022.3213773>

⁵ <https://ieeexplore.ieee.org/document/8878000>

III. SUMMARY OF OPINIONS

11. The opinions contained in this Declaration are based on the documents I reviewed and my professional judgment, as well as my education, experience, and/or knowledge regarding technologies relating to, among other things, transportation systems.

12. In forming my opinions expressed in this Declaration, I reviewed the following materials, as well as any other materials referenced in this Declaration:

Reviewed Materials	
EX1001	U.S. Patent No. 7,840,427 (“the ’427 patent”)
EX1004	Prosecution History of U.S. Patent Application No. 12/069,656
EX1005	UK Patent Application No. 2397683A to Olmi (“Olmi”)
EX1010	U.S. Patent Application Publication No. 2003/0040944 to Hileman (“Hileman”)
EX1030	U.S. Patent Application Publication No. 2001/0037174 to Dickerson (“Dickerson”)
EX1031	U.S. Patent Application Publication No. 2003/0036935 to Nel (“Nel”)
EX1032	International Patent Publication No. WO 2005/104059 A2 to Bhushan (“Bhushan”)

EX1033	U.S. Patent No. 5,799,263 to Culbertson (“Culbertson”)
EX1034	“A distributed geographic information system for the daily car pooling problem,” Roberto Wolfler Calvo et al. Computers & Operations Research 31 (2004) 2263-2278 (“Calvo”)
EX1035	U.S. Patent No. 10,520,325 to Lewinson (“Lewinson”)

13. In support of my opinions, I have taken into account how a person of ordinary skill in the art (as I discuss below in Section IV) would have understood the claims and the specification of the '427 patent at the time of the alleged invention, which I have been asked to assume is around and no later than February 12, 2007. My opinions reflect how such a skilled person would have understood the '427 patent, the references, and the state of the art at the time of the alleged invention.

14. As I discuss in detail below, it is my opinion that Olmi discloses or suggests all of the limitations of claims 1-5, 11-12, and 15, and that a person of ordinary skill in the art would have been motivated to implement, and had a reasonable expectation of success in implementing, modifications to Olmi with a reasonable expectation of success. (*See* my discussions below in Sections IX.A, IX.B.)

IV. PERSON OF ORDINARY SKILL IN THE ART

15. I have been asked to consider the time of the alleged invention for the challenged claims of the '427 patent to be around and up to February 12, 2007. I understand from reviewing the ' 427 Patent that this is the same date as the filing date of "Provisional application No. 60/900,808" that is identified on the Cover of the patent. (EX1001 at Cover ("Related U.S. Application Data").) Accordingly, I applied this understanding in my analysis herein.

16. Based on my knowledge and experience, I understand what a person of ordinary skill in the art would have known at the time of the alleged invention that I considered above. My opinions herein are, where appropriate, based on my understanding as to a person of ordinary skill in the art at the time of the alleged invention. In my opinion, based on the materials I have reviewed, and based on my experience in the technical areas relevant to the '427 patent, a person of ordinary skill in the art at the time of the alleged invention of the '427 patent would have had at least a bachelor's degree in computer science, computer engineering, software engineering, electrical engineering, or the equivalent and at least two years of experience in technologies relevant to or utilized in transportation systems. More education can substitute for practical experience and vice versa.

17. My opinions in this Declaration, including my analysis of the '427 patent and the references, are from the perspective of a person of ordinary skill in

the art, as I defined it above, during the relevant time frame around and up to February 12, 2007. I possessed at least the qualifications of such a person of ordinary skill in the art at that time.

V. TECHNOLOGICAL BACKGROUND

18. In this section, I discuss the state of the art relevant to the subject matter of the '427 patent as would have been known, understood, and appreciated by a person of ordinary skill in the art at the time of the alleged invention for the '427 patent. In particular, a person of ordinary skill in the art would have been aware of various developments in the areas of transportation systems and related processes, as I discuss below. This section is not intended to be technically comprehensive, but rather provide a foundation for the knowledge of a person of ordinary skill in the art at the relevant time. I rely on the following discussions and identified exhibit disclosures to support my opinions in Section IX, as they summarize features that a person of ordinary skill in the art would have been aware of, appreciated, and understood at the time of the alleged invention for the '427 Patent. Accordingly, I incorporate such disclosures and understanding in support of my opinions below concerning the knowledge of such a person or ordinary skill in the art at the relevant time, and how such knowledge and understanding would support my opinions concerning the features disclosed in Olmi and reasons for combining features similar to those disclosed in Olmi (§IX.B) in such a manner that, in my opinion, predicably results in a system or method that meets the limitations of the challenged claims of the '427 patent as I discuss below in Section IX.

19. Transportation systems were well-known prior to and at the time of the alleged invention of the '427 patent as a means of addressing widespread traffic congestion problems. Traffic congestion was a known problem with wide-ranging consequences, including those related to the transportation of persons and goods.

20. For example, Olmi (EX1005),⁶ which I discuss further below, explains the known critical problems relating to “road traffic congestion.” (EX1005, 3 (§3).) Travel times, parking, road network maintenance costs, pollution, and even traveler stress and related health concerns stemming from traffic congestion are issues that a person of ordinary skill in the art would have appreciated and contemplated when considering mechanisms to address them. (*Id.*, 3 (§3), 8 (§4.4); *see also* EX1030, ¶¶[0005]-[0012] (describing the “very serious concerns” relating to the growing reliance on individual transportation”); EX1010, ¶¶ [0002]-[0005]; EX1033, 1:6-61; EX1035, 1:25-55 (describing known traffic and pollution issues caused by single-occupancy vehicles).)

21. Those of ordinary skill in the art would have also understood and been aware of transportation systems and related processes that were designed to address such issues and to improve transportation efficiency of travelers and goods. For

⁶ Citations to EX1005 are to the underlying document page number(s) or Section number(s).

example, as I describe in detail below, Olmi discloses several known transportation systems and related processes that were designed to improve transportation issues known in the art and improvements Olmi sought to provide to such existing systems and approaches, include systems to facilitate carpooling and leverage of existing fixed route transportation network infrastructure. (*See e.g.*, EX1005, 4-9 (§§ 4-5.1), 19 (“seamlessly integrate with existing public transport”), 62-63; *see also* my discussions of Olmi below in Sections VIII and IX.) Other disclosures summarize approaches in transportation systems that were likewise known and appreciated by those of ordinary skill in the art at the time. (*See e.g.*, EX1010, Abstract, ¶¶ [0006]-[0011], [0024]-[0035], FIGS. 1-8; EX1031, ¶¶[0001]-[0016], [0025]-[0027] (describing transportation system for freight hauling); EX1032, Abstract, 1-3 (describing vehicle pooling transportation system processes); EX1033, Abstract, 2:64-5:41, FIGs. 1-5; EX1034, Abstract, 2263-65 (§§ 1-2), 2266-2272 (§§ 3-4.1.1), 2274-2277 (§§ 5-6); EX1035, 1:59-3:22, 3:48-7:29, FIGS. 1A-6.)

22. Use of communication devices in transportation system was also widely known by those of ordinary skill in the art. (*See e.g.*, EX1005, 29-32, 40 (§§ 6.2, 7, 7.2), FIGs. 4, 6; EX1010, ¶¶ [0025]-[0027], FIG. 1; EX1031, ¶¶ [0027]-[0029], [0051]-[0052], FIGS. 4A-4B; EX1032, Abstract, 1-5, 8-11, Figure sheets 1-3; EX1033, Abstract, 2:64-5:41, 6:19-8:62, FIGs. 1-5; EX1034, 2267.) Similarly, the use of networked computer systems and servers for managing transportation

system components and processes was known and understood by those of ordinary skill in the art. (*See e.g.*, EX1005, (§§ 6.2, 7, 7.2), FIGs. 4, 6; EX1010, ¶¶ [0021]-[0028], FIG. 1; EX1031, ¶¶ [0030]-[0050], FIGs. 2, 3A-4B; EX1034, 2269-2271 (§§ 3.2-4).)

23. Based on my experience, and from my review of the materials I identify in this Declaration, it is my opinion that a person of ordinary skill in the art at the time of the alleged invention would have been well aware of different transportation systems and processes designed to address known traffic and related issues with the transportation of vehicles, persons, and goods. This includes the use of carpooling and other types of ridesharing applications that leveraged and enhanced existing technologies related to fixed route transportation networks and other ridesharing optimization mechanisms. Given such knowledge and experience, and understanding of the technology underlying such transportation systems and processes, a person of ordinary skill in the art would have had reasons to consider Olmi as I discuss below in Section IX and integrate features and/or functionalities from such disclosures while leveraging their own experience and knowledge of existing transportation systems (consistent with those I discuss above in this section) to configure and provide transportation systems and processes that provide shared transport solutions, and communication protocols, consistent with that in the art at the time.

VI. OVERVIEW OF THE '427 PATENT

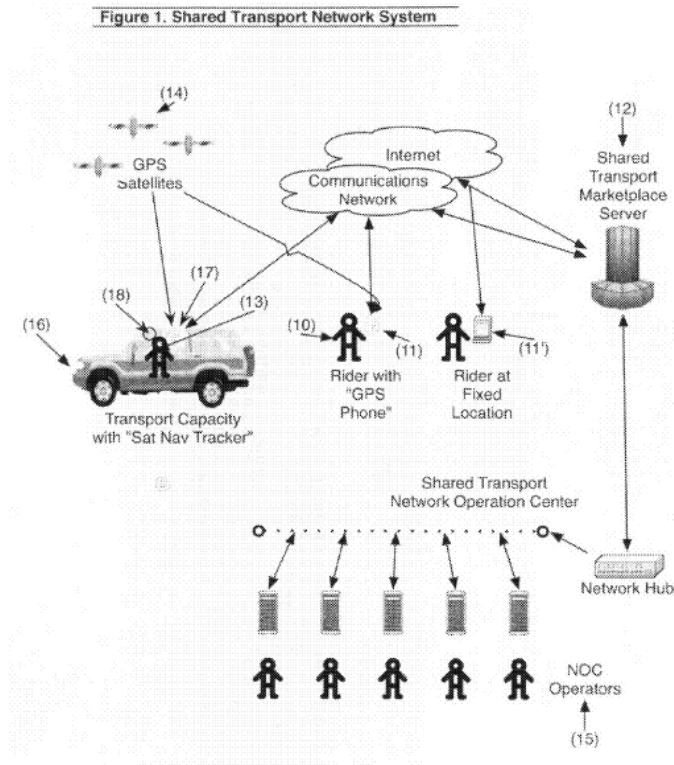
24. Based on my review, I understand the '427 patent to “relates to a ground transportation network” that, for example, “match[es]” individuals with transport capacity on a supply and demand basis. (EX1001, 1:8-12.) Consistent with my discussions above in Section V, the '427 patent discusses conventional transportation systems, processes, and concepts directed to addressing known transport capacity and demand issues consistent with what would have been known and appreciated by a person of ordinary skill in the art prior to and at the time of the alleged invention for the '427 patent. For example, the '427 patent describes a conventional central assigning system that works in conjunction with vehicle communication devices and employs known dynamic ridesharing and transportation network concepts. (*Id.*, 1:15-2:50.) The '427 patent also describes the use of existing traffic measurement systems, GPS systems, and traffic speed measurement systems (*Id.*, 3:51-4:5), and describes features of current carpooling systems and mass transport systems that give “confidence” to transport users on available capacity (*Id.*, 4:10-21). Thus, the '427 patent acknowledges that implementing existing proposals for dynamic ridesharing systems “*would represent advances over methods in common practice.*” (*Id.*, 1:41-42.)

25. However, I understand that the '427 patent expresses a belief that the alleged invention “makes such systems more practical and useful” by purportedly

reducing workload and/or steps necessary “to make this system more inconvenient,” improving “trustability,” increasing use, providing a device that communicates “visually” to riders, determining and/or registering transport capacity, and providing information about “ad-hoc” transport capacity “*in manners similar to traditional, centrally controlled transit systems.*”⁷ (*Id.*, 1:31-1:57.)

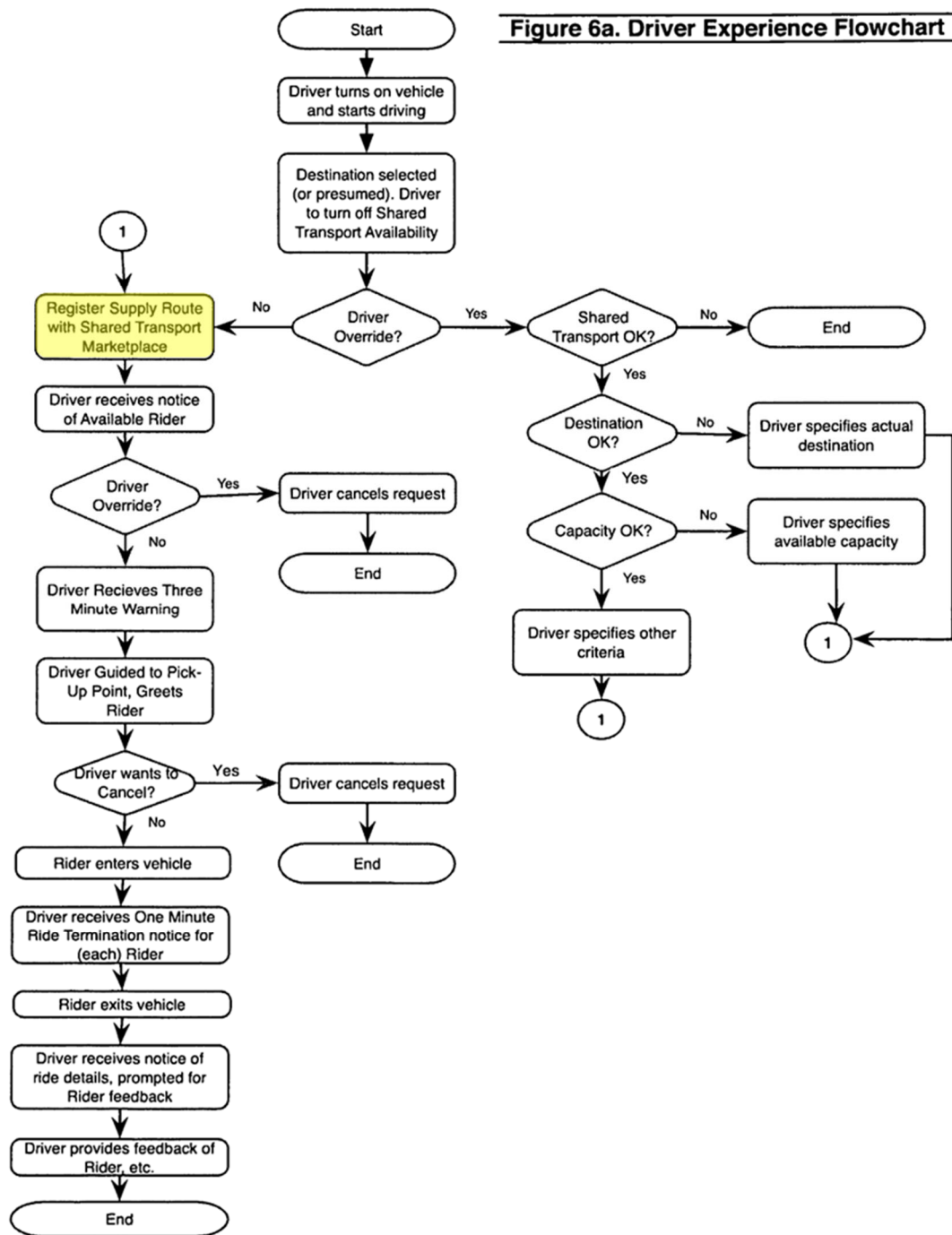
26. The '427 patent discusses its “Shared Transport System” (or marketplace) in the context of Figure 1 (below), which purportedly “enabl[es] private transport vehicles to serve as an extension of the mass transit system” by matching potential riders with potential drivers for the transport of persons. (EX1001, 3:36-40; *see also id.*, 2:54-5:2, FIG. 1.)

