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Extendable seatbelt anchor

Abstract

A system includes a seatbelt anchor, a seatbelt webbing extending from the seatbelt anchor; and a motor operatively coupled to the seatbelt anchor to move the seatbelt anchor between a first position and an extended position. The system includes a computer having a processor and a memory storing instructions executable by the processor to activate the motor to move the seatbelt anchor from the first position to the extended position in response to determining that tension in the seatbelt webbing is above a predetermined threshold in the absence of detection of a vehicle impact.

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Background/Summary

BACKGROUND

(1) A vehicle may include a seatbelt assembly. The seatbelt assembly may include a seatbelt retractor and webbing retractably payable from the seatbelt retractor. The seatbelt assembly may include an anchor coupled to the webbing, and a latch plate that engages a buckle. The seatbelt assembly may be disposed adjacent a seat of the vehicle. The webbing may extend continuously from the seatbelt retractor to the anchor. For example, one end of the webbing feeds into the seatbelt retractor, and the other end of the webbing is fixed to the anchor. The anchor may for example, be fixed to the seat. Alternatively, the anchor may be fixed to a vehicle body, e.g., a B-pillar, a floor, etc. The anchor may be attached in any suitable manner, e.g., with fasteners. The webbing may be fabric, e.g., woven polyester. The latch plate slides freely along the webbing and, when engaged with the buckle, divides the webbing into a lap band and a shoulder band. The seatbelt assembly may include a D-ring engaged with the webbing. For example, the webbing may freely slide through the D-ring. In other words, the webbing may extend from the anchor through the D-ring to the seatbelt retractor. The D-ring may be spaced from the seatbelt retractor. For example, the D-ring may be disposed between the seatbelt retractor and the roof. As another example, the seatbelt retractor may be adjacent to the floor and the D-ring may be adjacent to the

roof. The D-ring may be fixed to the vehicle body, e.g., the B-pillar. The seatbelt assembly may be a three-point harness, meaning that the webbing is attached at three points around the occupant when fastened the anchor, the seatbelt retractor, and the buckle. The seatbelt assembly may alternatively, include another arrangement of attachment points.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

(1) FIG. **1** is a perspective view of a vehicle including a seat and a seatbelt anchor.

(2) FIG. **2** is a magnified view of a portion of FIG. **1** with the seatbelt anchor in a first position.

(3) FIG. **3** is a perspective view of the seatbelt anchor in the first position.

(4) FIG. **4** is another perspective view of the seatbelt anchor in the first position.

(5) FIG. **5** is a perspective view of the seatbelt anchor in an extended position.

(6) FIG. **6** is a block diagram of a system of the vehicle.

(7) FIG. **7** is a flowchart illustrating an example process for controlling the position of the seatbelt anchor.

DETAILED DESCRIPTION

(8) A system includes a seatbelt anchor, seatbelt webbing extending from the seatbelt anchor, and a motor operatively coupled to the seatbelt anchor to move the seatbelt anchor between a first position and an extended position. A computer has a processor and a memory storing instructions executable by the processor to activate the motor to move the seatbelt anchor from the first position to the extended position in response to determining that tension in the seatbelt webbing is above a predetermined threshold in the absence of detection of a vehicle impact.

(9) The memory may store instructions executable by the processor to, after moving the seatbelt anchor to the extended position, activate the motor to return the buckle to the first position in response to determining that the tension in the seatbelt webbing is below the threshold.

(10) The seatbelt anchor may include a base segment and a moveable segment moveable relative to the base segment between the first position and the extended position. A lock may be moveable between an engaged position engaged with the moveable segment in the first position and a disengaged position disengaged with the moveable segment. The solenoid in the extended position locks the moveable segment relative to the engaged position in the first position. The memory may store instructions executable by the processor to, in response to determining that tension in the seatbelt webbing is above a predetermined threshold in the absence of detection of a vehicle impact, move the lock to the disengaged position prior to activating the motor. A rack may be on one of the motor and the moveable segment and a pinion may be on the other of the motor and the moveable segment. The pinion is meshed with the rack. The motor may be fixed to the base segment of the seatbelt anchor. The lock may be fixed to the base segment of the seatbelt anchor. The lock may be a solenoid. A seatbelt-tension sensor may be coupled to the seatbelt webbing.

