Title of the invention

Mobile station

Background of the invention

The present invention relates to docking station for a plurality of personal vehicles. More specifically, it is relates to mobile station which can be transported from one location to another with said personal vehicles loaded or unloaded.

Background

Personal-Vehicle includes various form of small vehicle for personal use. These include, but are not limited to: bicycle, electric powered bicycle (eBike), scooter, electric powered scooter (eScooter), tricycle, electric powered tricycle (eTricycle), wheel chair, and electric powered wheelchair (eWheelChair). Amongst the various PVs, bicycle is the most common form of personal vehicle.

Over the past ten years, there is a trend towards bicycle-sharing-system which provides short-term bicycle rental through an automated system in urban cities. Bicycle-sharing systems allow for one-way trips. Users check out a bicycle by credit card, membership card, and/or by cell phone at a docking station. The bicycle can be returned to another station within the system after use.

Bicycle sharing increases mobility and provides the “last mile” connection between transit node, such as a bus stop or train station, and final destination, such as office buildings or residential house. There are over 200 bicycle sharing programs worldwide nowadays. Bicycle sharing increases the number of bicycle trips, reduce automotive trips and associated pollutions, improves livability and public health.

Most bicycle-sharing system offer progressively higher charges for each additional 30 minutes, with the first 30 minutes free or having a minimum charge.

Cost of bicycle sharing system consists of capital cost and annual operating costs. Capital costs include fabrication of the bicycles and installation of the stations, license or purchase of the back-end system used to operate the equipment, member access

cards (if necessary), purchase or rental of maintenance and distribution vehicles, and installation. JCDecaux's Cyclocity system is estimated at $4,400 per bicycle; and Bixi is estimated to be $3,000 per bicycle.

Operating costs include maintenance, distribution, staff, insurance, office space, storage facilities, website hosting and maintenance. New York City's analysis of several systems concludes an average operating cost of about $1,600 per bicycle per year.

Over the lifetime of a bicycle, the total operation cost is 3-6 times of the capital cost. Nearly 50% of the operation cost is due to redistribution of the bicycles.

Problem of prior art:

The bicycles of a bicycle-sharing system are distributed through a number of stations at different fixed stations (FIG. 20). At peak hours, most of the bicycles are moving in the same direction. For example, during the morning peak hours, most bicycle-trips are made by commuters going away from train station to office area. To maximize the usage of the bicycles, it is necessary to hire a team of drivers and movers to bring the bicycles back to the train station for other users. It takes considerable amount of effort and time to unload individual bicycle from docking station, load them up and secure them in a transport vehicle (FIG.19). At the destination the reversed procedure is performed: unloading, loading and securing each bicycle to the other docking station. This effort of unloading and loading takes up precious time and incur high cost. It is not only the labor cost but also the opportunity cost. The longer the operation takes, the shorter the time that the bicycle is available to users. Therefore such operation is performed under great time pressure. The bicycles are more likely to get damaged during the stressful loading and unloading operation, hence increasing the repair and maintenance cost.

Objects of the present invention

In view of the short comings, there is a need to improve cost effectiveness and availability of bicycles during peak hours. Objects of the present invention include:

- to reduce operation cost for redistributing of bicycles,
- to eliminate damage of bicycles during loading and unloading between station and transport vehicles,
- to improve availability of bicycles during peak hours,
- to increase use frequency of share bicycles, and
- to facilitate fast deployment of bicycles vehicles to venues of special event such as a concert or a football match.

Although only bicycles are mentioned, above objects are applicable to other forms of personal vehicles.