⁷ Unless I have otherwise noted, the emphasis provided in portions of the referenced text is added.

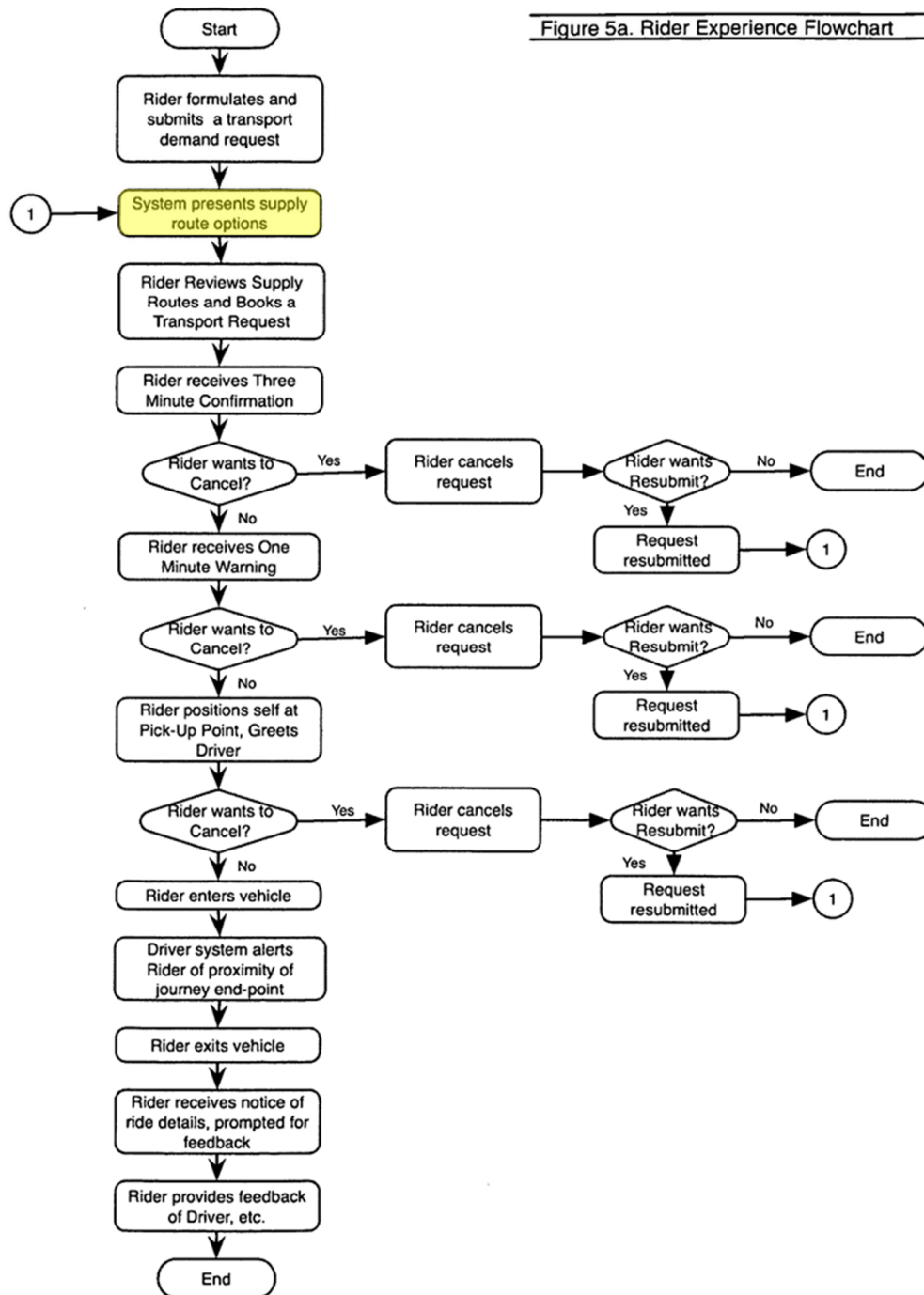


(*Id.*, FIG. 1.)

27. The '427 patent discloses that a prospective driver may register a supply route with the Shared Transport Marketplace (shown in yellow in Figure 6a (Driver Experience Flowchart) below), and that a prospective rider is presented with available supply route options (shown in yellow in Figure 5a (Rider Experience Flowchart) below) after submitting a transport demand request. (*Id.*, 21:62-22:12, FIGs. 5a, 6a.)



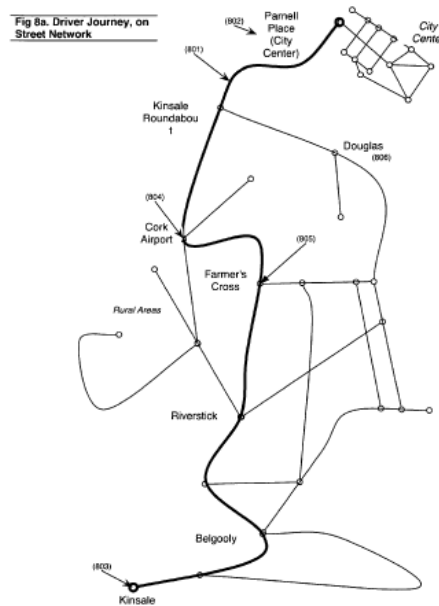
(*Id.*, FIG. 6a (annotated).)



(*Id.*, FIG. 5a (annotated).)

28. The '427 patent discusses features related to known concepts to “convert[] the computer’s representation of a driver’s route into a format which is

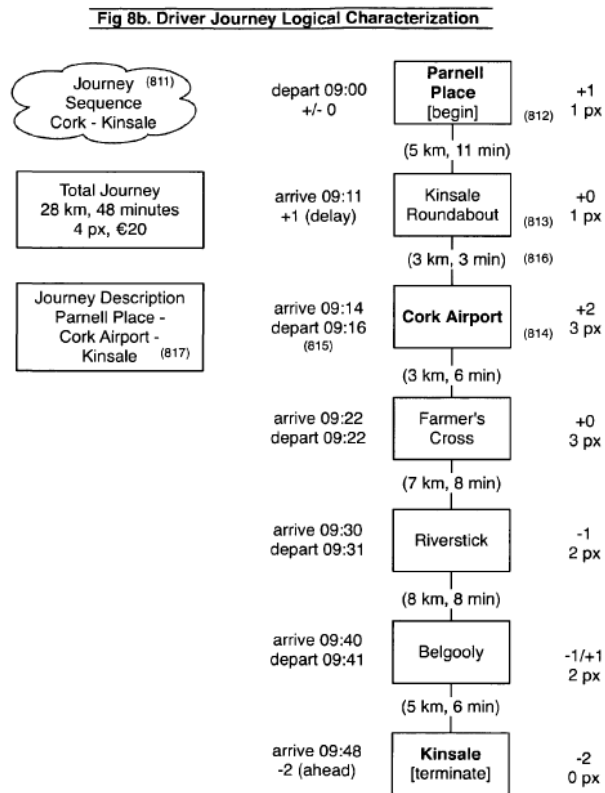
more usable for further analysis and presentation.” (EX1001, 14:49-51.) The system “can present the journey at the end of the route in the format of a very useful and concise set of major stops, rather than incomprehensible list of addresses of geographic co-ordinates.” (*Id.*, 14:66-15:5.) Figure 8a (below) shows the “route of the driver’s journey,” where the path of the driver’s route 801 is from certain points to others (e.g., “from Parnell Place 803 to Cork Airport 804 to Farmer’s Cross 805”). (*Id.*, 14:66-15:8.)



(*Id.*, FIG. 8a.)

29. The '427 patent explains that “once the geographic representation is abstracted to stop nodes, it is possible to show the driver’s route in a variety of alternate presentations, such as the presentation shown in FIG. 8b.” (*Id.*, 15:9-12, FIG. 8b (below).) Such abstraction encompasses, for example, the presentation

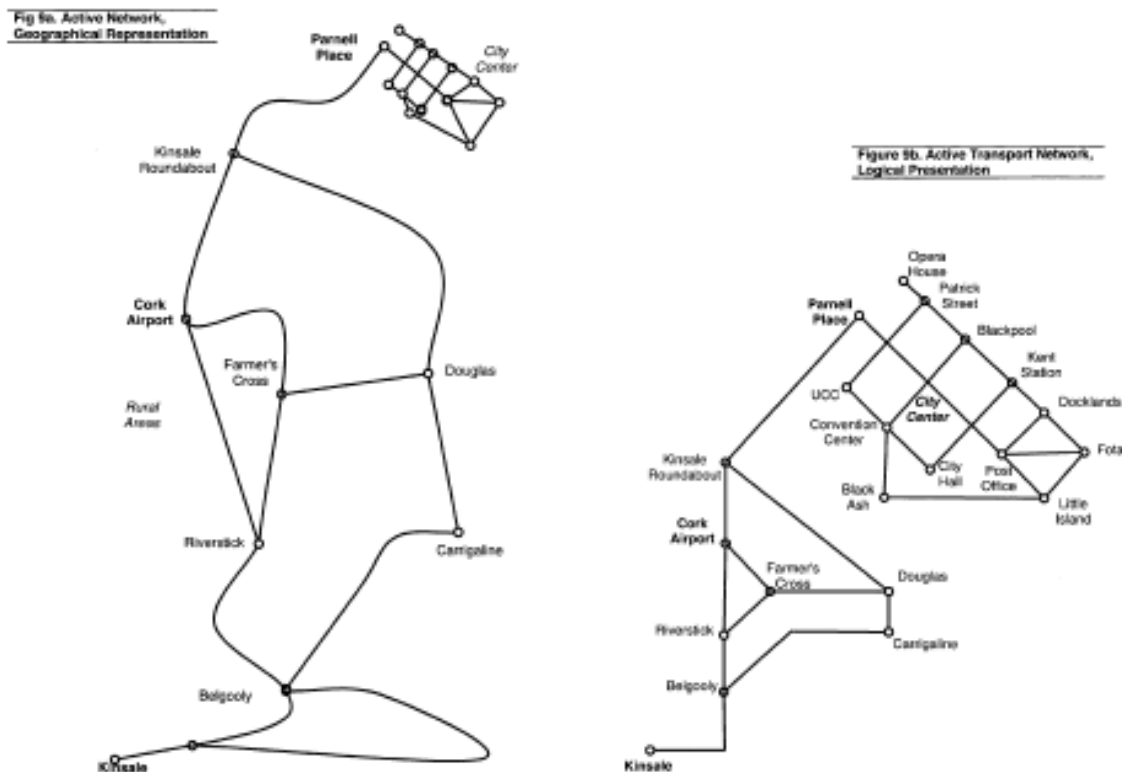
shown in Figure 8b below, which includes characterizations of start and end points as names/labels (e.g., place/location (town) names, etc. in boxes below), activity summary (information accompanying boxes below) at intermediate points (stop nodes), and/or a level of characterization. (*Id.*, 15:9-24, FIG. 8b (below).)



(*Id.*, FIG. 8b.)

30. The '427 patent explains that, while a city route may have dozens of stops, “perhaps only the most major stops (as coded separately using operator intervention or data entry, for example) would be shown in order to present the information more clearly.” (*Id.*, 15:17-22.) The “major stops of a route, as shown

in 817 [of Figure 8b], may not necessarily even include the start or end point.” (*Id.*, 15:22-25; *see also id.*, 15:26-30 (driver journeys “organized as stream of stop nodes”).) Figure 9a “shows the same network model as FIG. 8a, but trimmed to only show those segments and nodes in the network that have active transport capacity on them.” (*Id.*, 15:31-45; *see also id.*, 15:56-62 (“schematization of a shared transport network is shown in Fig. 9b, using the model of the 9a network”).)



(*Id.*, FIGs. 9a-9b.)

31. The '427 patent explains that “[t]raditional transport networks have known this for a long time, of course, and so maps of network capacity have long been available on public transport systems.” (*Id.*, 15:46-48). And while the

'427 patent represents that such features “have not been applied usefully to carpooling systems or...public shared transport,” the patent acknowledges that “[t]raditional public transport networks have also sought to make their transport more understandable by simplifying the geographic maps into quasi-geographic schematic representations that enhance readability and information display” (*id.*, 15:48-54), and that “programs and techniques” for generating schematic maps automatically “**are known in academia**” (*id.*, 15:56-60).

32. Beyond many other conventional features (as I have demonstrated below in §IX), the '427 patent discusses features related to a driver software interface, which is aimed at connecting riders and drivers, and providing transportation services while a vehicle is in transit, such as in the event that a user needs to arrange transport between a specific start point and end point for certain goods and persons. (EX1001, 3:5-15, 8:24-44, 8:60-9:8, 16:65-17:19.) For example, “[w]hen a driver starts the vehicle (‘Driver’ 13) a Driver Software Interface automatically determines if the Driver 13 is engaged in a traditional route (‘Supply Route’) and registers the transport capacity of the Driver 13 (‘Transport Capacity’) with the Shared Transport Marketplace 12.” (*Id.*, 7:24-44.) The Shared Transport Marketplace “provides to the Rider 10 and to the Driver 13 information about Transport Capacity...to provide the Rider with “a variety of services types and prices to choose from.” (*Id.*, 7:44-50.) To choose a service to transport a good, a “Rider

10, depending upon the mode preferred and the equipment available, can select a Pick-Up Point and Destination Point.” (*Id.*, 8:34-36). The Rider 10 “could be presented with a sorted list of transport options available, by class of service, type of vehicle, time until Transport Capacity arrives at start-point, estimated transit time to end-point, number of legs in the journey, and cost.” (*Id.*, 8:44-49). “[T]he Shared Transport Marketplace 12 will be working to optimize available capacity and services and will substitute Riders and Drivers.” (*Id.* at 9:16-19.) The ’427 patent also describes “[a]n active monitoring system for generation of usage/demand data for point-to-point routing of participating vehicles” by looking “for overlaps of capacity...to eliminate redundant capacity.” (*Id.*, 15:63-67).

