December 04, 2017

Autonomous guidance devices

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ABSTRACT

This disclosure describes autonomous guidance devices that help users navigate complex indoor spaces such as airports and large shopping centers. The devices are in the form of trolleys, shopping carts, luggage, etc. The devices provide information (e.g., by responding to voice queries) and guidance to the user (e.g., by escorting users to destinations) in such locations. Autonomous guidance devices are equipped with obstacle avoidance, path planning, guidance systems and indoor/outdoor maps. Applications of these devices can also span advertising and mapping services as well as assistance to visually impaired users and senior citizens.

KEYWORDS

- Autonomous vehicle
- Guidance device
- Mobility aids
- Indoor navigation
- Shopping cart

BACKGROUND

Visitors to large or complex indoor spaces such as airports and multi-level shopping centers rely on maps, e.g., physical maps, signage, or electronic maps, to help navigate to a preferred destination. Visually impaired users are particularly inconvenienced in such locations and may prefer a personal guide to escort them, e.g., to help avoid obstacles. In some locations, auditory guidance systems are available. Such systems provide directions via spoken feedback, e.g., “turn left in 10 feet.” However, these guidance systems are not autonomous and are often based on static information.

DESCRIPTION

This disclosure utilizes currently available technology in the areas of autonomous mechanisms, guidance systems, indoor and outdoor mapping, and self-driving vehicles to provide autonomous personal guidance devices. Moreover, advances in obstacle avoidance as well as path planning technologies are utilized in the development of autonomous devices. The personal guidance devices can be in various configurations, such as autonomous shopping carts, trolleys, suitcases, vehicles, etc.

An autonomous self-driving trolley can help visitors navigate indoor spaces such as airports and shopping malls by guiding them to the preferred destination. Also, such trolleys can serve as mobility aids for visually impaired users, both in indoor and outdoor settings.

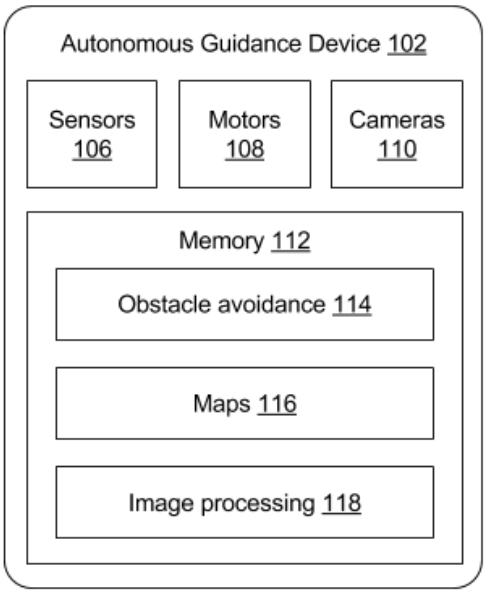

Fig. 1: Autonomous guidance device

The autonomous guidance device (102) includes sensors e.g., laser, sonar, etc. (106), motors (108) to propel the device, and one or more cameras (110). Cameras enable 3D visual perception in order to build and track relevant visual features. Memory (112) includes various

software modules, including obstacle avoidance (114) and high-quality indoor and outdoor maps (116). The maps can be stored locally or accessed over a network. Image processing module (118) processes the images from device cameras and provides 3D visual perception by continuous visual feature tracking. This helps in navigation of the guidance device, e.g., through crowds.

The autonomous guidance device can lead users in the user-specified direction. If a user is visually-impaired, the device can act like a guide dog and lead the user to the destination. For example, the device softly pulls users in the correct direction and employs a very tight feedback loop to allow users to react almost instantaneously to the light pulling.

The autonomous guidance device is also capable of maneuvering through crowded areas using obstacle avoidance technologies. The device employs path planning as well as mapping techniques to guide users to destinations. Further, the device responds to user queries regarding the area, e.g., locations of airport gates, baggage claim areas, ground transport services, shopping center/mall store information, etc.

Examples of use

Airport: A user Alice arrives at an airport and picks up an autonomous trolley at curbside check-in. She obtains her flight and gate information, e.g., from a digital assistant on her phone. After finding that her flight departs from gate A1, Alice instructs the autonomous trolley: "Navigate to Gate A1." The trolley responds: "Now going to Gate A1."

Alternatively, Alice may only have her flight number and instruct the autonomous trolley: "Navigate to flight A111." The trolley retrieve gate information automatically and guides the user to the correct gate. Alice then places her bags on the trolley and holds onto the trolley handle, which softly pulls Alice in the correct direction, guiding her to the destination

gate. Upon arriving at the desired gate, Alice picks up her bags from the trolley, and optionally, pays for using the trolley, e.g., via credit card or other payment mechanism.

After the user releases the trolley, the trolley drives itself back to a home-base or to a designated bay near the gates. If back at the home-base, the trolley is ready to pick up the next traveler. Alternatively, if stationed near an arrival gate, the trolley is available to guide arriving passengers to baggage claim and then to ground transport.

Shopping Center: A user picks up an autonomous shopping cart at a multi-level shopping center and instructs the cart: "Take me to Store ABC." The cart then guides the user to Store ABC. The cart is equipped with a detailed indoor map of the shopping center. The cart also employs obstacle avoidance mechanisms to maneuver through crowded hallways.

Apart from these applications, visually impaired, differently abled and senior citizen users, can especially benefit from autonomous devices. Such users can benefit from not only the navigation assistance of such devices but also the ability to respond to user queries. These devices can therefore double as a mobility aid and a digital information assistant for such users.

The autonomous guidance device can also be employed by advertisers to direct potential customers to an appropriate business location. The autonomous devices can also be used by service providers to deliver a superior customer experience, e.g., an airline can provide autonomous trolleys to passengers to guide them to appropriate locations in an airport. Also, such devices can be used by mapping applications to gather guidance information to build facility or indoor maps.

Further to the descriptions above, a user may be provided with controls allowing the user to make an election as to both if and when systems, programs or features described herein may enable collection of user information (e.g., information about a user's social network, social

actions or activities, profession, a user's preferences, or a user's current location), and if the user is sent content or communications from a server. In addition, certain data may be treated in one or more ways before it is stored or used, so that personally identifiable information is removed. For example, a user's identity may be treated so that no personally identifiable information can be determined for the user, or a user's geographic location may be generalized where location information is obtained (such as to a city, ZIP code, or state level), so that a particular location of a user cannot be determined. Thus, the user may have control over what information is collected about the user, how that information is used, and what information is provided to the user.

CONCLUSION

Autonomous guidance devices help users navigate complex indoor spaces such as airports and large shopping centers. Autonomous guidance devices are in the form of trolleys, shopping carts, luggage, etc. The devices provide information (e.g., by responding to voice queries) and guidance to the user (e.g., by escorting users to destinations) in such locations. The devices are equipped with obstacle avoidance, path planning, guidance systems and indoor/outdoor maps. Applications of these devices can also span advertising and mapping services as well as assistance to visually impaired users and senior citizens.