DECLARATION OF YONATAN LAVI

1. My name is Yonatan Lavi. I live in Tel Aviv, Israel. I am providing this declaration based on my personal knowledge and I am not being compensated for providing this declaration.

2. I have been informed by attorneys for Microsoft Corporation ("Microsoft") that Bradium has asserted several patents which list me as a co-inventor, along with Isaac Levanon. I understand that these patents include U.S. Patent Nos. 7,139,794 B2 ("the '794 Patent"), 7,908,343 B2 ("the '343 Patent"), 8,924,506 B2 ("the '506 Patent), and 9,253,239 B2 ("the '239 Patent"). I understand that all of these patents are related to six provisional U.S. patent applications filed on December 27, 2000, which also list myself and Mr. Levanon as co-inventors. In this declaration, I will discuss my knowledge of 3DVU, Inc. and 3DVU, Ltd. (collectively, "3DVU"),[1] which originally filed these patent applications.

3. I was first hired to work at 3DVU (then known as GACentral.com, Inc.) by Isaac Levanon in mid-1999 as a software developer. I, along with two other

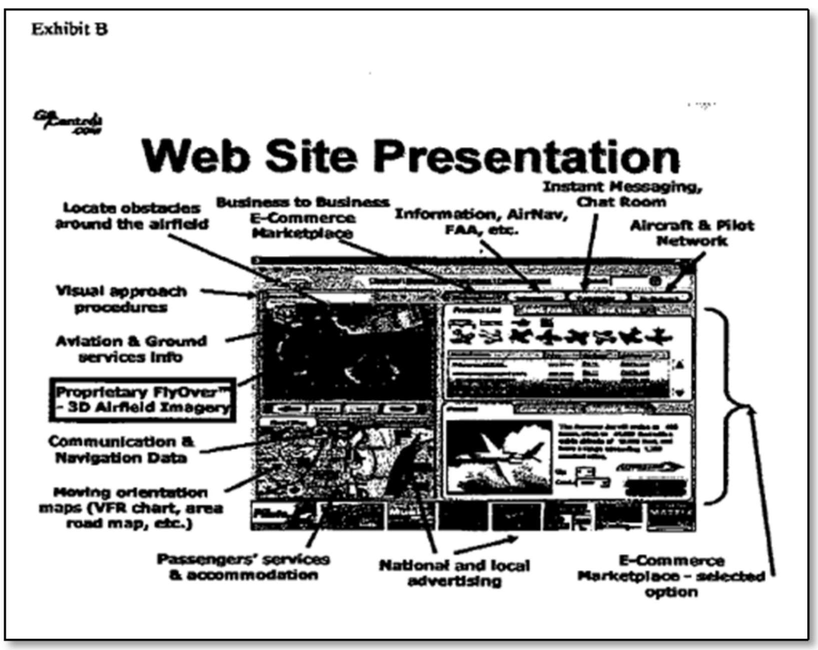
[1] 3DVU was originally formed as GACentral.com, Inc. and changed its name to FlyOver Technologies, Inc. in early 2000 before changing its name again to 3DVU. 3DVU, Ltd. was set up as a subsidiary of 3DVU, Inc., which was a US company. To avoid confusion, I will refer to all of these companies as "3DVU" unless the difference is relevant to a particular issue.

developers, Ohad Eder-Pressman and Eyal Navon, started working informally for Mr. Levanon and his company (3DVU) shortly after I graduated from high school. The three of us worked essentially as independent contractors (although there was no formal employment or other contract at the time) for a few months spanning the years 1999-2000. My recollection is that Mr. Levanon communicated mostly with Mr. Eder Pressman, although the three of us were paid individually. All three of us were offered (and I accepted) shares of stock in the company in the year 2000. Mr. Eder-Pressman and Mr. Navon were also recent high school graduates with some software development experience who were contracted by Mr. Levanon to write code for 3DVU. Mr. Levanon's role was primarily running the company, rather than in developing software. Mr. Levanon was not a computer programmer, and my recollection is that at that time and throughout the time that I worked at 3DVU he did not have the ability to write software code himself.

Original 3DVU prototype and 2000-2001 patent applications

4. When I initially worked for 3DVU in 1999 and 2000, 3DVU was primarily focused on developing a prototype of a website for visualizing aerial imagery for an area such as an airport. In particular, we wanted to develop a

website that might be used to show pilots a perspective view of the area around an airport, which was the scenario that many of our early efforts were designed around. The "GA" in the original name of the company was short for "general aviation." Mr. Levanon wanted the prototype to offer pilots the ability to simulate flying over an aerial photograph of an airfield. For example, Ex. B to a declaration that Mr. Levanon filed on January 10, 2006 during the prosecution of Application No. 10/035,981 (which became the '794 Patent) shows how the "FlyOver" imagery was part of a website showing information about an airfield:



I have attached a true and correct copy of the same document to this declaration as Exhibit A.

5. The "FlyOver" imagery in the 1999-2000 prototype basically took a two-dimensional image (like an aerial or satellite photograph) and transformed it (performing trigonometric calculations to determine where pixels from the image would appear on the screen) to create a view from a simulated perspective. The process of transforming a 2D image to view it from a three-dimensional perspective was already very well-known at the time, such as in texturing in video game applications. This original prototype also did not include any elevation data or way to visualize elevation data, so any scene that a user looked at with the "FlyOver" viewer would have looked like a flat plain or plateau, even if the user was looking at satellite or aerial photographs of a place with hills and valleys or other terrain.

6. The prototype also used a technique called "MIP-mapping," which is a basic computer graphics concept that I knew was well-known long in the industry before any work that we did at 3DVU. For example, the OpenGL software rendering library, which was developed by Silicon Graphics, used MIP-mapping extensively. In MIP-mapping, a source image is first divided up into a series of sub-images, which we sometimes referred to as image parcels or tiles. These sub-images are then down-sampled into a series of derivative images at progressively lower resolution. Progressively improving the

resolution of an image by gradually replacing lower-resolution mip-mapped versions of the image with higher-resolution versions of the image was also well-known. For example, many video games used mip-mapped textures to whose resolution would be progressively enhanced as the viewpoint approached a portion of the scenery. In fact, as I discuss further, the original 3DVU prototype used a mip-mapped file format called FXT1 which was originally developed by another company for texture compression in video games.

7. Although the overall process was not new, we did develop what we thought were some improvements to the way that image parcels in a MIP-map could be stored on a server and requested by a client. The 3DVU prototype in 1999-2000 stored the image data for a large set of tiles within a single large file (a master index file) that had a specified format. The idea of storing smaller bits of data within a larger file was also something that was well-known before we built this prototype, but most systems used a "lookup table" at the beginning of the file that listed the "offset" (distance from the start of the file, measured in bits or bytes) to the desired data. Ohad Eder-Pressman, who worked with us at 3DVU, figured that the system could skip using the lookup table if all of the tiles within the file were the same byte

size. If the tiles were all the same size, the client device could simply calculate the offset based on the X, Y position of the tile and the level of the tile within the hierarchy of resolutions. Calculating offsets in this manner also required a variable in the code (TileSize) for the size of the tile.

8. We described this method of calculating offsets for fixed byte size tiles in a Declaration that Mr. Levanon and I submitted to the U.S. Patent and Trademark Office on June 13, 2006 in support of the application that became the '794 Patent. As we explained on page 3/110 of that Declaration:

> **The function GenerateTileOffset computes the offset of each requested parcel inside the "Parcel data store" described by the patent. There is an explicit assumption of 2KB per compressed parcel in the data store, possible through use of a fixed-rate compression, which makes the implementation very simple.**

9. In the same declaration, we also provided an example of the code which the prototype used. The code at page 20/110 of this declaration shows how to calculate offsets within the master index file to locate particular tiles:

```
// Garage Operation. (Calculates offsets inside map tile
master index file)
static void GenerateOffsetTable()
{
     // BASE OFFSET: 1K
     const dword BASE_OFFS = 1024;
     // IMAGE CELL SIZE (TSxTSx16bit using FXT1): 4bit *
TS^2
     const dword BASE_HEADER = 16;
     g_TM.IMAGE_CELL_SIZE =
((g_TM.TileSize*g_TM.TileSize)>>1)+BASE_HEADER;

     dword I,OFFS = BASE_OFFS;

     for(I=0;I<g_TM.MaxLevel;I++)
     {
          // LEVEL OFFSET: #Tiles(T|Lvl(T)=L) *
IMAGECELLSIZE
          dword S = g_TM.TSize[I];
          dword X = (g_TM.XSize+S-1)/S; //divide + round up
          dword Y = (g_TM.YSize+S-1)/S; //divide + round up
          g_TM.XTiles[I] = X;
          g_TM.Offs[I] = OFFS;

          OFFS += X*Y*g_TM.IMAGE_CELL_SIZE;
     }
}

// calculates offset inside map tile master index file,
given the Texture's level and
// (X,Y) in that level's tile grid.
static dword GenerateTileOffset(dword Level,dword X,dword
Y)
{
     return g_TM.Offs[Level] + (X + Y *
g_TM.XTiles[Level])*g_TM.IMAGE_CELL_SIZE;
}
```

10. This source code used a formula to calculate the byte offset for a particular tile based on the size of each tile and the X, Y position and level of each tile.

11. As noted above, we also used compression to reduce the size of each data block corresponding to an image parcel (tile). However, in order to preserve the system of locating tiles by calculating offsets rather than using a lookup table, we used a variation of a texture compression format, known as FXT1, which had a fixed compression rate per pixel, so that a tile of a given size measured in pixels would always be the same size as measured in bytes.

FXT1 was an open source texture compression format released by a company called 3dfx in around 1998-1999, designed mainly for video games. We (at 3DVU) did not invent this file format, we simply used it (with slight modifications) for our application.

12. For example, as we mentioned on page 7/110 of the June 13, 2006 Declaration:

> **block, using the function DecodeFxt1. The FXT1 texture compression format has a fixed rate compression of 4 bits per pixel, yielding 2KB of data per each compressed 64 by 64 image parcel. This matches the compression rate for parcels specified in the patent application.**

13. The requirement for fixed byte size tiles based on fixed ratio compression is also reflected in the patents that were eventually filed based on the provisional applications that 3DVU filed in December 2000. The ‘343 Patent states at column 6, lines 19-22 that “[t]he preferred compression algorithm may implement for example a fixed 4:1 compression algorithm such that each compressed and stored image parcel has a fixed 2K byte size.” The same sentence appears in the ‘506 Patent at column 6, lines 25-28 and in the ‘239 Patent at column 6, lines 21-24. All of the independent clams of the ‘343 Patent and ‘506 Patent also say that the tiles have to be fixed byte size.

14. One of the intended purposes of the prototype that we built in 1999-2000 was to operate over “narrowband” communication channels, or communication channels with limited bandwidth. For example, the prototype that we built in 1999-2000 used a dial-up modem connection, and such modems at the time typically offered speeds such as 56 KBps, 28.8 KBps, 14.4 KBps, or even lower.

15. In our design of the prototype, limits on processing power and the limits on bandwidth were distinct issues. For example, the size of the tiles was an aspect of the design that affected the bandwidth over which the system could successfully operate, while the manner in which tiles were rendered and displayed was a design consideration that could affect how much computing power was required to successfully operate the device. While these considerations could occur in the same device, they were also independent of each other (for example, if a computer with a powerful processor was connected to the Internet with a very slow connection, or if a device with limited processing and rendering power was connected to the Internet with a fast connection) and I did not consider limited bandwidth and the processing power of the device (or the size or shape of the computing device) to be synonymous or interchangeable.

16. We (at 3DVU) did not attempt to operate any of the software on a Personal Digital Assistant (PDA) or other mobile computer system, or otherwise write special adaptations in the code specific to mobile operating systems, before I left for the IDF, or before the first provisional applications for patents relating to this prototype were filed in December 2000. My recollection is that the testing of our prototype in 1999-2000 was all on a browser interface operating on a standard home desktop personal computer. I do not recall exactly what model of computer or computers we used, but to the best of my recollection, the computers that we used for our prototype would have most likely had a processor such as an Intel Pentium II or III or a processor of similar computing power.

17. The software used in the original prototype, both for the server and for the client, was written primarily in standard C++ code. The original software was not written specifically for a mobile or embedded system. However, adapting the software for a PDA later on would have been a straightforward matter because the Windows CE (later Windows Mobile) mobile operating platform was designed to maximize the overlap in functionality with the Windows desktop environment, precisely so that developers could easily adapt Windows desktop applications for mobile use. The original software

also used standard, pre-existing network protocols to send and receive data, and the code was not specialized for the network layer.

18. I do not believe that we ever sold or licensed the "flyover" prototype. Additionally, significant development work and many changes to the code and the software took place between the original "flyover" prototype and the products that 3DVU worked on in later years, such as the Denso car navigation system and the Navi2Go app, which I will discuss further in this declaration.

19. I left 3DVU in March 2000 in order to begin my compulsory service in the Israel Defense Forces (IDF). I served in the IDF as a scientific programmer with the unit 8200, which is the Israeli Intelligence Corps unit responsible for collecting signal intelligence and code decryption. I served in the IDF for approximately 3 years. During the time that I was in the IDF, I had occasional contact with Isaac Levanon either when required me to sign something or when someone at 3DVU had a technical question. However, since I was on active duty in the IDF, my focus was on my military duties.

3DVU's role in vehicle navigation products

20. I returned to 3DVU full-time when my military service was complete in March 2003. At this time, 3DVU was working with a company called

Denso, which had a line of car navigation products. These Denso car navigation products used satellite or aerial imagery to show the route, in addition to simple maps. 3DVU's role in the development of this product consisted of processing the image data that was used in the navigation product, and rendering it with 3d perspective into a bitmap layer in real time. The user interface was designed primarily by Denso and would interact with the 3DVU portion of the software by making calls to an Application Programmer Interface (API), which 3DVU provided. Denso sold the final products in Japan under either the Kenwood or Daewoo brand names.

21. The final car navigation products consisted of a self-contained in-car navigation system, which stored all navigation data on a hard drive. This system did not download data over the Internet, or any other network. There were two major generations of these car navigation products released in 2002 and 2003. These car navigation products did not include any digital elevation model or digital terrain model. In other words, these products only showed the user a perspective view of flat imagery, without any representation of terrain. For example, a video on Mr. Levanon's YouTube account (available at https://www.youtube.com/watch?v=3btUNuCYM6M) shows what the early version of the Denso system looked like in operation,

and it is clear out several points in the video (note the horizon at, for example, 1:27 and 2:06-2:25) that the imagery being displayed only shows the imagery as a flat surface, and does not represent the terrain with an elevation model:

22. One significant difference between the first and second generations of the car navigation products is that the first generation used fixed ratio compression, while the second generation used variable ratio compression based on JPEG. JPEG compression effectively stores a series of numbers

representing the mathematical characteristics of waves that can be used to reconstruct an image, rather than a pixel-by-pixel bit map of an image. Compressing different images using JPEG, even if the uncompressed images are the same size in pixels and bit depth per pixel, will result in compressed images that have different byte sizes. This is referred to as "variable compression ratio." Variable ratio compression allowed us to use much less memory than fixed ratio compression because variable compression achieve higher average compression ratios. This was important in the car navigation products for Kenwood because the entire navigation database was stored on a hard drive, and therefore efficient use of memory was a significant consideration. After we began using variable ratio compression in 3DVU products, we did not go back to using fixed ratio compression for any later 3DVU product.

Improvements to 3DVU technology after 2000-2001

23. After I returned to 3DVU from the IDF, I started working on an improved algorithm for digital elevation modeling. I do not recall any development of digital elevation modeling before I left for my military service in 2000, and I am unaware if 3DVU had started experimenting on digital elevation modeling during the time that I was gone for my military service. However,

no digital elevation modeling had been incorporated into the car navigation product before I finished my military service and came back to 3DVU as an employee. I spent a large amount of my time after returning from my military service working on improving the digital elevation model.

