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Using Virtual Tile Routing For Navigating Complex Transit Hubs

Tech ID: 33622 / UC Case 2019-905-0

BACKGROUND

Many people have learned to appreciate the advent of GPS based navigational applications in our daily lives through the use of street level navigation, and many more loathe the same applications when using them to navigate established public transportation systems. Many of these travelers become confused and frustrated when attempting to understand and act on the directions given to them by such existing applications that primarily focus on large-scale street navigation, especially if the user has a visual or cognitive impairment. Several existing applications will not even attempt to aid someone in the navigation of say, a metro, train or bus station, and instead simply inform the user of the label of the route that the application intends the user to take. Without any small-scale directions many people find themselves struggling to figure out what platform or boarding zone they need to use to get on their preferred method of transportation, as well as how to get to these platforms and boarding zones in the first place. These transit hubs, plazas, malls, and the like have long been a pain in the side of developers and users alike when it comes to navigation. Innovation has long been overdue in this space concerning small scale transit plaza navigation, with major players holding large market shares in navigation not even attempting to address this longstanding problem. The only existing application to offer indoor navigation offers very limited as well as inconsistent functionality including only two-dimensional indoor mapping, due to manually uploaded floor plans that are only available in the first place from partnering locations. This has continued to be an issue due to a lack of adoption by existing locations, as each location is required to draw out their floor plan on an antiquated image file and submit it for approval. Solving this problem would ease a large amount of stress for those navigating in areas they are not familiar with, as well as saving time that could possibly make the difference between a missed train and a nearly missed train.

TECHNOLOGY DESCRIPTION

Researchers at the University of California, Santa Cruz have devised a system of methods for creating routes that allow for navigation within complex transit hubs and plazas through the use of tessellated virtual tiles. These virtual tiles range in size between 5 and 20 meters and are sized so as to define and differentiate between areas suitable for different purposes. This allows for users using tile-based navigation to clearly viewpoints of interest and the walkable pathways connecting them to the user. Firstly, tiles are loaded from a server containing various points of interest near the user in Geo-JSON format, such as a subway or light rail platform. This is then followed by loading secondary tiles that include the available walkable areas connecting these points of interest, such as hallways and escalators. These tiles are subsequently connected using tessellation in a manner allowing for routes to be easily generated throughout the newly generated map. This route is then calculated by accessing the now existing

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OTHER INFORMATION

KEYWORDS

GPS, BLE, tessellation, virtual tiles, transit hub navigation, route planning, way finding, small scale routing

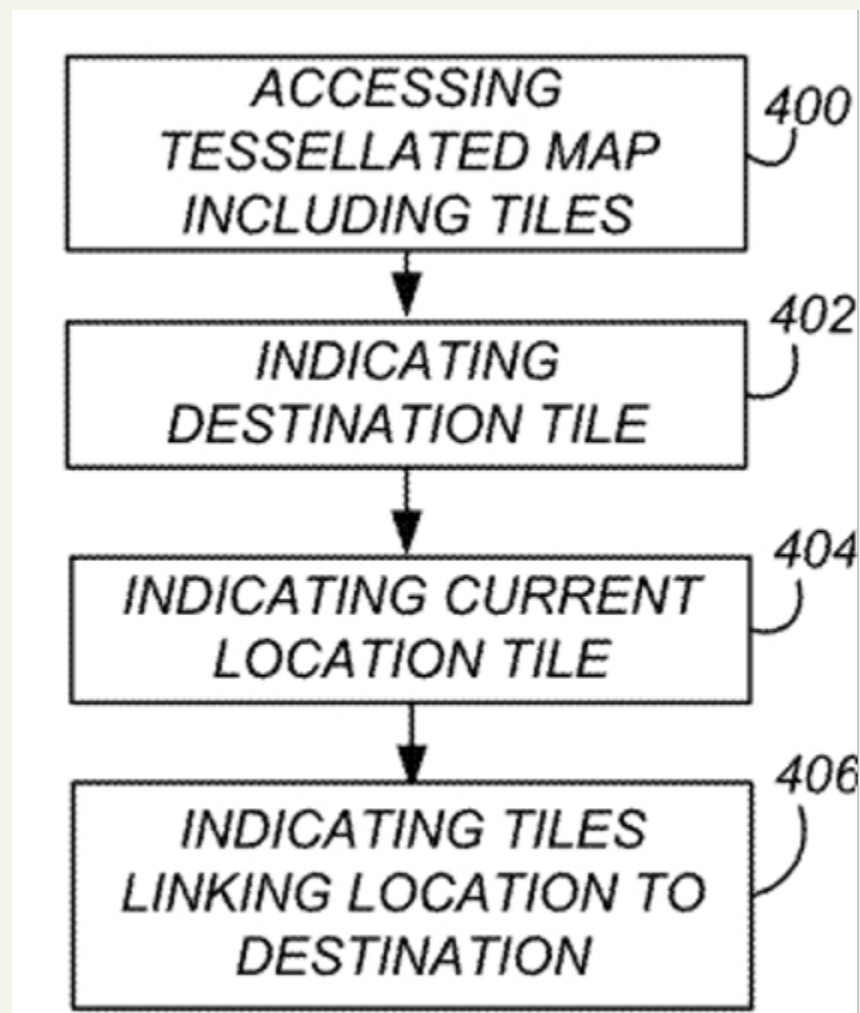
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RELATED CASES