(11) The memory storing instructions executable by the processor to detect the size of an occupant of the seat and to control operation of the solenoid and motor based on the detected size of the occupant.

(12) A seatbelt assembly includes a seatbelt anchor having a base segment and a moveable segment moveable relative to the base segment between a first position and an extended position, seatbelt webbing extending from the seatbelt anchor, and a motor operatively coupled to the anchor to move the moveable segment between the first position and the extended position. A lock is moveable between an engaged position engaged with the moveable segment in the first position and a disengaged position disengaged with the moveable segment. The solenoid in the extended position locks the moveable segment relative to the engaged position in the first position.

(13) A rack may be on one of the motor and the moveable segment and a pinion may be on the

other of the motor and the moveable segment. The pinion is meshed with the rack.
(14) The motor may be fixed to the base segment of the seatbelt anchor.
(15) The lock may be fixed to the base segment of the seatbelt anchor.
(16) A computer has a processor and a memory storing instructions executable by the processor to, in response to determining that tension in the seatbelt webbing is above a predetermined threshold in the absence of detection of a vehicle impact, move the lock to the disengaged position and activate the motor to move the moveable segment relative to the base segment from the first position to the extended position. The memory may store instructions executable by the processor to, after moving the seatbelt anchor to the extended position, activate the motor to return the buckle to the first position in response to determining that the tension in the seatbelt webbing is below the threshold.
(17) A seatbelt-tension sensor may be coupled to the seatbelt webbing.
(18) The memory stores instructions executable by the processor to detect the size of an occupant of the seat and to control operation of the lock and motor based on the detected size of the occupant.
(19) The lock may be a solenoid.
(20) With reference to the Figures, where like numerals indicate like features throughout the several views, an example of a system **10** of a vehicle **28** includes a seatbelt anchor **12**, a seatbelt webbing **14** extending from the seatbelt anchor **12**, and a motor **16** operatively coupled to the seatbelt anchor **12** to move the seatbelt anchor **12** between a first position and an extended position. The system **10** includes a computer **18** having a processor and a memory storing instructions executable by the processor to activate the motor **16** to move the seatbelt anchor **12** from the first position to the extended position in response to determining that tension in the seatbelt webbing **14** is above a predetermined threshold in the absence of detection of a vehicle impact.
(21) An example of a seatbelt assembly **20** includes the seatbelt anchor **12** including a base segment **22** and a moveable segment **24** moveable relative to the base segment **22** between the first position and the extended position. The seatbelt assembly **20** includes the seatbelt webbing **14** extending from the seatbelt anchor **12**. The motor **16** is operatively coupled to the seatbelt anchor **12** to move the moveable segment **24** between the first position and the extended position. A lock **26**, e.g., a solenoid, is moveable between an engaged position engaged with the moveable segment **24** in the first position and a disengaged position disengaged with the moveable segment **24**. The lock **26** in the extended position locks the moveable segment **24** relative to the engaged position in the first position.
(22) Movement of the seatbelt anchor **12** to the extended position may reduce tension in the seatbelt webbing **14**, e.g., permitting unlocking of a seatbelt retractor **30** such that the seatbelt webbing **14** is payable into and/or out of the seatbelt retractor **30**, providing increased range of movement for an occupant, etc. Unlocking of the seatbelt retractor **30** and the resultant increased range of movement helps to provide an enhanced occupant experience in situations where the seatbelt retractor **30** locks in the absence of a vehicle impact, e.g., locking of the seatbelt retractor **30** caused by the occupant leaning forward too quickly, the vehicle **28** being positioned on a steep decline, the vehicle **28** traversing a particularly bumpy surface, etc.
(23) The vehicle **28**, shown in FIG. **1**, may be any suitable type of ground vehicle, e.g., a passenger or commercial automobile such as a sedan, a coupe, a truck, a sport utility, a crossover, a van, a minivan, a taxi, a bus, etc.
(24) The vehicle **28** includes one or more seats **32**. The seats **32** may be arranged in the passenger cabin in any suitable position, i.e., as front seats (including front driver and passenger seats), rear seats, third-row seats, etc. The seats **32** may be supported by a floor **34** of the vehicle **28**. The seats **32** may be movable relative to the floor **34** to various positions, e.g., movable fore-and-aft and/or cross-vehicle. The seats **32** may be of any suitable type, e.g., a bucket seat **32**. In examples including more than one seat **32**, each seat **32** or any one or more of the seats **32** may include a

respective seatbelt assembly **20**.