- To provide mobile station which is transportable and is easy to moved and locked

Brief summary of the present invention

For the purpose of this invention disclosure, the following terms shall have the meaning as defined:
PVSS, or system = Personal-vehicle-sharing-system, such as bicycle-sharing-system
BSS = Bicycle sharing system
Control center = a physical or virtual center that manages the operation of PVSS, or BSS
PV = Personal vehicle, such as bicycle or scooter, or electric powered bicycle, or scooter.
Docking unit = a parking space, a dock or a structure to lock and secure individual PVs
Fixed station = a fixed location station consists of a plurality of docking units
Mobile station = a transportable station consists of a plurality of docking units
User, commuter = user of a PVSS, or BSS
User ID = an unique ID issue to valid users
PVID = a unique ID of a PV
Station ID = a unique ID of a mobile or fixed station
Start time = the time when a user checks out a PV
End time = the time when the user returns the PV to a docking unit
Start location = the location where a user checks out a PV, such as bicycle

End location = the location where the user returns the PV

An example of PVSS, Personal vehicle sharing system consists of:

- a number of PVs, each with a unique PV-ID
- a number of mobile stations, each with a unique Station-ID
- optionally, a number of fixed stations, each with a unique Station-ID
- optionally, means of registering the locations of each PVs
- optionally, means of registering the locations of each mobile station
- a number of docks to secure each PV, each dock with a unique ID
- means of registering the time of the PV being removed from the stations
- a number of users, each holding a unique User-ID
- means of payment collection
- a control center
- means of communication between PV dock, stations and control center

FIG. 1 shows the operation overview of a PVSS from a user's perspective.
PVs are stored and made available at a number of the mobile stations and fixed stations. Each PV is locked to a docking stand. Users can unlock any of the PVs from any station by presenting their user IDs.
When a user unlocks a PV from one of the stations, the user ID is registered into the processor together with the time information (start time). A second time information (end time) is generated when the PV is returned and locked to one of the station. Payment is calculated based on the duration from start time to end time.

FIG. 2 shows an alternative view that the user ID can be validated by a payment card such as credit card.

FIG.3 shows a schematic of the overall information flow from a system perspective.

Before the PVSS is ready for use, the location data of each fixed station and mobile station, the number of PV in each station and the number of available empty docking unit are registered into the control center. When all these information are cleared, the PVSS is ready for use.

A user presents the user ID at anyone of the docking unit with available PV. The system unlocks the PV after validating the user ID. The PV can be used. At this point the User ID, the PVID and Station ID, start location and the start time is registered to the control center.
When the PV is returned to a docking unit of any station (End-station), the end time is registered and communicated to the control center along with the PVID and Station-ID, and end-location. The usage time is calculated by comparing the start-time and end-time of this particular PV. Payment can be determined based on the usage time information. The start location and end location data can be used for analysis of trips made and planning projection for future operation.

The PV needs to be engaged and properly locked when it is being returned; otherwise, the system will not be able to register the return of the PV.

Mobile station:

Present invention of a mobile station for the releasable secure of a plurality of PVs, a transportable mode for carrying said PVs from one location to another, and a stationary mode to allow said PVs to be checked in and out by users. Said mobile station includes:

- a plurality of docking unit mounted on a platform structure,
- an ID reader at each docking unit to detect and read in user ID and PVID
- a lock at each docking unit
- a processor
- a GSP unit
- a wireless transmitter
- a rechargeable battery,
- optionally solar cells
- at least two wheels
- at least one coupling unit to releasably engage with a towing vehicle

Brief description of drawings:

FIG. 1 shows the overall operation of the present invention from a user’s perspective

FIG. 2 shows an alternative operation, making use of credit card as user identification and payment method

FIG. 3 shows the overview of operation from a system perspective

FIG. 4 shows a side view of a first preferred embodiment of the present invention

FIG. 5 shows a top view of said first preferred embodiment

FIG. 6 shows a front view of said first preferred embodiment

FIG. 7 shows a front view of said first preferred embodiment wherein a side wall (10) is released onto the ground to form a ramp.

FIG. 8 shows a schematic of the information components of the present invention

FIG. 9 shows a simple application of present invention between a train station and an office building

FIG. 10 shows an enhanced application of present invention between a train station and an office building

FIG. 11 shows more extended application of present invention between a train station and three office buildings

FIG. 12 shows the top view of a simple scooter with folded handle bar

FIG. 13 shows the side view of a simple scooter with folded handle bar

FIG. 14 shows the front view of a simple scooter with folded handle bar

FIG. 15 shows the side view of a simple scooter with the handle bar unfolded

FIG. 16 shows the front view of a second preferred embodiment of the present invention

FIG. 17 shows the side view of said second preferred embodiment

FIG. 18 shows the top view of said second preferred embodiment

FIG. 19 shows a prior art transportation vehicle for moving bicycles

FIG. 20 shows a prior art fixed station for docking share bicycles

Detailed Description of the Preferred Embodiments

Detailed descriptions of the preferred embodiment are provided herein. It is to be understood, however, that the present invention may be embodied in various forms. Therefore, specific details disclosed herein are not to be interpreted as limiting, but rather as a basis for the claims and as a representative basis for teaching one skilled in the art to employ the present invention in virtually any appropriately detailed system, structure or manner.