33. I have reviewed the prosecution file history for the ’427 patent (EX1004). I understand from my review that the claims of the ’427 patent were allowed (and subsequently issued) after what appears to me to be minimal examination, where the Office did not apply any prior art rejections, instead only raising what the examiner identified as enablement issues. (EX1004, 12-14, 25-37, 39-43.)

34. As I explain below, it is my opinion, based on my review of the materials referenced herein and my experience, these and other features described in the challenged claims of the ’427 patent were known in the prior art before the alleged invention of the ’427 patent. (*See my discussions below in Section IX.*)

VII. CLAIM CONSTRUCTION

35. I understand that terms of the challenged claims should be interpreted as would have been understood by a person of ordinary skill in the art at the time of the alleged invention, taking into consideration the language of the claims, the specification, and the prosecution history of the '427 patent (EX1004) at the time of the alleged invention (around and up to February 12, 2007). I have applied these understandings of the claim terms in my analysis and in forming my opinions where appropriate in this Declaration.

36. I also have been asked to provide my opinions regarding the challenged claims of the '427 patent and the prior art discussed in this Declaration under the following constructions for the following claim terms, which I understand are proposed by Petitioners or Patent Owner (PO), as indicated in the table below. I applied those meanings as presented in support of my opinions as requested. My opinions below regarding the challenged claims also demonstrate how the claimed features are disclosed and/or suggested even if no such express constructions are applied.

'427 Patent Term	Constructions
"predetermined transport vehicle journey" (claim 1)	<u>Petitioners' Construction</u> : "A trip along an existing route defined before demand for transport and

'427 Patent Term	Constructions
/ “predetermined journey of a transport vehicle” (claim 15)	independently of a transport user’s door-to-door trip.”
“network of nodes” / “nodes” (claims 1, 15)	<u>Petitioners’ Construction:</u> “The pick-up points and drop-off points interconnected by predetermined transport vehicle journey routes.” <u>Patent Owner’s Construction:</u> “Geographic locations (such as addresses or intersections) where a customer could be picked up or dropped off, and street segments between them.”

VIII. OVERVIEW OF THE REFERENCES

A. Overview of Olmi (EX1005)⁸

37. Based on my review, a person of ordinary skill in the art would have understood that Olmi discloses a method/system that leverages existing features/concepts from public transport and individual transport applications to address transportation problems. (EX1005, 8-9 (§5.1).) Olmi teaches a transportation sharing process where a central computer system analyzes “submitted itinerary requirements that it receives, and then intelligently groups travellers with compatible itineraries onto the same...transit vehicle” (*id.*, Abstract) to address problems with inefficient use of transportation services, among other things, in existing transportation networks (*id.*, 2-7 (“present invention is the breakthrough solution to transport problems and traffic congestion” by providing a “minimal impact system, which easily coexists with other forms of transport, and other traffic control schemes” while “maintaining people-mobility”), 4-7 (§§4.1-4.4).)

38. One configuration that Olmi describes relates to carpooling transport. (*Id.*, 8.) The carpooling configuration matches prospective passengers with carpool

⁸ The summary of Olmi here is applicable to my analysis below in Section IX. Accordingly, I incorporate my summary of Olmi, which reflects how a person of ordinary skill in the art would have understood the reference, into my analysis below.

drivers having compatible itineraries involving fixed journeys. (*Id.*) An itinerary is a data structure that specifies a travel plan (e.g., embarkation and disembarkation points, but can include multiple destination points, routing requirements, etc.). (*Id.*, 11-12, 32-35.)

39. Olmi explains that both carpool drivers with personal fixed itineraries and potential passengers are considered travellers, i.e., a person with a journey itinerary. (*Id.*, 11.) Travellers (both drivers and passengers) submit their predetermined personal itineraries to the central computer system by submitting a “journey request,” which is a data structure or a computer data format which includes a specification of a traveller or passenger itinerary,” as well as “other travel requirements relating to this itinerary.” (*Id.*, 12.) Prospective travellers define their predetermined personal itineraries by using a communicator device to send their journey requests to a central controlling computer system, which stores journey requests in a “journey requests database.” (*Id.*, 32.) Olmi also explains that “[m]athematically speaking, using the terminology of graph theory,” each traveller/passenger itinerary “can be encoded as a directed graph whose vertices are the embarkation and disembarkation points of the itinerary, and whose direct edges indicate the direction of travel.” (*Id.*, 11.)

40. Olmi explains that a vehicle can have a vehicle itinerary, which is a data structure that specifies the travel plan of the vehicle and comprises a “set of

prescribed geographic points or addresses to which the vehicle must navigate in a prescribed order” and may include a “specification of the road route that will enable the vehicle to reach the said geographic points or addresses.” (*Id.* 11-12.) “Typically these geographic points [of the vehicle itinerary] will be traveller embarkation and destination points,” e.g., pick-up and drop-off points for passengers of the vehicle, as well as points corresponding to “additional stops en route.” (*Id.*, 12). Similar to traveller itineraries, each vehicle itinerary “can be encoded as a directed graph whose vertices are the said geographic points or addresses, and whose direct edges indicate the direction of travel between these geographic points or addresses.” (*Id.*)

41. For example, carpool drivers may have a “car pool intended itinerary specification,” which “include[s] details of the vehicle itinerary that the car pool driver intends to follow,” as well as “related information such as the number of available passenger seats in the car pool vehicle.” (*Id.*, 12.) A carpool driver may use a communicator device in their vehicle to “submit his car pool intended itinerary specification...to the controlling computer system.” (*Id.*, 35; *see also id.*, 15, 32, 40.) The vehicle itineraries are stored in a “transit vehicle current itineraries database,” which contains transit vehicle records for currently operational transit vehicles, i.e., “a vehicle that is currently conveying travellers, or a vehicle that is currently empty but is ready to convey travellers.” (*Id.*, 34.) Carpool intended itinerary specifications are also “entered in the journey request database as a journey

request record, with a relational link set up from this transit vehicle record to this journey request record...because [the carpool driver] is also a traveller, and his personal itinerary forms part of the itinerary commitments of his vehicle.” (*Id.*, 35.)

42. Olmi also describes intelligent grouping processes that match vehicles/drivers having a predetermined vehicle journey with a traveller having a compatible journey itinerary and facilitating the transportation of the passenger along the vehicle's journey route. (*Id.*, 15-20 (§§5.5-5.6), 21-27 (§5.7), 35-39.) For example, Olmi describes matching prospective travellers/passengers from the journey request database with available carpool drivers from the transit vehicle current itineraries database. (*Id.*, 35-39.) Olmi also describes other features/components, including a digitised street layout map, communicator devices, controlling computer, positions/navigation systems, and a data transmission system. (*Id.*, 12-15 (§§5.3-5.4).)

IX. THE PRIOR ART DISCLOSES ALL OF THE LIMITATIONS OF THE CHALLENGED CLAIMS

A. Olmi Discloses the Limitations of Claims 1-5, 11, 12, and 15

43. In my opinion, Olmi discloses each limitation of claims 1-5, 11, 12, and 15, and thus discloses those claims. Below, I address each limitation in turn.

1. Claim 1

i) [1.pre] “A method of sharing transportation employing a ground transportation network comprising the steps of”

44. I have been asked to assume that the preamble of claim 1 is limiting. Under that assumption, it is my opinion that Olmi discloses the limitations therein.⁹

⁹ Olmi describes the invention as having two configurations—taxibus and carpooling—that may operate independently or concurrently, and discloses embodiments that integrate features of both. (EX1005, 8, 30.) A person of ordinary skill in the art would have understood that these configurations address substantially similar transportation problems using comparable hardware and communication architectures, and therefore any features described solely with respect to the taxibus configuration could readily be implemented in the carpooling configuration. (*Id.*, 66.) Therefore, even if any of the features that I rely on herein were assumed to arise solely from the taxibus configuration or from a separate embodiment, a person of ordinary skill in the art would have viewed their incorporation into the carpooling

As I discuss above in Section VIII, Olmi teaches a transportation sharing process/method (“[a] method of sharing transportation”) where a central computer system analyzes “submitted itinerary requirements that it receives, and then intelligently groups travellers with compatible itineraries onto the same...transit vehicle” (EX1005, Abstract) to address problems with inefficient use of transportation services, among other things, in existing transportation networks (*id.*, 2-7). As I discussed, Olmi discloses that a carpool or public transport driver submits a predetermined itinerary, a prospective traveller/passenger submits a desired itinerary in the form of a journey request, and an intelligent grouping module matches vehicles/drivers with travellers having compatible journey itineraries and facilitates the transportation of the travellers along the vehicle’s journey route. (*Id.*,

configuration as a routine design choice involving the application of known technologies using known techniques. (*Id.*, 5, 9, 11-14, 59, 66.) For example, Olmi’s discussion of integrating public transport stops, fixed embarkation points, and kiosk communicator devices further confirms that such features would predictably yield the same benefits when applied to carpooling. (*Id.*, 40, 70, 78.) For these reasons, a person of ordinary skill in the art would have had both good reason and a reasonable expectation of success in implementing any taxibus-specific features in Olmi’s carpooling configuration.

15-20 (§§5.5-5.6), 21-27 (§5.7), 35-39; *see also* my discussions above in Section VIII.)

45. Olmi's system and process also "employ[s] a ground transportation network" as exemplified in Figures 4 and 6 (below).

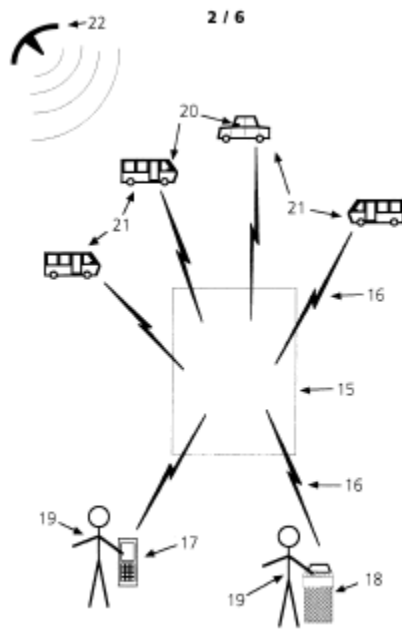


Figure 4

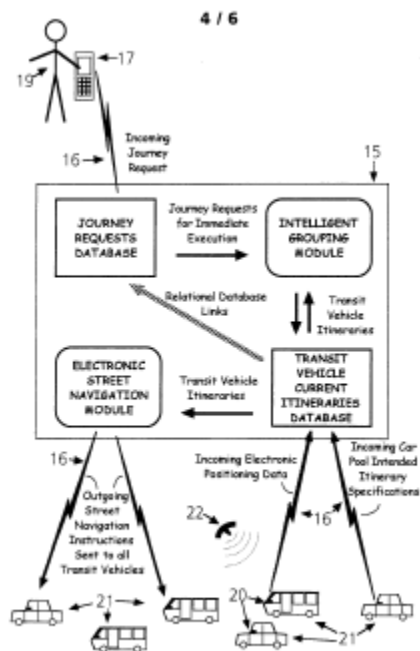


Figure 6

(*Id.*, FIGs. 4, 6.)

46. Olmi's Figure 4 shows a "central controlling computer system 15 [that] has, by means of the data transmission system 16, a two-way communications connection with the communicator devices 17 and 18 of the prospective travellers 19, and a two-way communications connection with the communicator devices 20 of the transit vehicles 21." (*Id.*, 29; *see also id.*, 29-35.) Data transmitted over transmission system 16 includes journey requests detailing the travellers' itinerary

requirements, the controlling computer system's responses to these requests (sent back to travellers), and other categories of information. (*Id.*, 30.) Figure 6 of Olmi "illustrates the data-processing elements of the controlling computer system 15" shown in Figure 4. (*Id.*, 32; *see also id.*, 29.) For example, the controlling computer system's main elements include "the intelligent grouping module, the journey requests database, the transit vehicle current itineraries database, and the electronic street navigation module," which together enable the communication and shared transportation functions of Olmi's ground transportation network/system. (*Id.*, 32.) Olmi explains that the embodiment shown in Figures 4 and 6 is "capable of running the invention's two main transport modes," including the carpooling mode. (*Id.*, 30.) Thus, Figures 4 and 6 depict a "ground transportation network" of ground transportation vehicles, passengers, and a controlling computer system that enables communication between entities of the network as part of Olmi's shared transportation method.

47. Accordingly, it is my opinion that a person of ordinary skill in the art would have understood that Olmi discloses a "shared transportation method employing a ground transportation network" as claimed.

ii) [1.a] "providing a computer network;"

48. In my opinion, a person of ordinary skill in the art would have understood that Olmi discloses this limitation.

49. As I discussed above in Section VIII and for limitation [1.pre], Olmi discloses “providing a computer network.” Olmi’s “single central controlling computer system 15 orchestrates all transit vehicles 21 and travellers 19.” (EX1005, 31.) Olmi explains that every passenger and driver has a “communicator device” (e.g., cellular telephone) that allows them to “interact[] with this transportation invention...to send and/or receive data over the data transmission system (typically to the controlling computer system).” (*Id.*, 14; *see also id.*, 40 (communicator devices are “desirable in any car pool vehicle regularly participating in car pooling”).) The “data transmission system 16 comprising land lines, **cellular telephone networks**, and **Internet transmission** is used to provide a **two-way data exchange between this centralized controlling computer system 15 and the communicator devices 17 and 20** (of the travellers 19 and transit vehicles 21 respectively).” (*Id.*, 31; *see also id.*, 13 (data transmission system facilitates data transmissions “over the Internet or other **computer networks**”).) Olmi also explains that its transportation sharing features (e.g., for matching drivers and passengers) may be enabled by using an “electronic positioning system...such as the American GPS (Global Positioning System), the broadcast positioning signal of which is received by GPS receivers contained in the vehicle communicator devices (and optionally in passenger communicator devices).” (*Id.*, 31.) Further, Olmi discloses using computer instructions or code (e.g., a set of data-processing instructions) to

perform specific data-processing functions. (*Id.*, 12-13.) Thus, Olmi's system includes a controlling computer system and remotely-located components, such as an electronic positioning system and communicator devices used by travellers and transit vehicle drivers, with communication enabled by a data transmission system operating over a network. (*Id.*, 12-15.)