(25) Each of the seats **32** includes a seatback and a seat bottom. The seatback may be supported by the seat bottom and may be stationary or movable relative to the seat bottom. The seatback and the seat bottom may be adjustable in multiple degrees of freedom. Specifically, the seatback and the seat bottom may themselves be adjustable, in other words, adjustable components within the seatback and/or the seat bottom, and/or may be adjustable relative to each other.

(26) Each seatbelt assembly **20** includes the seatbelt retractor **30**. The seatbelt webbing **14** is retractably payable from the seatbelt retractor **30**. The seatbelt assembly **20** includes the seatbelt anchor **12** fixed to the seatbelt webbing **14** with the seatbelt webbing **14** extending from the seatbelt anchor **12** to the seatbelt retractor **30**. The seatbelt assembly **20** includes a buckle **36** and a latch plate **38** that releasably engages the buckle **36**. The seatbelt assembly **20** may be disposed adjacent the seat **32**. As an example, the seatbelt assembly **20** is shown adjacent the front driver seat. The seatbelt assembly **20** controls kinematics of the occupant of the respective the seat **32**, e.g., during sudden decelerations of the vehicle **28**. The seatbelt webbing **14** may extend continuously from the seatbelt retractor **30** to the seatbelt anchor **12**. For example, one end of the seatbelt webbing **14** feeds into the seatbelt retractor **30**, and the other end of the seatbelt webbing **14** is fixed to the seatbelt anchor **12**. The seatbelt anchor **12** may, for example, be fixed to the floor **34**, as shown in the example in the Figures. As other examples, the seatbelt anchor **12** may be fixed to a pillar, the seat **32**, etc. The seatbelt anchor **12** may be attached to the seat **32** in any suitable manner, e.g., with fasteners. The seatbelt webbing **14** may be fabric, e.g., woven polyester.

(27) The latch plate **38** slides freely along the seatbelt webbing **14** and, when engaged with the seatbelt buckle **36**, divides the seatbelt webbing **14** into a lap band and a shoulder band. The seatbelt assembly **20** may include a D-ring engaged with the seatbelt webbing **14**. For example, the seatbelt webbing **14** may freely slide through the D-ring. In other words, the seatbelt webbing **14** may extend from the seatbelt anchor **12** through the D-ring to the seatbelt retractor **30**. The D-ring may be spaced from the seatbelt retractor **30**. For example, the D-ring may be disposed between the seatbelt retractor **30** and the roof. As another example, the seatbelt retractor **30** may be adjacent to the floor **34** and the D-ring may be adjacent to the roof. The D-ring may be fixed to the vehicle **28** body, e.g., a pillar. The seatbelt assembly **20** may be a three point harness, as shown in the example shown in the Figures.

(28) The seatbelt retractor **30** may be moveable from the unlocked position to the locked position by conventional mechanisms currently known in the art. In the locked position, the seatbelt retractor **30** prevents extension of the seatbelt webbing **14** from the seatbelt retractor **30**. The seatbelt retractor **30** may include a housing and a spool that is rotatable relative to the housing. The seatbelt retractor **30** may include a locking device engageable with the spool to restrict payout of the seatbelt webbing **14** from the retractor. In the unlocked position, the locking device allows payout of the seatbelt webbing **14** from and to the retractor and, in the locked position, the locking device restricts payout of the seatbelt webbing **14** from the retractor. The locking device may be any suitable locking device known in the art, e.g., weighted pendulum/pawl, centrifugal clutch, etc. With the spool in the unlocked position, the seatbelt webbing **14** may be extended from and retracted into the retractor. In other words, the seatbelt webbing **14** may be coiled and uncoiled freely about the spool. With the spool in the locked position, the seatbelt retractor **30** controls extension of the seatbelt webbing **14** to control the kinematics of the occupant in the event of certain vehicle impacts. Specifically, the spool is locked relative to the housing. In some examples, the seatbelt retractor **30** may include a torsion bar, load limiter, etc., including known structures in some examples, that allows for a limited amount of payout of the seatbelt webbing **14**. The spool may be in the unlocked position by default, i.e., in the absence of a sudden deceleration. The spool may change from the unlocked position to the locked position during a sudden deceleration of the vehicle **28**. Specifically, the locking device may engage the spool in response to deceleration of the vehicle **28**, e.g., a sudden slowing of the vehicle **28**, sudden stop, vehicle impact, etc. In other

