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# FOLDABLE VEHICLE

## Abstract

A foldable vehicle may include a chassis comprising a static support, a dynamic chassis frame that includes at least two substantially opposite frame parts and a folding mechanism for decreasing or increasing a distance between the at least two substantially opposite frame parts across a lateral axis of the vehicle between a folded state and an unfolded state; and a controller to control the folding mechanism.

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## Background/Summary

CROSS REFERENCE OF RELATED APPLICATIONS [0001] The present application is a continuation application of U.S. patent application Ser. No. 18/113,038 filed on Feb. 22, 2023, now U.S. Pat. No. 12,240,532, which is a divisional application of U.S. patent application Ser. No. 17/370,063, filed on Jul. 8, 2021, now U.S. Pat. No. 11,661,117, which is incorporated herein by reference in its entirety.

FIELD OF THE INVENTION
[0002] The present invention relates to vehicles. More particularly, the present invention relates to a foldable vehicle.
BACKGROUND OF THE INVENTION
[0003] As the number of vehicles per mile of road is growing each year due to an increase in demand, congestion and parking problems, especially in urban areas and big cities, where the population density is high, increase too. Public transport is an alternative to private vehicles, but it has its shortcomings, such as insufficient rural area coverage, availability, comfort and more. Other alternatives such as personal vehicles (e.g. mini cars or motorcycles) have a smaller footprint on the road and in parking but pose a risk in terms of safety. The stability of a vehicle may correlate to the width of that vehicle, a narrower vehicle typically means a higher center of gravity, rendering that vehicle more susceptible to driving conditions, especially in higher velocities. Even though small vehicles are economical in terms of costs (e.g., price, gasoline and parking space), the risks associated with driving small vehicles might overcome the benefits.
[0004] Vehicles with adjustable width were introduced, offering comfort and safety while in an expanded state, as well as easy parking on narrow available spaces.
[0005] A classic steering system typically turns the wheels at an angle by turning the wheel (e.g., with a wheel column) that is coupled to the wheel shaft. The wheel shaft is typically linked to the wheels (e.g., usually the front wheels) via a steering rack. The steering systems of vehicles with adjustable width may require redesigning to comply with the changing distance between the wheels.
[0006] Vehicles with adjustable dimensions (e.g., width, height, or length) may also require a designated controller. The controller may need to be adapted to control the various elements involved in the width adjustment of the vehicle. The controller may need to address various situations and risks linked to the adjustment of the width of the vehicle.
[0007] It may be desired to provide a vehicle that is easily and efficiently foldable to allow parking in narrow parking spaces. It may also be desired to provide a steering assembly that is adapted to narrow down or widen up to comply with adjustable distance between the wheels. It may also be desired to provide a controller that is configured to control a foldable vehicle safely.
SUMMARY OF THE INVENTION
[0008] There is thus provided, in accordance with an embodiment of the invention, a foldable vehicle that includes a chassis comprising a static support, a dynamic chassis frame linked to the static support that includes at least two substantially opposite frame parts and a folding mechanism for decreasing or increasing a distance between the at least two substantially opposite frame parts across a lateral axis of the vehicle between a folded state and an unfolded state; and a controller to

control the folding mechanism.

[0009] According to some embodiments of the invention, the folding mechanism includes at least one carousel connected to at least one of the frame parts.

[0010] According to some embodiments of the invention, the at least one carousel is connected to the static support and pivots about an axis orthogonal to the static support.

[0011] According to some embodiments of the invention, the at least one carousel is positioned at a substantially equal distance from the two frame parts.

[0012] According to some embodiments of the invention, the folding mechanism comprises one or a plurality of pistons connected to the static support, the pistons are configured to drive the at least one carousel.

[0013] According to some embodiments of the invention, the frame parts retract to the static support in the folded state.

[0014] According to some embodiments of the invention, the chassis comprises one or a plurality of tracks, the at least two frame parts slide along the tracks between the folded state and the unfolded state.

[0015] According to some embodiments of the invention, the foldable vehicle further comprises a locking mechanism to lock the at least two substantially opposite frame parts in a state that is selected from the group of states consisting of the unfolded state, the folded state and an intermediate state.

[0016] According to some embodiments of the invention, the foldable vehicle further comprises a split steering mechanism comprising a gearbox connectable to a steering wheel by a steering column; and two shafts, a first shaft of the two shafts for linking the gearbox to a first front wheels of a vehicle, and a second shaft of the two shafts for linking the gearbox to a second front wheel of the vehicle; wherein the gearbox is configured to transmit and split rotation of the steering column to rotation of the shafts, so that the rotation of each of the shafts correlates to the rotation of the steering column.

[0017] According to some embodiments of the invention, the split steering mechanism comprises extendable shafts that extend and retract with the decreasing or increasing of the distance between the two frame parts of the foldable vehicle.

[0018] According to some embodiments of the invention, the split steering mechanism is configured to keep a turn angle of front wheels of the foldable vehicle during the decreasing or increasing of the distance between the two frame parts of the foldable vehicle.

[0019] According to some embodiments of the invention, the split steering mechanism comprises extendable shafts that extend and retract with the decreasing or increasing of a height of the foldable vehicle.

[0020] According to some embodiments of the invention, the split steering mechanism is configured to keep a turn angle of front wheels of the foldable vehicle during the decreasing or increasing of a height of the foldable vehicle.

[0021] According to some embodiments of the invention, the foldable vehicle further comprises one or more sensors located on the vehicle for sensing parameters associated with assessing risk to the vehicle.

[0022] There is thus provided, in accordance with an embodiment of the invention, a method for controlling folding and unfolding of a foldable vehicle using a controller, the method includes using the controller, receiving a folding or unfolding command; using the controller, obtaining sensed data from one or more sensors located on the vehicle for sensing parameters associated with assessing risk to the vehicle; using the controller, assessing the risk; using the controller, checking whether the risk is below a threshold; using the controller, commencing the folding or unfolding if the risk is below a threshold; and using the controller, checking whether the folding or unfolding is complete.

[0023] According to some embodiments of the invention, the method further includes suspending

the folding or unfolding of the foldable vehicle if the risk is not below a threshold.

[0024] According to some embodiments of the invention, the method further includes, after suspending the folding or unfolding, obtaining sensed data from the one or more sensors, assessing the risk and checking whether the risk is below a threshold.

[0025] According to some embodiments of the invention, the method further includes if the folding or unfolding is not complete, obtaining sensed data from the one or more sensors, assessing the risk and checking whether the risk is below a threshold until the folding or unfolding is complete.

[0026] According to some embodiments of the invention, the method further includes suspending the folding or unfolding of the foldable vehicle if the risk is not below a threshold.

[0027] According to some embodiments of the invention, the method further includes after suspending the folding or unfolding, obtaining sensed data from the one or more sensors, assessing the risk and checking whether the risk is below a threshold.

[0028] According to some embodiments of the invention, the method further includes limiting speed of the foldable vehicle if the foldable vehicle is in the folded state.

[0029] According to some embodiments of the invention, the method further includes, using the controller, autonomously generating a folding or unfolding command.

[0030] According to some embodiments of the invention, the method further includes, using the controller, resolving conflicts between received commands of folding or unfolding.

[0031] There is thus provided, in accordance with an embodiment of the invention, a split steering mechanism that includes a gearbox connectable to a steering wheel by a steering column; and two shafts, a first shaft of the two shafts for linking the gearbox to a first front wheels of a vehicle, and a second shaft of the two shafts for linking the gearbox to a second front wheel of the vehicle; wherein the gearbox is configured to transmit and split rotation of the steering column to rotation of the shafts, so that the rotation of each of the shafts correlates to the rotation of the steering column.

