A sensor for sensing when a latch of a child safety seat is coupled to a seat assembly of a vehicle. The sensor may include a first housing member that is mounted to a seat frame of the vehicle. The sensor may also include a second housing member that can move relative to the first housing member. A sensor subassembly may sense the relative movement of the second housing member. The latch of the child safety seat can be snapped onto a ring of the second housing member and subsequently tightened to secure the child seat to the vehicle. Coupling the child seat to the ring moves the second housing member relative to the first housing member. This movement is sensed by the sensor which provides an output signal. The output signal can be processed to provide an indication to the vehicle driver that the child seat has been coupled to the seat, and/or disable an airbag and/or disable a seat movement device.
LOWER ANCHOR AND TETHERS FOR CHILDREN (LATCH) DETECTION AND MEASUREMENT DEVICE

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The subject matter disclosed generally relates to a sensor that can sense when a child safety seat has been coupled to a seat of a vehicle.

[0003] 2. Background Information

[0004] Infants and small children are typically placed within a child safety seat when traveling in a vehicle such as an automobile. The safety seat is strapped onto a seat with the seat belt of the vehicle.

[0005] There has been enacted legislation that will require all vehicles to have a ring that extends from between the seat cushions of a seat assembly. Child safety seats will have a corresponding latch that will snap onto the ring and secure the safety seat to the seat assembly. The ring must have a relatively low profile so that occupants of the vehicle can sit on the seat without discomfort when the child safety seat is not in use. The low profile makes it difficult to determine whether the safety seat latch has been properly attached to the ring.

[0006] There has been enacted legislation to require automobile manufacturers to disable the passive restraint system for occupants under a predetermined weight. Vehicles that comply with this legislation may have a weight sensor in the seat that senses the weight of the occupant and provides a feedback signal to the restraint system. Unfortunately, the new latch feature of the child safety seat may be tightened to create an improper reading of the occupant’s weight. The additional tension force of the latch may increase the force sensed by the weight sensor since there is no weight sensor to determine whether the latch has been properly attached to the seat assembly.

[0007] It would be desirable to provide a system that would indicate when a latch of a child safety seat has been attached to a seat assembly of a vehicle.

BRIEF SUMMARY OF THE INVENTION

[0008] A sensor that can sense when a latch of a child safety seat has been coupled to a seat assembly.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. 1 is a side view showing a child safety seat coupled to a seat assembly of a vehicle;

[0010] FIG. 2 is a top front perspective view showing a sensor mounted to a seat frame;

[0011] FIG. 3 is a schematic showing a sensor system;

[0012] FIG. 4 is a top perspective view showing an embodiment of a sensor;

[0013] FIG. 5 is top perspective view showing another embodiment of the sensor.

DETAILED DESCRIPTION

[0014] Disclosed is a sensor for sensing when a latch of a child safety seat is coupled to a seat assembly of a vehicle. The sensor may include a first housing member that is mounted to a seat frame of the vehicle. The sensor may also include a second housing member that can move relative to the first housing member. A sensor subassembly may sense the relative movement of the second housing member. The latch of the child safety seat can be snapped onto a ring of the second housing member and subsequently tightened to secure the child seat to the vehicle. Coupling the child seat to the ring moves the second housing member relative to the first housing member. This movement is sensed by the sensor which provides an output signal. The output signal can be processed to provide an indication to the vehicle driver that the child seat has been coupled to the seat, and/or disable an airbag and/or disable a seat movement device.

[0015] Referring to the drawings more particularly by reference numbers, FIG. 1 shows a child safety seat 10 coupled to a seat assembly 12. The seat assembly 12 is typically part of a vehicle such as an automobile. The child safety seat 10 is typically configured to support an infant or small child, and rest on the seat cushions 14 of the seat 12. The child seat 10 includes a latch (not shown) that is coupled to the seat assembly 12. The tension of the latch may be tightened through strap 16.

[0016] As shown in FIG. 2, a sensor 20 can be mounted to a seat frame 22 of the seat assembly. The sensor 20 includes a ring 24 that extends from between the seat cushions (not shown). The latch of the child safety seat can be snapped onto the ring to secure the child seat to the seat frame 22.

[0017] As shown in FIG. 3, the sensor 20 can be coupled to a controller 30 or computer of the vehicle. The sensor 20 can provide an input signal to the controller 30. The controller 30 can then provide an output signal to a display 32. The display 32 provides an indication that the latch of the child safety seat has been properly secured to the seat assembly. The display 32 may provide a visual or audio indication. For example, the display may be a light lamp that is illuminated on the dashboard of the vehicle, or the indication may be a noise, or the cessation of a noise emitted by the vehicle.