words, the locking device may be moved from the unlocked position to the locked position by a change in inertia. The locking device may engage the spool in response to an activation sensor. The activation sensor senses sudden deceleration of the vehicle **28** and triggers activation of the locking device, i.e., moves the locking device to the locked position. As one example, the activation sensor may be in the retractor and may be, for example, a weighted pendulum, a centrifugal clutch, or any other suitable type.

(29) The seatbelt anchor **12** is moveable between the first position and the extended position. In the example shown in the Figures, the seatbelt anchor **12** includes a base segment **22** and a moveable segment **24** moveable relative to the base segment **22** between the first position and the extended position. Specifically, the moveable segment **24** is movable away from the base segment **22** from the first position, shown in FIGS. **1-4** to the extended position, shown in FIG. **5**, and the moveable segment **24** is moveable toward the base segment **22** from the extended position to the first position. The movement of the seatbelt anchor **12** from the first position to the extended position reduces tension in the seatbelt webbing **14** when the latch plate **38** is coupled to the buckle **36** and the seatbelt retractor **30** is in the locked position.

(30) The base segment **22** may support the moveable segment **24**, i.e., the weight of the moveable segment **24** is borne by the base segment **22**. The moveable segment **24** supports other components of the system **10**, such as the motor **16**, the solenoid, etc. In the example shown in the Figures, the base segment **22** is supported by a floor **34** of the vehicle **28**. In other examples, the base segment **22** may be fixed to the seat **32** or any other suitable structure.

(31) The seatbelt anchor **12** may include a mounting bracket **40** fixed to a component of the vehicle **28**, e.g., the floor **34** in the example shown in the Figures. The mounting bracket **40** supports the base segment **22** and the moveable segment **24** on the floor **34**, i.e., the weight of the base segment **22** and the moveable segment **24** are borne by the mounting bracket **40**. The mounting bracket **40** may be fixed to the floor **34** in any suitable way, e.g., fasteners, welding, etc. The base segment **22** may be pinned to the mounting bracket **40**. Specifically, a pin may extend through the base segment **22** and the mounting bracket **40**. The base segment **22** may pivot about the pin.

(32) The base segment **22** and the moveable segment **24** are moveable relative to each other. For example, one of the base segment **22** and the moveable segment **24** may telescopically receive the other of the base segment **22** and the moveable segment **24**. In the example shown in the Figures, the base segment **22** telescopically receives the moveable segment **24**. In such an example, the moveable segment **24** slides relative to the base segment **22** between the first position and the extended position.

(33) The motor **16** is operatively coupled to the seatbelt anchor **12** to move the seatbelt anchor **12** between the first position and the extended position. In the example shown in the Figures, the motor **16** is anchored to the base segment **22** and is engaged with the moveable segment **24** to move the moveable segment **24** relative to the base segment **22** when the motor **16** is activated. The motor **16** moves the moveable segment **24** relative to the base segment **22** between the first position and the extended position. In the example shown in the Figures, the motor **16** has a casing fixed the base segment **22**. The motor **16** includes an armature fixed to the casing and a shaft rotatable relative to the armature.

(34) The system **10** includes a rack **42** on one of the motor **16** and the moveable segment **24** and a pinion **42** on the other of the motor **16** and the moveable segment **24**. The pinion **42** is meshed with the rack **42**. In the example shown in the Figures, the pinion is on the motor **16** and the rack **42** is on the moveable segment **24**. Activation of the motor **16** rotates the pinion **44** to translate the rack **42** and moveable segment **24**. The motor **16** may be of any suitable type, e.g., a DC motor including, for example, those as are known.