[0032] According to some embodiments of the invention, wherein each of the shafts has a varying length.

[0033] According to some embodiments of the invention, the split steering mechanism is configured to facilitate concurrent different lengths of the shafts.

[0034] According to some embodiments of the invention, the split steering mechanism is configured to apply Ackerman correction when turning the front wheels.

## Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0035] In order for the present invention to be better understood and for its practical applications to be appreciated, the following Figures are provided and referenced hereafter. It should be noted that the Figures are given as examples only and in no way limit the scope of the invention. Like components are denoted by like reference numerals.

[0036] FIG. **1**A is a top view of a chassis of a foldable vehicle in an unfolded state, in accordance with some embodiments of the present invention.

[0037] FIG. **1**B is a top view of the chassis of the foldable vehicle shown in FIG. **1**A, in a folded state.

[0038] FIG. **2** is a bottom view of a folding mechanism of the chassis of a foldable vehicle, shown in FIG. **1**A.

[0039] FIG. **3** is a side view of a foldable vehicle with seats, showing some parts of the vehicle, in accordance with some embodiments of the present invention.

[0040] FIG. **4** is a frontal view of a split steering mechanism connected to front wheels of a foldable vehicle, in accordance with some embodiments of the present invention.

[0041] FIG. **5** is a side view of a chassis of a foldable vehicle with a controller, in accordance with some embodiments of the present invention.

[0042] FIG. **6** is a flowchart of a method of controlling the folding and unfolding process of a foldable vehicle, in accordance with some embodiments of the present invention.

[0043] FIG. **7** is a bottom view of a split steering mechanism, in accordance with some embodiments of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0044] In the following detailed description, numerous specific details are set forth in order to provide a thorough understanding of the invention. However, it will be understood by those of ordinary skill in the art that the invention may be practiced without these specific details. In other instances, well-known methods, procedures, components, modules, units and/or circuits have not been described in detail so as not to obscure the invention.

[0045] Although embodiments of the invention are not limited in this regard, discussions utilizing terms such as, for example, "processing," "computing," "calculating," "determining," "establishing", "analyzing", "checking", or the like, may refer to operation(s) and/or process(es) of a computer, a computing platform, a computing system, or other electronic computing device, that manipulates and/or transforms data represented as physical (e.g., electronic) quantities within the computer's registers and/or memories into other data similarly represented as physical quantities within the computer's registers and/or memories or other information non-transitory storage medium (e.g., a memory) that may store instructions to perform operations and/or processes. Although embodiments of the invention are not limited in this regard, the terms "plurality" and "a plurality" as used herein may include, for example, "multiple" or "two or more". The terms "plurality" or "a plurality" may be used throughout the specification to describe two or more components, devices, elements, units, parameters, or the like. Unless explicitly stated, the method embodiments described herein are not constrained to a particular order or sequence. Additionally, some of the described method embodiments or elements thereof can occur or be performed simultaneously, at the same point in time, or concurrently. Unless otherwise indicated, the conjunction "or" as used herein is to be understood as inclusive (any or all of the stated options).

[0046] A foldable vehicle, according to some embodiments of the present invention, is introduced, which may include systems and mechanisms for adjusting the width of the foldable vehicle and for controlling such adjustment. A foldable vehicle may refer to a vehicle with adjustable width or length, a vehicle with retractable and extendable elements, a vehicle that is not constant in the dimensions thereof and the like, hereinafter foldable vehicle. A foldable vehicle, according to some embodiments of the invention, is configured to folds or unfold, thereby decreasing or increasing the lateral dimension of the vehicle (hereinafter-the width). According to some embodiments of the present invention, increasing or decreasing the width of the vehicle involves decreasing or increasing the distance between opposing wheels (also referred to as left wheel and right wheel). The width of a foldable vehicle may be increased or decreased by increasing or decreasing the distance between opposite parts of the vehicle. For example, a folding mechanism of the foldable vehicle may increase or decrease the distance between two substantially opposite frame parts across a lateral axis of the vehicle between a folded state and an unfolded state. According to some embodiments of the invention, increasing or decreasing the distance between opposite parts of the vehicle may increase or decrease the distance between opposing wheels. Hereinafter decreasing the width of the vehicle is referred to as folding, and to increasing the width of the vehicle is referred to as unfolding.

[0047] In some embodiments of the present invention a foldable vehicle or a foldable vehicle may comprise a chassis. The chassis may comprise, a static support, a dynamic chassis frame and a folding mechanism. The dynamic chassis frame may include at least two substantially opposite frame parts. The folding mechanism may decrease or increase a distance between the at least two substantially opposite frame parts across a lateral axis of the vehicle between a folded state and an

unfolded state.

[0048] A foldable vehicle according to some embodiments of the present invention may be useful in areas where parking space is scarce. Folding the vehicle may decrease the width, thus reducing the width of the required parking space for the vehicle to park on. The foldable vehicle may also be easier to maneuver in a narrow road. When the width of a vehicle is decreased, the center of mass of that vehicle is raised higher above the ground, stability of the vehicle may be reduced. When in a folded state, a foldable vehicle, according to some embodiments of the present invention, may be driven at low speeds to avoid overturning. For example, in the folded state, a controller of the foldable vehicle may limit the driving speed of the foldable vehicle. According to some embodiments of the present invention, the foldable vehicle may unfold gradually during a drive, in order to maintain stability of the foldable vehicle (e.g., depending on parameters such as velocity, road conditions, weight of the vehicle, turning radius, etc.).

[0049] Driving a foldable vehicle, according to some embodiments of the present invention, at speeds above a predetermined threshold speed may not be recommended, and in some embodiments the foldable vehicle may be configured to avoid speeding above such threshold speed limit, for example, by having a controller of the vehicle prevent driving the vehicle at speeds above the threshold speed limit. When the foldable vehicle is in an unfolded state, the center of mass is lowered and as a result the stability of the vehicle is increased. For example, a foldable vehicle may be in a folded state while parking for saving parking space or for parking at a limited parking space. When the foldable vehicle exits the parking space and starts moving at a low to medium velocities (e.g., velocities up to 40 kilometers per hour) the vehicle may still remain in the unfolded state. According to some embodiments of the present invention, the foldable vehicle may be limited to be driven at speeds below or up to a predetermined threshold speed (e.g., 40 Km/h).

[0050] According to some embodiments of the present invention, a folding or unfolding process of the foldable vehicle may be initiated by a user (e.g., the driver) of the foldable vehicle, or automatically in the case of an autonomous foldable vehicle. In some embodiments the folding or unfolding process may be limited to commence and complete only when the vehicle is driving and is traveling at speeds below or up to a predetermined speed. The folding or unfolding process may be controlled by a controller of the foldable vehicle.

[0051] In some embodiments of the present invention, the foldable vehicle may include a frame that defines a static support. The static support may be designed to support one or a plurality of seats, and may be a part (e.g., the floor) of a passenger cabin that includes a steering wheel, windshield, one or more walls, one or more windows, one or more doors, a dashboard with various indicators, screens, and other components that are typically part of a dashboard, as well as other components.