[0018] The controller 30 may also disable the air bag 34 adjacent to the child seat 10. The air bag 34 may be disabled when the controller 30 determines that the child latch has been properly secured to the seat assembly. Additionally, movement of the seat assembly may stretch or even break the child seat strap. The controller 30 may also prevent movement of the seat when the latch is secured to the seat assembly. Movement may be inhibited by disabling the seat motor, engaging some type of mechanical latch, or other means.

[0019] The input signal from the sensor 20 may be a signal that has two levels, one level to indicate that the latch has not been properly attached and another level that the child seat has been properly attached. Alternatively, the input signal may have an amplitude that varies with the latch force sensed by the sensor 20. For example, the voltage of the input signal may vary between 0-5V for a load range of 0-30 lbs. The controller 30 can then determine whether the amplitude exceeds a threshold value and drive the display 32, accordingly. Although a controller 30 is shown and described, it is to be understood that the sensor 20 may provide the input signal directly to the display 32.

[0020] FIG. 4 shows an embodiment of a sensor 20. The sensor 20 may include a first housing member 40 and a
second housing member 42. The first housing member 40 may include a flange 44 with an opening 46. A fastener (not shown) can pass through the opening 46 to secure the flange 44 and first housing member 40 to a seat assembly (see FIG. 2). Although a flange 44 and opening 46 are shown and described, it is to be understood that the sensor 20 may be attached to the seat assembly by other means.

[0021] The second housing member 42 can move relative to the first housing member 40. The second housing member 42 includes the ring 24. The ring 24 can be formed with the second housing member 42 or attached to the housing member 42, for example with a welding process. The first housing member 40 may include stop surfaces 48 that engage flanges 50 of the second housing member 42 to limit the travel of the second member 42. A portion of the second housing member 42 may reside in a cavity 52 of the first housing member 40 to minimize the profile of the sensor 20.

[0022] The sensor 20 further includes a sensor subassembly 60 that senses movement of the second housing member 42. The subassembly 60 may include a magnet 62 and a Hall Effect sensor 64. Located between the magnet 62 and Hall Effect sensor 64 is an armature 66. The armature 66 is mounted to a restraining plate 68 that is attached to the second housing member 42. Movement of the second housing member 42 moves the armature 66 and changes the magnetic field sensed by the Hall Effect sensor 64. The Hall Effect sensor 64 provides an output signal on wires 70 that varies in accordance with movement of the armature 66 and second member 42. Although a Hall Effect sensor is shown and described, it is to be understood that other types of sensors such as force or pressure sensors may be employed.

[0023] The sensor 20 may include a biasing spring 72 that biases the second housing member 42 toward the magnet 62 and Hall Effect sensor 64. The spring 72 may be captured by a wall 74 of the first housing member 40 and the restraining plate 68. The spring 72 may be centered about button 76. The sensor subassembly 60 may be enclosed by a cover 78 that is attached to the first housing member 40 through fastener apertures 80.

[0024] In operation, the child seat latch is snapped onto the ring 24. The latch is tightened which causes a force in the direction indicated by the arrow shown in FIG. 4. The force moves the second housing member 42 and armature 66. Movement of the armature 66 is sensed by the Hall Effect sensor 64. The output signal of the Hall Effect sensor 64 varies as a function of the armature movement. The output signal can be processed by the controller (see FIG. 3) to determine the latch force and whether the child seat latch has been attached to the ring 24 and seat assembly 22.

[0025] FIG. 5 shows another embodiment of a sensor 20. Instead of a Hall Effect sensor this sensor 20 includes a switch 100 with a mechanical button 102. The button 102 is in contact with the restraining plate 68. Movement of the second housing member 42 will move the plate 68 away from the button 102. The switch button 102 is internally biased so that the button 102 moves in an outward direction with the plate 68. Movement of the button 102 beyond some limit will cause the switch 100 to provide an output signal. The output signal may represent that the second housing member 42 has traveled a certain distance, a distance that may indicate a proper attachment of the child seat latch to the ring 24. The proper attachment force can be established by the spring force of the spring 72.

[0026] While certain exemplary embodiments have been described and shown in the accompanying drawings, it is to be understood that such embodiments are merely illustrative of and not restrictive on the broad invention, and that this invention not be limited to the specific constructions and arrangements shown and described, since various other modifications may occur to those ordinarily skilled in the art.