(35) The lock **26** is moveable between an engaged position engaged with the moveable segment **24** in the first position and a disengaged position disengaged with the moveable segment **24**. The lock **26** in the extended position locks the moveable segment **24** relative to the engaged position in the

first position. As set forth further below, the lock **26** is moved to the disengaged position to release tension in the seatbelt webbing **14** and unlock **26** the retractor in the absence of a vehicle impact. In the event of a detection of a vehicle impact, the lock **26** is maintained in the engaged position. As shown in the example in the Figures, the lock **26** may be fixed to, i.e., anchored to, the first segment of the seatbelt anchor **12** and moveable into and out of engagement with the moveable segment **24**.
(36) In the example shown in the Figures, the lock **26** is a solenoid. Specifically, in the example shown in the Figures, the solenoid includes a housing **46** and a plunger **48** extendable from and retractable into the housing **46** (by generation of a magnetic field as is known in the operation of a solenoid). With reference to FIGS. **4** and **5**, the moveable segment **24** includes a hole **50** positioned to be aligned with the plunger **48** when the moveable segment **24** is in the first position. The plunger **48** is extended into the hole **50** in the engaged position to prevent movement of the moveable segment **24** relative to the base segment **22**. The plunger **48** is retracted from the hole **50** in the disengaged position to allow movement of the moveable segment **24** relative to the first segment, i.e., by operation of the motor **16**.
(37) The vehicle **28** may include a computer **18** having a processor and a memory storing instructions executable by the processor to perform the process described herein, including the example process in FIG. **7**. The computer **18** may be, for example, a restraints control module. Use of “in response to,” “based on,” and “upon determining” herein indicates a causal relationship, not merely a temporal relationship. The computer **18** may operate the motor **16** and the lock **26** based on input from other components that, for example, detect the size of an occupant in the seat **32**, the level of tension in the seatbelt webbing **14**, a vehicle impact, etc. As an example and as described further below, the system **10** may include an occupant-classification system **52** (OCS), an impact sensor **54**, a seatbelt-tension sensor **56**, and a latch sensor **58**.
(38) As set forth above, the system **10** may include an occupant-classification sensor. Specifically, the system **10** may include an occupant-classification system **10** (OCS), as shown in FIG. **6**, and the OCS **52** includes the occupant-classification sensor. The OCS **52** may be of a conventional type currently known in the art. The occupant-classification sensor detects at least one size measurement of the occupant, e.g., weight, width, height, etc. As an example, the occupant-classification sensor may be a weight sensor in the seat **32** for detecting the weight of the occupant. In such an example, the weight sensor may include a sealed bladder and a pressure sensor in communication with the sealed bladder for detecting pressure changes in the bladder when an occupant sits on the seat **32**. As another example, the occupant-classification sensor may be a camera in the passenger cabin for detecting the size and/or shape of the occupant. In such an example, the camera can detect electromagnetic radiation in some range of wavelengths. For example, the camera may detect visible light, infrared radiation, ultraviolet light, or some range of wavelengths including visible, infrared, and/or ultraviolet light. For example, the camera **205** can be a charge-coupled device (CCD), complementary metal oxide semiconductor (CMOS), or any other suitable type. The camera may be positioned such that a field of view of the camera encompasses the seat **32**. Based on the detection by the occupant-classification sensor, the OCS **52** determines the size of an occupant seated in the seat **32**. The size of the occupant may be classified based on anthropomorphic size. As examples, the OCS **52** may classify the occupant as being within a size range associated with an adult occupant, e.g., 5.sup.th percentile female to 95.sup.th percentile male, a child seat **32**, etc.
(39) The system **10** can include an impact sensor **54** that is configured to detect an impact to the vehicle **28**. The impact sensor **54** may be, as an example, the impact sensor **54** may be of a conventional type currently known in the art. The impact sensor **54** may be of any suitable type, for example, post-contact sensors such as accelerometers, pressure sensors, and contact switches; and pre-impact sensors such as radar, LIDAR, and vision-sensing systems. The vision-sensing systems may include one or more cameras, CCD image sensors, CMOS image sensors, etc. The vehicle **28**