[0052] In some embodiments of the present invention, the static support may be coupled to a dynamic chassis, for example by connector. The dynamic chassis may include one or more moving frames, parts, structures or assemblies that facilitate the folding and unfolding of the foldable vehicle. In some embodiments of the present invention, the dynamic chassis may include two substantially opposite frame parts coupled to the static support, wherein Each frame of the opposite frames may include or support wheels. For example, the left frame may be linked (e.g., via a suspension) to the left side wheels (e.g., front left wheel back left wheel), whereas the right frame may be linked (e.g., via a suspension) to the right side wheels (e.g., right front wheel, right back wheel). Wheels that are located on the same side (e.g., right or left) of the vehicle are hereinafter referred to as following wheels. In some embodiments of the present invention the dynamic chassis may include a moving frame for each wheel of the foldable vehicle. For example, the dynamic chassis may include four movable frames each supporting a different wheel of the foldable vehicle. The dynamic chassis may include one moving frame, wherein a subset of the wheels may be linked to the static support and the rest of the wheels may be linked to the moving frame.

[0053] In some embodiments of the present invention, the foldable vehicle may include one or a

plurality of folding mechanisms for facilitating the folding and unfolding of the vehicle. The folding mechanism may include one or a plurality of actuators, drivers, motors, pistons, power trains and driving mechanisms the like, hereinafter referred to as actuators. A folding mechanism, according to some embodiments of the present invention, may be used to couple the static support to the dynamic chassis. The folding mechanism may be configured to apply force on the components of the dynamic chassis so as to pull them closer together or push them apart to a folded state or an unfolded state respectively or an intermediate state therebetween. The width of the vehicle may be increased or decreased by operating the folding mechanism to increase or decrease, respectively, the distance between the frame parts.

[0054] The folding mechanism may include tracks, rails, guides, transmission elements, linear transmission elements and the like for transferring the moving parts of dynamic chassis to and between the folded state and the unfolded state. Tracks may be used to guide the moving parts along a predetermined path, and maintain the moving parts substantially parallel and opposite each other. The tracks may include sliding elements, bearings, linear bearings, magnets, lubricating materials and the like. Tracks may be provided on the static support and/or on the dynamic chassis.

[0055] The Dynamic chassis may include moving parts (e.g., substantially opposite frame parts) that fold into, above or below the static support. The dynamic chassis may fold or unfold with respect to the static support along an axis of rotation of the wheels or an axis parallel to the axis of rotation of the wheels.

[0056] In some embodiments of the present invention, the foldable vehicle may fold or unfold without changing the overall height of the vehicle. The foldable vehicle may maintain the center of mass of the foldable vehicle, along a vertical axis substantially orthogonal to a plane between front wheels and back wheels of the vehicle, during the folding and unfolding of the foldable vehicle.

[0057] In some embodiments of the present invention, the foldable vehicle may include one or a plurality of controllers (hereinafter, for brevity-controller). The foldable vehicle may also include one or a plurality of sensors. For example, the foldable vehicle may include sensors that measure velocity, acceleration, location, temperature, the number and physical location of the passengers in the vehicle, the turning of the wheels, the turning of the steering wheel, distance of the vehicle from objects, the distance between a set of parallel wheels, the distance between the moving parts of the dynamic chassis, and other vehicle and/or travel parameters. The controller may be connected to the sensors, obtain sensed data from said sensors and process the obtained sensed data.

[0058] The controller may be configured to control the folding mechanism. The controller may be configured to receive an input to initiate folding or unfolding of the foldable vehicle. For example, a user of the vehicle, such as the driver may initiate a signal to be issued to the controller to fold or unfold the vehicle. For example, the user may press a button, turn on a knob, press a virtual button on a touch screen, use a wireless communication device such as a smartphone and employ another means of user interface to send a signal to the controller to fold or unfold the vehicle.

[0059] In some embodiments of the present invention, the foldable vehicle may be autonomous and/or remotely controllable. The controller may automatically generate or may receive a signal to fold or unfold the vehicle from a user, or from a remote device, such as a computer, other controller, a third party device or other remote control device. For example, the controller may receive commands from the autonomous foldable vehicle for folding and unfolding the autonomous foldable vehicle. In some embodiments of the present invention, the controller may receive an unfolding signal (e.g., user initiated) and generate a command signal to the folding mechanism to unfold the vehicle when and only when the receiving sensed data indicating that the vehicle is traveling at a speed below a predetermined speed limit threshold (e.g., 40 Km/h), such as, between a first predetermined speed threshold and a second predetermined speed threshold, which is higher than the first speed threshold and below or same as a predetermined speed limit threshold (e.g., 40 Km/h). In some embodiments, the controller may limit the speed of the foldable vehicle (e.g., by controlling the motor or other part/s of the propulsion system of the vehicle) to remain below or up

to the predetermined speed limit threshold until the unfolding process is completed.

[0060] In some embodiments of the present invention, the controller may receive or generate a command to partially fold and unfold the foldable vehicle. The foldable vehicle may be configured to have a relation between the speed of the foldable vehicle and the width of the vehicle (e.g., the extent of unfolding). The controller (or a control unit of the autonomous vehicle) may determine the extent of unfolding as a function of speed of the foldable vehicle. During the folding, the controller may limit the speed of the folding vehicle accordingly (e.g., limit the speed of the foldable vehicle as a function of the width of the vehicle). During the folding or the unfolding, the controller may limit or suspend the folding or unfolding according to the speed of the foldable vehicle.

[0061] In some embodiments of the present invention, the foldable vehicle may be autonomous. The foldable vehicle may send signals to the controller for controlling the folding and unfolding of the vehicle. The foldable vehicle may receive signals from sensors and autonomously control the foldable vehicle (e.g., control the speed, direction, folding and unfolding of the foldable vehicle).

[0062] Similarly, in some embodiments of the present invention, the controller may receive a folding signal (e.g., user initiated) and generate a command signal to the folding mechanism to fold the vehicle when and only when the receiving sensed data indicating that the vehicle is traveling at a speed below a predetermined speed limit threshold (e.g., 40 Km/h), for example.

[0063] In some embodiments, the controller may limit the speed of the foldable vehicle (e.g., by controlling the motor or other parts of the propulsion system of the vehicle) to remain below or up to the predetermined speed limit threshold until the folding process is completed.

[0064] In some embodiments of the present invention the controller may use location data (e.g., GPS). The foldable vehicle may use the location data for folding and unfolding the foldable vehicle. For example, the foldable vehicle may detect a parking space in the vicinity of the foldable vehicle, and fold in preparation for parking. The foldable vehicle may use the location data to detect that the foldable vehicle is going into a highway, and unfold in preparation for entering the highway. The foldable vehicle may use location data for detecting areas with narrow roads, as a result the foldable vehicle may fold (e.g., some narrow roads may only allow vehicles with small width).

[0065] The controller may be configured to fold and unfold the moving parts of the dynamic chassis in a synchronic and stable manner. For example, the controller may operate the folding mechanism so as to move the two opposing frame parts of the dynamic chassis concurrently and cause these parts to move at the same velocity.

[0066] The foldable vehicle may be configured (e.g., by employing a designated controller) to fold and unfold only while moving. The motion of the opposite frame parts during folding and unfolding is along an axis which is substantially perpendicular to the general direction of travel of the vehicle.

[0067] For example, the vehicle may be designed to fold and unfold during the movement of the vehicle and within a range of allowed velocities (e.g., between 5.38 Km/h and 40 Km/h). The range of allowed velocities may be predetermined. The range of allowed velocities may be determined according to regulation, safety, manufacturing, business reasons and the like. The range of allowed velocities may be predetermined by a manufacturer of the vehicle and any other authorized body (e.g., government body, regulation body, sales representative). The range of allowed velocities may vary. For example, in some countries the range of allowed velocities may be between 5.38 Km/h and 40 Km/h, in other countries the range of allowed velocities may be between 0 (the vehicle may remain unfolded at very low speeds) and 90 Km/h (the vehicle may remain folded at high speeds). The range of allowed velocities may vary according to driving conditions such as turning radius and speed during a turn. The foldable vehicle may be configured to prevent operation of the folding mechanism to folding or unfold the vehicle when the vehicle is stationary or traveling at very low speeds (e.g., below 5.38 Km/h).