50. Thus, in my opinion, a person of ordinary skill in the art would have understood that Olmi discloses providing a "computer network." For instance, Olmi provides a controlling computer system 15 (which has interconnected computing components), which is one example of a "computer network." Moreover, the controlling computer system 15 along with other remotely-located components (described above) in Olmi's transportation network, which operate in an interconnected network of associated computer-based devices and associated software/computing components, is another example of a "computer network."

iii) [1.b] "establishing an electronic registry in said computer network of capacity containing an indication of the spare transport capacity and location of a plurality of transport vehicles;"

51. In my opinion, a person of ordinary skill in the art would have understood that Olmi discloses this limitation.

52. As I discussed above in Section VIII and for limitations [1.pre]-[1.a], Olmi's central controlling computer system 15 (alone or collectively with the other components of the Olmi system, each a "computer network") (*see* my discussions

above for limitation [1.a]) includes a transit vehicle current itineraries database, which is “an electronic registry...of capacity” (e.g., vehicle transport availability). (See my discussions above in Section VIII; EX1005, 11-12, 14, 16.) For example, “[t]he transit vehicle current itineraries database contains a data record, ...call[ed] the transit vehicle record, for each currently operational transit vehicle,” i.e., “a vehicle that is currently conveying travellers, or a vehicle that is currently empty but is ready to convey travellers.” (EX1005, 34.) Each vehicle record in the database includes various data fields, such as “[t]he current geographic position of the transit vehicle” (“location of a plurality of transport vehicles”) and “[t]he passenger capacity of the transit vehicle” (“indication of the spare transport capacity”). (*Id.*, 34; *see also id.*, 12 (carpool intended itinerary includes the “number of available passenger seats in the car pool vehicle”).)

53. Accordingly, it is my opinion that a person of ordinary skill in the art would have understood that Olmi discloses “establishing an electronic registry in said computer network of capacity containing an indication of the spare transport capacity and location of a plurality of transport vehicles,” as claimed. (See also my discussions above in Section VIII.)

iv) **[1.c] “establishing a network of nodes in said computer network representing a plurality of pick-up points and a plurality of drop-off points;”**

54. In my opinion, a person of ordinary skill in the art would have understood that Olmi discloses this limitation.

55. For example, as explained above for limitations [1.pre]-[1.b] and discussed further below, Olmi “establish[es] a network of nodes” in the “computer network” (*see* my discussions above for limitation [1.a]) by generating and maintaining the data structures for traveller and vehicle itineraries, where each itinerary can be encoded as a directed graph whose vertices are the embarkation and disembarkation points (and any other points) of the itinerary (“representing a plurality of pick-up points and a plurality of drop-off points”), and whose direct edges indicate the direction of travel. (*See* my discussions above in Section VIII; *see also* EX1005, 11 (“Mathematically speaking, using the terminology of graph theory, most **traveller or passenger itineraries** can be encoded as a **directed graph whose vertices are the embarkation and disembarkation points** of the itinerary, and whose directed edges indicate the direction of travel.”), 12 (“Mathematically speaking most **vehicle itineraries** can be encoded as a **directed graph whose vertices are the said geographic points or addresses**, and whose directed edges indicate the direction of travel between these geographic points or addresses.”).) Olmi explains that a vehicle itinerary may have multiple pick-up and drop-off points

because a carpool vehicle may have multiple passengers. (*Id.*, 34 (each transit vehicle record includes a data field reflecting “the **total number of designated passenger places**...in the vehicle”), 81-82 (describing “[g]roup travel by...car pool” where a traveller and their friend can board or alight together, “which means that the transit vehicle has less **pick-up and drop-off points on its route** to slow it down”).) As I discussed below, Olmi discloses this limitation under both Petitioners’ and PO’s proposed constructions of “network of nodes” / “nodes.” (*See* my discussions above in Section VII.)

56. Similar to the ’427 patent, Olmi discloses that these pick-up and drop-off locations (“nodes”) may be existing, predefined points, such as those along preexisting routes (e.g., bus stops). For example, Olmi explains that passengers can specify a destination location in safe and convenient locations other than their true destination, such as a designated shop or similar location. (EX1005, 83 (“passengers can specify an address...just a hundred metres away from their home,” e.g., “in front of a local shop or similar location”); *see* EX1001, 14:47-61 (establish pick-up and drop-off points (nodes) so riders/drivers “can be guided to places that are safe and convenient”).) Similarly, Olmi’s system/method contemplates routing vehicle transports to “**main roads and larger streets (just as with regular buses), with passenger drop-offs and pick-ups taking place exclusively on these main roads.**” (EX1005, 78.)

57. Olmi also contemplates schemes to eliminate pick-up and drop-off point ambiguities by providing “**pre-defined passenger pick-up (and optionally set-down) points**” that can be used “when making a journey request.” (*Id.*, 88.) For example, Olmi’s shared transport system/process can be integrated with existing public transportation systems, such that fixed embarkation and destination points (e.g., bus stops) may serve as nodes in Olmi’s network of nodes. (*Id.*, 19 (“[T]he intelligent grouping module will have the ability to route...a traveller itinerary via existing modes of public travel such as buses and trains as well as by taxibus or car pool transit vehicles. This will enable this invention to seamlessly integrate with existing public transport...”), 62-64 (§§7.16-7.17) (including existing modes of public transport / integrated multi-modal transport system), 63 (“[o]nce existing public travel modes are integrated into this controlling computer system”), 64 (computer system calculates routes and arrange for vehicle transport to a drop-off point (node) “at the appropriate Underground station” to catch a train), 70 (describing integration of invention with existing public transport modes); EX1001, 14:61-65 (network of nodes/stops can incorporate “existing databases of stops from existing bus networks”).)

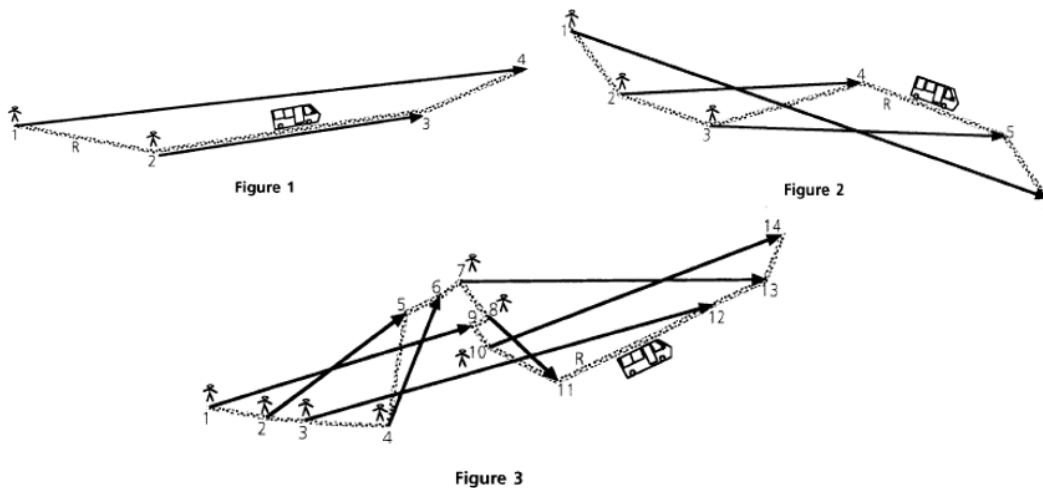
58. For reasons above and as I further discuss below, it is my opinion that a person of ordinary skill in the art would have understood that these fixed pick-up and drop-off nodes/points are likewise included in the “network of nodes” that

Olmi's system/method establishes and processes using traveller and vehicle itinerary data structure information.

59. As an initial matter, a person of ordinary skill in the art would have understood that Olmi discloses that these pick-up and drop-off points may be along one or more predetermined/fixed vehicle routes. For example, Olmi explains that "travellers [passengers or carpool drivers] that have identical pick-up or drop-off points" can be "plac[ed]...on the same transit vehicle." (EX1005, 74.) Thus, in my opinion, based on the disclosures of Olmi, a potential carpool passenger's pick-up and drop-off points may be along a predetermined route of a carpool driver. Olmi explains that "the invention can also work with existing public transport such as buses, trains or trams," such that a passenger is matched with a fixed-route transport vehicle with a compatible vehicle itinerary to the itinerary specified in the passenger's journey request. (EX1005, 70.) Thus, in my opinion, Olmi discloses scenarios where a potential passenger's pick-up and drop-off points are along a fixed public transport route.

60. In my opinion, a person of ordinary skill in the art would also understand that Olmi discloses that these predetermined routes, along which passengers are picked up and dropped off at predefined points, form a "network of nodes." For example, Olmi explains that its intelligent grouping module processes the traveller and vehicle itineraries including these predefined embarkation and

disembarkation points (“nodes”) to match potential riders with vehicle(s) and determine predetermined/fixed vehicle route(s) that intersect traveller nodes. (EX1005, 21-27.) For example, Olmi determines compatibility between a set S of traveller itineraries, as shown in Figures 1-3 below, which correspond to a set S of two travellers (Figure 1), three travellers (Figure 2), and seven travellers (Figure 3), respectively. (*Id.*) Each of the below figures depicts a network of nodes that represents embarkation and destination points maintained in a data structure used by Olmi’s “computer network.” (*Id.*; see my discussions in Section VIII and for limitations [1.a] and [1.d] (incorporated herein and further describing features of a network of nodes).)



(EX1005, FIGS. 1-3.)

61. Olmi’s carpool scenario is exemplified using Olmi’s Figure 1, annotated below, where route **R** reflects in this example a carpool predetermined journey (see my discussions below for limitations [1.d]) following the path from

nodes 1, 2, 3, to 4, such as a predetermined commuting route (e.g., work (node 1) to home (node 4) following the path including node 2 and node 3).

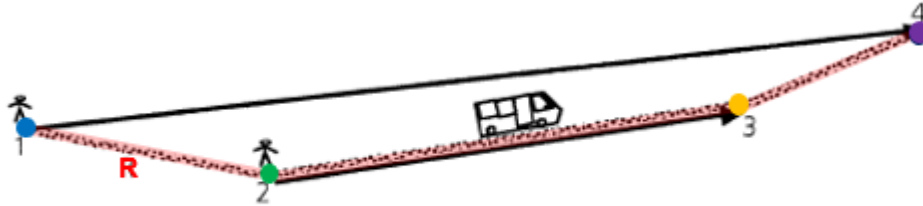


Figure 1

62. Figure 1 (annotated above) also shows a traveller's requested journey reflected by pick-up and drop-off points (nodes 2 to 3) that overlap/intersect the carpool driver's predetermined vehicle journey (from nodes 1, 2, 3, to 4). (EX1005, 21-27, FIG. 1.) Thus, it is my opinion that a person of ordinary skill in the art would have understood that the “pick-up,” “drop-off,” and waypoints along a route (e.g., collectively nodes 1, 2, 3, and 4) form a “network of nodes... representing a plurality of pick-up points and a plurality of drop-off points” that Olmi's computer system 15 “establish[es]..in said computer network” (see my discussions above for limitation [1.a]) by generating and maintaining traveller and vehicle itineraries based on predefined node data (e.g., fixed locations that may correspond to existing public transportation stops, main street locations, etc. represented as nodes in Olmi's graph theory-based data structures).

63. As I discuss above, I was asked to consider Petitioners' proposed construction of “network of nodes.” (See my discussion above in Section VII). For

the reasons I discuss above and below, in my opinion, Olmi’s method/system discloses this term under Petitioners’ proposed construction. (*See* also my discussion for limitation [1.d.i] relating to Petitioners’ proposed constructions of “predetermined transport vehicle journey”.) For example, for the reasons explained above and those summarized below, Olmi discloses:

<u>“network of nodes”</u>
“The pick-up points and drop-off points interconnected by predetermined transport vehicle journey routes”: As discussed above and shown in Figure 1, each of the pick-up and drop-off points may be along one or more predetermined transport vehicle journey routes (e.g., a carpool driver’s predetermined route or a fixed public transit route), and the pick-up and drop-off points are encoded as vertices (e.g., points 1-4 in Figure 1) in a directed graph, with direct edges (e.g., the connecting lines with arrows in Figure 1) connecting the pick-up and drop-off points and indicating the direction of travel. (EX1005, 11-12, 15-20 (§§5.5-5.6), 21-27 (§5.7), 32-39.) Thus, the pick-up and drop-off points/nodes are interconnected by predetermined/fixed transport vehicle itineraries/routes. (<i>See also</i> my discussions above in Section VII and below for limitation [1.d.i].)

64. I have been informed that, in district court, Patent Owner (PO) disagrees with Petitioners’ proposed construction of the claimed “network of nodes”

that I was asked to consider. In my opinion, Olmi's system also includes a "network of nodes" under PO's proposed construction, i.e., "geographic locations (such as addresses or intersections) where a customer could be picked up or dropped off, and street segments between them," because as discussed above, Olmi discloses representing a predetermined transport route as a set of geographic locations (e.g., public transportation stops, main street locations, etc.) along which a passenger may be picked up or dropped off, connected by the street segments along that predetermined route indicating the direction of travel. (*See* my discussions above for this limitation and references to the teachings in Olmi and how they meet this claim limitation, which are applicable to demonstrate that even under PO's proposed construction, Olmi discloses this limitation; see also my discussions above in Section VII.) For example, Olmi describes that a carpool or public transport driver submits a predetermined itinerary, a prospective traveller/passenger submits a desired itinerary in the form of a journey request, and an intelligent grouping module matches vehicles/drivers with travellers having compatible journey itineraries and facilitates the transportation of the travellers along the vehicle's journey route. (*Id.*, 15-20 (§§5.5-5.6), 21-27 (§5.7), 35-39.)

65. I was also asked to consider Olmi under the assumption that Petitioners' proposed construction is not applied to the claim term. Under that assumption, my opinions do not change as Olmi, including as modified herein, still discloses a

“network of nodes” or “nodes” under any reasonable interpretation of the term consistent with the language of the claims of the ’427 patent, its specification, and from my review of the prosecution history for the ’427 patent (EX1004), for the same reasons that I explain herein. Meaning, the Olmi system and method still discloses the claimed “network of nodes” or “nodes” in a manner consistent with the ’427 patent. (*See also* my discussions for limitations [1.pre]-[1.b], [1.d]-[1.f].)