may include multiple impact sensors **54** located at numerous points in or on the vehicle **28**.
(40) The system **10** may include a seatbelt-tension sensor **56** coupled to the seatbelt webbing **14**. The seatbelt-tension sensor **56** detects the level of tension in the seatbelt webbing **14** resulting from forces exerted by the occupant on the seatbelt webbing **14** when the latch plate **38** is engaged with the buckle **36** and the seatbelt retractor **30** is locked. The seatbelt-tension sensor **56** may be of a conventional type currently known in the art. The seatbelt-tension sensor **56** may include a strain gage, or other suitable structure. The seatbelt-tension sensor **56** can be supported at, e.g., fixed to, the seatbelt anchor **12** connected to the seatbelt webbing **14**, or at any other suitable location. Tension of the seatbelt webbing **14** may generate strain in the seatbelt anchor **12** and the seatbelt-tension sensor **56** may detect such strain.
(41) The system **10** may include a latch sensor **58** that detects when the latch plate **38** is buckled, i.e., when the latch plate **38** is engaged with the buckle **36**. The latch sensor **58** may be a switch, a proximity sensor, or any suitable sensor. The latch sensor **58** may be support by the buckle **36**.
(42) With reference to FIG. **7**, the process **700** controls movement of the position of the seatbelt anchor **12** in the first position and the extended position. The process **700** starts with the vehicle **28** operating under typical conditions, e.g., with the latch plate **38** buckled into the buckle **36**, with tension in the seatbelt webbing **14** below the threshold amount, with the buckle **36** in the first position, without having detected an impact to the vehicle **28**, with the lock **26** in the locked position, etc. The computer **18** collects data, e.g., from the latch sensor **58**, the seatbelt-tension sensor **56**, the impact sensor **54**, etc. . . . , via the communication network. The computer **18** may collect such data continuously, at intervals (e.g., every milliseconds), etc. The computer **18** may collect such data throughout the process.
(43) With reference to blocks **705**, the process **700** includes detecting the size of an occupant of the seat **32** and to control operation of the lock **26** and motor **16** based on the detected size of the occupant. At block **705**, the process **700** included determining whether an adult is in the seat **32**. At the start of block **705**, the process can include determining whether the latch plate **38** is buckled or unbuckled from the buckle **36**, e.g., based on data received from the latch sensor **58**. In block **705** may include detection and classification of the size of the occupant by the OCS **52**, as described above. In the event the seat **32** is occupied by an occupant other than and adult human, e.g., occupied by a child seat **32**, the process **700** returns to the start. In the event the seat **32** is occupied by an adult, the process **700** continues to block **710**.
(44) Next at a block **710**, the process includes determining whether tension of the seatbelt webbing **14** is above or below the predetermined threshold, e.g., based on data collected by the seatbelt-tension sensor **56**. For example, the computer **18** may compare the tension in the seatbelt webbing **14** indicated in the data collected by the seatbelt-tension sensor **56**. In response to determining that the tension of the seatbelt webbing **14** is below the threshold, the process **700** to the block **705**. In response to determining the tension of the seatbelt webbing **14** is above the threshold, the computer **18** moves to the block **715**.
(45) In block **715**, the process includes determining whether a vehicle impact has been detected. In response to determining that a vehicle impact has not been detected the process moves to block **720**. At block **720**, the lock **26** is maintained in the engaged position to lock **26** the seatbelt anchor **12** in the first position.
(46) In response to determining that a vehicle impact has not been detected the computer **18** moves to a block **725**. In other words, at block **725**, an adult occupant is seated in the seat **32**, the tension in the seatbelt webbing **14** is above the threshold (e.g., due to the seatbelt retractor **30** being in the locked position and force being exerted on the seatbelt webbing **14** by the occupant), and no vehicle impact is detected. In such a condition, the seatbelt retractor **30** is unnecessarily in the locked position and the process **700** includes moving the seatbelt anchor **12** to the extended position to allow the seatbelt retractor **30** to move to the unlocked position in blocks **725** and **730**.
(47) Specifically, in block **725**, the process **700** includes unlocking the lock **26** to allow the

moveable segment **24** to move relative to the base segment **22** from the first position to the extended position. In the example shown in the Figures in which the lock **26** is the solenoid, the plunger **48** is moved to the retracted position to disengage the hole **50** in the moveable segment **24** to unlock **26** the moveable segment **24** from the base segment **22**.