[0068] The foldable vehicle may be configured to fold and unfold while traveling along a substantially straight path or when taking a turn (e.g., when the front wheels are turned at an angle sideways). For example, the front wheels may be turned at an angle so as to turn the vehicle to the left or to the right, the vehicle may fold or unfold while the front wheels remain turned at an angle so that the vehicle may maintain its accurate movement during the folding or unfolding. Maintaining the turn angle of the wheels regardless of the folding and unfolding may be applied as a safety measure for the vehicle. For example, when the vehicle is turning, the wheels are turned at an angle in a certain direction, if an unfolding is initiated (e.g., the vehicle is in a turn and the vehicle is accelerating towards high velocities so the unfolding is automatically initiated) and the turn angle is not maintained, the vehicle might change direction during the turn and crash. The foldable vehicle may maintain the turning angle of the foldable vehicle during the folding and unfolding of the foldable vehicle and during normal driving. The foldable vehicle may maintain the turning angle of the foldable vehicle if the folding and unfolding of the foldable vehicle was suspended. For example, if the foldable vehicle suspended the folding of the foldable vehicle, so that the vehicle is between the folded and the unfolded state, the user may maintain control over the steering of the foldable vehicle, and the turning angle of the foldable vehicle may be maintained. In some embodiments of the present invention, during a turn while the foldable vehicle is folding or unfolding, the foldable vehicle may maintain the turn angle of the wheels (e.g., the steering radius) until a user of the vehicle (e.g., driver) does any change (e.g., turns the steering wheel).

[0069] In some embodiments of the present invention, the foldable vehicle may prevent acceleration or declaration during the folding and unfolding. Alternatively or additionally, the foldable vehicle may allow acceleration or declaration during the folding and unfolding. For example, the foldable vehicle may accelerate or decelerate during the folding or unfolding within predetermined ranges of acceleration and/or velocities. In some embodiments of the present invention, the user of the vehicle may maintain control on the velocity, acceleration and deceleration (e.g., gas and brake pedals) of the foldable vehicle during the folding and unfolding of the folding of the foldable vehicle. The foldable vehicle may enable the use of the steering wheel to steer the foldable vehicle during the folding and unfolding. In some embodiments of the present invention, during the folding, the foldable vehicle may enable the acceleration (e.g., increasing of speed), if for example, the speed does not exceed a predetermined limit (e.g., according to the width of the vehicle at the moment).

[0070] In some embodiments of the present invention, the split steering mechanism may adjust the front wheels for Ackerman correction, which includes adjustment of the turn angle of the front wheels when the car is turning. During a turn, to the left for example, the front left wheel may travel a smaller distance than the front right wheel, Ackerman correction will adjust the turn angle of the front wheels to account for the difference in the traveled distance during a turn of the vehicle. The split steering mechanism may turn the front left wheel at an angle and the front right wheel in a different turn angle to adjust for Ackerman correction. In some embodiments of the invention, the Ackerman correction may be active also during folding and unfolding of the vehicle.

[0071] In some embodiments of the present invention, the split steering mechanism may adjust according to a vehicle's width (e.g., folding and unfolding) and/or according to the vehicle's height (e.g., the height of the vehicle may be adjustable and/or changeable). The vehicle may adjust the height of thereof, the split steering mechanism may keep the turn angle of the wheels in different heights of the vehicle. For example, the split steering mechanism may keep the turn angle of the wheels before, during and after a height adjustment of the vehicle or any of the wheels. The split steering mechanism may keep the turn angle of the wheels, while tolerating differences in height between different sides of the vehicle.

[0072] In some embodiments of the present invention, the split steering mechanism may adjust the front wheels for Ackerman correction in relation to the height of the vehicle and/or any of the wheels of the vehicle. For example, the split steering mechanism may adjust the front wheels for

Ackerman correction if the height of one side of the vehicle is different than another side of the vehicle. The split steering mechanism may adjust the front wheels for Ackerman correction if the height of at least one of the wheels (e.g., one of the front wheels) is different than another wheel (e.g., one wheel is higher and all other wheels are on the same height). For example, the split steering mechanism may adjust the front wheels for Ackerman correction before, during and after a height adjustment of the vehicle or any of the wheels. The split steering mechanism adjusts the front wheels for Ackerman correction, while tolerating differences in height between different sides of the vehicle.

[0073] FIG. **1**A is a top view of a chassis of a foldable vehicle in an unfolded state, in accordance with some embodiments of the present invention. Foldable vehicle **100** may include static support **20**. Static support **20** may be rectangular but can also be formed in another form. Static support **20** may have a flat surface to provide for linear displacement of part or parts that are dynamically coupled to static support **20**. A driver seat may be mounted on static support **20**. Additionally, passenger seat or seats may also be supported by static support **20**.

[0074] Static support may also include a passenger cabin (not shown in this figure for brevity) that includes a steering wheel **50**, windshield, one or more walls, one or more windows, one or more doors, a dashboard with various indicators, screens, and other components that are typically part of a dashboard, as well as other components.

[0075] Static support **20** and other parts of foldable vehicle **100** may be assembled from multiple parts. For example, static support **20** may be welded or assembled from a plurality of bars or rods made of metal, metal composite, carbon filer or composite material or other rigid material. Static support **20** and other parts of foldable vehicle **100** (e.g., frame part **22***a* and frame part **22***b*) may be manufactured from lightweight material or materials to reduce the weight of the vehicle. For example, static frame **20** may be manufactured from aluminum to enhance weight to strength ratio.

[0076] A folding mechanism, according to some embodiments of the present invention, may include one or a plurality of actuators **30**. Folding mechanism **31** may include one or more actuators **30**. In some embodiments of the present invention, two actuators are provided, located at a front end and at a back end of static support **20**. Actuator **30** may be bolted, welded, assembled to, screwed to or mounted on or otherwise coupled to static support **20**. In some embodiments of the invention one or a plurality of actuators may be coupled to frame parts **22***a* and/or **22***b*. The folding mechanism may be configured to facilitate the folding and unfolding of foldable vehicle **100**. The folding mechanism may be configured to move frame parts **22***a* and **22***b* along a substantially parallel axis. In some embodiments of the present invention, the parallel axis may be substantially perpendicular to the general direction of travel of the vehicle. For example, the folding mechanism and actuator **30** may be parallel to an axis between the center of the front wheels, so as to pull and push the front wheels along said axis, during the folding and unfolding of foldable vehicle **100**.

[0077] Actuator **30** may include piston **32**. Actuator **30** may drive piston **32** using hydraulics, pneumatics, mechanical drivers, and/or electrical components. Piston **32** may be extend and retracted. For example, piston **32** may be extended fully or partially or retract fully or partially. Piston **32** may be connected to carousel **34** via pivot joint **36**. Piston **32** may be welded, assembled to or connect to carousel **34**. The linear motion of piston **32** may cause carousel **34** to rotate about an axis of rotation clockwise or anti-clockwise.