24. The digital elevation model basically consisted of a database containing elevation data for geographic regions. A digital terrain model is a 3-D representation of terrain that uses the coordinates of points in space (based on some sort of mapping data containing elevations) as the vertices for a model that represents the surface of the earth. A well-known challenge in 3-D modeling, including modeling terrain surfaces, was how to manage digital terrain models at varying levels of detail. The problem is roughly analogous to the level of detail challenge in displaying textures. For example, a digital terrain model at a high resolution (that is, with a high number of vertices) can take a lot more system resources to load or download. However, a digital terrain model at a low resolution (that is, with a low number of vertices) will look blocky and unnatural viewed close up. There were a number of methods already known for building 3-D meshes at various levels of detail based on viewpoints, for example, by adding additional vertices as the viewpoint gets closer to the mesh.

25. I worked on developing a specific algorithm for building 3-D meshes at various levels of detail that was intended to be less computationally intensive than previous methods. I believed that I was successful in developing a new algorithm for displaying 3-D meshes, such as terrain, and I described this algorithm in a patent application filed on February 8, 2006, which eventually issued as US patent number 7,561,156 B2 ("the '156 patent") on July 14, 2009. The work that I invested in developing this algorithm, reflected in the '156 patent, all took place after I returned from the IDF in 2003, and not before I left for the IDF in 2000. Consequently, the digital terrain modeling algorithm that I developed is not reflected in the patents originally filed in 2000 and 2001, because I had not developed it yet.

26. We started introducing my new 3-D digital terrain model into 3DVU technology toward the end of 2005. For example, a 3DVU press release dated November 22, 2005, which I accessed via the Internet Archive at https://web.archive.org/web/20060210012618/http://www.3dvu.com/pdf/Daewoo__pr.pdf, announced that the third generation of the 3DVU mapping platform would include "full landscape elevation." The same press release includes a quote from Mr. Levanon stating that "for the first time, navigating users will view realistic imagery with the elevation of mountains and valleys

on their mobile devices." This press release and statement are consistent with my recollection that the 3-D terrain model was introduced around 2005. A true and correct copy of this press release, as shown on the Internet Archive, is attached as Exhibit B.

Discussions with Microsoft

27. I was aware from discussions with Isaac Levanon that Mr. Levanon had some discussions with Microsoft in 2005 because Mr. Levanon wanted to sell the company. However, Mr. Levanon did not provide a significant amount of detail to me about those negotiations. I recall Mr. Levanon asking me some very high-level technical questions during this time period, which I understood to have been in response to inquiries from Microsoft. These questions did not go into any significant technical detail about the operation of our technology, and only provided a very rough description of what our software was ideally capable of.

28. At the time that these discussions took place, 3DVU only had two or three developers working for it, including myself. Another developer named Lion Burger came to 3DVU during the period when I was serving in the IDF and left in 2007. 3DVU hired another developer around this time, although I do not recall if this individual began work before or after the discussions took

place, and this developer only worked at 3DVU for about a year and a half. 3DVU's headquarters was listed as Mr. Levanon's home in in Ra'anana, Israel, while the actual office that we worked from in working hours was an apartment in a residential building in Herzelia, Israel. I recall that Mr. Levanon's wife and children may have had some formal title within the company, but I did not see them regularly at the office, with the exception of Mr. Levanon's daughter Mor Levanon, who began showing up approximately around 2007.

29. While Mr. Levanon was in discussions with Microsoft, Mr. Levanon occasionally sent me questions about 3DVU's development process which may have originated from Microsoft, although Mr. Levanon generally sent me these questions by email in a way that did not indicate where the question came from. These questions were somewhat awkward and difficult to answer, because 3DVU at the time did not really have an organized software development process due to the fact that there were only two or three developers working there at a time. At one point during this period, I got on a phone call with someone from Microsoft at Mr. Levanon's request. In the phone call I was asked to give a technical overview about the state of software development in the company and the existing capabilities of our

software library, although not any technical details of the operation of that technology. My ability to answer questions during this conversation was extremely limited because I had almost no experience at the time in spoken English. I do not believe that either the information that I provided in the questions that I answered for Mr. Levanon, or the information that I provided in the phone call with Microsoft, would have been at a sufficient level of technical detail to provide any useful information about how to re-create our technology at that point. I am also unaware of any source code or other similar detailed technical information being provided to Microsoft during this period.

30. At the time of the negotiations with Microsoft, there were issues with the 3DVU software that would have presented significant challenges if we had attempted to scale them. For example, our software at the time required preprocessing of image, terrain, and other geographic data, which we typically retrieved from commercial sources, before it was ready to load onto a server. However, our preprocessing software was not yet parallelized, i.e., set up so that processing could be performed simultaneously by different processing elements. With large scale maps, the issue was processing the data in such a way that would avoid conflicts or

errors along boundaries between adjacent data processed by different processing elements. We needed to solve this problem in order for the software to be realistically scaled up to display a worldwide map. This particular problem took me working alone much of the next two years, into 2007 or 2008. Additionally, the application programmer interface (API) (the set of definitions, protocols, and tools used for working with our software) was not very mature or user-friendly, which meant that it would have been difficult for a programmer from an outside company that acquired us to write applications to work with our mapping engine and expect them to work.

<u>Navi2Go</u>

31. 3DVU also worked on a product called Navi2Go in the later years that I worked at 3DVU. While some of my work on image preprocessing and the visualization library related to this product, the Navi2Go product was mostly designed by other developers at 3DVU. Navi2Go was generally designed to allow users to look up directions and retrieve satellite imagery covering the area of a route using a web application, then load the route instructions and imagery onto a PDA or other mobile device. Once the route and imagery were downloaded, either the web app or the mobile device/PDA could

display the imagery along the route from a perspective view, much like the car navigation products. The primary way that Navi2Go was designed to be used was in this manner, in which the user first downloaded the routing information and imagery onto a desktop computer, then transferred this information on to a portable device (for example, using a memory card of some type or a USB drive).

32. Navi2Go was also primarily written in standard C++ code language. There was a separate project involving code which was written for Java2ME, which is an operating environment based on the Java programming language and was commonly used for small cell phones (also known as "feature phones") at the time. However, this project did not include any digital elevation or terrain modeling features, and would have only displayed imagery of a region as a "flat" projection, in a similar manner to the 1999-2000 prototype. Although the Java-based product and the C++ code libraries generally did not (and could not) share software infrastructure, some of the operation of this software shared similarities with the C++ code at a high level, such as the image decompression and the high level structure

of the rendering software. For example, the image below,[2] which to the best of my recollection is a fair and accurate depiction of the appearance of the web application user interface at the time we introduced the Navi2Go application, includes a "save-to-PDA" option in the upper right hand corner of the screen:

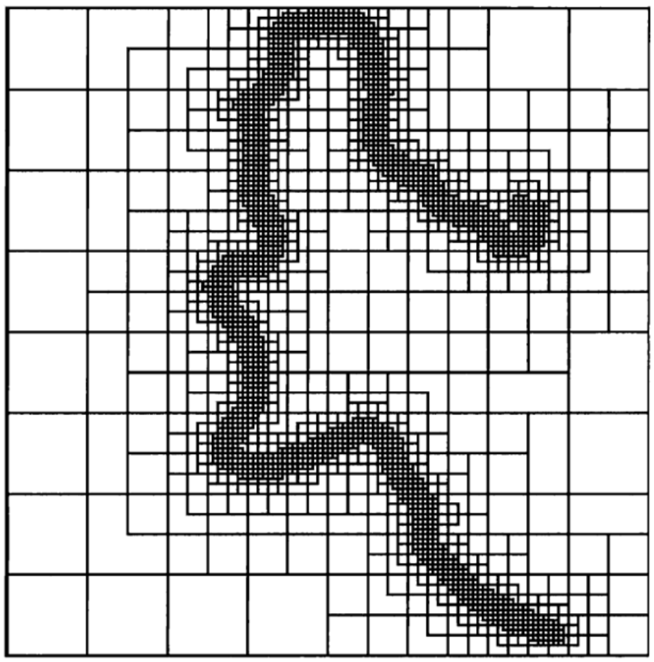
33. We developed an algorithm in order to allow the web application to most efficiently retrieve in advance the imagery that would be needed for a particular route. After the user's route was calculated, the algorithm determined which tiles of the underlying imagery database were intersected by the routes, and calculated which tiles to download so that higher

[2] This image was retrieved from a news article about Navi2Go at http://bgr.com/2007/12/08/3d-roadmapping-with-navi2go/, which I have also attached as Exhibit C.

resolution imagery would be download for areas closest to the routes and lower resolution imagery would be downloaded to show areas that would appear more distant in the background, but would not to be shown close to the viewing perspective. The amount of high-resolution imagery download by the software could vary based on the available memory on the portable device which it would be downloaded to.

34. We described this algorithm in a provisional U.S. patent application (No. 60/880,674) filed in January 2007, and a non-provisional U.S. patent application (No. 12/015,068) which was published in 2008. The published application (US 2008/0294332 A1) is attached as Exhibit D. For example, paragraph 9 of the published application says that "the purpose of this invention is to provide a solution for the off-line visualization of memory-consuming datasets such as aerial photography, terrain elevation and 3D buildings, within the storage and connectivity limitations of today's mobile/portable computing platforms as navigation products, such as Personal Navigation Devices (PND's)." Additionally, Fig. 4c shows an example of how the application would download higher-resolution tiles closest to a route and lower-resolution tiles further away:

FIG. 4c



35. Some versions of Navi2Go also allowed a user to download the same information onto a mobile device over a cell phone network in real time; however, there were some significant problems with this operating mode which made it generally impractical for most users. First of all, the speed of wireless networks at the time made the real-time downloading feature generally very sluggish, choppy, and unsatisfying. Second, the large amount of data that needed to be downloaded, including imagery, meant that users who used the real-time downloading feature would incur very large data usage charges from their cellular carrier. Downloading the data first onto a

desktop computer, then transferring it to a portable device avoided both of these problems.

36. Like every other implementation of 3DVU's technology by 2007, Navi2Go used variable ratio compression (specifically JPEG) to transmit and store imagery. As I previously explained, variable compression ratios allowed more efficient compression than the fixed compression ratio, fixed byte size tile techniques that 3DVU used in 1999-2000 before I left for the IDF. Therefore, reverting to the old fixed compression ratio techniques would have meant that the imagery would require more storage or more bandwidth than with variable compression, which would have been significantly disadvantageous either for storing downloaded data on a mobile device or downloading it in real time.

37. Although I am aware that Navi2Go received some attention from trade shows and trade papers, my impression was that this program did not experience significant success. For example, 3DVU never grew from its headcount of 2-3 developers at any given time from the time that Navi2Go was released until I left 3DVU, which I would have expected if the software had done very well commercially.

Compensation for working at 3DVU

38. Toward the end of my time at 3DVU in 2008-2009, I began to notice irregularities in my pay statements. I noticed that my pay suddenly became adjusted (without my permission) so that most of my compensation was characterized as a bonus rather than a salary, which reduced the amount that 3DVU would have needed to pay in various government-required salary withholdings, which were based on salary only. Additionally, I began to experience delays receiving my paychecks. My impression at the time was that 3DVU was struggling to maintain its status as a financially viable business. I left 3DVU in August 2009 because, in addition to 3DVU's evident financial difficulty, it had become apparent to me that the company was not growing and it did not appear to me that it was likely to grow or have increased commercial success in the future. I also never received my final paycheck for working at 3DVU after I told Mr. Levanon that I was leaving.

39. I also received stock certificates and stock options periodically while I worked at 3DVU. As I previously mentioned, while I was working informally at 3DVU in 2000 before I left for my compulsory military service, I received a stock certificate for approximately 2% of the common

stock of 3DVU. I asked Mr. Levanon on at least one occasion whether I could see the list of shareholders in the company, and he refused to share the list. These shares never paid any dividends, at least not to me. At the time that I worked at 3DVU, I would have expected that I would receive compensation based on my stocks if either the company or substantially all of its assets were sold. I never received any compensation when any of the patents owned by 3DVU were transferred to another company. I am not currently aware of any reason to believe that I would receive anything if Bradium made any revenue based on the patents originally filed by 3DVU.

Assignments of 3DVU Patents

40. While I worked for 3DVU, I signed documents assigning the patents to 3DVU and its predecessor, FlyOver Technologies, Inc. I was not aware of the patents being transferred to Inovo, Ltd. or any other entity. In fact, the first time I learned of Inovo, Ltd. was a few years after I had left 3DVU, when I searched the U.S. Patent and Trademark Office website out of curiosity for patents listing myself as the inventor. I noticed that some of the more recent patents to issue listed Inovo, Ltd. as the assignee and I was surprised because I had never heard of this company before.

41. Counsel for Microsoft have showed me a document which is purportedly an assignment of U.S. Patent Application No. 13/027,929, which issued as the ‘506 Patent, from myself and Mr. Levanon to Inovo, Ltd. The last page of this document (Exhibit E), contains a signature above my name and the date April 3, 2011, along with two additional signatures and the printed names Nurit Roth and Nir Levanon. Nurit Roth is the name of Isaac Levanon’s wife, and Nir Levanon is the name of Isaac Levanon’s son. I did not sign this document. First, as I discussed above, I was surprised to learn independently later on that the 3DVU patents had been assigned to Inovo. Second, I had no contact with Mr. Levanon or anyone else affiliated with 3DVU after a few months after I left in 2009, with one exception. On one occasion in approximately 2010, Isaac contacted me and asked me to assist him in debugging what seemed like data corruption in one specific tile in the real-world dataset I had generated a couple of years earlier. I looked at it for a few days but then left because I did not think that Mr. Levanon intended to pay me for my time, and I just left afterwards. Neither of us (Mr. Levanon or myself) contacted each other since. I have no recollection on this occasion or any other of signing a document transferring any of the patents on which I am named as an inventor from 3DVU to another company in

2011, or meeting Isaac Levanon's wife and son in order for them to witness me signing such a document, and I believe that I would remember if this had happened.

42. An earlier inventor declaration, submitted during the prosecution of the '794 Patent on January 17, 2006, states in paragraph 5 that "In August 2000, we first met with the patent attorney Gerald B. Rosenberg, NewTechLaw, Suite 520, Palo Alto, California 94301, to discuss this invention, companion inventions and preparation of patent applications." This statement is false. I did not travel to Palo Alto, California to meet with a patent attorney in 2000. At the time I left 3DVU in 2009, I had never been to the United States, and I did not travel to the United States in August 2000, when I was on active duty with the IDF.

Later contact with Bradium

43. Although I do not recall any contact with Mr. Levanon after I left 3DVU, other than what I described above, I believe that Mr. Levanon had sufficient contact information to reach me if necessary. For example, I had provided my Yahoo! personal email address to Mr. Levanon.

44. In January and March 2015, an attorney representing Bradium, Christopher Coulson, contacted me by telephone and email (using the same Yahoo!

email address that I had given Mr. Levanon several years earlier) in order to ask if I would agree to act as a consultant for Bradium. Mr. Coulson contacted me again in January of 2016, and I ultimately declined his request. Attached as Exhibit F to this declaration are true and correct copies of email correspondence between me and Mr. Coulson.

45. Other than the emails and discussions between myself and Mr. Coulson described above, I have never received any contact from any representative of Bradium.

I hereby declare that all the statements made in this Declaration are of my own knowledge and true; that all statements made on information and belief are believed to be true; and further 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 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

I declare under the penalty of perjury that all statements made in this Declaration are true and correct.

Executed Jan 31, 2017 in Ra'anana, Israel.