A first embodiment of the present invention of a mobile station is shown in the transportable mode in FIG. 4 (side view), FIG. 5 (top view), and FIG. 6 (front view). A schematic of the information components is shown in FIG. 8.
The platform structure (8) is used to secure the docking units (4) and bicycles (6). A set of wheels (9) allows the mobile station to be tow away easily. A coupling unit (11), in the form of a through hole at one or both ends to engage and disengage via a hook from a towing vehicle (not shown).

FIG. 7 shows a first embodiment of said mobile station in the stationary mode. A side wall (10) can be hinged down and doubled up as a ramp. A plurality of bicycles (6), each locked to a docking unit and secured on a platform structure (8). When a user presents a user ID, the embedded ID Reader (26) read in the ID information, the station processor (23) received and transmits the user ID to a control center via the antenna (22). Once the control center confirmed the validity of the user ID, approval will be sent back and the station processor release the lock (27) on the docking station. At this point, a set of information including the start time, start location from GPS (24), bicycle ID, User ID and station ID will be sent to the control center. The user can now check the bicycle out for use.
At the destination station, the bicycle is returned to an available docking unit, the automatic lock (27) will be activated and the bicycle is locked and secured. At this point, another set of information; including the bicycle ID, the end time, the end location, and the destination station ID, will be sent to the control centre. Charges to the user ID will be calculated based on the time different between the start time and the end time.

Since the bicycles, or PVs, can be transported directly by the mobile station, without the need to first unload the bicycles and then load them up on a transportation vehicle, a significant amount of time can be saved for redistribution of the bicycles.

FIG. 9 shows an improved method to speed up supplies of bicycles at train stations during peak hours when the demand of bicycles is high.
Consider a simple scenario of commuting between a train station and an office building. During the morning peak hours, a lot of commuters need to travel from the

train station to the office building. The bicycles stored at the mobile station (31) located at the train station, are quickly checked out by the users. At the office building, an empty mobile station (33) is quickly filled up with bicycles (34) from the train station coming to the office building.

To make the same bicycles available for more commuters arriving at the train station, there is a need to redistribute the bicycles from the office building back to the train station.

In the case of prior art, fixed bicycle docking stations (FIG. 20) are located at the train station and at the office building. Each bicycle has to be removed from the station at the office, uploaded onto a transportation vehicle (FIG. 19), driven to the train station, and unloaded and docked at the train station before other users have access to the bicycles. Such operation takes considerable amount of time and labor cost. In addition, bicycles can be damaged during the stressful loading and unloading of bicycles. Furthermore, commuters may choose to take other forms of transport if they cannot wait for the bicycle to be returned to the train station.

All of these shortcomings can be reduced with the present invention since the mobile station (33) can be transported directly, fully or partly loaded with bicycle and quickly replenish the supply of bicycles at the train station.
Since the cost for redistributing bicycles is nearly half of the operation cost, by eliminating the need to load and unload bicycles between stations and transport vehicles, the present invention of a mobile station helps to reduce operation cost significantly.
In addition, the damage of bicycles, during loading and unloading between station and transport vehicles is completely eliminated. Furthermore the use frequency bicycles is increased as the speed of bicycle replenishment improved, because less time is spent waiting for them.

Now turning to FIG. 10 - to further speed up supply of bicycles at the train station, a third mobile station (32) is fully loaded with bicycles waiting at a location near to the train station. As soon as the mobile station (31) is emptied at the train station, the third

mobile station (32) can be deployed within very short time since it is already fully loaded and is at a nearer location than the mobile station (33) at the office building.