[0078] Carousel **34** may connect to shafts **40***a* and **40***b* through pivot joints **38***a* and **38***b*, respectively. Carousel **34** may connect to one or a plurality of shafts. For example, carousel **34** may connect to one or a plurality of moving frame parts. Carousel **34** may apply a pulling or pushing force to the movable frame parts via one or a plurality of shafts. Each of carousels **34** may be positioned along the central longitudinal axis of static base **20** or at another location. For example, a first carousel **34** may be positioned in the middle between the front wheels, and a second carousel **34** may be positioned in the middle between the back wheels. Each carousel **34** may apply symmetrical and opposite forces on the opposite frame parts **22***a* and **22***b* so as to reduce or

increase the distance between the frame parts. Carousels **34** may be positioned at different locations between frame parts **22***a* and **22***b*. For example, a first carousel **34** connected at a distal portion of static frame **20**, may be positioned closer to frame part **22***a*, while a second carousel **34** connected at a proximal portion of static frame **20**, may be positioned closer to frame part **22***b*.

[0079] Shafts **40***a* and **40***b* may be connected to frame parts **22***a* and **22***b* respectively. Shafts **40***a* and **40***b* may be of similar or different lengths. For example, if carousel **34** is centered between frame part **22***a* and **22***b*, shaft **40***a* and shaft **40***b* may connect at opposite locations on frame parts **22***a* and **22***b* respectively, wherein shafts **40***a* and **40** may have similar lengths. For example, if both carousels **34** are placed closer to frame part **22***a* than to frame part **22***b*, shafts **40***a* and **40** may have different lengths as a result. Shafts **40***a* and **40***b* may be extendable (e.g., telescopic poles, pistons, adjustable length shafts). Shafts **40***a* and **40***b* may vary in length in correlation to the intended maximal extent of the folded and unfolded states. Shafts **40***a* and **40***b* may be used to limit the extent of the unfolding and folding of foldable vehicle **100**. For example, the length of shafts **40***a* and **40***b* may limit how far apart frame parts **22***a* and **22***b* can be moved when unfolded. If shafts **40***a* and **40***b* are shorter, frame parts **22***a* and **22***b* may be allowed to travel a shorter distance between the folded and unfolded states. Is shafts **40***a* and **40***b* are longer, frame parts **22***a* and **22***b* may be allowed to travel a longer distance between the folded and unfolded states.

[0080] Actuator **30** may extend piston **32**, causing carousel **34** to rotate. When rotated in one direction, carousel **34** may push shafts **40***a* and **40***b* apart. When shafts **40***a* and **40***b* are pushed apart, the distance between frames **22***a* and **22***b* increases, resulting in unfolding of foldable vehicle **100**. When rotated in a second direction opposite to the first direction, carousel **34** may pull shafts **40***a* and **40***b* closer. When shafts **40***a* and **40***b* are pulled closer, the distance between frames **22***a* and **22***b* decreases, resulting in folding of foldable vehicle **100**.

[0081] Actuator **30** may have a locking mechanism for locking vehicle **100** in a fully unfolded state, a fully folded state and any intermediate state. The folding mechanism may include one or more latches, stoppers, locks, switches, sensors, controllers, limiters and other elements for locking or otherwise limiting the folding mechanism. For example, the folding mechanism may have a stopper for preventing frame parts **22***a* and **22***b* from extending or retracting beyond a certain limit to avoid dismantling of the frame parts. According to some embodiments of the present invention, a folding mechanism may include latches for locking frame parts **22***a* and **22***b* in the folded state, in the unfolded state and in any intermediate state between the folded the unfolded states. According to some embodiments of the present invention, a folding mechanism may lock foldable vehicle **100** in a fully unfolded state, a fully folded state and any intermediate state electrically (e.g., by controlling how much pistons of the folding mechanism extend and retract).

[0082] Vehicle **100** may be propelled by an electric motor, by an internal combustion engine or by hybrid propulsion unit. Vehicle **00** may have front wheels **10***a* and **10***b* and back wheels **10***c* and **10***d*. Vehicle **100** may have a split steering mechanism. The Split steering mechanism may include steering wheel **50**. Steering wheel **50** may be coupled to steering column **52**. Steering column **52** may connect to steering assembly **54** (e.g., power steering unit). Steering assembly **54** may include an electric motor and gears for assisting the driver in turning steering wheel **50**. Steering assembly **54** and/or steering column **52** may be connected through universal joint **56** to shaft **58**. Shaft **58** may convey the turning motion of steering wheel **50** onward to gearbox **62** through universal joint **60**. Universal joint **65** may be connected to lever gear **66** with extendable shaft **64**. Extendable shaft **64** may extend or retract with the unfolding or folding of the vehicle, respectively. Extendable shaft **64** may maintain the rotation status of the split steering mechanism and in turn the turn angle of the wheels during the unfolding or folding of vehicle **100**. Lever gear **66** connects to front wheels **10***a* and **10***b* through tie shaft **68**.

[0083] First suspension **67***a* and second suspension **67***b* (shown in FIG. **4**) may connect the wheels of the vehicle to the dynamic frames. First suspension **67***a* and second suspension **67***b* may define an axis substantially vertical to first suspension **67***a* and second suspension **67***b*. Wheel **10***a* (and

other wheels) may pivot about the vertical axis (e.g., when the vehicle turns and the wheels turn angle). Tie shaft **68** may move relatively to frame **22***a* for turning wheel **10***a* at an angle, and first suspension **67***a* (and second suspension **67***b*) may remain static relative to frame **22***a* while wheel **10***a* is turning at an angle.

[0084] FIG. **1**B is a top view of the chassis of the foldable vehicle shown in FIG. **1**A, in a folded state. Foldable vehicle **100** may fold when actuator **30** causes piston **32** to retract. When piston **32** retracts carousel **34** is rotated so as to pull shafts **40***a* and **40***b*, and in turn frames **22***a* and **22***b* get pulled closer together. Front wheels **10***a* and **10***b* may be turned at an angle and may maintain their turn angle during the folding or unfolding of vehicle **100**.

[0085] In some embodiments of the invention, foldable vehicle **100** may keep the turn angle of front wheels **10***a* and **10***b* while adjusting for Ackerman correction of the relative turn angle between wheels **10***a* and **10***b*. The split steering mechanism may be used in foldable vehicles and in small vehicles. It may be difficult to implement a steering system in foldable vehicles and small vehicles (e.g., a steering system that adjusts the wheels for Ackerman correction). Typically, a steering system might require space in the front of the vehicle. In small vehicles implementing a typical steering (e.g., with adjustment for Ackerman correction) might be difficult due to design constraints (e.g., placement of pedals and other elements in the front of the vehicle). The Split steering mechanism may adjust for Ackerman correction and vacate space in the front of the vehicle (e.g., pedals).

[0086] FIG. **2** is a bottom view of a folding mechanism of a foldable vehicle, in accordance with some embodiments of the present invention. Static support **20** may include plate **24** extending laterally across static support **20**. Carousel **34** may be pivotally connected to static support **20** on plate **24**, so as to be capable of rotating in a place of rotation that is substantially perpendicular to static support **34**. Static support **34** may have one, two or more folding assemblies, one folding assembly may be positioned at a proximal end of static support **34** while the other folding assembly may be positioned at a distal end of static support **34** for an efficient and uniform power distribution during the folding and unfolding of dynamic chassis frame part **22***a* and **22***b*. In some embodiments of the present invention the folding mechanism may include one, two or more pairs of opposite folding assemblies for a smooth operation to save power and evenly distribute momentum on frame part **22***a* and **22***b* of the dynamic chassis.

[0087] The folding mechanism may include one or more rails **44** and a plurality of sliding elements **46**. Sliding elements **46** may connect to dynamic chassis frame part **22***a* and **22***b* so as to facilitate sliding of frame part **22***a* and **22***b* along rails **44**.