Yonatan Lavi

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor:	Isaac LEVANON *et al*
Assignee:	3DVU, Inc.
Serial No.:	10/035,981
Filed:	December 24, 2001
Title:	System And Methods For Network Image Delivery ......
Examiner:	Philip B. Tran
Group:	2155
Confirmation No.:	3619
Attorney Docket:	927/2

Declaration of Inventors

We, Isaac Levanon and Yoni Lavi, being first duly sworn, depose and say:

1. We hereby declare that we believe we are the original, first and co-inventors of the subject matter which is claimed herein for which a utility patent is sought on the invention described and claimed in the above-identified application; that we have reviewed and understand the contents of the application, including the claims; and, that we acknowledge our duty to disclose to the PTO information of which we are aware which is material to patentability of this invention as defined in 37 C.F.R. 1.56.

2. Our invention was reduced to practice in (Israel) prior to 25 July 2000 – the date of filing by Skoll of the application which matured into US Patent 6,671,424.

3. The herein invention was first defined in October 1999, we had a working model in December 1999 and we can establish that we had the first working product on about 24 January 2000.

The screenshot evidence of Exhibit A, relied upon when making the above assertion, is a proof of actual reduction to practice which requires a showing that the apparatus actually existed and worked for its intended purpose (MPEP 715.07|||). The screenshots in Exhibit A further establish possession of the whole invention claimed as it was part of a released product prepared in January 2000 and modified thereafter.

The image of Exhibit B illustrates a web based application created at the end of 1999 where by the invention is an integral part of the web solution and shown in upper left window as "Proprietary FlyOver™ - 3D Airfield Imagery".

Exhibit C shows files confirming that the Invention was introduced in Word Document named "GA Central – Executive Summary.doc" dated 3/20/2000 and Power Point presentation named GA Central2.ppt dated 5/13/2000.

Exhibit D is one slide from the PowerPoint presentation listed in Exhibit C. Exhibit D presents "The FlyOver™ A 3D Visualization Technology" as an explanation of the invention of image delivery with dynamic viewing frustum of six degrees of freedom optimized for narrowband communication channels as low as 4 kilobyte per second, where by the image is a screenshot captured at the end of 1999 of the application based on the invention.

Exhibit E illustrate the preprocessor subdivides the image into a quad-tree of compressed images. The images in the Exhibit E are screenshot captured by running the application based on the patent as of late 1999.

This process can be alternately described as the source image data is preferably pre-processed to obtain a series K_{1-N} of derivative images of progressively lower image resolution. The source image data, corresponding to the series image K_0, is also subdivided into a regular array such that each resulting image parcel of the array has a 64 by 64 pixel resolution where the image data has a color or bit per pixel depth of 16 bits, which represents a data parcel size of 8K bytes. The resolution of the series K_{1-N} of derivative images is preferably related to that of the source image data or predecessor image in the series by a factor of four. The array subdivision is likewise related by a factor of four such that each image parcel is of a fixed 8K byte size, as is explained in the patent application.

This is further illustrated in Exhibit F where the images are screenshots from the patent 1999.

The viewer (client) uses the patent application's method to optimize the streaming of network image over narrowband communication. The client included a 3D renderer that provided views of the image from arbitrary location with full maneuverability – Dynamic Viewing Frustum.

We assert that the initial implementation of the invention has been completed in 1999. It was used to provide a perspective 3D view of imagery and allowed the user to "fly over" the image interactively. All principles and implementation details disclosed in the patent were in use by this program.

The technology is illustrated again in the screenshots and presentation in Exhibit G taken by the actual invention as of late 1999.

These screenshots illustrate the invention, fully functional, as described in our patent applications and as was implemented and presented from late 1999.

Exhibit H is a series of images 1, 2, 3, and 4 on a timeline where 1 is the earliest and 4 is the latest, for the same operator controlled image viewpoint frustum, where the update image parcel is clearly noticeable from image 1 through 2 and 3 to image 4. The update picture parcel is requested by the client and associated with a request queue. The issuing of said request is over a limited bandwidth communications channel. Such picture parcel request queue over narrowband bandwidth communication channel as illustrated in Exhibit G, is shown in the timeline images in Exhibit G. Whereby, within time (pictures 1 to 4 in Exhibit H), the picture parcel request from the controlled image viewpoint is progressively building the picture parcels from 64 by 6ý pixels tiles, until the image reached its full resolution as in image 4 of Exhibit G. This is explaining several claims of our patent, including 1, 2, 3, 4, 5, 6, 8, 11, and 12. Other claims that have to do with the portable display client system such as, image compression, display resolution, video memory and navigational controls (for example), are illustrated in Exhibits E, F, and G. And the same Exhibits E, F, G covers the packet data streaming over communication network as in the related claims. Some of our claims are internal calculations, such as the preprocessing of the image and the compression, which can be illustrated only, with no screenshot to show them.

The statement of fact above establishes that the claimed subject matter has been relied upon and existed prior to Skoll reference.

4. Our company was originally formed as GACentral.com, Inc. change its name to FlyOver Technologies, Inc. in early 2000 and changed it name again to 3DVU Inc. relatively recently, so the original materials bear the company names GACentral.com and FlyOver Technologies.

5. In August 2000, we first met with the patent attorney Gerald B. Rosenberg, NewTechLaw, Suite 520, 285 Hamilton Avenue, Palo Alto, California 94301, to discuss this invention, companion inventions and preparation of patent applications. Over the succeeding months, Mr. Rosenberg prepared the provisional applications, which was filed by his office on 27 December 2000.

6. The evidence submitted is sufficient to establish a reduction to practice of the invention in the US or a NAFTA or WTO member country prior to the effective date of the Skoll reference.

7. We hereby declare that all statements made herein of our own knowledge are true and that all statements made on information and belief are believed to be true; and further 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 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Isaac Levanon

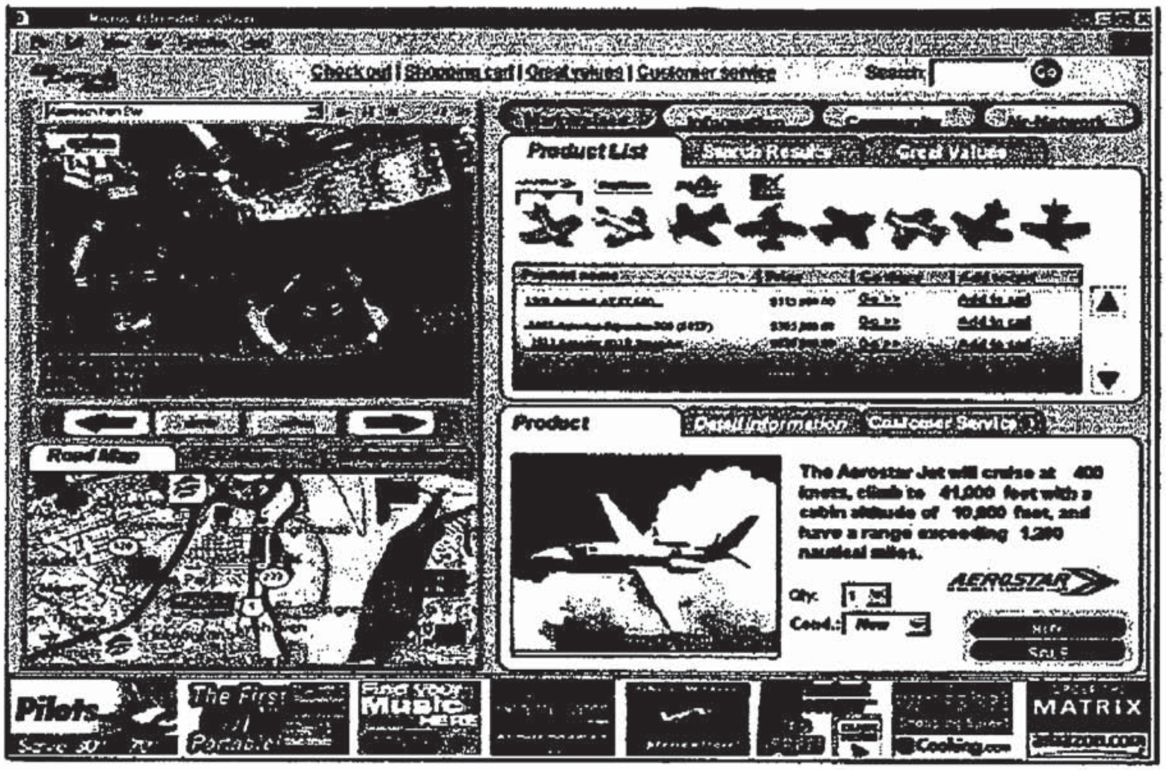
Dated: December 27, 2005

Yoni Lavi

Dated: December 27, 2005

10-JAN-2006 07:52P FROM: TO:01215712738300 P:9

EXHIBIT A



PAGE 9/17 * RCVD AT 1/10/2006 12:50:29 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/27 * DNIS:2738300 * CSID: * DURATION (mm-ss):04-52

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Exhibit B

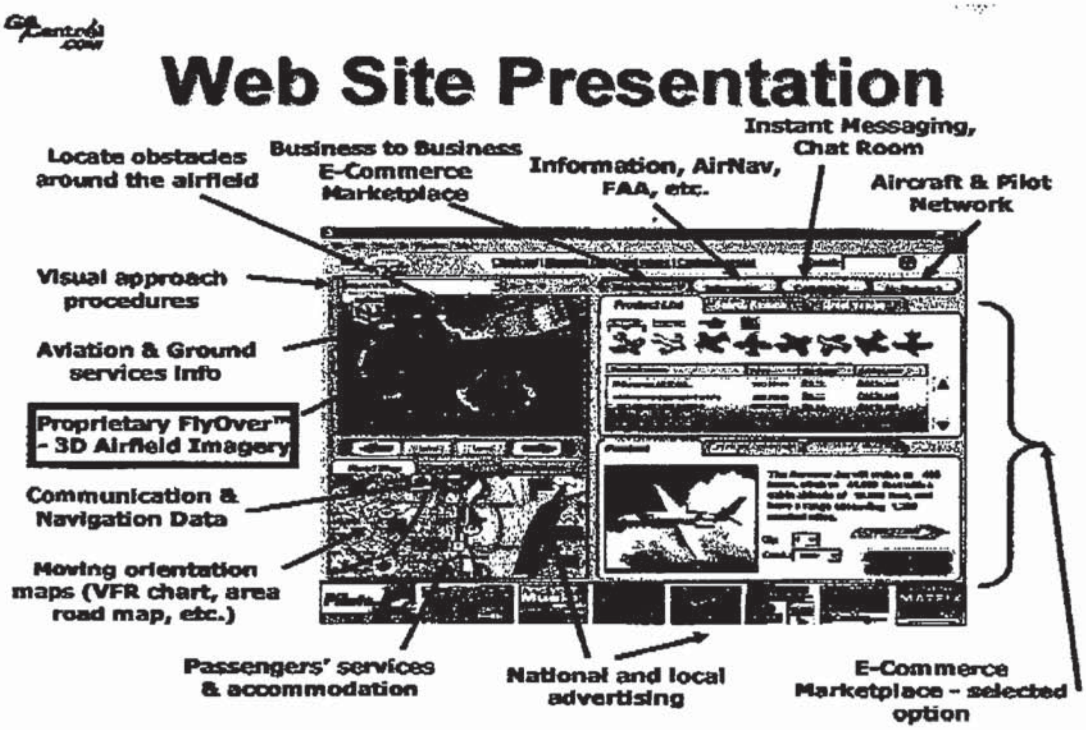

Exhibit C


File Actions Options Help
New
Open
Favorites
Add
Extract
Encrypt
View
CheckOut
Wizard
Name
Type
Modified
Size
Ratio
Packed
Path
GA Central - Executive Summary.doc
Microsoft Word Document
1,600,400
25%
1,280,...
Microsoft PowerPoint Presentation
5/13/2000 12:20 AM
836,096
42%
486,812

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Exhibit D

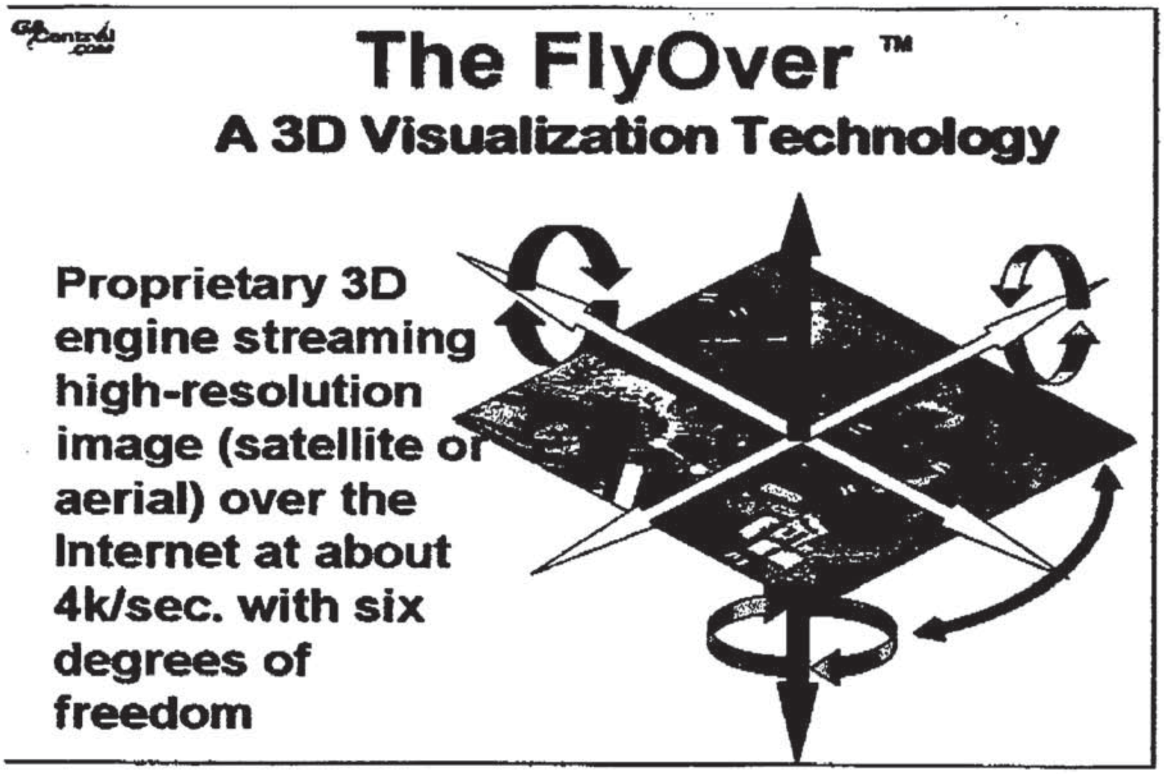

Exhibit E

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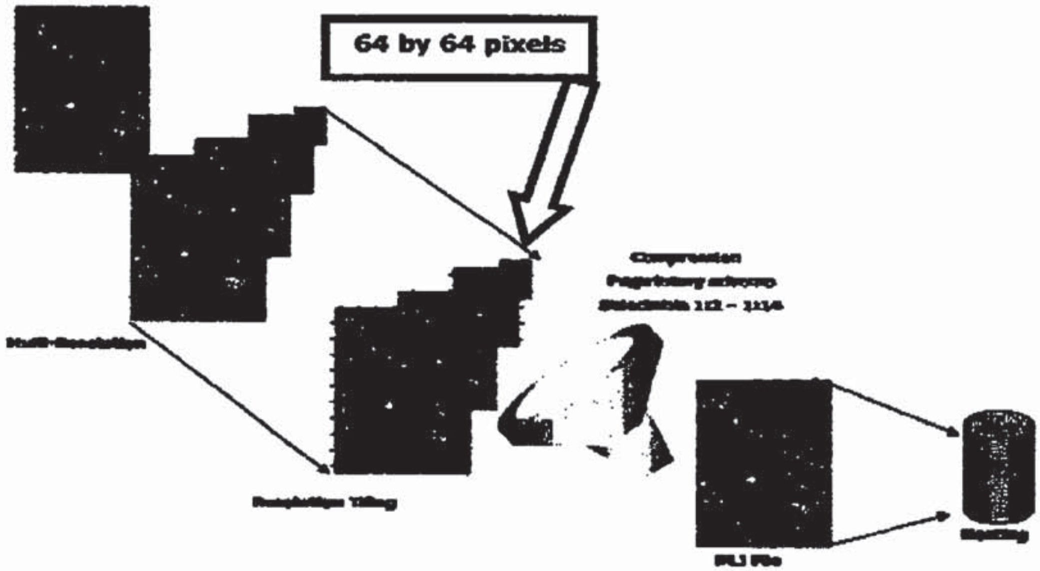

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Exhibit F

The FlyOver is a propriety image streaming technology allowing the simulation of 3D realistic maneuvers over aerial/satellite imagery. FlyOver is based on extremely efficient algorithm and very easy to use software tools for streaming very large area of high-resolution color image.