- v) **[1.d] “abstracting a geographic representation of a predetermined transport vehicle journey by calculating places where said predetermined transport vehicle journey intersects said nodes and representing said predetermined transport vehicle journey in the format of a set of said nodes;”**

66. In my opinion, a person of ordinary skill in the art would have understood that Olmi discloses this limitation.

67. For ease of analysis, I break element **[1.d]** into the following parts, which I address in turn below:

68. **[i]** a geographic representation of a predetermined transport vehicle journey; and

69. **[ii]** abstracting **[i]**, which is satisfied by

70. **[ii.a]** calculating places where said predetermined transport vehicle journey intersects said nodes, and

71. **[ii.b]** representing said predetermined transport vehicle journey in the format of a set of said nodes.

(1) [1.d.i] “a geographic representation of a predetermined transport vehicle journey”

72. **First**, based on my review, it is my opinion that a person of ordinary skill in the art would have understood that Olmi discloses that a carpool/vehicle driver may take a “predetermined transport vehicle journey.” Consistent with my discussions of Olmi above in Section VIII (and for limitations [1.pre]-[1.c]), Olmi discloses that a carpool/vehicle driver may take a “predetermined transport vehicle journey.” As I discussed above (*see* my discussions of Olmi in Section VIII and for limitations [1.pre]-[1.c]), Olmi discloses that a driver’s vehicle itinerary may comprise a “set of prescribed geographic points or addresses to which the vehicle must navigate in a prescribed order.” (EX1005, 11-12.) As I discussed, carpool drivers may have a “car pool intended itinerary specification,” which “include[s] details of the vehicle itinerary that the car pool driver intends to follow.” (*Id.*, 12.) A carpool driver uses a communication device in their vehicle to “submit his car pool intended itinerary specification...to the controlling computer system.” (*Id.*, 35; *see also id.*, 15, 32.) Thus, in my opinion, a carpool/vehicle journey may be a fixed and predetermined established route/path from the carpool driver’s start location to the end location. Similarly, when a driver is operating a transit vehicle on a fixed public transport route (e.g., bus, train, or tram), the vehicle’s journey follows a predetermined route. (EX1005, 70.)

73. As I discuss above, I was asked to consider Petitioners' proposed construction of "predetermined transport vehicle journey." (*See* my discussion above in Section VII.) For the reasons I discuss above and below, in my opinion, Olmi's method/system discloses this term under Petitioners' proposed construction.¹⁰ For example, for the reasons explained above and those summarized below, Olmi discloses:

¹⁰ I have been informed that Patent Owner (PO) disagrees with Petitioners' proposed construction of the claimed "predetermined transport vehicle journey" that I was asked to consider. I was also asked to consider Olmi under the assumption that Petitioners' proposed construction is not applied to the claim term. Under that assumption, my opinions do not change in that Olmi as modified herein still discloses a "predetermined transport vehicle journey" under any reasonable interpretation of the term consistent with the language of the claims of the '427 patent, its specification, and from my review of the prosecution history for the '427 patent, for the same reasons that I explain above how Olmi discloses this limitation. That is, the teachings in Olmi that I discuss above that support my opinion that Olmi discloses this limitation under Petitioners' proposed construction of the claimed "predetermined transport vehicle journey" are also applicable and support my

“predetermined transport vehicle journey”

“A trip along an existing route”: As I discussed above (*see* my discussions of Olmi for limitations [1.pre]-[1.c]), a driver may take trips along a predetermined/existing route (e.g., fixed personal itinerary for carpool such as a predetermined commuting route from work to home, or a public transport driver’s fixed vehicle itinerary). (EX1005, 11-12, 15-20 (§§5.5-5.6), 21-27 (§5.7), 32-39.)

“defined before demand for transport”: that a driver has submitted to the central computer system before being matched with a potential passenger. (EX1005, 19, 62-64, 70, 78, 83, 88.)

“and independently of a transport user’s door-to-door trip”: and independently of any potential passenger’s submitted journey itinerary. (EX1005, 19, 62-64, 70, 78, 83, 88; *see also* my discussions above in Section VIII.)

74. **Second**, it is my opinion that a person of ordinary skill in the art would have understood that Olmi discloses a “geographic representation” of that

opinion that Olmi discloses this claim term (and this limitation) in context of the ’427 patent.

predetermined transport vehicle journey. For example, Olmi's carpool scenario is exemplified using Olmi's Figure 1, annotated below, where route **R** reflects in this example a carpool predetermined journey following the path from nodes **1**, **2**, **3**, to **4**, such as a predetermined commuting route (e.g., work (node **1**) to home (node **4**) following the path including node **2** and node **3**). (EX1005, 11, 12, 34, 81-82, FIG. 1.)

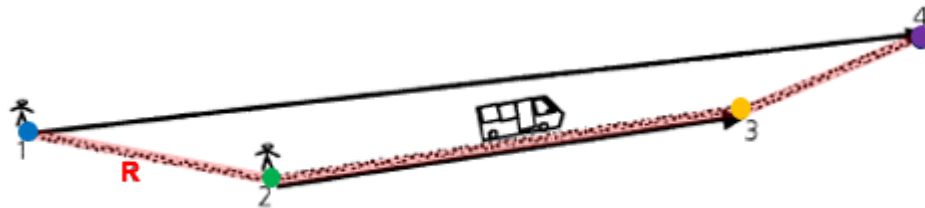
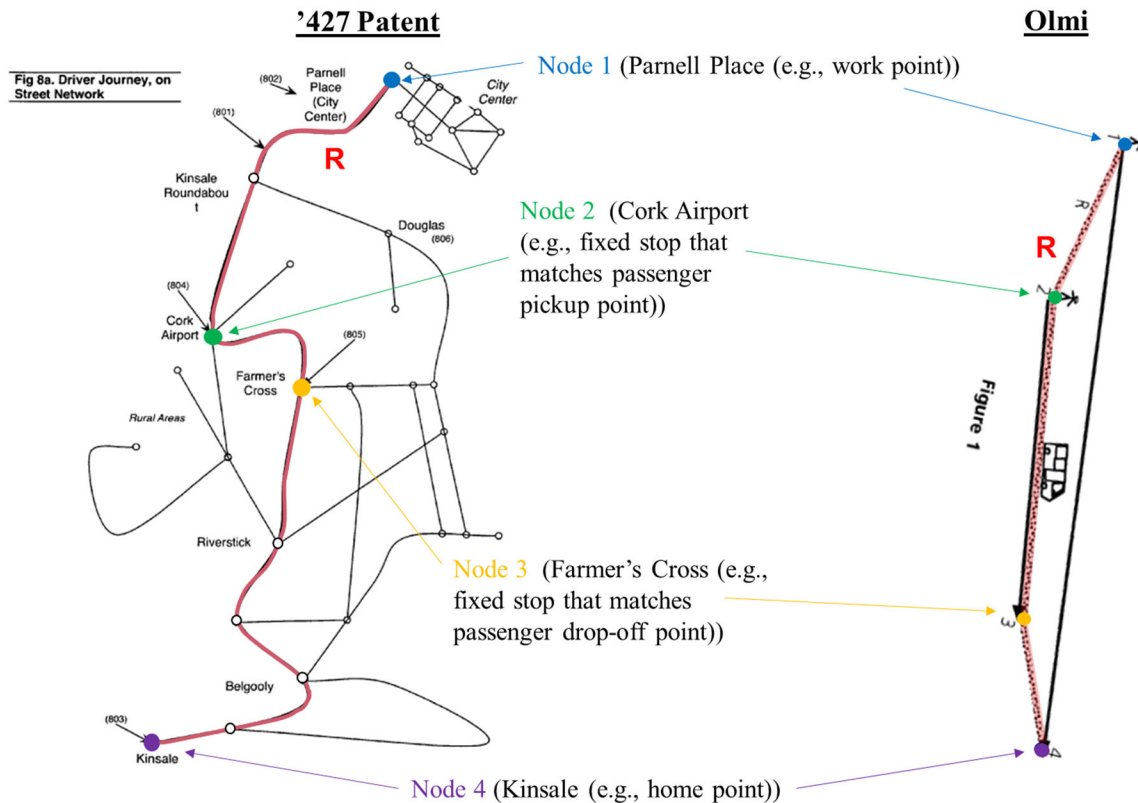


Figure 1

75. The carpool route **R** may be established via the driver's registration of the journey for potential transport sharing, etc., as explained above. (*Id*, 11, 12, 15, 32, 35.) As explained for limitation [1.c] and below for claim 2, the locations along the carpool route **R** (e.g., nodes **1**, **2**, **3**, to **4**), including pick-up and drop-off locations for a traveller (e.g., nodes **2**, **3**), can be fixed locations corresponding to public transportation stops, locations of main streets, etc. (See my discussions for limitations [1.c] and claim 2; EX1005, 11, 12, 19, 34, 62-64, 81-82.)

76. To illustrate similarities between this claimed feature, I provide below an exemplary comparison between the carpool vehicle journey exemplified using

Olmi's Figure 1 and the vehicle journey depicted in Figure 8a of the '427 patent, as comparatively shown below.



(EX1001, FIG. 8a (left, annotated)¹¹; EX1005, FIG. 1 (right, rotated/annotated).)

¹¹ See EX1005, 14:66-15:8 (“The route of the driver’s journey is shown in FIG. 8a as a dark line (801) moving from the north of the map toward the south of the map.... [T]he driver’s route 801 can automatically indicate that the path of this route is from Parnell Place 802 to Cork Airport 804 to Farmer’s Cross 805.”), FIG. 8b (driver journey from “Parnell Place (start)” to “Kinsale (terminate)”.)

77. Thus, in my opinion, Olmi's Figure 1 discloses an example of "a geographic representation of a predetermined transport vehicle journey" consistent with that described in the '427 patent and as recited in limitation [1.d].

a) [1.d.ii.a] "calculating places where said predetermined transport vehicle journey intersects said nodes"

78. In my opinion, a person of ordinary skill in the art would have understood that Olmi discloses "calculating places where said predetermined transport vehicle journey intersects said nodes." For instance, the points (e.g., nodes) maintained in Olmi's databases may be associated with, for example, fixed or predetermined stops/pick-up points that are along (i.e., intersect with) the carpool driver/vehicle's predetermined route. As I discussed above (*see* my discussions for limitations [1.c] and [1.d.i]), these pick-up and drop-off points ("nodes") may be associated with designated traveller pick-up/destination points provided in the traveller's journey request and itinerary. For example, as shown in Figure 1 (discussed further above and reproduced/annotated below), a traveller's requested journey reflected by pick-up and drop-off points (nodes 2 to 3) overlap/intersect the carpool driver's predetermined vehicle journey R (from nodes 1, 2, 3, to 4). (EX1005, 11, 12, 19, 34, 62-64, 81-82.)

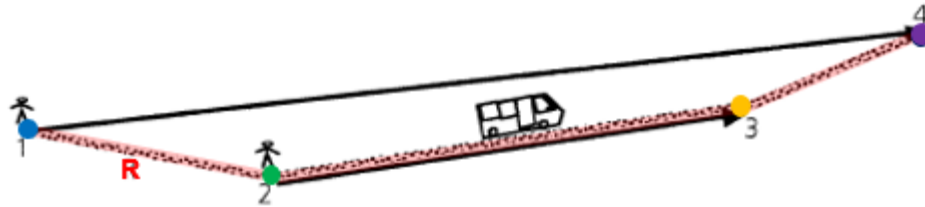


Figure 1

79. Olmi's system 15 performs processes to facilitate the traveller's requested transport without adversely affecting the carpool driver's original predetermined journey. For example, Olmi explains that a traveller itinerary is defined by embarkation and destination points, that a vehicle itinerary comprises prescribed geographic points or addresses to which the vehicle must navigate in a prescribed order, and that those geographic points are typically traveller embarkation and destination points. Olmi further explains that, in car pooling, the driver submits a car-pool intended itinerary specification that includes the vehicle itinerary the driver intends to follow, typically from the driver's current location to the driver's intended destination, with any additional stops en route also specified. (*Id.*, 11-12, 41-42.) Thus, Olmi's car-pool vehicle has a predetermined journey, and the relevant traveller pick-up and drop-off points are nodes against which that predetermined journey is evaluated.

80. For instance, as explained above, Olmi's carpooling transportation operations involve a carpool driver who has an established/predetermined vehicle journey path from a start node to an end node, e.g., work to home (or vice versa). A

traveller may send a journey request with pick-up/destination points, which are represented as nodes in the data structures stored in Olmi's itinerary database(s) in accordance with Olmi's teachings. (*See, e.g.*, EX1005, 11-13, 22-24, 32, 42-43.) The central computer 15 processes the request (*see* my discussions for limitations [1.c], [1.d.ii.b], [1.f]) to determine whether the traveller's journey information (e.g., in its itinerary record) matches requirements to support transport, including whether the nodes corresponding to the passenger/traveller's pick-up/drop-off points intersect/overlap with a carpool driver's/vehicle's preexisting route. (EX1005, FIGs. 1-3, 6, 8-9 (matching passengers with carpool drivers having compatible itineraries), 11-12 (carpool intended itinerary specification), 13 (carpool driver has own itinerary), 15-16, 19, 25, 30, 32, 35, 41-48 (discussing carpooling details).) Olmi contemplates that the pick-up and drop-off points (nodes) for a passenger/traveller can be points (nodes) corresponding to existing fixed points (e.g., existing stop/pick-up points along a main street, fixed stop locations, public transportation stop points, etc.) that likewise intersect the carpool's vehicle's preexisting route. (*See* my discussions for limitations [1.c] and [1.c] and claim 2.) A person of ordinary skill in the art would have understood based on the disclosures of Olmi that such designated pick-up/drop-off nodes associated with the fixed or predetermined stop/pick-up points (nodes) are directly along the way (and thus intersect) the preexisting route for the carpool driver/vehicle.