[0088] FIG. **3** is a side view of a chassis of a foldable vehicle with seats, in accordance with some embodiments of the present invention. Vehicle **100** may have one or a plurality of front seats **98** and may have one or a plurality of back seats **99**. Vehicle **100** may have a plurality of seats in a plurality of arrangements. For example, Vehicle **100** may have **3** rows of seats with two chairs in each row. During the folding and unfolding of vehicle **100** seat **98** may remain at a constant distance from steering wheel **50**. The steering wheel **50** may be rotated and remain at a desired rotated position during the folding or unfolding of vehicle **100**.

[0089] FIG. **4** is a frontal view of a split steering mechanism connected to the front wheels of a foldable vehicle, in accordance with some embodiments of the present invention. Steering wheel **50** may be connected to steering column **52**.

[0090] Steering assembly **54** and/or steering column **52** may be connected through universal joint **56** to shaft **58** that transmits the turning motion of steering wheel **50** onward to gearbox **62** through universal joint **60**.

[0091] Gearbox **62** may connect to each of two opposite extendable shafts **64** via universal joint **63**. Each extendable shaft **64** may connect to lever gear **66** of either of the wheels via universal joint **65**. Gearbox **62** may be configured to convert rotation of steering wheel **50** to wheels **10***a* and **10***b* through each of the two extendable shafts **64**. Extendable shafts **64** may extend and retract with the

unfolding and folding of the vehicle while facilitating the turning of wheels **10***a* and **10***b* at an angle when the vehicle is in the folded or unfolded state, or in an intermediate state. Gearbox **62** may be configured to convert the rotation of steering wheel **50** to wheels **10***a* and **10***b* while maintaining the Ackerman angle between wheels **10***a* and **10***b*. Suspension **69** may suspend wheel **10***a* (and other wheels) to frame **22***a*. In some embodiments of the present invention shafts **64** may not be extendable, the steering system may be a split steering system. For example, shafts **64** may have constant length. Shafts **64** may have a constant length and adjust for Ackerman angle and/or keep a turn angle of the front wheels of the vehicle. For example, a split steering system may be useful in small, micro-cars with the shafts having a constant length. The split steering system may allow space for the feet of the driver and any other front passenger.

[0092] FIG. **6** is a flowchart of a method for folding and unfolding of a foldable vehicle, in accordance with some embodiments of the present invention. The method of the folding and unfolding may involve using a controller. The controller may receive a folding or unfolding command **602**. For example, the controller may receive a command for folding or unfolding the vehicle from a user of the vehicle, such as the driver. Additionally, the controller may generate or receive a folding or unfolding command. For example, if the folding vehicle is autonomous, the controller may generate and/or receive a folding or unfolding command autonomously. The folding or unfolding method includes obtaining sensed data **604** (e.g., measurements and signals) from one or more sensors (e.g. sensors located on the vehicle, and/or external sensors) for sensing parameters associated with assessing risk to the vehicle, both external to the vehicle and internal to the vehicle, that may hinder the folding or unfolding process. For example, the controller may obtain sensed data from one or more proximity sensors, so as to evaluate the risk of colliding with a near obstacle, one or more acceleration sensors (e.g., gyro sensor) to identify risky maneuver or dangerous acceleration, one or more velocity sensors to identify dangerous speeds, one or more imaging sensors (e.g., camera, lidar) for obtaining an image of a proximal vicinity of the vehicle and processing the image to identify risks, one or more location sensors (e.g., GPS sensor) and any other one or more sensors for measuring data regarding the extent of folding and unfolding and any associated potential risk. The controller may obtain sensed data for assessing risk.

[0093] The controller may assess risk **606** related to the folding and unfolding. The risk may be assessed by assessing if the sensed data is within predetermined limits. For example, the controller may assess if the velocity of the foldable vehicle is within a non-risky range (e.g., between 5.38 Km/h and 40 Km/h). The controller may assess if the vehicle is making a sharp acceleration or deceleration. The controller may assess if the foldable vehicle is in a location that is not safe for folding or unfolding. The controller may assess a risk of acceleration related to folding and unfolding during a sharp turn.

[0094] To assess risk (e.g., combined risk), the controller may have a combined risk assessment where the controller may combine risk assessments categories. The controller may assess if in each risk assessment category (e.g., velocity, acceleration, proximity to other vehicles) the risk is below a threshold. The controller may have a pass/fail criteria for each risk assessment category. The controller may assess the combined risk by checking if at least one of the risk assessment categories yields a risk above a threshold. The controller may assess risk by assigning a risk index (e.g., value of assessed risk) for each risk assessments category. The controller may assess the combined risk by combining the risk indexes of the risk assessment categories.

[0095] The controller may receive a command for folding and unfolding the vehicle from another device (e.g., car computer, safety controller, autonomous control unit) or a remote device (e.g., a remote computer, cloud system, remote monitoring system, remote control system, autonomous driving remote control etc.). The controller may also generate a folding or unfolding command in one or more certain situations (e.g., an unfolding command when the speed of the vehicle is approaching a predetermined speed limit threshold). According to some embodiments of the present invention, the controller may be configured to resolve conflicts between conflicting

commands. For example, if the controller receives a command from a user (e.g., the driver) to commence folding of the vehicle, and at the same time the folding mechanism is executing an unfolding command the controller may be configured to resolve the conflict between the conflicting commands, according to a conflict resolution rule or set of rules. The controller may be configured to assess risk, priority, safety, car conditions, system state, car surroundings, road conditions, velocity, acceleration and other factors, and resolve conflicts between received and/or generated commands based on the assessed risk.

[0096] The controller may check if the risk is below a threshold **608**. For example, the controller may check if the risk assessment categories are below a threshold. The controller may check if the combined risk assessment is below a threshold.

[0097] If the risk is below a threshold, the controller may commence folding or unfolding **610**. The controller may be configured to give feedback to user/s of the vehicle and/or to other party (e.g., another computing system, a remote computer, autonomous controller) regarding various aspects and steps. For example, the controller may be configured to cause an indication to be presented to the driver as to whether the vehicle is performing folding or unfolding. The controller may be configured to cause an indication to be presented to the driver or to a third party (e.g., device, software, cloud controller, server. etc.) that there is risk preventing the initiation of the folding or unfolding process. The controller may be configured to cause an indication to be presented to the driver that the folding or unfolding process has been suspended. The controller may be configured to cause an indication to be presented to the driver that the folding or unfolding process has completed. The controller may be configured to provide feedback regarding the folding position of the vehicle. For example, the controller may cause an indication to be presented to the driver indicating that the vehicle is in the folded state, in the unfolded state or in an intermediate position between the folded state and the unfolded state.

[0098] If the risk is not below a threshold **608**, the controller may suspend the folding or unfolding **612**. For example, the controller may delay, pause, cancel and ignore the received command for folding or unfolding **602**. After the controller suspended the folding or unfolding **612**, the controller may go back to steps **604-608** until the risk is below a threshold.

[0099] The controller may check if the folding or unfolding is complete **614**. If the folding or unfolding is not complete, the controller may go back to obtaining sensed data **604**, assessing risk **606** and checking is the risk below a threshold **608** (repeating steps **604-608**). For example, if during the folding and unfolding the risk is not below a threshold, the controller may suspend the folding or unfolding until the risk is below a threshold. During the folding or unfolding, the controller may repeat obtaining sensed data **604**, assessing risk **606** and checking is the risk below a threshold **608** until the folding or unfolding is complete. For example, if the risk is not below a threshold **608**, the controller may suspend the folding or unfolding **612** and repeat **604-608** until the risk is below a threshold. When the risk is below a threshold **608**, the controller may commence the folding or unfolding **610**, until the folding or unfolding is complete.