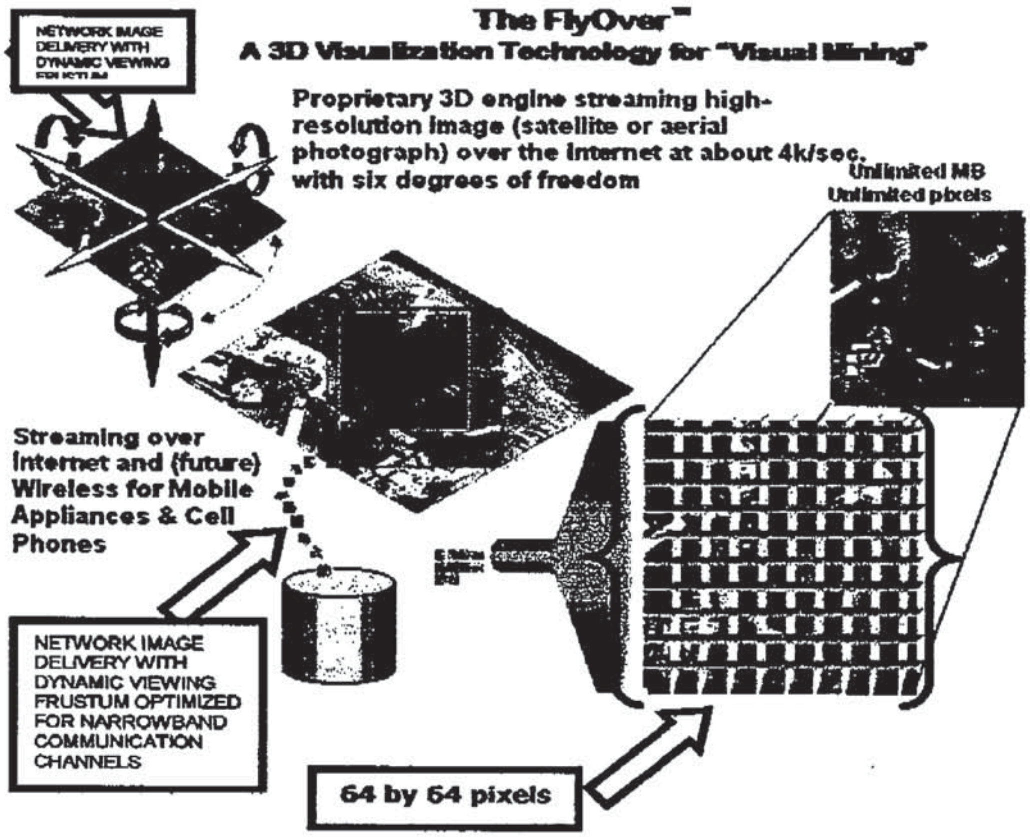

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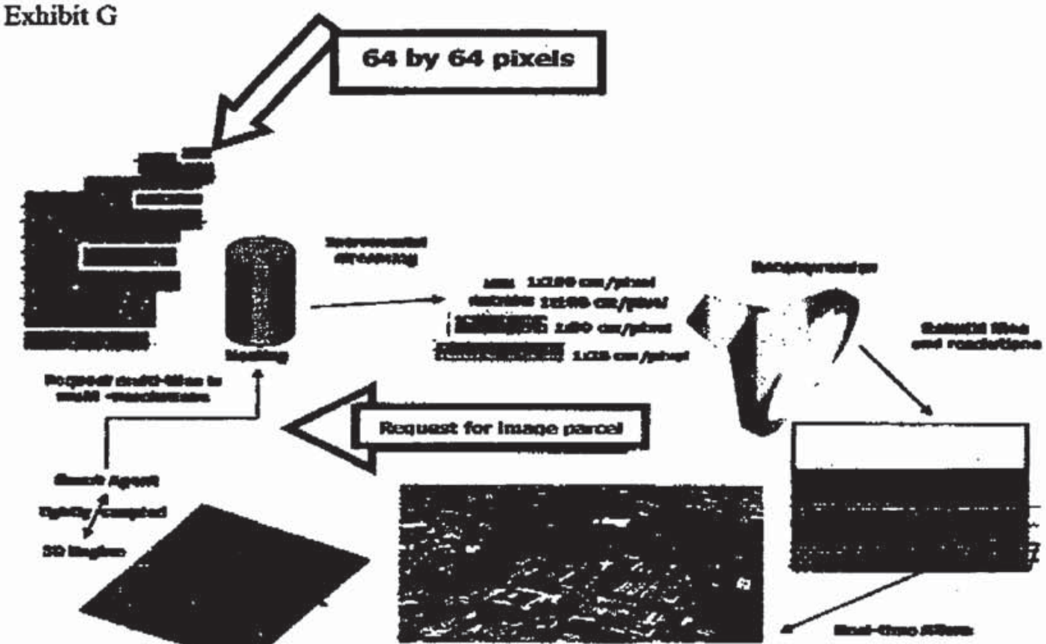
Exhibit G



Extremely thin software based real-time smart streaming agent tightly coupled to efficient 3D engine, decoder and real-time filters On Any Digital Device

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Exhibit H

Image 1

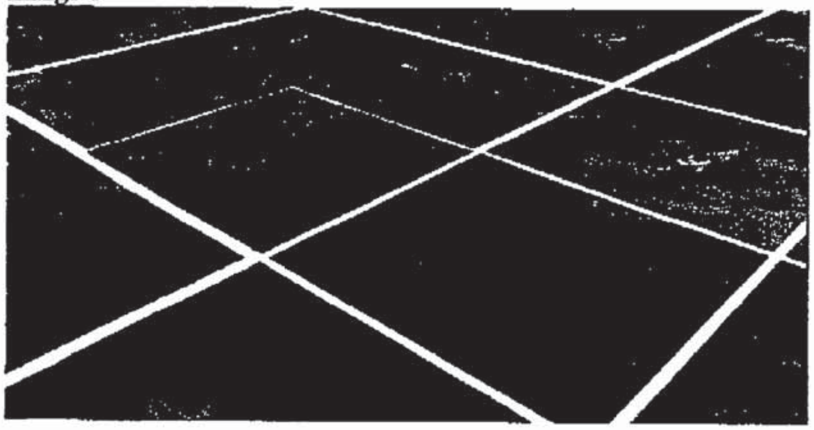
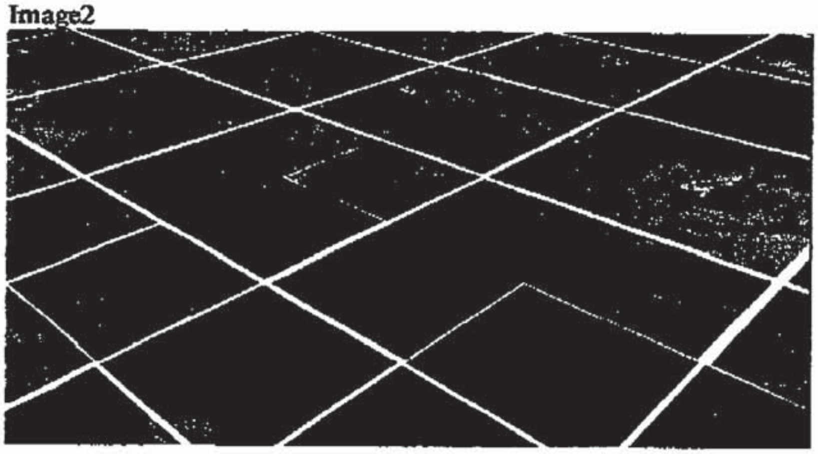


Image2



BEST AVAILABLE COPY

Image 3

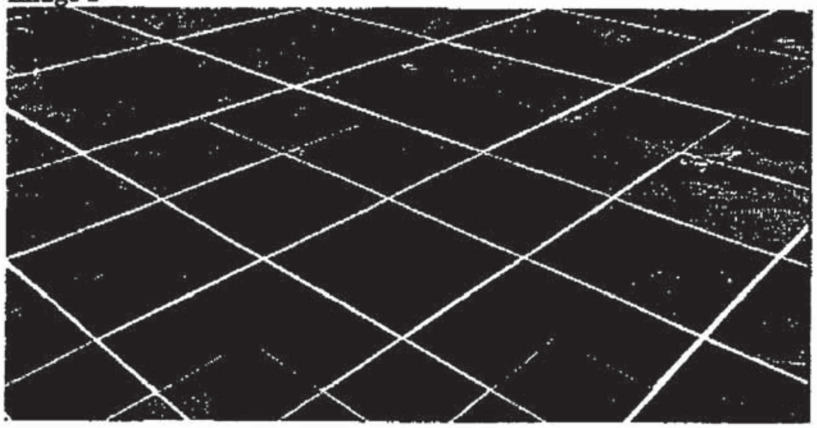


Image 4

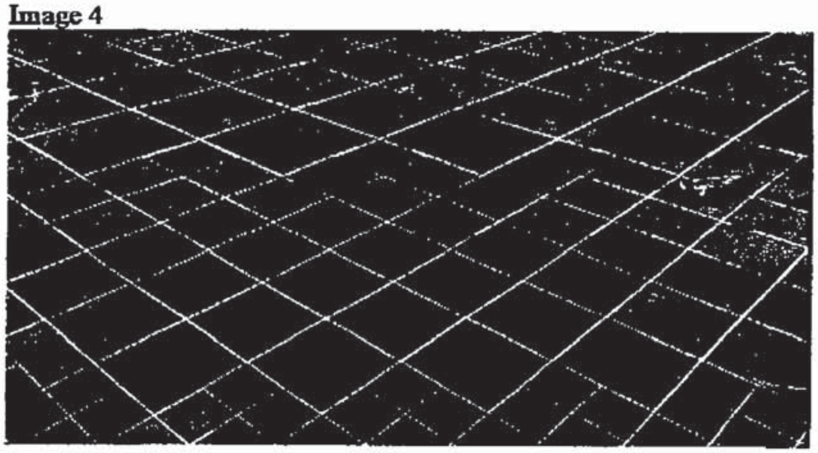


EXHIBIT B

Daewoo Taps 3DVU for 3D Image with Full Landscape Elevation in Their Next Car Navigation System

3DVU's technology offers the most realistic car navigation system ever with 3D imagery and terrain elevation

Raanana, Israel -- Nov. 22, 2005 - 3DVU announced today that its 3rd generation VisualMap™ technology presenting satellite imagery and terrain elevation, will fuel Daewoo Precision Industries' in-car navigation system. This system is targeted for the preinstalled OEM and dealer option markets in Korea. For the first time, drivers will able to benefit from a truly realistic navigation aid.

Isaac Levanon, Chairman and Chief Executive Officer of 3DVU stated, "Daewoo's decision signifies the new and inevitable trend of presenting more realistic and intuitive navigation aids for users. This is part of the continuous wave of solutions to be offered by major car-navigation entities with 3DVU's technology".

3DVU has overcome major technical barriers to enhance the drivers' navigation experience by providing smooth continuous movements with 3D perspective over images with terrain elevation in such limited computing devices such as in-car navigation systems. The technology is software based and platform independent thus can be ported and integrated into any car navigation system and Personal Navigation Device (PND).

"For the first time, navigating users will view realistic imagery with the elevation of mountains and valleys on their mobile devices" added Levanon.

About 3DVU

3DVU was established in the year 2000 to revolutionize the way our world is viewed, navigated and interacted with. The vision remains to allow users to view the source of mapping – imagery. We have developed a unique technology that streams imagery in 3D to any digital device, anywhere.

3DVU's technology presents the most realistic navigation aid available on any digital device, anywhere. The groundbreaking technology enables in-car navigation systems, PDAs, PNDs, mobile handsets and PCs to display realistic, 3D virtual worlds. Using Visual Map™, satellite and aerial imagery, as well as mapping data, such as point of interest and route information, can now be streamed over limited-bandwidth communications with realistic 3D views and smooth maneuverability.

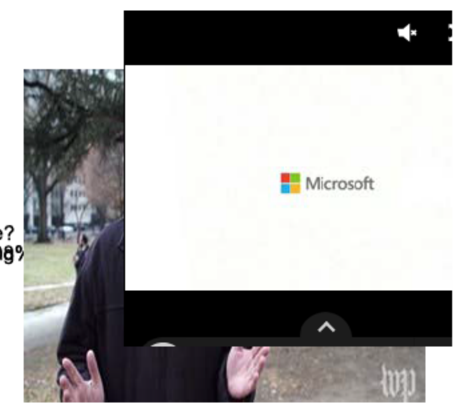
3DVU is changing the face of mapping by providing the freedom to look at the world in more realistic and compelling ways. The company is strategically partnered with carmakers, navigation systems and mobile devices and handset developers, major satellite and aerial image-sensing entities, mapping and GIS data providers.

3D Roadmapping with Navi2Go

BGR Staff
December 8th, 2007 at 1:09 PM

Share (https://www.facebook.com/sharer/sharer.php?u=http%3A%2F%2Fbgr.com%2F2007%2F12%2F08%2F3d-roadmapping-with-navi2go%2F)

Tweet (https://twitter.com/share?text=3D%20Roadmapping... roadmapping-with-navi2go%2F)



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Keep up with the latest ({)

By Washington Post ({) / December 17, 2016 11:32 PM

TRENDING

ACCESSORIES

The best and cheapest way to start building the smart home of your dreams

EXHIBIT C

Google Maps are great, they let you find locations from New York to Navy Pier in Chicago and zoom in to see what bumps in the road you need to watch out for. But now, Navi2Go takes that two steps further. You can “drive” the entire road through a simulation not only on your computer, but more importantly on your Windows Mobile phone. We think that it is pretty cool, but not sure about the overall functionality, before seeing a more finished product than the current alpha version. It's out for residents of the U.K. right now, but we have to wait to Q2 of next year to see it across the pond. 2008 will also be the year where it comes out in a Symbian version, too. We guess we have to wait a little before we can decide if it's more than a clever novelty, and actually useful in the day to day life. Hurry up Navi2Go, we don't like waiting.

[Via Übergizmo (http://www.ubergizmo.com/15/archives/2007/12/navi2go_3d_image_navigation_on_windows_mobile_phones_1.html)]

Read (http://www.navi2go.net/site/dev/2007.08.01/route.asp)(IE 6+ only)

(http://bgr.com/2016/12/18/best-smart-home-kit-amazon-smartthings/)

RETAIL

2 NES Classic Edition: Best Buy shares more details about upcoming availability (http://bgr.com/2016/12/16/nes-classic-edition-best-buy-in-stock/)

GAMING

3 Download seven classic Ubisoft games free on PC this weekend (http://bgr.com/2016/12/17/ubisoft-free-pc-games-download/)

SCIENCE

4 Watch these potential Mars robot designs endure the Utah desert (http://bgr.com/2016/12/18/new-mars-rover-germany-robots/)

APPS & SOFTWARE

5 The worst things about iOS 10.2 (http://bgr.com/2016/12/16/ios-10-2-update-problems-worst/)

The Alienware Area-51 is a spaceship disguised as a gaming PC The Verge (https://adfarm.mediaplex.com/ad/ck/12309-227241-46760-7)

35 Signs That Are So Clever You'll Laugh Out Loud Offbeat (http://offbeat.topix.com/slideshow/17907?utm_source=outbrain&utm_campaign=17907&tpx_term=1L05PEG7IBLVVFKH&cvar=t1:i-square-D0DPJ6PMM8M32JN3&utm_medium=1580434)

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(//bgr.com/#/the-real-connection-between-cable-and-the-web-and-why-it-matters/inst-RPPOhzx)

Brand Content by CableMover

The Real Connection between Cable and the Web – and Why It Matters (//bgr.com/#/the-real-connection-between-cable-and-the-web-and-why-it-matters/inst-RPPOhzx)

Cable is more important than you'd think. With the right package, you can ensure you're online the moment you move into a new place. We'll explain how.