81. Accordingly, Olmi discloses that its system performs processes to calculate locations (e.g., places) where the carpool driver/vehicle's predetermined transport journey intersects pick-up/drop-off points ("calculating places where said predetermined transport vehicle journey intersects said nodes") in the network of such points maintained by Olmi's system (e.g., points represented as nodes in the data structures of Olmi's system). (*See* my discussions above for limitations [1.a]-[1.c]; EX1005, 11-13, 23.)

b) [1.d.ii.b] "representing said predetermined transport vehicle journey in the format of a set of said nodes"

82. In my opinion, a person of ordinary skill in the art would have understood that Olmi also discloses "representing said predetermined transport vehicle journey in the format of a set of said nodes." Olmi explains that a vehicle itinerary, which as discussed above (*see* my discussions for limitation [1.d.i]) may be a predetermined itinerary input by a carpool driver ("predetermined transport vehicle journey"), is represented as "a data structure or a computer data format" which "comprise[s] a **set of prescribed geographic points** or addresses to which the vehicle must navigate in a prescribed order." (EX1005, 11-12.) "Typically these geographic points [of the vehicle itinerary] will be traveller embarkation and destination points," e.g., pick-up and drop-off points for passengers of the vehicle, as well as points corresponding to "additional stops en route." (*Id.*, 12). Olmi

explains that each vehicle itinerary is “encoded as a directed graph whose vertices are the said geographic points or addresses, and whose directed edges indicate the direction of travel between these geographic points or addresses.” (*Id.*, 12.) Olmi discloses that this encoded vehicle itinerary is stored as part of a transit vehicle record in the controlling computer system’s transit vehicle current itineraries database. (*Id.*, 34.) Thus, a person of ordinary skill in the art would have understood based on the disclosures of Olmi, that a vehicle itinerary in Olmi’s system is represented/encoded as a set of geographic points/nodes (e.g., pick-up or drop-off points) that is stored within the controlling computer system’s transit vehicle current itineraries database (“representing said predetermined transport vehicle journey in the format of a set of said nodes”).

83. Accordingly, for the reasons explained above for limitation [1.d] and its component parts ([1.d.i]-[1.d.ii.a] and my discussions for this component [1.d.ii.b]), Olmi discloses abstracting a geographic representation of the points/nodes of a predefined vehicle itinerary (“abstracting a geographic representation of a predetermined transport vehicle journey”) by performing processes to calculate locations where the carpool driver/vehicle’s predetermined transport journey intersects pick-up/drop-off points (“calculating places where said predetermined transport vehicle journey intersects said nodes”) and then representing/encoding that vehicle itinerary as a set of geographic points/nodes

stored within the central computer's transit vehicle current itineraries database ("representing said predetermined transport vehicle journey in the format of a set of said nodes").

84. Thus, for the reasons explained above in Section IX.A.1.e, Olmi discloses "abstracting a geographic representation of a predetermined transport vehicle journey by calculating places where said predetermined transport vehicle journey intersects said nodes and representing said predetermined transport vehicle journey in the format of a set of said nodes," as recited in limitation [1.d].

vi) **[1.e] "providing an electronic registry in said computer network of demand containing an indication of the demand for transportation needs of a plurality of transport users;"**

85. In my opinion, a person of ordinary skill in the art would have understood that Olmi discloses this limitation.

86. For reasons that I discussed above in Section VIII and for limitations [1.pre]-[1.d], Olmi discloses that prospective travellers/passengers use their communicator devices to submit journey requests, which include traveller/passenger itinerary specifications, to indicate their travel requirements and preferences, and these journey requests are stored as journey request records in a journey requests database ("electronic registry...of demand"). (*See also e.g.*, EX1005, 12 ("A journey request is defined as a data structure or a computer data format which includes a specification of a traveller or passenger itinerary, and may also include a

specification of any other travel requirements relating to this itinerary....”), 32 (“In figure 5 a prospective traveller 19 uses a communicator device 17 to formulate and send his journey request to a central controlling computer system 15 via the data transmission system 16....The data in each such incoming journey request is stored as a journey request record in the journey requests database.”).) Also for reasons that I discussed above in section VIII and for limitations [1.pre]-[1.d]), the journey requests database is part of the controlling computer system, which is (alone or collectively with the other components) Olmi’s “computer network,” and thus the journey requests database “provid[es] an electronic registry in said computer network of demand.” A person of ordinary skill in the art would have understood that in Olmi, the journey requests and corresponding journey request records stored in the journey requests database provide “an indication of the demand for transportation needs of a plurality of transport users” because the journey requests allow prospective travellers to specify how many traveller seats are required for each journey. (EX1005, 16 (“[T]he journey request will allow travellers to specify the number of traveller seats required on the journey.”), 32 (each journey request record contains a data field reflecting “[t]he number of travellers to be conveyed on the said itinerary”).)

87. Thus, in my opinion, Olmi’s journey request database is “an electronic registry in said computer network of demand containing an indication of the

demand for transportation needs of a plurality of transport users,” and thus Olmi discloses limitation [1.e].

- vii) [1.f] “**effecting a match in a match engine in said computer network of said transport capacity of at least one transport vehicle in said electronic registry of capacity with said transport demand for a journey of at least one transport user in said electronic registry of demand for transport between at least two of said nodes.**”

88. In my opinion, a person of ordinary skill in the art would have understood that Olmi discloses this limitation.

89. For reasons that I explained above in Section VIII and for limitations [1.pre]-[1.e], Olmi’s controlling computer system 15 is, alone or collectively with the other components of the Olmi system (e.g., the system associated with Figures 4 and 6), a “computer network.” (*See e.g.*, my discussions above for limitation [1.a].) Olmi’s computer system 15 includes an “intelligent grouping module” (“matching engine in said computer network”), which is “a data-processing module which, on the basis of traveller journey requests” (“transport demand for a journey of at least one transport user”) “and on the basis of the transit vehicles available” (“transport capacity of at least one transport vehicle”) “intelligently groups the travellers associated with the journey requests into the said transit vehicles” (“effecting a match in a match engine in said computer network of said transport capacity of at

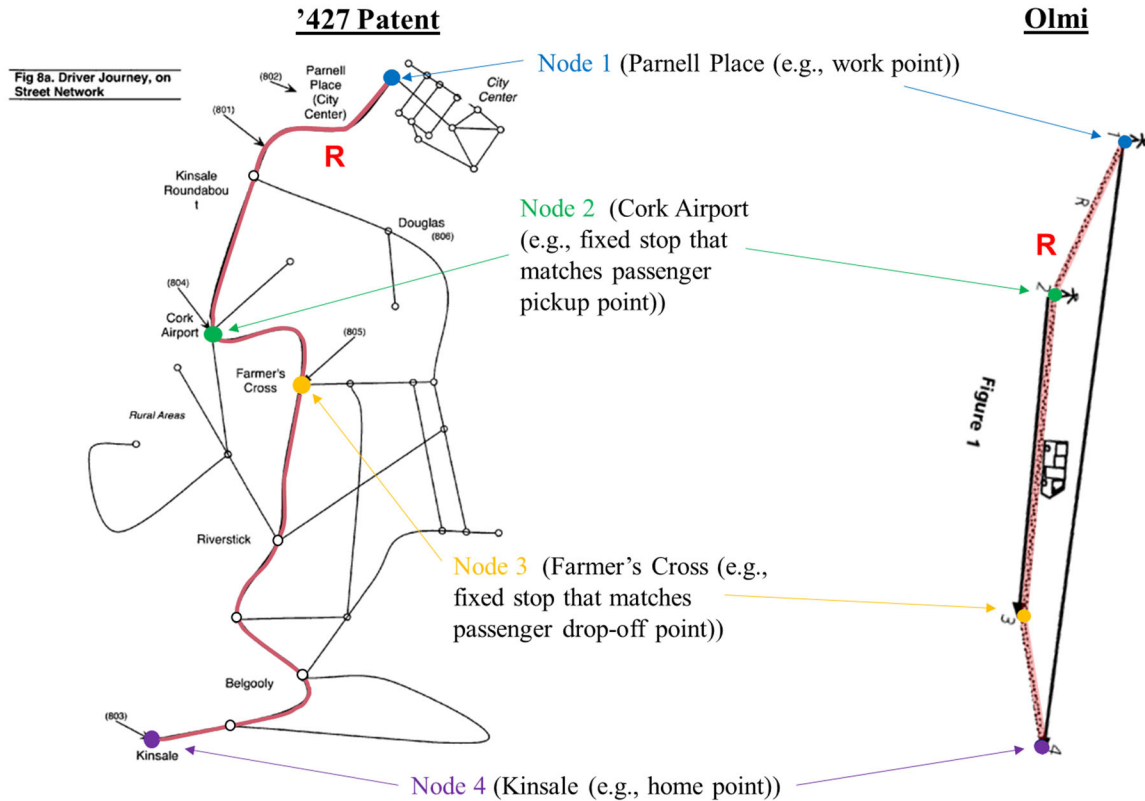
least one transport vehicle...with said transport demand for a journey of at least one transport user”). (EX1005, 13-14.)

90. For example, Olmi explains that the “car pooling configuration provides a very effective means of matching prospective passengers with car pool drivers having compatible itineraries.” (*Id.*, 9.) A carpool driver’s “car pool intended itinerary specification” contains information about the “number of available passenger seats in the car pool vehicle” (*id.*, 12), which is stored in the “transit vehicle current itineraries database” (“transport capacity of at least one transport vehicle in said electronic registry of capacity”) (*id.*, 34). A prospective carpool passenger can submit in their journey request “[t]he number of travellers to be conveyed” and “[a] specification of the type of transit vehicle requested by the traveller,” e.g., “a car pool vehicle” (“transport demand for a journey of at least one transport user”). (*Id.*, 32.)

91. It is also my opinion that a person of ordinary skill in the art would have understood that Olmi discloses that the intelligent grouping module matches traveller(s) to a vehicle “for transport between at least two nodes.” Olmi discloses that the journey request includes traveller/passenger itinerary information, including the traveller’s embarkation and destination points (and any other points). (EX1005, 11 (traveller/passenger itinerary includes at least “the traveller’s **embarkation point** and the traveller’s **destination point**”), 21 (“[E]ach traveller itinerary...is expressed

as a directed graph whose vertices encode the traveller's **embarkation and destination points (and any other points)**, and whose directed edges indicate the direction of travel.”), 32 (journey request record includes a data field specifying the “itinerary of the traveller”).) Similarly, a car pool intended itinerary specification includes “details of the vehicle that the car pool driver intends to follow,” including a starting point (e.g., “**current location point or address**”) and “**intended destination point or address**,” as well as any “additional stops en route.” (*Id.*, 12.)

92. For example, as I discussed above (*see* my discussions for limitation [1.d.i]) and again shown below, route **R** reflects a carpool driver/vehicle's predetermined journey following the path from nodes **1**, **2**, **3**, to **4** (such as a predetermined commuting route (e.g., work (**node 1**) to home (**node 4**) following the path including **node 2** and **node 3**). As I discussed, each of these nodes may be (and are in such scenarios disclosed by Olmi) predefined and correspond to, e.g., fixed locations that may correspond to existing public transportation stops, main street locations, etc. (*See* my discussions for limitation [1.d.i]; EX1005, 11, 12, 19, 34, 62-64, 81-82.)



(EX1001, FIG. 8a (left, annotated)¹²; EX1005, FIG. 1 (right, rotated/annotated).)

¹² See EX1001, 14:66-15:8 (“The route of the driver’s journey is shown in FIG. 8a as a dark line (801) moving from the north of the map toward the south of the map.... [T]he driver’s route 801 can automatically indicate that the path of this route is from Parnell Place 802 to Cork Airport 804 to Farmer’s Cross 805.”), 15:9-12 (discussing that “once the geographic representation is abstracted to stop nodes” as discussed with respect to Figure 8a’s geographic representation, “it is possible to show the driver’s route in a variety of alternate presentations, such as the presentation shown

93. Consistent with Olmi's teachings (as I explained above for this limitation and also for limitations [1.pre]-[1.e]), the carpool driver/vehicle's itinerary information would include capacity information, such as available seats in the vehicle, and related route information (**R** going from a starting point (**node 1**) to a destination point (**node 4**) via nodes **2** and **3**). (EX1005, 12, 21-23, 41-42.) As also explained, the carpool predetermined route **R** may be established via the driver's registration of the journey for potential transport sharing, resulting in data structures stored in Olmi's driver/vehicle itinerary databases in the controlling computer system of the computer network. (See my discussions for section VIII and for limitations [1.a]-[1.d]; EX1005, 34-35, 41-42.) The route **R** follows a path that intersects two nodes (**node 2** and **node 3**), which as explained above, may be fixed stop/pick-up points that were determined to be along route **R** (e.g., intersects predetermined route **R**). (See my discussions for limitations [1.d.i]-[1.d.ii]; EX1005, 11-12, 21-23, 31-33, 42.) A prospective passenger (e.g., a user) may provide a journey request that seeks transport for one or more people from locations corresponding to **node 2** to **node 3**, which as shown in this example, match the intersecting nodes along route **R**. (EX1005, 11-12, 21-23, 31-33, 42.) Thus, a person

in FIG. 8b"); FIG. 8b (driver journey from "Parnell Place (start)" to "Kinsale (terminate)").)

of ordinary skill in the art would have understood based on Olmi's disclosures that the passenger's journey request reflects the requested transport (e.g., demand for one or more seats for transport from embarkation point (node 2) to destination point (node 3)). Consistent with Olmi's teachings discussed above for limitation [1.d], Olmi's grouping module processes the requests to identify a match between the requested demand (e.g., passenger's journey request for at least one person's transport from node 2 to node 3 (e.g., at least two of said nodes)) with the available capacity (e.g., carpool driver/vehicle's available seats) traveling along route R that includes the predetermined journey from nodes 1, 2, 3, to 4. (See also my discussions for limitation [1.b], [1.d], [1.e], and claim 2; EX1005, 12-19, 32-34, 62-64, 70, 78, 83, 88.)

94. Thus, for the reasons explained above and also in Section VIII and for limitations [1.pre], [1.a], [1.e], it is my opinion that a person of ordinary skill in the art would have understood that Olmi discloses "effecting a match in a match engine" (e.g., intelligent grouping module) "in said computer network" (computer system 15 or collective system (see e.g., my discussions for limitation [1.a])) "of said transport capacity of at least one transport vehicle in said electronic registry of capacity" (e.g., carpool vehicle with seat availability as set forth in vehicle/carpool driver itinerary data structures and stored in vehicle itinerary database, see, e.g., my discussions for limitation [1.b]) "with said transport demand for a journey of at least one transport

user in said electronic registry of demand for transport between at least two of said nodes” (e.g., traveller/passenger journey request including transport demand regarding transport for a user(s) between two locations (e.g., transport start/end point demand) that correspond to preestablished nodes maintained in the network of nodes of Olmi’s system that intersect the carpool driver/vehicle’s predetermined route). (See my discussions in Section VIII and for limitations [1.c]-[1.e].)

2. Claim 2: “A method as set forth in claim 1 wherein the step of establishing said network of nodes is determined from an existing database of stops for bus networks.”