(48) At block **730**, the process includes activating the motor **16** to move the seatbelt anchor **12** to the extended position. Specifically, with the lock **26** in the unlocked position, in the example shown in the Figures the motor **16** turns the pinion **42** to move the rack **42** to extend the moveable segment **24** relative to the base segment **22** to the extended position. When the moveable segment **24** moves to the extended position, tension in the seatbelt webbing **14** is relieved, which allows the seatbelt retractor **30** to move to the unlocked position.

(49) At blocks **735** and **740**, the process includes returning the seatbelt anchor **12** to the first position and locking the seatbelt anchor **12** in the first position. Specifically, in block **735**, after the moveable segment **24** was moved to the extended position in block **730**, the process **700** includes activating the motor **16** to move the seatbelt anchor **12** to the first position. Specifically, the motor **16** turns the pinion **42** to move the react to retract the moveable segment **24** relative to the base segment **22** to the first position. When in the first position, the process **700** includes locking the lock **26** to lock **26** the moveable segment **24** relative to the base segment **22** in the first position, as shown in block **740**. In the example shown in the Figures in which the lock **26** is the solenoid, the plunger **48** is aligned with the hole **50** in the first position and the plunger **48** is moved to the extended position to engage the hole **50** in the moveable segment **24** to lock **26** the moveable segment **24** to the base segment **22**. After block **740**, the process **700** returns to the start.

(50) As set forth above, the computer **18** includes a processor and a memory. The memory includes one or more forms of computer readable media, and stores instructions executable by the computer **18** for performing various operations, including as disclosed herein. For example, the computer **18** can be a generic computer **18** with a processor and memory as described above and/or may include an electronic control unit (ECU) or controller for a specific function or set of functions, and/or a dedicated electronic circuit including an ASIC that is manufactured for a particular operation, e.g., an ASIC for processing sensor data and/or communicating the sensor data. In another example, computer **18** may include an FPGA (Field-Programmable Gate Array) which is an integrated circuit manufactured to be configurable by a user. Typically, a hardware description language such as VHDL (Very High-Speed Integrated Circuit Hardware Description Language) is used in electronic design automation to describe digital and mixed-signal system **10**s such as FPGA and ASIC. For example, an ASIC is manufactured based on VHDL programming provided pre-manufacturing, whereas logical components inside an FPGA may be configured based on VHDL programming, e.g., stored in a memory electrically connected to the FPGA circuit. In some examples, a combination of processor(s), ASIC(s), and/or FPGA circuits may be included in the computer **18**. The memory can be of any type, e.g., hard disk drives, solid state drives, servers, or any volatile or non-volatile media. The memory can store the collected data sent from the sensors.

(51) The computer **18** is generally arranged for communications on a communication network **60** that can include a bus in the vehicle **28** such as a controller area network (CAN) or the like, and/or other wired and/or wireless mechanisms. Via the communication network **60**, the computer **18** may transmit messages to various devices in the vehicle **28**, and/or receive messages (e.g., CAN messages) from the various devices, e.g., the various sensors, etc. Alternatively or additionally, in cases where the computer **18** comprises a plurality of devices, the communication network may be used for communications between devices represented as the computer **18** in this disclosure.

(52) Computer executable instructions may be compiled or interpreted from computer programs created using a variety of programming languages and/or technologies, including, without limitation, and either alone or in combination, Java, C, C, Visual Basic, Java Script, Perl, HTML, etc. In general, a processor e.g., a microprocessor receives instructions, e.g., from a memory, a computer readable medium, etc., and executes these instructions, thereby performing one or more

processes, including one or more of the processes described herein. Such instructions and other data may be stored and transmitted using a variety of computer **18** readable media. A file in a networked device is generally a collection of data stored on a computer readable medium, such as a storage medium, a random-access memory, etc. A computer readable medium includes any medium that participates in providing data e.g., instructions, which may be read by a computer **18**. Such a medium may take many forms, including, but not limited to, non-volatile media and volatile media. Instructions may be transmitted by one or more transmission media, including fiber optics, wires, wireless communication, including the internals that comprise a system bus coupled to a processor of a computer **18**. Common forms of computer-readable media include, for example, RAM, a PROM, an EPROM, a FLASH-EEPROM, any other memory chip or cartridge, or any other medium from which a computer can read.