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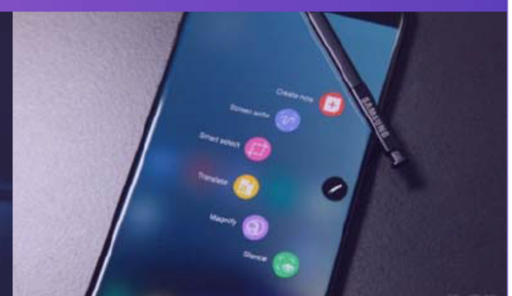
The worst things about iOS 10.2 (http://bgr.com/2016/12/16/ios-10-2-update-problems-worst/)

By Zach Epstein (http://bgr.com/author/zach-epstein/)
December 16th at 12:13 PM

(http://bgr.com/2016/12/16/faraday-future-tesla-drag-race-video/)

Faraday Future SUV smokes a Tesla Model X in intriguing drag race video (http://bgr.com/2016/12/16/faraday-future-tesla-drag-race-video/)

By Yoni Heisler (http://bgr.com/author/yoni-heisler/)
December 16th at 6:26 PM



(http://bgr.com/2016/12/16/galaxy-note-7-explosions-investigation/)

Samsung reportedly knows why the Galaxy Note 7 exploded (http://bgr.com/2016/12/16/galaxy-note-7-explosions-investigation/)

By Chris Smith (http://bgr.com/author/chris-smith/)
December 16th at 5:04 PM

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EXHIBIT C

EXHIBIT D

US 20080294332A1

(19) **United States**

(12) **Patent Application Publication**

LEVANON et al.

(10) **Pub. No.: US 2008/0294332 A1**

(43) **Pub. Date: Nov. 27, 2008**

(54) **METHOD FOR IMAGE BASED NAVIGATION ROUTE CORRIDOR FOR 3D VIEW ON MOBILE PLATFORMS FOR MOBILE USERS**

(75) Inventors: **Issac LEVANON**, Raanana (IL); **Yonatan LAVI**, Raanana (IL)

Correspondence Address:
Lilling & Lilling PLLC
PO Box 435
Jerusalem 91003 (IL)

(73) Assignee: **3-D-V-U Israel (2000) Ltd.**, Raanana (IL)

(21) Appl. No.: **12/015,068**

(22) Filed: **Jan. 16, 2008**

Related U.S. Application Data

(60) Provisional application No. 60/880,674, filed on Jan. 17, 2007.

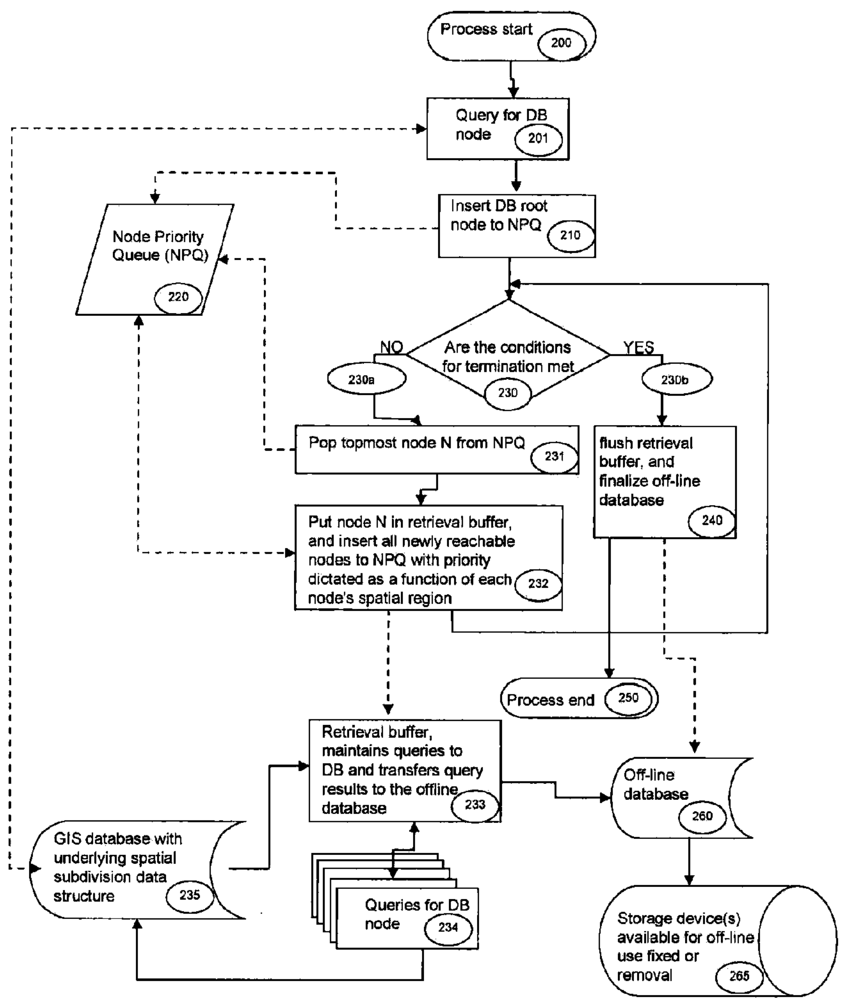
Publication Classification

(51) **Int. Cl.**
G01C 21/36 (2006.01)

(52) **U.S. Cl.** **701/200**

(57) **ABSTRACT**

The invention proposes a method for displaying an image based navigation route corridor for 3D view on mobile platforms for mobile users. The invention comprises the combination of some technical solutions. 1. Display of a relevant area around a selected or calculated route (route corridor). 2. Selection of the relevant area that is a small dataset. 3. Creation of the customized route corridor dataset. 4. Provide 3D viewers ability to allow the display of the created route corridor in 2D, isometric view, or 3D perspective and then allow 3D maneuverability over the created route corridor. Combination of these technical solutions comprises a method of facilitating the display of the route corridor on mobile computing platform in 3D perspective.



Microsoft, Ex. 1017
Microsoft v. Bradium, IPR2016-00449

FIG. 1

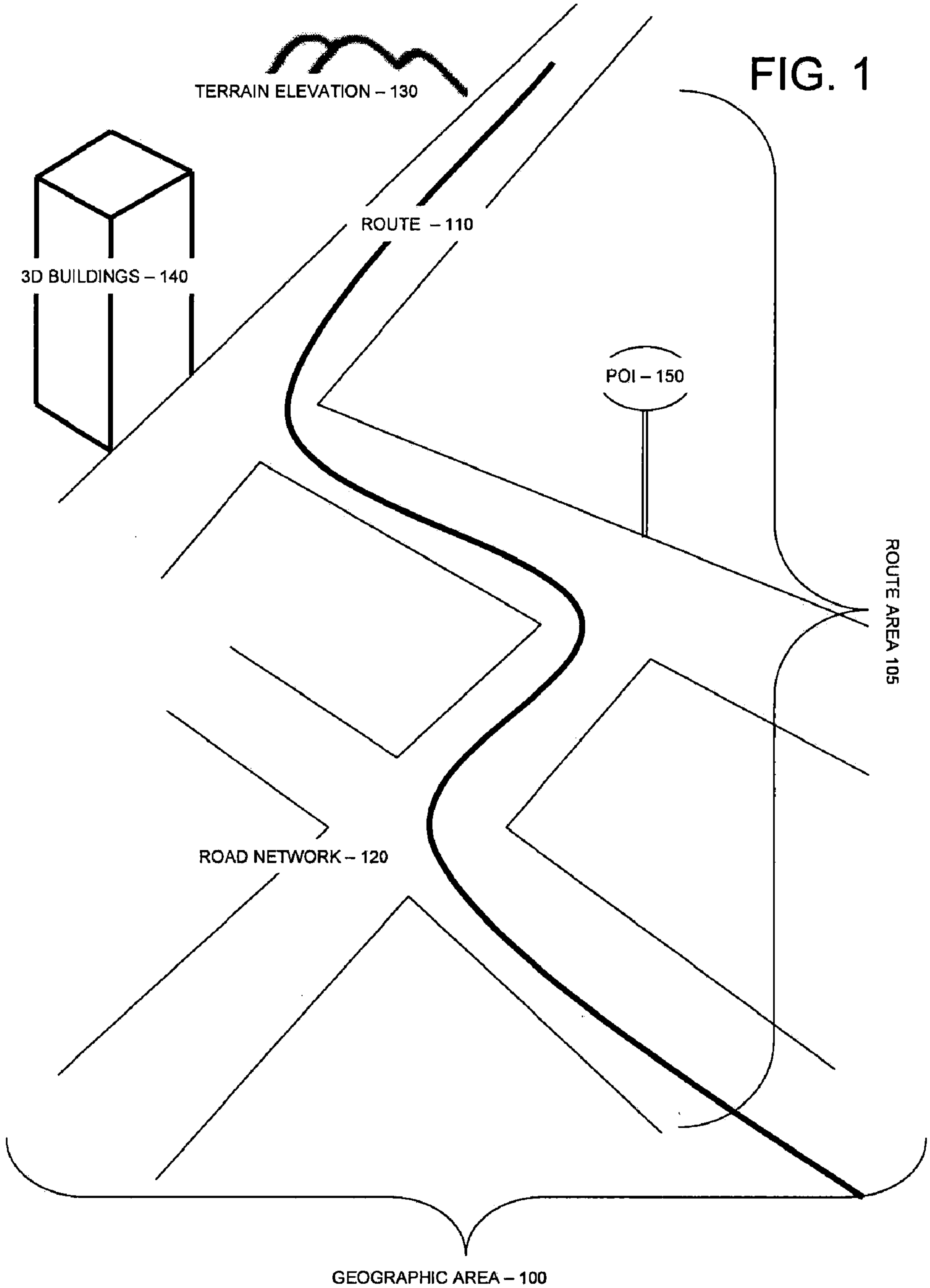
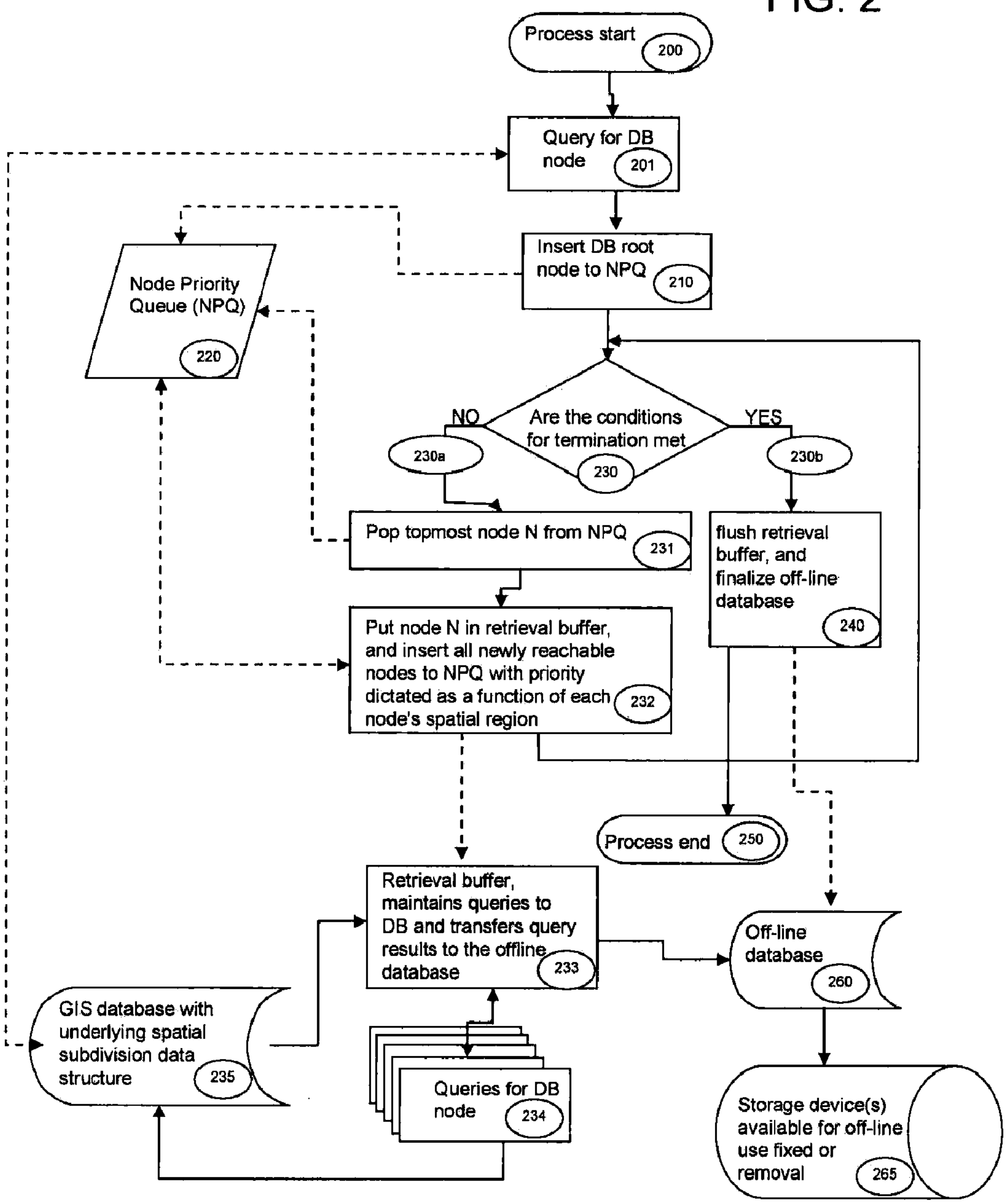

TERRAIN ELEVATION – 130
ROUTE – 110
3D BUILDINGS – 140
POI – 150
ROUTE AREA 105
ROAD NETWORK – 120
GEOGRAPHIC AREA – 100

FIG. 2



Process start
200
Query for DB node
201
Insert DB root node to NPQ
210
Node Priority Queue (NPQ)
220
NO
YES
Are the conditions for termination met
230
230a
230b
Pop topmost node N from NPQ
231
flush retrieval buffer, and finalize off-line database
240
Put node N in retrieval buffer, and insert all newly reachable nodes to NPQ with priority dictated as a function of each node's spatial region
232
Process end
250
Retrieval buffer, maintains queries to DB and transfers query results to the offline database
233
Off-line database
260
GIS database with underlying spatial subdivision data structure
235
Queries for DB node
234
Storage device(s) available for off-line use fixed or removal
265