[0100] If the folding or unfolding is complete **614**, the controller may receive a new command **616** for folding or unfolding. When a new command is received, the controller may go to step **602** and continue to step **604** and so on.

[0101] The controller may receive a new command during the folding or unfolding (e.g., during step **610**). The controller may be configured to resolve conflict between folding and unfolding commands. For example, during any of steps **604-614** the controller may ignore or suspend any new commands, until the folding or unfolding are complete.

[0102] In some embodiments of the present invention, the foldable vehicle may have a locking mechanism, the controller may operate said locking mechanism once the folding is complete, so as to lock the vehicle in the folded state or the unfolded state. In some embodiments of the present invention the locking mechanism, may lock the vehicle in a position between the folded state and the unfolded state (e.g., if the controller suspended the folding or unfolding until the risk is below a

threshold).

[0103] In some embodiments of the present invention, the folding and unfolding may be automated. For example, upon reaching a predetermined speed, the foldable vehicle may automatically unfold. In some embodiments of the present invention, the foldable vehicle may be configured to suspend the folding and unfolding of the foldable vehicle. For example, a sharp turn of the vehicle (e.g., the user of the vehicle turned the steering fast) may lead the foldable vehicle to suspend the folding and unfolding of the foldable vehicle. Additionally, upon excessive acceleration and deceleration, the foldable vehicle may suspend the folding and unfolding. In some embodiments of the present invention, during a panic steering (e.g., an unexpected maneuver) or during an emergency brake, the folding mechanism may stop the folding and unfolding of the foldable vehicle and lock the folding mechanism.

[0104] FIG. **5** shows a side view of a chassis of a foldable vehicle with a controller, in accordance with some embodiments of the present invention. Foldable vehicle **100** may include controller **300**. Controller **300** may be configured to control the folding and unfolding of vehicle **100**. Foldable vehicle **100** may include one or a plurality of sensors. Controller **300** may connect to the sensors. Controller **300** may read measurements from the sensors.

[0105] Controller **300** may assess based on measurements form the sensors risk factors associated with folding or unfolding vehicle **100**. For example, controller **300** may read measurements from sensors for assessing if another vehicle is too close to foldable vehicle **100** so that if foldable vehicle **100** would unfold, foldable vehicle **100** might crash into the vehicle close to foldable vehicle **100**, additionally, controller **300** may read measurements from sensors regarding acceleration and determine that vehicle **100** undergoing a turn at high acceleration which would be risky.

[0106] Controller **300** may decide based on the calculated risk factor whether to commence the folding and unfolding of vehicle **100**. For example, if the risk factor is high, controller **300** may prevent the folding or unfolding from being initiated, additionally, if controller **300** detects a high risk during the folding or unfolding of vehicle **100**, controller **300** may suspend the folding or unfolding in an intermediate position, controller **300** may commence the folding or unfolding after the risk had subsided.

[0107] Controller **300** may assess based on measurements form the sensors limitations associated with folding or unfolding of vehicle **100**. For example, controller **300** may read the velocity of vehicle **100** and decide if to initiate unfolding (e.g., when the velocity is approaching 40 Km/h during acceleration).

[0108] In some embodiments of the present invention, the controller may obtain data regarding road conditions and the friction between the wheels and the road. The controller may adjust an upper limit of velocity of the vehicle in the folded state. Obtained data regarding the road conditions and the traction of the wheels may yield a risk assessment above a threshold. The controller may lower the limit of allowed vehicle velocity (e.g., the vehicle may drive up to 30 Km/h instead of 40 Km/h in the folded state). The controller may adjust parameters of the foldable vehicles according to the obtained data. For example, if the road conditions are bad, the controller may adjust the parameters of the brake pedals and acceleration pedals to account for the road conditions. In some embodiments of the present invention, the controller may change the speed of the vehicle (or motor) and parameters of the brakes in order to compensate for road conditions (e.g., if there's a different traction or friction coefficient difference between the left and the right wheels to the road).

[0109] In some embodiments of the present invention, the controller may have a manual mode and an automatic mode. In the manual mode, the controller may receive commands from a user of the foldable vehicle to fold and unfold the foldable vehicle. For example, in the manual mode, a user may press a button for folding or unfolding the foldable vehicle. In the automatic mode, the foldable vehicle may continuously collect and analyze data from sensors, and generate

automatically to fold or unfold the foldable vehicle.

[0110] FIG. **7** is a bottom view of a split steering mechanism, in accordance with some embodiments of the present invention. The split steering mechanism may include gearbox **62**. Gearbox **62** may be connectable to a steering wheel by steering column **58**. The split steering mechanism may include two shafts **64** connected to gearbox **62**. Gearbox **62** may include a central gear connected to steering column and two peripheral gears connected to the shafts. The central gear may transmit and split rotation of the central gear to rotation of the peripheral gears. A first shaft of the two shafts **64** may link the gearbox **62** to a first front wheel of a vehicle, and a second shaft of the two shafts **64** may link the gearbox **62** to a second front wheel of the vehicle. The gearbox **62** may be configured to transmit and split rotation of steering column **58** to rotation of the shafts **64**, so that the rotation of each of the shafts **64** substantially correlates (e.g., is substantially identical) to the rotation of the steering column **58**. Shaft **64** may connect to lever gear **66**.

[0111] In some embodiments of the present invention lever gear **66** may be connected to a frame part of the vehicle (e.g., connected to one of two substantially opposite frame parts) with protruding element **66***a*. Levers **66** may move apart when the foldable vehicle unfolds. Levers **66** may move closer together when the foldable vehicle folds. Lever gear **66** may connect to lever **61** with lever first joint **61***a*. Lever gear **66** may include two gears, a first gear connected to shaft **64** and a sconed gear connecting lever first joint **61***a*. Lever gear **66** may transmit rotation of shaft **64** (through the first gear and the second gear) to lever **61** so that when the steering wheel is rotated, lever **61** may rotate. For example, lever **61** may rotate in a direction opposite to a rotation direction of the steering wheel.

[0112] In some embodiments of the present invention lever **61** may connect lever gear **66** to tie shaft **68** with lever second joint **61***b*. When lever **61** is rotated, tie shaft **68** may turn a front wheel of the vehicle. For example, when the vehicle is in the folded state, lever gear **66** may remain static (e.g., connected to a frame part with protruding clement **66***a*), a rotation of steering column **58** may rotate lever gear **61** so as to move tie shaft **68** (e.g., in accordance with Ackermann correction), tie shaft **68** may change a turn angle of a front wheel of the vehicle.

[0113] Typically, vehicles where a steering rod is connected in front of an axis between front wheels of the vehicle, the front wheels may be turned at angles that do not comply with Ackerman correction (e.g., reverse Ackerman). In some embodiments of the present invention, lever **61** connecting tie shaft **68**, wherein tie shaft **68** is connected in front of an axis between front wheels of the vehicle, may apply Ackerman correction. Lever gears **61**, tie shafts **68** and the front wheels may be positioned along a virtual rectangle that conforms with Ackerman correction. Dimensions (and angles) of the virtual rectangle may conform with a length of lever **61**, a length of tie shaft **68**, a distance between front wheels of the vehicle and other dimensions of the vehicle, in order to apply Ackerman correction.