95. In my opinion, a person of ordinary skill in the art would have understood that Olmi discloses claim 2.

96. As I discussed for limitation [1.c], Olmi discloses that, similar to the ’427 patent, Olmi’s shared transport system/process can be integrated with existing public transportation systems, such that establishing the network of nodes may be determined from a preexisting group of nodes corresponding to, e.g., bus stops in bus networks. (See my discussions for limitation [1.c]; EX1005, 19 (“[T]he intelligent grouping module will have the ability to route...a traveller itinerary via existing modes of public travel such as buses and trains as well as by taxibus or car pool transit vehicles. This will enable this invention to seamlessly integrate with existing public transport....”), 62-64 (§§7.16-7.17) (including existing modes of public transport / integrated multi-modal transport system), 63 (“[o]nce existing

public travel modes are integrated into this controlling computer system...”), 64 (computer system calculates routes and arrange for vehicle transport to a drop-off point (node) “at the appropriate Underground station” to catch a train), 70 (describing integration of invention with existing public transport modes). Such teachings are consistent with features contemplated in the ’427 patent. (*See e.g.*, EX1001, 14:61-65 (network of nodes/stops can incorporate “existing databases of stops from existing bus networks”).) Thus, in my opinion, a person of ordinary skill in the art would have understood that “the step of establishing said network of nodes” (e.g., creating, storing, and maintaining data structures in the database(s) of computer system 15 relating to, e.g., the embarkation/destination points of travellers and vehicles) would have involved “determin[ing]” the points/nodes in the network “from an existing database of stops for bus networks” or other public transportation networks.

3. Claim 3¹³: “A method as set forth in claim 1 wherein the step of establishing said network of nodes is determined by creating an in-vehicle system.”

97. In my opinion, a person of ordinary skill in the art would have understood that Olmi discloses claim 3.

¹³ I have been asked to assume the language of claim 3 encompasses using an in-vehicle system to establish the network of nodes, consistent with the specification of

98. For reasons that I discussed for limitations [1.b]-[1.c], Olmi discloses “establishing a network of nodes” corresponding to a plurality of pick-up and drop-off points along a predetermined carpool journey route. (See my discussions for limitation [1.b]-[1.c].) Olmi further discloses that all transit vehicles are equipped with a vehicle communicator device, which may be an in-vehicle cellular telephone, wireless PDA, or similar device (“in-vehicle system”). (EX1005, 40-41.) Olmi discloses that a driver inputs their predetermined vehicle itinerary (which may contain multiple stops) by using the user interface of a vehicle communicator device. (*Id.*, 14 (“[A]ny car pool vehicle drivers use **communicator devices** to send their **car pool intended itinerary specifications**, to a controlling computer system....”), 32 (“[C]ar pool vehicle drivers will use a **communicator device** to submit their **car pool intended itinerary specification** to the controlling computer system....”), 41-42 (“At the journey start, a driver thus identified who wants to engage in car pooling must **inform the controlling computer system of his intended itinerary....The user interface of the vehicle communicator device** would be designed so as to let the driver easily specify the destination address (or addresses) on his itinerary....”).) Thus, a person of ordinary skill in the art would have understood that Olmi discloses

the ’427 patent, which explains that a “network of stops can, for example, be...created by the in-vehicle system 17.” (EX1001, 14:59-65.)

that a vehicle driver establishes the stops/nodes of the predetermined vehicle journey (“wherein the step of establishing said network of nodes”) by creating the journey/network using an in-vehicle communicator device/system (“is determined by creating an in-vehicle system”).

4. Claim 4: “A method as set forth in claim 1 wherein said geographic representation is received from a GPS unit.”

99. In my opinion, a person of ordinary skill in the art would have understood that Olmi discloses claim 4.

100. Olmi discloses that each vehicle communicator device and passenger communicator device (*see* my discussions for limitation [1.a]) contains a “GPS unit” that determines the current location of the vehicle/passenger and transmits the location information to the controlling computer system. (EX1005, 14 (Olmi’s system includes an “electronic positioning system” which may be the “American GPS (Global Positioning System)”)), 15 (“[A]ll transit vehicles are equipped with a communicator device; and...the electronic positioning system is able to locate the geographic position of all operational transit vehicles....[I]t is advantageous for the electronic positioning system to be able to locate travellers as well as transit vehicles...”), 29 (“An electronic positioning system 22 provides the controlling computer system with data regarding the current geographic location of the transit vehicle communicator devices 20 and (optionally) some passenger communicator devices 17.”), 31 (“The electronic positioning system 22 in this embodiment is a

satellite positioning system such as the American GPS (Global Positioning System), the broadcast positioning signal of which is received by GPS receivers contained in the vehicle communicator devices (and optionally in passenger communicator devices). These GPS receivers transmit electronic positioning data to the controlling computer system via the data transmission system.”), FIG. 6.)

101. In my opinion, Olmi discloses that the “geographic representation” of a carpool driver’s predetermined vehicle journey is “received from a GPS unit” for at least the reasons that I discuss below. (*See also* my discussions for limitation [1.d.i].)

102. First, the “driver’s intended itinerary...comprises his **current location** point or address and his intended destination point or address” (EX1005, 12), where the current location is determined using electronic positioning data (*id.*, 31). Olmi also discloses that geographical representation data is kept up-to-date with geographic position data from each of the transit vehicles. (*See* my discussions for limitation [1.d]; EX1005, 34 (“The transit vehicle current itineraries database is regularly maintained by data processing instructions which ensure the current geographic position data field (1) for each transit vehicle record is kept updated with the latest geographic position data for that transit vehicle, received from the electronic positioning system.”).) Thus, in my opinion, a person of ordinary skill in the art would have understood that the itinerary information used to create the

geographic representation of the predetermined journey (*see* my discussions for limitation [1.d.i]) relies on current location data from the vehicle communicator device's GPS unit ("wherein said geographic representation is received from a GPS unit").

103. Second, Olmi discloses that vehicles may have "in-car satellite navigation systems" that "make use of a digitized street layout map, and make use of data from a satellite electronic positioning system, in order to provide the car driver with real-time navigation instructions which are based on, and dynamically respond to, the vehicle's current geographic location." (EX1005, 14; *see also id.*, 18 (navigation module uses current geographic location that "rely on a **digitised street layout map** and use an electronic positioning system to provide current location data"), 31 (navigation module uses electronic position data to determine current vehicle location and "by relating this current location to a **digitised street layout map**, will provide the vehicle driver with **real-time** navigation instructions...").) Thus, in my opinion, a person of ordinary skill in the art would have understood that the geographic representation of a predetermined vehicle itinerary may be provided via digitized street layout map and real-time navigation instructions using data from the GPS unit ("wherein said geographic representation is received from a GPS unit").

5. Claim 5: “A method as set forth in claim 1 further comprising the step of gathering data to display real time transport capacity between selected nodes of said plurality of nodes.”

104. In my opinion, a person of ordinary skill in the art would have understood that Olmi discloses claim 5.

105. As I discussed for limitation [1.b], Olmi discloses collecting capacity information (“transport capacity”) and storing it in a transit vehicle current itineraries database. (See my discussions for limitation [1.b].) Olmi explains,

The transit vehicle current itineraries database contains a data record, which we shall call the transit vehicle record, for each currently operational transit vehicle. By a currently operational transit vehicle we mean a vehicle that is currently conveying travellers, or a vehicle that is currently empty but is ready to convey travellers. The format of the transit vehicle record includes ... [t]he passenger **capacity** of the transit vehicle (excluding the driver); that is, the total number of designated passenger places (seated or standing) in the vehicle.

(EX1005, 34.)

106. Olmi discloses that this stored capacity information reflects “real time transport capacity.” For example, Olmi discloses that real-time transportation data is used in its matching and route determination and navigation features. (EX1005, 16-17 (data transmissions occur “more or less instantaneously,” as “such speed is necessary if the invention is to operate effectively in **real time**”), 18, 27 (navigation

module can dynamically adapt transport vehicle routing using real-time electronic position data), 30 (configuration where the vehicle itinerary data from the database on system 15 is sent to the navigation module in vehicles 2, to provide navigation operations), 38, 42 (“transit vehicle record details the car pool vehicle’s **real-time current location**, the vehicle’s intended itinerary, and the **number of available passenger seats in the vehicle**” (“capacity”), which is also included in a new journey request record in the journey request database), 44 (real-time countdown to estimated carpool vehicle arrival time provided on passenger’s communicator device), 47 (similar for taxibus arrival time), 62 (integrating public transport modes where computer system 15 “must have real-time knowledge of the current location, routing, and destination of all participating public transport vehicles”), 64 (similar teachings), 76 (intelligent grouping module performing optimization processes based on real-time traffic conditions), 88-89 (similar), 94-95 (real-time countdown to pick-up). As such, a person of ordinary skill in the art would have understood that the capacity information stored in the transit vehicle current itineraries database reflects “real time transport capacity.”

107. A person of ordinary skill in the art would also understand that Olmi further discloses features for displaying the real-time transport capacity. As I discussed for limitation [1.f], Olmi discloses that the controlling computer system’s intelligent grouping module matches a prospective passenger with a suitable car pool

vehicle based on capacity and other features. (*See* my discussions for limitation [1.f].) Olmi explains that “[a]s soon as a suitable car pool vehicle is found, the controlling computer system provides details to the passenger: the vehicle’s distance from the passenger (in minutes), an estimate for the total car pool journey time (in minutes), and the cost of this car pool journey.” (EX1005, 43.) “Should the controlling computer system find more than one suitable car pool option, a list of the suitable vehicles will be detailed on the passenger’s communicator device,” upon which the passenger may “select[] any vehicle from the list in order to proceed with the car pool trip.” (*Id.*) Figure 8 below “shows part of the sequence of user-interface events on the text display screen of a communicator device when a passenger submits a journey request to the controlling computer system” for, e.g., “car pool transport.” (*Id.*, 29.)

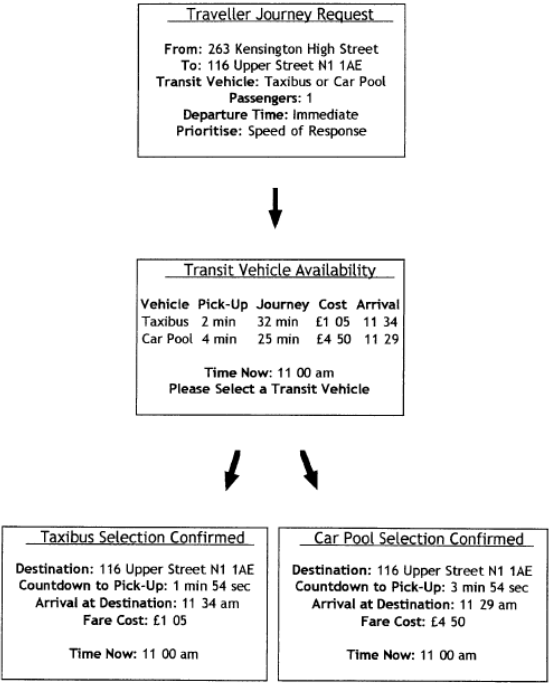


Figure 8

(*Id.*, FIG. 8; *see also id.*, 29, 32, 43, 47.)

108. As shown at the top of Figure 8, a traveller submits a “traveller journey request” including capacity (i.e., passengers) and selected nodes (e.g., pick-up and drop-off points marked “from” and “to”). (*Id.*, FIG. 8.) As I discussed for limitation [1.c], these nodes may be part of a predefined set of node data corresponding to fixed locations such as existing public transportation stops, main street locations, etc. (*See* my discussions for limitation [1.c].) As further shown in the middle of Figure 8, after a user inputs a traveller journey request and available transit options are identified, the controlling computer system displays on the passenger’s communicator device the “transit vehicle availability,” which shows real-time data

corresponding to vehicles currently available that meet the passenger's capacity requirements, pick-up and drop-off locations, and other specifications. (EX1005, FIG. 8.) Accordingly, it is my opinion that a person of ordinary skill in the art would have understood that Olmi discloses that the controlling computer system gathers transit vehicle data to display real-time transit options (reflecting vehicles that meet the transport capacity requirements) for trips between two selected pick-up and drop-off locations (from a plurality of fixed/predetermined nodes) ("the step of gathering data to display real time transport capacity between selected nodes of said plurality of nodes").

6. Claim 11: "A method as set forth in claim 1 further comprising the step of generating transport user displays of real time transport information according to the stored capacity and to real time vehicle monitoring."

109. In my opinion, a person of ordinary skill in the art would have understood that Olmi discloses claim 11.

110. It is my opinion that Olmi discloses claim 11 in the context of transport user displays that are displayed to the passenger both before and after vehicle selection. First, as I discussed above for claim 5, Olmi discloses gathering data to generate a display on a transport user's communicator device of real time transport capacity (e.g., available vehicles) between user-selected nodes ("the step of generating transport user displays of real time transport information"). (See my discussions for claim 5.) As I further discussed for claim 5, this displayed data is

based on and reflects the capacity information stored in the transit vehicle current itineraries database (“according to the stored capacity”). (*Id.*) Olmi also explains that the controlling computer system provides details such as “the vehicle’s distance from the passenger (in minutes),” as shown in yellow in Figure 8 below. (EX1005, 43.)

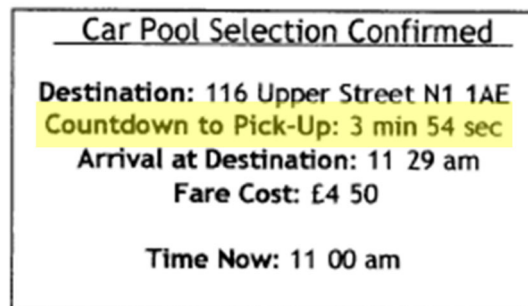
Transit Vehicle Availability				
Vehicle	Pick-Up	Journey	Cost	Arrival
Taxibus	2 min	32 min	£1 05	11 34
Car Pool	4 min	25 min	£4 50	11 29
Time Now: 11 00 am				
Please Select a Transit Vehicle				

(*Id.*, FIG. 8 (excerpted/annotated); *see also id.*, 29, 32, 43, 47.)

111. As I discussed for claim 4, each vehicle communicator device and passenger communicator device contains a GPS unit that determines the current location of the vehicle/passenger and transmits the location information to the controlling computer system. (*See* my discussions for limitation [4].) Thus, in my opinion, a person of ordinary skill in the art would have understood that the displayed real-time distance information (i.e., the distance a transport vehicle is from a passenger) is generated based on the real-time location of the passenger and real-time location of the vehicle (“according...to real time vehicle monitoring”).

Accordingly, Olmi discloses generating a display to the transport user (“the step of generating transport user displays”) before vehicle selection that is comprised of real-time vehicle location information for vehicles with available capacity (“of real time transport information according to the stored capacity and to real time vehicle monitoring”).