2019-905-0, 2021-594-0

tessellated map made out of virtual tiles and having the user indicate their destination, this method is superior to existing indoor navigational applications as routing is not necessarily limited to predefined pathways and is instead dynamically generated. Dynamically generated routes allow for much more flexibility in response to congestion as well as changing environments, and often provide much more efficient directions than pre-generated pathways are capable of. The destination of the user is then placed onto a designated virtual tile, the location of the user is calculated via GPS and iBeacons when available through the utilization of bluetooth low energy (BLE) causing the tile they reside within to become known to the application as well as indicated to the user. The use of Geo-JSON files allows for the relatively easy creation of complex transit hub and plaza maps, as well as the use of existing maps already published by many existing locations. Geo-JSON formatting also allows for the creation of three-dimensional environments which greatly improves the usability of such navigation within multi-level environments. These methods of localization, primarily BLE and improved pedestrian dead reckoning, allow for greatly improved localization over existing GPS-based systems allowing for a decrease in positioning error from 5-10 meters all the way down to 3 meters, an up to 70% increase in accuracy. Once the current location and destination are known and indicated onto tiles, the tiles that link the user's current location and destination are then subsequently calculated and connected to provide a coherent route. The user is able to view their current location within this route at any time in reference to relevant landmarks either visually or in verbal form. The specific tiles at which the user is boarding a train, bus or accessing any other point of interest are clearly highlighted within the navigable space to avoid confusion. Through the use of this tile navigation a user is able to see exactly where they are and where they are going when navigating a transit hub or other densely packed walkable area. These methods of virtual tile routing can exist either in a standalone application or be added onto existing applications in order to greatly increase usability within the aforementioned complex transit hubs and plazas that are currently neglected by existing navigation applications.



APPLICATIONS

- transit hub navigation

- transit plaza navigation
- navigational aid for the impaired
- dense walkable environment visualization

ADVANTAGES

- simplifies navigation of transit hubs considerably over existing applications
- uses local routing directions rather than street level directions
- clearly labeled navigable areas relative to current standards
- improved user localization compared to GPS by up to 70%
- use of Geo-JSON a widely accepted format for web-based navigation
- possible three-dimensional mapping

INTELLECTUAL PROPERTY INFORMATION

Country	Type	Number	Dated	Case
United States Of America	Published Application	20210018321	01/21/2021	2019-905

RELATED MATERIALS

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- ▶ [Camera-Based Reader for Blurry and Low-Resolution 1D Barcodes](#)
- ▶ [Inertial Odometry System and Methods](#)

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