[0114] In some embodiments of the present invention, a length of lever **61** and of tie shaft **68** may be determined according to Ackerman correction. Lever **61** may be extend from lever gear **66** towards a proximal direction of the vehicle (e.g., front of the vehicle). Lever **61** may be positioned forward of an axis between front wheels of the vehicle (e.g., closer towards a front of the vehicle). The length of lever **61** may be determined according to the distance between front wheels of the vehicle and other dimensions of the vehicle (e.g., a length of the vehicle, distance of front wheels of the vehicle form a center of the vehicle, etc.). The length of lever **61** may be determined according to Ackerman correction when the vehicle is in the folded state. The length of lever **61** may be determined according to Ackerman correction when the vehicle is in the unfolded state. The length of lever **61** may be determined according to Ackerman correction depending on any state between the folded state and the unfolded state. For example, The length of lever **61** may be determined according to a mathematical average of the distance between front wheels of the vehicle, in the folded state and the unfolded state.

[0115] In some embodiments of the present invention, a vehicle (e.g., a small vehicle, micro

vehicle) may have a split steering system. The split steering system may adjust the front wheels for Ackerman correction. The split steering system may turn the front left wheel at a first turn angle and the front right wheel in a second, different turn angle to adjust for Ackerman correction. Typically, in small and micro vehicles, there's not much space for the feet of the driver. The split steering system may provide precious space, e.g., space for the feet of the driver and a front passenger.

[0116] In some embodiments of the present invention, the split steering system may adjust according to a vehicle's width (e.g., folding and unfolding) and/or according to the vehicle's height. The vehicle may adjust the height of thereof, the split steering system may keep the turn angle of the wheels in different heights of the vehicle. For example, the split steering system may keep the turn angle of the wheels before, during and after a height adjustment of the vehicle or any of the wheels. The split steering system may keep the turn angle of the wheels, while tolerating differences in height between different sides of the vehicle.

[0117] In some embodiments of the present invention, the split steering system may adjust the front wheels for Ackerman correction in relation to the height of the vehicle and/or any of the wheels of the vehicle. For example, the split steering system may adjust the front wheels for Ackerman correction if the height of one side of the vehicle is different than another side of the vehicle. The split steering system may adjust the front wheels for Ackerman correction if the height of at least one of the wheels (e.g., one of the front wheels) is different than another wheel (e.g., one wheel is higher, and all other wheels are on the same height). For example, the split steering system may adjust the front wheels for Ackerman correction before, during and after a height adjustment of the vehicle or any of the wheels. The split steering system adjust the front wheels for Ackerman correction, while tolerating differences in height between different sides of the vehicle.

[0118] In some embodiments of the present invention, a split steering mechanism may include a gearbox connectable to a steering wheel by a steering column. split steering mechanism may include two shafts, a first shaft of the two shafts for linking the gearbox to a first front wheels of a vehicle, and a second shaft of the two shafts for linking the gearbox to a second front wheel of the vehicle. The gearbox may be configured to transmit and split rotation of the steering column to rotation of the shafts, so that the rotation of each of the shafts correlates (e.g., is substantially identical) to the rotation of the steering column. For example, when the user of the vehicle rotates the steering wheel, the rotational motion is transferred to the gearbox, wherein the gearbox may be configured to transmit and split the rotation of the steering column to rotation of the shafts.

[0119] In some embodiments of the present invention, the split steering mechanism may be configured to facilitate a varying length of each of the shafts. For example, the shafts may be telescopic, the length of the shafts may vary according to a height of a wheel and/or a width of the vehicle. The split steering mechanism may change the turn angle of the wheels while facilitating varying lengths of each of the shafts.

[0120] In some embodiments of the present invention, the split steering mechanism may be configured to facilitate concurrent different lengths of the shafts. If one of more wheels of the vehicle are at a different height than the rest of the wheels (e.g., the vehicle is parked on a curb, a front wheel of the vehicle is elevated, the vehicle is ascending an uneven ramp, etc.), a length of the first shaft may be different than the length of the second shaft. The split steering mechanism may be configured to facilitate different lengths of the shafts when one of more wheels of the vehicle are at a different height than the rest of the wheels. If a frame part of the vehicle extends at a different rate or to a different extent than the other frame part, a length of the first shaft may be different than the length of the second shaft. The split steering mechanism may be configured to facilitate different lengths of the shafts when the frame parts of the vehicle have concurrent different distances from a center of the vehicle.

[0121] In some embodiments of the present invention, the split steering mechanism may be configured to apply Ackerman correction when turning the front wheels.

[0122] In some embodiments of the present invention, a foldable vehicle may include a split steering mechanism comprising a gearbox connectable to a steering wheel by a steering column. The split steering mechanism may also include two shafts, a first shaft of the two shafts for linking the gearbox to a first front wheels of a vehicle, and a second shaft of the two shafts for linking the gearbox to a second front wheel of the vehicle. The gearbox may be configured to transmit and split rotation of the steering column to rotation of the shafts, so that the rotation of each of the shafts correlates (e.g., is substantially identical) to the rotation of the steering column.

[0123] Different embodiments are disclosed herein. Features of certain embodiments may be combined with features of other embodiments. Thus, certain embodiments may be combinations of features of multiple embodiments. The foregoing description of the embodiments of the invention has been presented for the purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed. It should be appreciated by persons skilled in the art that many modifications, variations, substitutions, changes, and equivalents are possible in light of the above teaching. It is, therefore, to be understood that the appended claims are intended to cover all such modifications and changes as fall within the true spirit of the invention.

[0124] While certain features of the invention have been illustrated and described herein, many modifications, substitutions, changes, and equivalents will now occur to those of ordinary skill in the art. It is, therefore, to be understood that the appended claims are intended to cover all such modifications and changes as fall within the true spirit of the invention.

## Claims

**1**. A foldable vehicle comprising: a chassis comprising a static support, a dynamic chassis frame linked to the static support that includes at least two substantially opposite frame parts and a controlled folding mechanism for decreasing or increasing a distance between the at least two substantially opposite frame parts across a lateral axis of the vehicle between a folded state and an unfolded state; and a split steering mechanism comprising a steering wheel, a steering column; and two shafts, a first shaft of the two shafts for linking to a first front wheel of a vehicle, and a second shaft of the two shafts for linking to a second front wheel of the vehicle; wherein the split steering mechanism is configured to transmit and split rotation of the steering column to rotation of the shafts, so that the rotation of each of the shafts correlates to the rotation of the steering column.

**2**. The foldable vehicle of claim 1, wherein the split steering mechanism comprises extendable shafts that extend and retract with the decreasing or increasing of the distance between the two frame parts of the foldable vehicle.

**3**. The foldable vehicle of claim 1, wherein the split steering mechanism is configured to keep a turn angle of front wheels of the foldable vehicle during the decreasing or increasing of the distance between the two frame parts of the foldable vehicle.

**4**. The foldable vehicle of claim 1, wherein the split steering mechanism comprises extendable shafts that extend and retract with the decreasing or increasing of a height of the foldable vehicle.

**5**. The foldable vehicle of claim 1, wherein the split steering mechanism is configured to keep a turn angle of front wheels of the foldable vehicle during the decreasing or increasing of a height of the foldable vehicle.

**6**. A split steering mechanism comprising: a steering wheel connected to a steering column; and two shafts, a first shaft of the two shafts for linking the steering wheel to a first front wheel of a vehicle, and a second shaft of the two shafts for linking the steering wheel to a second front wheel of the vehicle; wherein the split steering mechanism is configured to transmit and split rotation of the steering column to rotation of the shafts, so that the rotation of each of the shafts correlates to the rotation of the steering column, and wherein each of the shafts has a varying length.

**7**. The split steering mechanism of claim 6, configured to facilitate concurrent different lengths of

the shafts.

**8**. The split steering mechanism of claim 6, configured to apply Ackerman correction when turning the front wheels.

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