EXHIBIT D

FIG. 3

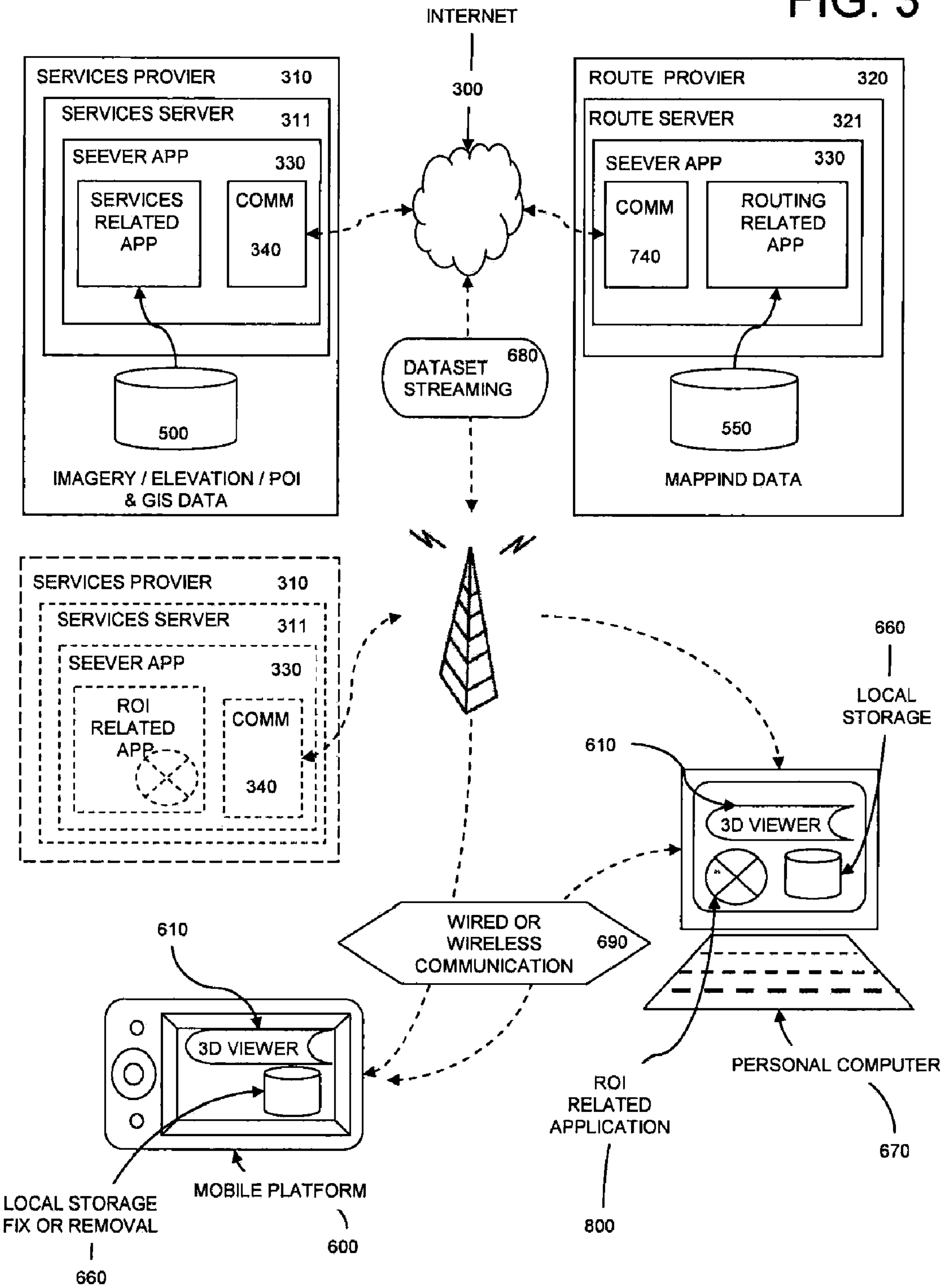


FIG. 4a

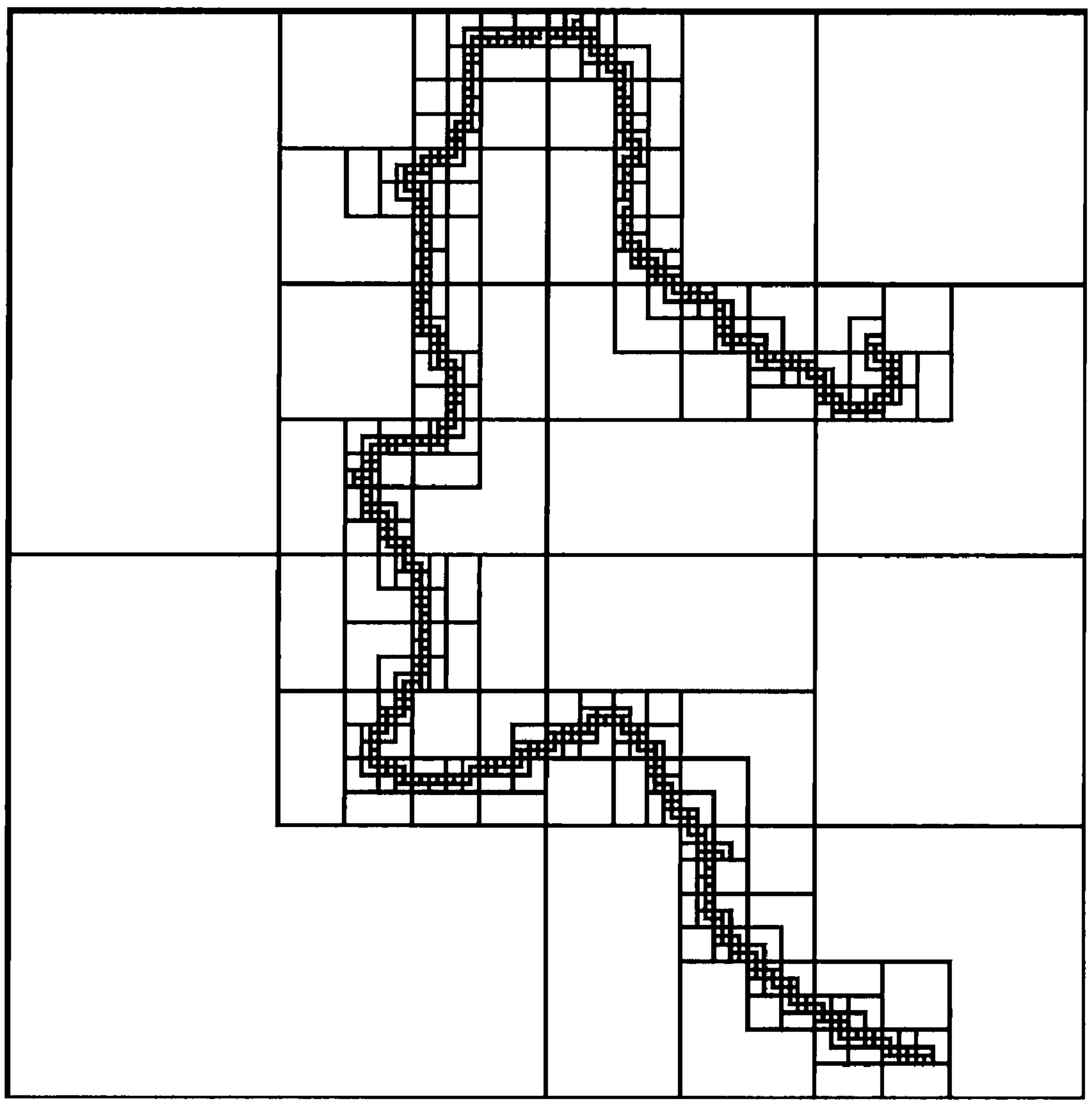


FIG. 4b

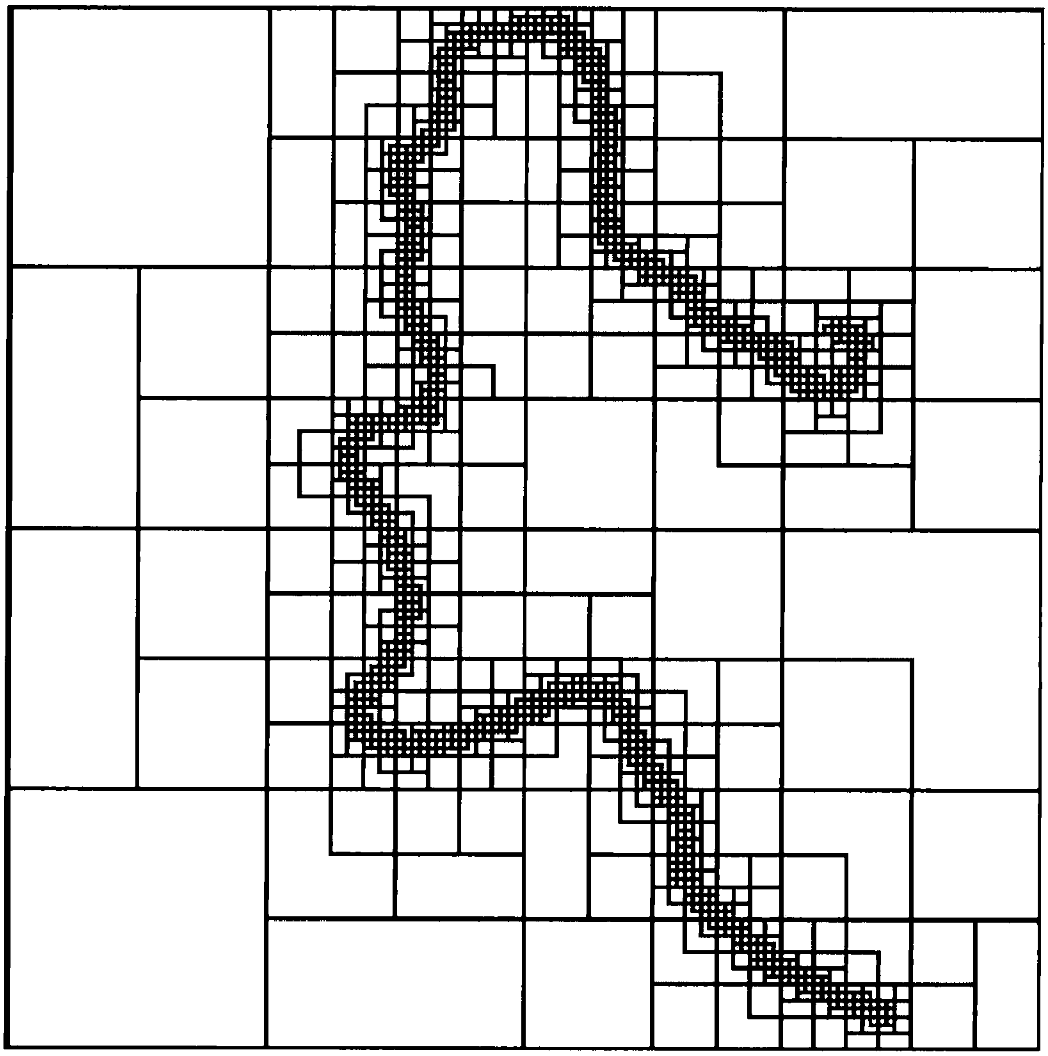


FIG. 4c

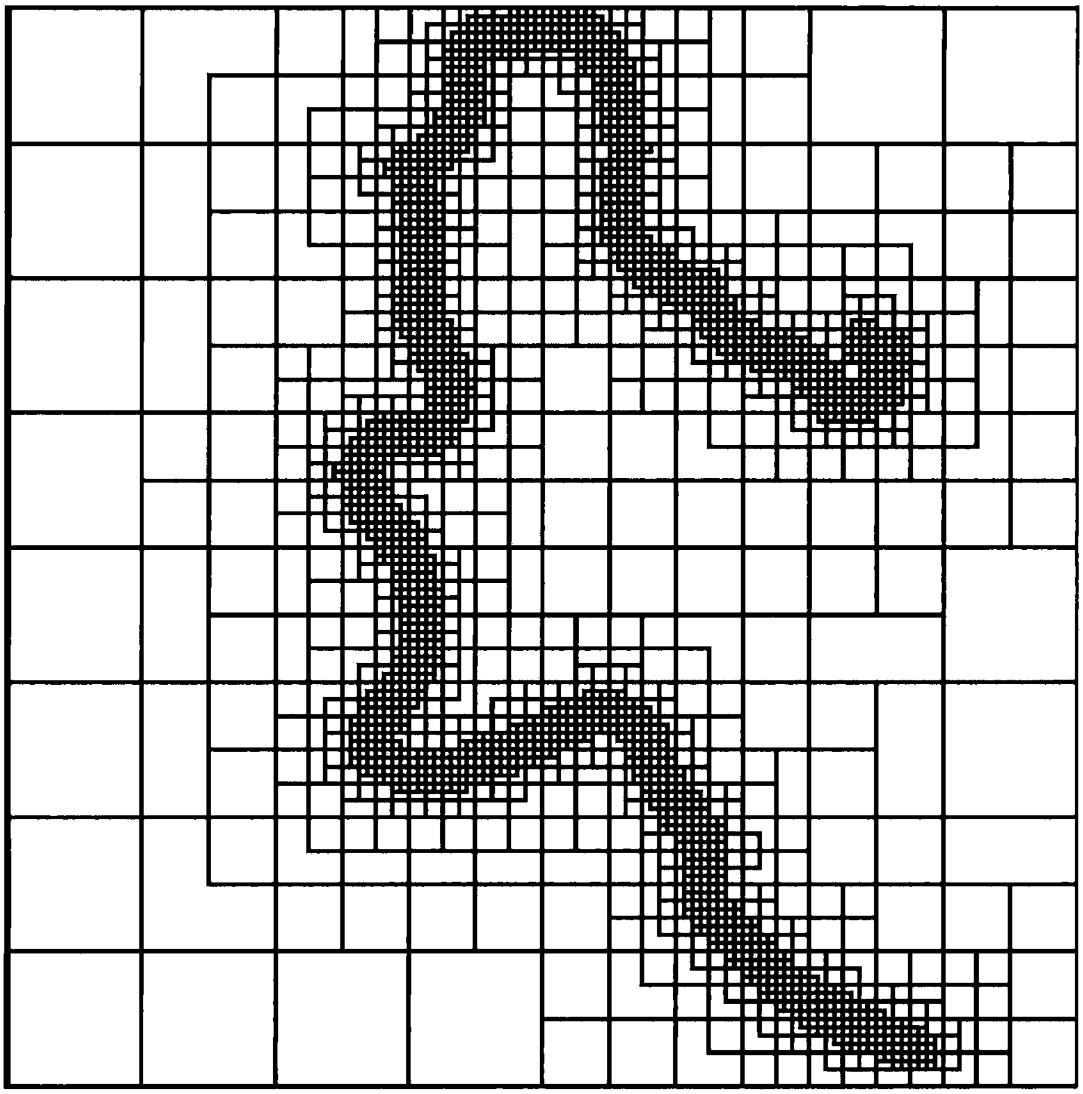


FIG. 4d

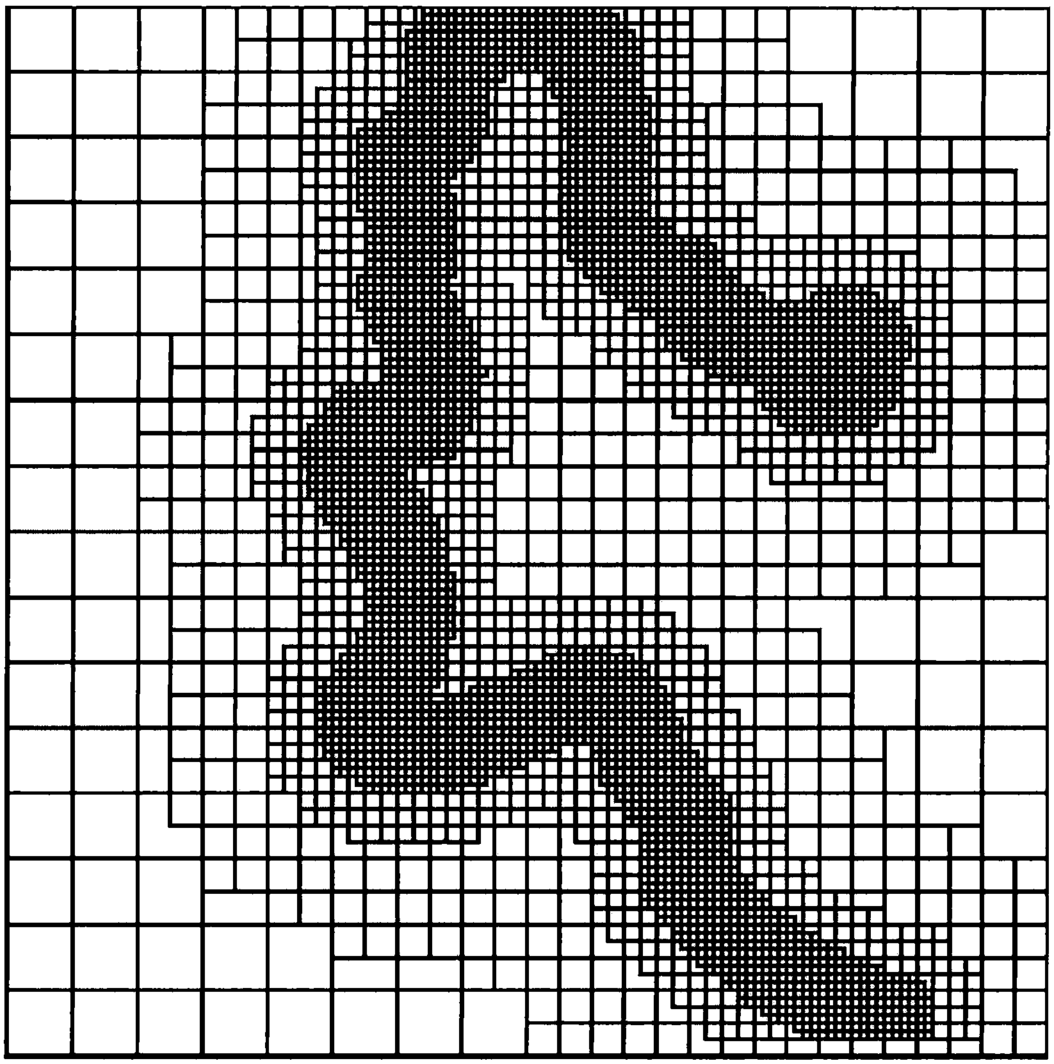
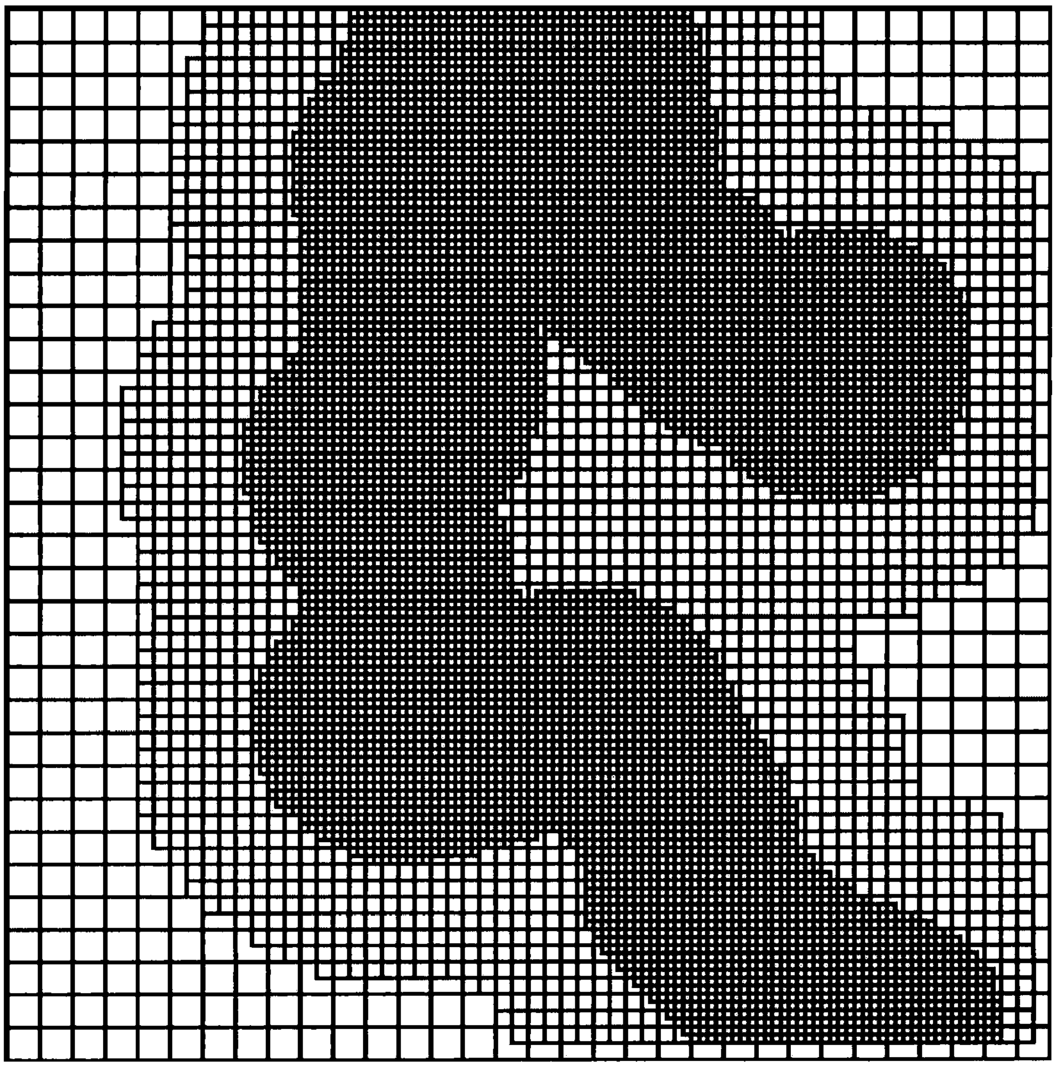


FIG. 4e



METHOD FOR IMAGE BASED NAVIGATION ROUTE CORRIDOR FOR 3D VIEW ON MOBILE PLATFORMS FOR MOBILE USERS

FIELD OF THE INVENTION

[0001] The present invention is directed to facilitating a navigational route corridor over imagery in 3D perspective for users of mobile computing platforms via a dynamic retrieval of Region Of Interest (ROI) as a subset from a navigation and/or Geographic Information System (GIS) database(s).

BACKGROUND

[0002] Modern commuters use different types of mobile/portable computing platforms to obtain various navigation services. Mobile/portable computing platforms that provide navigation features and services include both dedicated computing devices and general purpose computing devices. Dedicated computing devices include in-vehicle navigation systems, personal (i.e., portable or hand-held) navigation devises (PNDs) and personal travel assistance (PTA) systems. General-purpose computing devices include portable personal computers such as notebook computers, and personal digital assistants (PDAs). General purpose computing devices can provide navigation features and services by operating application software and by using geographic data. Mobile or portable computing platforms that provide navigation features and services include standalone systems that have geographic data and navigation application software installed locally, client devices that access geographic data or navigation application software located at a remote location, and hybrid devices that have some geographic data or navigation application software installed locally but obtain or use geographic data or navigation application software located at a remote location.

[0003] Some of the various geographically-related features and services provided by the different types of mobile or portable computing platforms include route calculation and guidance. For example, some mobile/portable computing platforms provide users with optimum routes for road travel between the present location and a target destination within the geographic region.

[0004] Using the user's conscious input, and optionally automatic input regarding the user's physical location, such as via a GPS system, a navigation application program running on or accessible by a mobile or portable computing platform system examines various paths between the starting point and target destination to determine the optimal route of travel there between. The user of the mobile or portable computing platform is then provided with information about the optimum route in the form of instructions that identify the maneuvers required to be taken by the end user to travel from the starting location to the destination location.

[0005] Another geographically-related feature provided by some mobile/portable computing platforms is a business or person locating service, commonly referred to as electronic yellow or white pages. Such a service can identify addresses of individuals or businesses. These services can also identify for a user which businesses of a certain type (e.g., Chinese restaurants) are located within a given range (e.g., 3 miles) of a given location.

[0006] Another geographically-related feature provided by some mobile or portable computing platforms provides information to end users based upon their location. Some types of information, such as advertising, provide directed information based upon the user's location, delivering advertising to end users who are traveling in a geographic region.

[0007] A further geographically-related feature provided by some mobile or portable computing platforms provides details concerning 3D building for urban navigation. Such urban navigation attempts to provide a virtual representation of the real world by building shape, height, facade textures and images into 3D models. With appropriate 3D viewers, the urban scene is rendered on the computing device. New advances in technology in both hardware and software will transform the bird-eye-view to street-view where the virtual 3D buildings becoming part of advance urban navigation system to be found in most mobile and portable devices in the near future.

[0008] Although present mobile/portable computing platforms that provide geographically-related features and services are able to provide many useful advantages, there is room for further improvement.

[0009] The purpose of this invention is to provide a solution for the off-line visualization of memory-consuming datasets such as aerial photography, terrain elevation and 3D buildings, within the storage and connectivity limitations of today's mobile/portable computing platforms as navigation products, such as Personal Navigation Devices (PND's). Typically, such a system cannot maintain a connection to a remote database server, and thus has to store all visualized content in its own storage devices, which don't have nearly enough space to store the entire database.

SUMMARY OF THE INVENTION

[0010] It is an objective of the invention to provide intuitive 3D virtual reality navigation for navigating users on a mobile computing platform.

[0011] It is another objective to provide a means to overcome the limitation associated with mobile devices that are limited in processing power and storage area to present, in 3D perspective, the area surrounding a route using imagery and other navigational and GIS (Geographic Information System) based elements and databases such as but not limited to terrain elevation, point of interest (POIs), and 3D buildings which may cover very large area such as entire continents and by an image based dataset, that required very large dataset compare to the traditional vector map and route presented on a vector generated map.

[0012] To address these and other objectives, in a first aspect, the present invention comprises a method of facilitating the display of a Region-of-Interest (ROI) and more specifically a relevant area around a selected or calculated route (route corridor), presented on the aerial or satellite image with or without additional navigational elements such as terrain elevation, POIs, and 3D buildings.

[0013] To allow the selection of relevant area that is a small dataset that may or may not be customized, as a subset from large size databases. This invention supports any formally defined ROI within the limitations of the technique used to create an ordering on the database nodes. The invention supports ROIs described as arbitrarily complex planar graphs, and general polygonal meshes. This naturally covers route(s) and/or closed area(s).