(53) The disclosure has been described in an illustrative manner, and it is to be understood that the terminology which has been used is intended to be in the nature of words of description rather than of limitation. Many modifications and variations of the present disclosure are possible in light of the above teachings, and the disclosure may be practiced otherwise than as specifically described.

Claims

1. A system comprising: a seatbelt anchor; seatbelt webbing extending from the seatbelt anchor; a motor operatively coupled to the seatbelt anchor to move the seatbelt anchor between a first position and an extended position; and a computer having a processor and a memory storing instructions executable by the processor to activate the motor to move the seatbelt anchor from the first position to the extended position while the seatbelt webbing is buckled across an occupant in response to determining that tension in the seatbelt webbing is above a predetermined threshold in the absence of detection of a vehicle impact.
2. The system of claim 1, wherein the memory stores instructions executable by the processor to, after moving the seatbelt anchor to the extended position, activate the motor to return the seatbelt anchor to the first position in response to determining that the tension in the seatbelt webbing is below the threshold.
3. The system of claim 1, wherein the seatbelt anchor includes a base segment and a moveable segment moveable relative to the base segment between the first position and the extended position.
4. The system of claim 3, further comprising a lock moveable between an engaged position engaged with the moveable segment in the first position and a disengaged position disengaged with the moveable segment, the solenoid in the extended position locking the moveable segment relative to the engaged position in the first position.
5. The system of claim 4, wherein the memory stores instructions executable by the processor to, in response to determining that tension in the seatbelt webbing is above a predetermined threshold in the absence of detection of a vehicle impact, move the lock to the disengaged position prior to activating the motor.
6. The system of claim 4, further comprising a rack on one of the motor and the moveable segment and a pinion on the other of the motor and the moveable segment, the pinion being meshed with the rack.
7. The system of claim 6, wherein the motor is fixed to the base segment of the seatbelt anchor.
8. The system of claim 4, wherein the lock is fixed to the base segment of the seatbelt anchor.
9. The system of claim 4, wherein the lock is a solenoid.
10. The system of claim 1, further comprising a seatbelt-tension sensor coupled to the seatbelt webbing.
11. The system of claim 1, further comprising a buckle spaced from the seatbelt anchor and a latch plate slidably engaged on the seatbelt webbing, the clip being releasably engageable with the

buckle.

12. The system of claim 1, further comprising an occupant-classification sensor, the memory storing instructions executable by the processor to detect the size of an occupant of the seat and to control operation of the solenoid and motor based on the detected size of the occupant.

13. A seatbelt assembly comprising: a seatbelt anchor having a base segment and a moveable segment moveable relative to the base segment between a first position and an extended position; seatbelt webbing extending from the seatbelt anchor; a motor operatively coupled to the anchor to move the moveable segment between the first position and the extended position; a lock moveable between an engaged position engaged with the moveable segment in the first position and a disengaged position disengaged with the moveable segment, the solenoid in the extended position locking the moveable segment relative to the engaged position in the first position; and a computer having a processor and a memory storing instructions executable by the processor to, in response to determining that tension in the seatbelt webbing is above a predetermined threshold in the absence of detection of a vehicle impact, move the lock to the disengaged position and activate the motor to move the moveable segment relative to the base segment from the first position to the extended position while the seatbelt webbing is buckled across an occupant.

14. The seatbelt assembly of claim 13, further comprising a rack on one of the motor and the moveable segment and a pinion on the other of the motor and the moveable segment, the pinion being meshed with the rack.

15. The seatbelt assembly of claim 13, wherein the motor is fixed to the base segment of the seatbelt anchor.

16. The seatbelt assembly of claim 13, wherein the lock is fixed to the base segment of the seatbelt anchor.

17. The system of claim 13, wherein the memory stores instructions executable by the processor to, after moving the seatbelt anchor to the extended position, activate the motor to return the seatbelt anchor to the first position in response to determining that the tension in the seatbelt webbing is below the threshold.

18. The system of claim 13, further comprising a seatbelt-tension sensor coupled to the seatbelt webbing.

19. The system of claim 12, further comprising an occupant-classification sensor, the memory storing instructions executable by the processor to detect the size of an occupant of the seat and to control operation of the lock and motor based on the detected size of the occupant.

20. The system of claim 13, wherein the lock is a solenoid.