FIG.11 shows a more extensive application of the present invention of mobile station. Consider a scenario where there are commuters from a train station that need to travel to three separate office buildings. At the train station there are three mobile stations (41, 42, 43) fully loaded with bicycles. Commuters start checking out bicycles (49), from the mobile station (43) and riding to the office buildings. At each of the office buildings, there is an empty mobile station (44, 45, 46) waiting to receive the bicycles (49) coming from the train station. In addition, fully loaded mobile station (48) located near to the train station, is ready to replace any of the stations (41, 42, 43) as soon as one of them are emptied. Another empty mobile station (47) is ready to replace any of the mobile stations (44, 45, 46) at the office buildings, as soon as anyone of them are fully loaded with incoming bicycles. The status of all the mobile stations, including their location, number of bicycles available for use, and number of empty docking available for parking, are continuously transmitted to a control center. This information enables the control centre to arrange timely distributions of loaded and empty mobile stations to where it is most needed.

The advantages of lower operation cost and improved efficiency is demonstrated in the above examples. The flexibility of deployment of mobile station to different locations enables fast distribution of bicycle, or other forms of PVs, to support the sudden increase of transportation demand between bus stops or train stations to the venue of mass events, such as concerts.

Although the examples shown are based on bicycle, it is obviously possible same advantages can be applied to other form of PVs, such as scooters, eBikes, eScooters, tricycles, eTricycles, or wheelchairs.

A second preferred embodiment of the present invention of mobile station is shown in FIG. 16 (front view), FIG. 17 (side view) and FIG. 18 (top view). This second preferred embodiment is able to provide over a hundred of docking units of a foldable scooter (or eScooter) within the same space of 9 bicycles as in the previous illustrated

embodiments. In case of eScooter, the docking unit can also provide battery recharging facilities.

The scooter (or eScooter) is shown in FIG. 12 (top view, FIG. 13 (Side view) and FIG. 14 (front view) with the handle folded. FIG. 15 showing the scooter with the handle bar unfolded and ready for ride.

The usage procedure is similar to the previous example. When a valid user ID is detected at a docking unit, the scooter is unlocked. The User removes the scooter from the docking unit and unfolds the handle bar before riding to the destination. At the destination station, the user returns the scooter to one of the available docking units, and the scooter will be locked in the docking unit automatically. Charges to the user ID will be calculated based on the time of the scooter being used.

More advantageously the second embodiment of the present invention of a mobile station helps to reduce operation cost more significantly by eliminating the need to load and unload over hundreds of scooters between the station and the transportation vehicle.
Large number of scooters can be transported directly on the mobile station (FIG 16, 17, 18). Similar to the first embodiment, the second embodiment of the present invention enable fast redistribution of scooters while eliminating damages of scooters during the loading and unloading operation. Frequency of the usage of scooters increases because they can be replenished quickly.

While the invention has been described in connection with the preferred embodiments, it is not intended to limit the scope of the invention to the particular form set forth, but on the contrary, it is intended to cover such alternatives, modifications, and equivalents as may be included within the spirit and scope of the invention as defined by the appended claims.

Claims:

What is claimed is:

1. A mobile station includes:

- a platform contains a plurality of docking unit,
- means of releasably securing personal vehicle to said docking unit,
- ID reader at said docking unit,
- a processor,
- GSP unit,
- wireless transmitter,
- battery and means of recharging the battery,
- at least two wheels,
- at least one coupling unit to releasably engage with a towing vehicle.
- means of converting said mobile station from a stationary mode to a transportable mode.

2. A mobile station as claimed in claim 1, whereby said personal vehicle is bicycle.

3. A mobile station as claimed in claim 1, whereby said personal vehicle is electric powered bicycle, and means of charging said electric bicycle.

4. A mobile station as claimed in claim 1, whereby said personal vehicle is scooter.

5. A mobile station as claimed in claim 1, whereby said personal vehicle is electric powered scooter, and means of charging said electric scooter.

6. A mobile station as claimed in claim 1, whereby said personal vehicle is wheelchair.

7. A mobile station as claimed in claim 1, whereby said personal vehicle is electric powered wheelchair, and means of charging said electric wheelchair.