112. Similarly, after a passenger selects a vehicle, “[t]he waiting passenger’s communicator device will generally provide a countdown to the estimated time of arrival of his requested car pool...vehicle,” as shown below in Figure 8. (EX1005, 86.)



(*Id.*, FIG. 8 (excerpted/annotated).)

113. A person of ordinary skill in the art would have understood that this transport user display showing real-time distance/location information is also generated based on the available vehicle capacity (since the selected vehicle is chosen from a list of vehicles displayed based on available capacity) and on the real-time passenger vehicle monitoring discussed above, which allows for calculating

distance/time between the passenger and the vehicle. Accordingly, Olmi also discloses generating a display to the transport user (“the step of generating transport user displays”) after vehicle selection that is comprised of real-time vehicle location information for a selected vehicle with available capacity (“of real time transport information according to the stored capacity and to real time vehicle monitoring”).

7. Claim 12: “A method as set forth in claim 11 wherein said display is in the form of a departure board.”

114. In my opinion, a person of ordinary skill in the art would have understood that Olmi discloses claim 12.

115. As I discuss above, Olmi discloses claim 11. As I discussed for claims 4 and 11, Olmi discloses “display[ing]” transportation-related information on a “transit vehicle availability” display of the passenger’s communicator device, as reproduced below.

<u>Transit Vehicle Availability</u>				
Vehicle	Pick-Up	Journey	Cost	Arrival
Taxibus	2 min	32 min	£1 05	11 34
Car Pool	4 min	25 min	£4 50	11 29
Time Now: 11 00 am				
Please Select a Transit Vehicle				

(EX1005, FIG. 8 (excerpted).)

116. Olmi also discloses that this information may be displayed “in the form of a departure board.” For example, Olmi discloses that rather than using a portable communicator device (e.g., cellular telephone or wireless PDA), the traveller communicator device may be in the form of a “roadside kiosk communicator device unit,” which “comprise[s] a display screen and keyboard (or a more robust virtual touch-screen keyboard),” and is “incorporated into bus stops or similar roadside structures” and “located both on high streets and on quieter residential streets.” (EX1005, 40.) Olmi explains that these “roadside kiosk communicator device[s]” are “easily spotted since the kiosk structure will be clearly visible from the road.” (Id., 44.) A person of ordinary skill in the art would have understood that a public display located at bus stops or similar structures that, like other communicator devices, is capable of displaying transit vehicle availability like in Figure 8 above, is a “departure board.”

8. Claim 15

i) [15.pre] “A ground transportation network comprising”

117. In my opinion, Olmi discloses this limitation for the same reasons I discussed above for limitation [1.pre] (describing a “ground transportation network”). (See my discussions for limitation [1.pre].)

ii) [15.a] “a computer network;”

118. In my opinion, a person of ordinary skill in the art would have understood that Olmi discloses this limitation for the same reasons I discussed for limitation [1.a] (describing a “computer network”). (See my discussions for limitation [1.a].)

iii) [15.b] “an electronic registry of capacity in said computer network containing an indication of the spare transport capacity and location of a plurality of transport vehicles;”

119. In my opinion, a person of ordinary skill in the art would have understood that Olmi discloses this limitation. for the same reasons I discussed for limitation [1.b] (describing the Olmi system including an electronic registry of capacity like that claimed in limitation [15.b]). (See my discussions for limitation [1.b].)

iv) [15.c] “a display system for displaying a network of nodes in said computer network representing a plurality of pick-up points and a plurality of drop-off points;”

120. In my opinion, a person of ordinary skill in the art would have understood that Olmi discloses this limitation. As I discussed for limitation [1.c], Olmi discloses establishing “a network of nodes in said computer network representing a plurality of pick-up nodes and a plurality of drop-off points,” where the network of nodes corresponds to the pick-up/drop-off points of a carpool driver’s predetermined vehicle journey. (See my discussions for limitation [1.c].) As I

discussed for claim 4, Olmi discloses that vehicles may have in-car satellite navigation systems (“a display system”) that display digitized street layout maps which provide the car driver with real-time navigation instructions corresponding to their predetermined itinerary (i.e., the “network of nodes” corresponding to the route) and based on the vehicle’s current location. (*See* my discussions for claim 4.)

121. Olmi discloses the claimed “network of nodes” / “nodes” under Petitioners’ and PO’s constructions for the same reasons I explain above for limitation [1.c]. (*See* discussions above for limitation [1.c] regarding how Olmi discloses the claimed “network of nodes” / “nodes” under Petitioners’ and PO’s constructions.)

122. In addition to considering Petitioners’ and PO’s constructions (Section VII), as I explained above for limitation [1.c], I was also asked to consider Olmi under the assumption that Petitioners’ and PO’s proposed construction are not applied to the claim term (“network of nodes” / “nodes”). Under that assumption, my opinions do not change in that Olmi as modified herein still discloses a “a network of nodes” or “nodes” as recited in claim 15 under any reasonable interpretation of the term(s) consistent with the language of the claims of the ’427 patent, its specification, and from my review of the prosecution history for the ’427 patent, for the same reasons that I explain herein. That is, Olmi discloses “a display system for displaying a network of nodes in said computer network representing a

plurality of pick-up points and a plurality of drop-off points” as claimed for the same reasons I discuss above in context of how I apply both Petitioners’ and PO’s proposed constructions. The disclosures of Olmi, as I apply above, still in my opinion, disclose the claimed network of nodes / nodes as recited in this claim limitation [15.c] and in the challenged claims. (*See also* my discussions for limitations [15.pre]-[15.b], [15.d]-[15.f].)

123. Accordingly, Olmi discloses “a display system for displaying...” as recited in limitation [15.c].

- v) **[15.d] “an electronic registry of demand in said computer network containing an indication of the demand for transportation needs of a plurality of transport users;”**

124. In my opinion, Olmi discloses this limitation for the same reasons as I discussed for limitation [1.e] (describing the Olmi system including an electronic registry of demand like that claimed in limitation [15.d]). (*See* my discussions for limitation [1.e].)

- vi) **[15.e] “a matching engine in said computer network to effect a match of said transport capacity of at least one transport vehicle in said electronic registry of capacity with said transport demand for a journey of at least one transport user in said electronic registry of demand;”**

125. In my opinion, Olmi discloses this limitation for the same reasons as I discussed for limitation [1.f]. (*See* my discussions for limitation [1.f].)

- vii) [15.f] “a processor in said computer network for abstracting a geographic representation of said transport demand for a journey relative to said nodes by calculating places where a predetermined journey of a transport vehicle intersects said nodes and representing said predetermined journey in the format of a set of said intersected nodes.”

126. In my opinion, Olmi discloses this limitation for similar reasons to those I discuss above for limitations [1.d]-[1.f]. (*See* my discussions for limitations [1.d]-[1.f].) The analysis for those limitations demonstrates how the computer system 15, or system including system 15, (“computer network”) in Olmi includes a central controlling computer system that would have performed the same features recited in limitation [15.f]. (*See* my discussions for section VIII and limitations [1.d]-[1.f].) Olmi explains that the controlling computer system is a “data-processing system...comprising a set of distributed (typically portable or mobile) computer processors,” and thus Olmi discloses that “a processor in said computer network” would have performed the same features recited in limitation [15.f]. (EX1005, 13.)

127. Further, as I explained for limitation [15.d], Olmi discloses maintaining a registry of demand. Likewise, as I discussed for limitation [1.d], Olmi discloses abstracting a geographic representation of a predetermined transport vehicle journey by calculating places where that journey intersects the nodes and representing the

predetermined journey in the format of a set of the intersected nodes, similar to that claimed in limitation [15.f]. (*See* my discussions for limitation [1.d].)

128. Thus, for similar reasons discussed above for those limitations/claims, Olmi discloses “a processor in said computer network for abstracting a geographic representation of said transport demand for a journey relative to said nodes by calculating places where a predetermined journey of a transport vehicle intersects said nodes and representing said predetermined journey in the format of a set of said intersected nodes,” as claimed. (*See* my discussions for limitation [1.d]-[1.f] and [15.c]-[15.d].)

B. Olmi Discloses and/or Suggests the Limitations of Claims 1-5, 11, 12, and 15

1. Claims 1-5, 11, 12, and 15

129. Olmi discloses that the invention has “two main configurations: electronic navigation taxibus transport, and car pooling transport.” (EX1005, 8.) The features of Olmi’s system that I described above in Section IX.A are attributable either to the carpooling configuration (as I applied above in Section IX.A) or are applicable to both carpooling and taxibus configurations. My opinions in Section IX.A are based on Olmi’s disclosed carpooling configuration and on system features that Olmi describes as usable across its disclosed transport modes.

130. I have also been asked to assume a scenario where disclosure relied on above (such as Olmi’s discussion of integration with existing public transport, use

of predetermined or fixed embarkation and destination points, or use of roadside kiosk communicator devices) is described only in connection with Olmi's taxibus configuration. In that scenario, it is my opinion that a person of ordinary skill in the art would have been motivated to apply those features in Olmi's carpooling configuration in a manner that still meets claims 1-5, 11, 12, and 15.

131. I incorporate all of my opinions above in Section IX.A regarding Olmi's disclosures for claims 1-5, 11, 12, and 15. In addition, Olmi explains that "[t]his invention can run either of these configurations separately, or **can run them both at the same time.**" (EX1005, 8.) Thus, in my opinion, a person of ordinary skill in the art would have understood that Olmi's system has the flexibility such that taxibus features and carpool features may be integrated into the same system/method that runs both configurations at the same time. A person of ordinary skill in the art would have further recognized that Olmi also explains that "[t]he car pooling configuration of this invention," while more simplistic than the taxibus, still "manages to solve **all the problems** of car pooling described in section 4.3" of Olmi, similar to the taxibus configuration. (*Id.*, 9.) Furthermore, Olmi discloses that the preferred embodiment of Figures 4 and 6, as I discussed above in Section IX.A, which operates using a central controlling computer system rather than a distributed series of processors incorporated in the communicator devices (EX1005, 29-30), incorporates features of both the taxibus and carpooling configurations. (*Id.*, 31-66.)

In addition to being compatible with the same hardware embodiments, “[i]n both taxibus and car pooling, the transportation capabilities of this invention are completely scalable.”¹⁴ (*Id.*, 9.) In my opinion, a person of ordinary skill in the art would have understood that the taxibus and carpooling configurations address substantially similar problems and rely on similar hardware architectures, and accordingly would have recognized that the taxibus features could be readily implemented in a carpooling system.

132. Accordingly, in my opinion, a person of ordinary skill in the art would have understood that the scope of the problems solved by the taxibus and carpooling configurations is similar, and both operate using similar hardware configurations and associated processes performed by the computer system. Therefore, such a skilled person would have been motivated to consider the disclosures in Olmi collectively

¹⁴ Again, while Olmi discloses the Figures 4 and 6 configurations incorporates taxi bus and carpooling features, each feature is not required for the other. Meaning, Olmi discloses providing carpooling features using the components and processes as I discuss above in Section IX.A without requiring taxibus features. Having said that, a person of ordinary skill in the art would understand that Olmi also discloses that features associated with the taxi bus configuration and the carpooling configuration can be integrated.

and likewise been motivated to integrate features disclosed with respect to the taxibus configuration with those of the carpooling configuration to implement Olmi's system (e.g., Figures 4 and 6) to perform shared transportation network operations for carpooling using features associated with Olmi's taxibus configuration.

133. For example, even if the features discussed above—such as integration with existing public transportation systems or the use of predetermined, fixed embarkation and destination stops in Olmi's network of nodes, (*see, e.g.,* my discussions for limitations [1.c]-[1.d.i])—were deemed to be described solely in the context of Olmi's taxibus configuration, a person of ordinary skill in the art would have appreciated and understood that they could have likewise been advantageously used in the context of Olmi's carpooling configuration. In fact, Olmi explains, “[i]t is anticipated that just by introducing a taxibus service...the general public will start to make better use of existing public transport” because the taxibus service would allow for an easier and more efficient experience going to and from public “transport departure and arrival points (train stations, bus stops, and so forth).” (EX1005, 62.) A person of ordinary skill in the art would have understood that integrating the carpooling configuration to integrate with existing public transport stops would predictably yield similar benefits, because, for example, as drivers and passengers could share rides, for example, when arriving at or departing from a public transport

stop, or could share rides that bridge two modes of public transport (e.g., between bus and train). Integrating public transport stops into Olmi's network of nodes would also have enabled the use of kiosk communicator devices at bus stops (*see* my discussions for claim 12) would have advantageously provided access to carpooling services for passengers who either did not have a personal communicator device with them or whose personal communicator devices were not configured to use the carpooling service. In my opinion, including these features (and others that may be found to be associated with Olmi's taxibus service) in the carpooling configuration would have been a routine design choice that would predictably yield a more efficient carpooling system capable of servicing a broader population. Such integration would, in turn, foreseeably reduce traffic and parking congestion, lower pollution, and improve overall quality of life, consistent with the benefits Olmi attributes to the invention. (*See, e.g.,* EX1005, 2-3.)

134. Accordingly, under this assumed scenario I was asked to consider, it is my opinion that a person of ordinary skill in the art would have been motivated to implement, and had a reasonable expectation of success in implementing, a modification to Olmi's carpooling configuration to include features assumed for purposes of this analysis to be disclosed for the taxibus configuration, especially given it would have involved the application of known technologies (e.g., known shared transport system features, as discussed by Olmi and I explain for Section

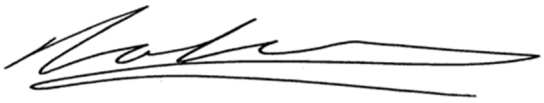
IX.A and above here) according to known techniques (e.g., known software and hardware techniques for implementing such features as the computer-implemented and network-implemented processes described by Olmi as I explain above here and for Section IX.A). Such a modification would have predictably resulted in a modified Olmi system/process in which a shared transport system in a carpooling configuration incorporates features such as fixed or predetermined stop points, integration with existing public transport stops, and kiosk-based rider interfaces, thereby providing a more predictable and efficient carpooling system.

135. Because the combined features in such a modified Olmi system and process are the same features that I discuss above from Olmi in my analysis for Section IX.A, the foreseeable resulting system and process would include the same features and meet each limitation of claims 1-5, 11, 12, and 15 for the reasons explained here and above for Section IX.A.

X. CONCLUSION

136. I declare that all statements made herein of my knowledge are true, and that all statements made on information and belief are believed to be true, and that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Dated: March 11, 2026

By: 

Petros Ioannou, Ph.D.