[0014] To allow the customized creation of the route corridor dataset, based on limitations dictated or controlled by others or set/preset by the user, covering among others but not limited to, communication bandwidth to the device, and storage space, whether on fixed or removable media, processing power and memory availability or allocated in the device that display the route corridor.

[0015] In a second aspect a 3D viewer is provided to allow the display of the created route corridor in 2D, Isometric view or 3D perspective and then to allow 3D maneuverability over the created route corridor, including, but not limited to, the movement over the route corridor that may or may not be in any adjustable, preset or controlled by the user; direction from origin to target or vise versa, angle of view, height, zoom level and speed.

[0016] To address these and other objectives, in a second aspect, the present invention comprises a method of facilitating the display of such ROI as route corridor on mobile computing platform in 3D perspective.

BRIEF DESCRIPTION OF THE FIGURES

[0017] For a better understanding of the invention and to show how it may be carried into effect, reference will now be made, purely by way of example, to the accompanying drawings.

[0018] With specific reference now to the drawings in detail, it is stressed that the particulars shown are by way of example and for purposes of illustrative discussion of the preferred embodiments of the present invention only, and are presented in the cause of providing what is believed to be the most useful and readily understood description of the principles and conceptual aspects of the invention. In this regard, no attempt is made to show structural details of the invention in more detail than is necessary for a fundamental understanding of the invention; the description taken with the drawings making apparent to those skilled in the art how the several forms of the invention may be embodied in practice. In the accompanying drawings:

[0019] FIG. **1** is a schematic 3D perspective of a virtual area illustrating an embodiment for representing 3D route corridor and associated navigation and GIS elements;

[0020] FIG. **2** is a flowchart of the method used to construct FIG. **1**;

[0021] FIG. **3** illustrates database structure, file system, and data flow of FIG. **2**; and

[0022] FIG. **4** (*a-e*) illustrates a dynamic creation of ROI based on storage size availability used in 2D and 3D virtual scenery of FIG. **1**;

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0023] A method and apparatus for the construction of an ordering relation between the nodes of a navigation, mapping or GIS database, based on a formal description of a Region-of-Interest (ROI), and its use in a streaming read (download) process to build a subset of the original database is disclosed.

[0024] This process may be terminated at any time, depending on programmable conditions, and all nodes that were successfully retrieved are then used to produce an off-line version of the database that provides the ability to view the relatively more important information in an off-line application that does not have access to the original database. Users of mobile computing platforms are provided with a viewer that renders this off-line database, displaying the ROI as a route "corridor" in 2D, Isometric view or 3D perspective.

[0025] This invention in its general form is known as "caching", and is in widespread use. The invention is a novel application of this technique, in a specific way that outperforms a general-purpose cache mechanism applied on an on-line viewer to produce a database for the off-line application.

[0026] More specifically, we focus on a scenario where the user would like to plan a route between several known locations $A_1, \ldots, A_n$. The ROI is determined as a subset of the road network (a sub-graph, as this network can be seen as a planar graph), containing one or more of the shortest (or otherwise best in respect to some quantifiable metric) routes starting in A_i and reaching A_{i+1}, for any value of i in $\{1, \ldots, n-1\}$. However, this is just an example; the proposed method isn't directly dependent on the exact details of the how the ROI geometry is constructed.

[0027] The ordering relation between the nodes is constructed by assigning a real number (called priority) for any node N in the database.

[0028] The GIS database employs a spatial subdivision scheme, so that each node in the database corresponds to a certain (possibly unbound) region. The priority assigned to any given node is computed as a function G of this region. A scalar field F is constructed given the ROI specifications, and then G(N) is defined as the integral of F over N's region. One method of construction for F(x) is as some decreasing function of d(x), being the minimal distance between the geometry of the ROI and x. Taking a hyperbolic function such as $F(x)=1/(c+d(x)^p)$ for some constants c>0, p>0 in particular achieves a good balance in terms of the tradeoff between detail and coverage for regular (constant-density) datasets such as aerial photography.

[0029] The streaming read process begins traversing the database, always selecting the node with the highest evaluated priority and then retrieves that node. On tree-based data structures, such as Binary Space Partitioning (BSP) trees, Kd-trees or quad-trees, this can be implemented using an algorithm similar to Breadth-First Search (BFS) only using a priority queue instead of a regular First In, First Out (FIFO) queue. The scan is stopped when the conditions for termination apply (such as when a size limit is exceeded, or by an instruction from the user), or if the queue of available nodes is exhausted.

[0030] This invention can also be applied simultaneously on multiple source databases that would share the same off-line storage, simply by extending the order relation to apply between any two nodes from any two source databases. Also, the relative priority of nodes can be adjusted according to their relative memory cost-efficiency. Vector graphics data, for example, is vastly more memory-efficient than aerial photography, informally meaning that it provides more useful information for navigation purposes "per byte", and thus should receive better priority. These techniques allow the system to manage the available storage for the off-line application more intelligently.

[0031] This invention has the following advantages in relation to general-purpose caching:

[0032] 1. To prepare a cache for off-line use, an on-line viewer would normally have no way to access and visualize all database nodes near or inside the ROI at the same time, so instead, the viewer would have to examine different combinations of positions and resolution levels, making it much more difficult to prioritize between the nodes of each database and even more so between different databases. It would take the evaluation of many different combinations because "spacing out" between the positions too much result in aliasing problems, making this approach almost impractical for complex ROIs such as those produced by long-distance route planning.

[0033] 2. A general-purpose read cache is typically used as a transparent layer of abstraction, in that the viewer reads "through" the cache without being aware of its existence. However, in the case of an off-line viewer, there is an issue that some seemingly accessible nodes in the databases may not exist in the cache, and thus cannot be retrieved—this type of failure may occur for any query to the database done by the application. In contrast, the off-line database created by the method herein is easier to use since all of its nodes are available off-line.

[0034] 3. The hierarchy traversal used by this method can be seen as a "generator" for database node references, so by simply buffering these references it is easy to achieve high performance in the streaming read process by keeping multiple simultaneous requests to the server. This takes care of the otherwise unreasonable time cost of waiting on the I/O, which would be the connection's latency times the total amount of nodes retrieved. However, implementing this optimization in an on-line viewer is more difficult, because it typically maintains the requests for nodes corresponding to one specific resolution/position combination only; also, it has no way to estimate in real time what are the next k highest-priority nodes (in regards to the entire ROI), which could make it download lesser-priority nodes that might not make it into the final cache at all, resulting in a waste of resources.

[0035] With reference now to FIG. **1** a schematic 3D perspective of the geographic area **100**. In a present embodiment, the display of the route area **105** defines a plurality of road networks **120**, terrain elevations **130**, 3D buildings **140** and POIs **150** and a route **110** within the geographic area **100**.

[0036] FIG. **2** is a flow chart of the method used to produce the database from which to render images as depicted in FIG. **1**. At process start **200** the system sends a query **201** to the GIS database **235** and retrieves necessary information in order to be able to query the database for the root node of the spatial subdivision hierarchy, and then retrieves it and inserts it to the Node Priority Queue (NPQ) **220**. The process then enters a loop **230**, under termination conditions such as time and/or space limits. If the termination conditions are not met **230***a*, the program removes a single node from the NPQ **220**, and places it in the retrieval buffer **233**. The program then evaluates the priority of all children of that node in the hierarchy. For each such node **232**, an evaluation function is applied on the spatial region defined by that node in the spatial subdivision data structure. The result of this function is then used as priority and the node is inserted with that priority to the NPQ **220**. Then the process loops back to **230**.

[0037] The retrieval buffer **233** maintains a list of queries **234** to the GIS database **235** consisting of nodes removed from the NPQ so far that have not yet been received. It may block the operation of step **232** to prevent the system from growing the buffer indefinitely. When a buffered query completes successfully, it stores the data and node information in preparation for use in the final off-line database **260**.

[0038] When the termination condition of the loop is met **230***b*, the process **240** flushes the retrieval buffer **233**, and finalizes the off-line database **260** from the data provided so far from the queries made by the retrieval buffer **233**, so that it can then be used by the off-line application in place of the original database. It then transfers this database to the storage device(s) **265** used by the off-line application. After this, the process terminates **250**.

[0039] FIG. **3** illustrates a ROI system used in 3D virtual scenery of FIG. **1**. The system comprised of a services provider **310** and route provider **320** and optional ROI provider **810**. Whereby the services provider utilize a services server **311** and the route provider utilize a route server **321**. Said services server **311** and route server **321** and ROI server **811**, may utilize server application **330** to operate said servers. A related services application **312** may be controlled by said server application **330** for the services provider **310** that is connected to imagery, data storage **500** comprised of polarity of imagery, terrain elevation, POIs and GIS datasets, and route related application **322** may be controlled by said server application **330** for the route provider **320** that is connected to mapping data **550**, and ROI related application **800** may be controlled by said server application **330** for the ROI provider **810** that is connected to services provider **310** and route provider **320** via the Internet **300** or directly. The server application **330** also may control a communication application **340** that connected each said server and services to the Internet **300**.

[0040] Said Internet **300** provides for a dataset streaming **680** via wired **681** or wireless **682** communications.

[0041] ROI related application **800** may be installed on the user personal computer **670**, whereby relevant data streamed over the Internet **300** from the services provider **310** and route provider **320** is manipulated by the ROI related application **800** to create the target ROI for a said route. The personal computer **670** may contain a 3D viewer **610** to preview the route and the ROI. Said ROI may be stored on the local storage **660** in the personal computer **670**.

[0042] The selected ROI may be streamed via wired or wireless communication **690** to the mobile platform **600** from the ROI provider **810** and/or from the user's personal computer **670** local storage **660**. The said transferred ROI will be stored in the mobile platform **600** storage media **680** that can be fixed or removable media.

[0043] The mobile platform may contain a 3D viewer in order to view the said ROI. The mobile platform may contain internally or connected via wire or wireless to locator device such as GPS in order to track the user mobile platform location and place the location over the displayed ROI.

[0044] FIG. **4** (*a*-*e*) shows the set of nodes selected from a quad-tree based database, using a simple ROI created by a route connecting between two locations, with varying limits on the size of the output database produced. The more memory is allotted, the more nodes surrounding the ROI can make it into the output database. Each node is shown graphically as a square depicting its region as defined by the quad-tree's spatial subdivision.

[0045] Thus the scope of the present invention is defined both combinations and sub combinations of the various features described hereinabove as well as variations and modifications thereof, which would occur to persons skilled in the art upon reading the foregoing description.

[0046] In the claims, the word "comprise", and variations thereof such as "comprises", "comprising" and the like indicate that the components listed are included, but not generally to the exclusion of other components.

We claim:

1. A method of generating and facilitating the display of a Region-of-Interest (ROI) to users of mobile computing platforms:

Said ROI comprising of a relevant area around a selected or calculated navigational route namely route corridor

Said ROI generated from datasets comprising of some or the combination of imagery, terrain elevation, Point-Of-Interests, and 3D objects such as but not limited to 3D building with or without their images facades as graphic or raster

Said datasets are located on local or remote server

Said route is selected or calculated from a local or remote sever

Said ROI generator function on local or remote server such server may be a hosted server or personal computer (PC)

Said ROI generator determine the region of interest based on the information provided from the said selected or calculated route

Said POI is small subset of the datasets indicated above

Said ROI described as arbitrarily complex planar graphs, and general polygonal meshes. This naturally covers route(s) and/or closed area(s)

Said ROI datasets is placed on the device storage, fixed or removable media

Said ROI generator allow the customized creation of the route corridor dataset, based on limitations dictated or controlled by others or set/preset by the user, covering among others but not limited to, communication bandwidth to the device, and storage space, whether on fixed or removable media, processing power and memory availability or allocated in the device that display the route corridor.

Said ROI rendered on the device graphics display

* * * * *

EXHIBIT E

STATEMENT UNDER 37 CFR 3.73(b)

Applicant/Patent Owner: Isaac Levanon and Yonatan Lavi

Application No./Patent No.: 13/027,929 Filed/Issue Date: February 15, 2001

Entitled: **OPTIMIZED IMAGE DELIVERY OVER LIMITED BANDWIDTH COMMUNICATION CHANNELS**

INOVO LIMITED, a Corporation
(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that it is:

1. ☒ the assignee of the entire right, title, and interest; or
2. ☐ an assignee of less than the entire right, title and interest
(The extent (by percentage) of its ownership interest is ______%)

in the patent application/patent identified above by virtue of either:

A. ☒ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel ______, Frame ______, or for which a copy thereof is attached.

OR

B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: ______________ To: ______________
The document was recorded in the United States Patent and Trademark Office at
Reel ______, Frame ______, or for which a copy thereof is attached.
2. From: ______________ To: ______________
The document was recorded in the United States Patent and Trademark Office at
Reel ______, Frame ______, or for which a copy thereof is attached.
3. From: ______________ To: ______________
The document was recorded in the United States Patent and Trademark Office at
Reel ______, Frame ______, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet.

☐ As required by 37 CFR 3.73(b)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

______________ Signature | April 3, 2011 Date

Nurit Roth, Chief Financial Officer, INOVO Limited
Printed or Typed Name | ______________ Telephone Number

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EXHIBIT E

ATTORNEY DOCKET NO. 369401-991122

ASSIGNMENT

WHEREAS, **Issac Levanon and Yonatan Lavi** have made certain inventions or discoveries (or both) set forth in an Application for Letters Patent of the United States of America entitled

OPTIMIZED IMAGE DELIVERY OVER LIMITED BANDWIDTH COMMUNICATION CHANNELS

_______ issued as U.S. Patent No. ______________________

___X___ filed as Serial No. __13/027,929__ on __February 15, 2011__

_______ filed herewith

WHEREAS, INOVO Limited, an Anguilla company whose address is PO BOX 1551 The Valley Anguilla, British West Indies, and who, together with its successors and assigns is hereinafter called "Assignee", is desirous of acquiring the entire right, title and interest together with the benefits and privileges hereinafter recited;

NOW, THEREFORE, for valuable consideration furnished by Assignee to me, receipt and sufficiency of which I hereby acknowledge, effective as of the date signed, I hereby, without reservation:

1. Assign, transfer and convey to Assignee the entire right, title and interest together with the benefits and privileges in and to said inventions and discoveries, said Application for Letters Patent or similar forms of protection of the United States of America, and all other applications for Letters Patent on said inventions and discoveries in whatsoever countries, including all divisional, renewal, substitute, continuation and convention applications based in whole or in part upon said inventions or discoveries, or upon said application, and any and all Letters Patent, reissues and extensions of Letters Patent or similar forms of protection granted for said inventions and discoveries or upon said applications, and every priority right that is or may be predicated upon or arise from said inventions, said discoveries, said applications and said Letters Patent;

2. Authorize Assignee to file patent applications in any or all countries or groups of countries on any or all of said inventions and discoveries in our name or in the name of Assignee or otherwise as Assignee may deem advisable, under the International Convention or any other relevant convention or treaty or otherwise;

3. Authorize and request the Commissioner of Patents and Trademarks of the United States of America and the empowered officials of all other governments to issue or transfer all said Letters Patent to Assignee, as assignee of the entire right, title and interest therein, or otherwise as Assignee may direct;

4. Warrant that I have not knowingly conveyed to others any rights in said inventions, discoveries, applications or patents or any license to use the same or to make, use or sell anything embodying or utilizing any of said inventions or discoveries; and that I have good right to assign the same to Assignee without encumbrance;

5. Bind my heirs, legal representatives and assigns, as well as myself, to do, upon Assignee's request and at Assignee's expense, but without additional consideration to me or them, all acts reasonable serving to assure that said inventions and discoveries, said patent

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EXHIBIT E

applications and said Letters Patent shall be held and enjoyed by Assignee as fully and entirely as the same could have been held and enjoyed by me, my heirs, legal representatives and assigns if this assignment had not been made; and particularly to execute and deliver to Assignee all lawful application documents including petitions, specifications, and oaths, and all assignments, disclaimers, and lawful affidavits in form and substance as may be requested by Assignee; to communicate to Assignee all facts known to me relating to said inventions and discoveries or the history thereof; and to furnish Assignee with any and all documents, photographs, models, samples and other physical exhibits in my control or in the control of my heirs, legal representatives or assigns which may be useful for establishing any facts of my conceptions, disclosures, and reduction to practice of said inventions or discoveries.

6. Grant the attorneys of record the power to insert on this Assignment the serial number of said Application as further identification of said Application in order to comply with the rules of the United States Patent and Trademark Office for recordation of this Assignment.

This Assignment may be executed in one or more counterparts, each of which shall be deemed an original and all of which may be taken together as one and the same Assignment.

IN WITNESS WHEREOF:

[signature]		April 3, 2011
Issac Levanon		Date

Witness #1
Witnessed: [signature]
Nurit Roth

April 3, 2011
Date

Witness #2
Witnessed: [signature]
Nir Levanon

April 3, 2011
Date

WEST\223322644.1

EXHIBIT E

IN WITNESS WHEREOF:

		April 3, 2011
Yonatan Lavi		Date

Witness #1
Witnessed: ____________________
Nurit Roth

April 3, 2011
Date

Witness #2
Witnessed: ____________________
Nir Levanon

April 3, 2011
Date

Day, Evan S. (SDO)

From:	Yoni Lavi [redacted]@yahoo.com>
Sent:	Wednesday, August 31, 2016 12:27 PM
To:	Day, Evan S. (SDO)
Subject:	Fw: Contact

----- Forwarded Message -----
From: Yoni Lavi [redacted]@yahoo.com>
To: "Coulson, Chris" <CCoulson@kenyon.com>
Sent: Wednesday, March 18, 2015 5:30 PM
Subject: Re: Contact

Dear Chris,

The number you have is correct.
I answered the phone earlier today and heard only line noise.

You could try calling me again.

If it doesn't work a second time, could you please put your inquiry in writing?
I do prefer to communicate in writing, my speech isn't very fluent in english.

Regards,
Yoni

From: "Coulson, Chris" <CCoulson@kenyon.com>
To: '[redacted]@yahoo.com'" [redacted]@yahoo.com>
Sent: Wednesday, March 18, 2015 4:07 PM
Subject: Contact

Dear Yoni,

Do you have a moment to talk by telephone?

I am a US lawyer representing Bradium, an entity that has an interest on several patents on which you are listed as co-inventor. I would like to speak with you briefly at your convenience. I tried to call [redacted] but I was not successful.

Regards,

Chris Coulson
Kenyon & Kenyon LLP
One Broadway | New York, NY 10004-1007
212.908.6409 Phone | 212.425.5288 Fax
ccoulson@kenyon.com | www.kenyon.com

EXHIBIT F

Day, Evan S. (SDO)

From:	Yoni Lavi [redacted]@yahoo.com>
Sent:	Wednesday, August 31, 2016 12:26 PM
To:	Day, Evan S. (SDO)
Subject:	Fw: Contact

----- Forwarded Message -----
From: Yoni Lavi [redacted]@yahoo.com>
To: "Coulson, Chris" <CCoulson@kenyon.com>
Sent: Saturday, January 30, 2016 7:39 PM
Subject: Re: Contact

Hi Chris.

I'm a FTE of Facebook, Inc. at present (Since Apr 2015, in fact) and cannot be otherwise employed or work as a contractor in any capacity.
If this situation changes, I will notify you.

I'm sorry this couldn't work out.
Thanks again.

Regards,
Yoni

From: "Coulson, Chris" <CCoulson@kenyon.com>
To: 'Yoni Lavi [redacted]@yahoo.com>
Sent: Thursday, January 28, 2016 1:12 AM
Subject: RE: Contact

Dear Yoni,

May we schedule a time for a short telephone call?

Chris Coulson
Kenyon & Kenyon LLP
Tel: 212.908.6409

From: Yoni Lavi [redacted]@yahoo.com]
Sent: Wednesday, March 18, 2015 11:31 AM
To: Coulson, Chris
Subject: Re: Contact

Dear Chris,

The number you have is correct.
I answered the phone earlier today and heard only line noise.

You could try calling me again.

EXHIBIT F

If it doesn't work a second time, could you please put your inquiry in writing?
I do prefer to communicate in writing, my speech isn't very fluent in english.

Regards,
Yoni

EXHIBIT F

Day, Evan S. (SDO)

From:	Yoni Lavi [redacted]@yahoo.com>
Sent:	Wednesday, August 31, 2016 12:20 PM
To:	Day, Evan S. (SDO)
Subject:	Fw: Proposed Consulting Agreement
Attachments:	Consulting Retention Agreement for Yoni Lavi.pdf

----- Forwarded Message -----
From: "Coulson, Chris" <CCoulson@kenyon.com>
To: '[redacted]@yahoo.com"[redacted]@yahoo.com>
Sent: Thursday, March 19, 2015 1:17 AM
Subject: Proposed Consulting Agreement

Dear Yoni,

As we discussed today, please find attached a consulting agreement. Please let me know if you have any questions about the agreement. Also, please either let me know your current consulting rate, or write it into this document in the space provided.

If the consulting agreement is agreeable as written, please sign it and return to me by scanned copy.

Chris Coulson
Kenyon & Kenyon LLP
One Broadway | New York, NY 10004-1007
212.908.6409 Phone | 212.425.5288 Fax
ccoulson@kenyon.com | www.kenyon.com