What is claimed is:
1. A sensor assembly that is coupled to a latch of a child safety seat, comprising:
   a first housing member;
   a second housing member that moves relative to said first housing member and is coupled to the latch of the child safety seat; and,
   a sensor subassembly that is coupled to said first and second housing members and senses a movement of said second housing member.
2. The assembly of claim 1, wherein said second housing member includes a ring that is coupled to the latch of the child safety seat.
3. The assembly of claim 1, further comprising a biasing spring that is coupled to said first housing member and a second housing member.
4. The assembly of claim 1, wherein said sensor subassembly includes a magnet and a Hall Effect sensor.
5. The assembly of claim 1, wherein said sensor subassembly includes a switch that is coupled to said second housing member.
6. The assembly of claim 1, wherein said first housing member includes a flange adapted to be mounted to a seat frame.
7. The assembly of claim 1, wherein said first housing member includes a stop that limits the movement of said second housing member.
8. A sensor assembly that is coupled to a latch of a child safety seat, comprising:
   a first housing member;
   a second housing member that moves relative to said first housing member and is coupled to the latch of the child safety seat; and,
   sensor means for sensing a movement of said second housing member.
9. The assembly of claim 8, wherein said second housing member includes a ring that is coupled to the latch of the child safety seat.
10. The assembly of claim 8, further comprising a biasing spring that is coupled to said first housing member and a second housing member.
11. The assembly of claim 8, wherein said sensor means includes a magnet and a Hall Effect sensor.
12. The assembly of claim 8, wherein said sensor means includes a switch that is coupled to said second housing member.
13. The assembly of claim 8, wherein said first housing member includes a flange adapted to be mounted to a seat frame.
14. The assembly of claim 8, wherein said first housing member includes a stop that limits the movement of said second housing member.
15. A sensor system that is coupled to a latch of a child safety seat that is placed on a seat assembly, comprising:
a sensor that is mounted to the seat assembly and coupled to the latch of the child safety seat; and,

a display that is coupled to said sensor and provides an indication of when the latch of the child safety seat is coupled to said sensor.

16. The system of claim 15, further comprising a controller that receives an input signal from said sensor and provides an output signal to said display to indicate when the latch of the child safety seat is coupled to said sensor.

17. The system of claim 15, wherein said sensor includes a ring that is coupled to the latch of the child safety seat.

18. The system of claim 15, wherein said sensor includes a first housing member, and a second housing member that can move relative to said first housing member, and a biasing spring that is coupled to said first and second housing members.

19. The system of claim 15, wherein said sensor includes a magnet and a Hall Effect sensor.

20. The system of claim 15, wherein said sensor includes a switch.

21. The system of claim 18, wherein said first housing member includes a flange adapted to be mounted to a seat frame of the seat assembly.

22. The system of claim 18, wherein said first housing member includes a stop that limits the movement of said second housing member.

23. A sensor system that senses when a latch of a child safety seat is placed on a seat assembly, comprising:

sensor means for sensing when the latch of the child safety seat is coupled to the seat assembly; and,

a display that is coupled to said sensor means and provides an indication of when the latch of the child safety seat is coupled to the seat assembly.

24. The system of claim 23, further comprising a controller that receives an input signal from said sensor means and provides an output signal to said display to indicate when the latch of the child safety seat is coupled to seat assembly.

25. The system of claim 23, wherein said sensor means includes a ring that is coupled to the latch of the child safety seat.

26. The system of claim 23, wherein said sensor means includes a first housing member, and a second housing member that can move relative to said first and second housing member and a biasing spring that is coupled to said first housing members.

27. The system of claim 23, wherein said sensor means includes a magnet and a Hall Effect sensor.

28. The system of claim 23, wherein said sensor means includes a switch.

29. The system of claim 26, wherein said first housing member includes a flange mounted to a seat frame of the seat assembly.

30. The system of claim 26, wherein said first housing member includes a stop that limits the movement of said second housing member.

31. A method for sensing when a latch of a child safety seat is coupled to a seat assembly, comprising:

coupling the latch of the child safety seat to a sensor that is mounted to the seat assembly; and,

displaying an indication that the latch of the child safety seat is coupled to the sensor.

32. The method of claim 31, wherein the sensor provides an input signal to a controller that provides an output signal to the display to indicate that the latch of the child safety seat is coupled to the sensor.

33. The method of claim 32, wherein the input signal has a varying amplitude.

34. The method of claim 32, wherein input signal has one of two values.

35. A seat assembly that is coupled to a latch of a child safety seat, comprising:

a seat frame;

a seat cushion located on said seat frame; and,

a sensor that is mounted to said seat frame and is coupled to the latch of the child safety seat.

36. The assembly of claim 35, wherein said sensor includes a ring that is coupled to the latch of the child safety seat.

37. The assembly of claim 35, wherein said sensor includes a first housing member, and a second housing member that moves relative to said first housing member, and a biasing spring that is coupled to said first and second housing members.

38. The assembly of claim 35, wherein said sensor includes a magnet and a Hall Effect sensor.

39. The assembly of claim 35, wherein said sensor includes a switch.

40. The assembly of claim 37, wherein said first housing member includes a flange that is mounted to said seat frame.

41. The assembly of claim 37, wherein said first housing member includes a stop that limits the movement of said second housing member.

42. A seat assembly that is coupled to a latch of a child safety seat, comprising:

a seat frame;

a seat cushion located on said seat frame; and,

sensor means for sensing when the latch of the child safety seat is coupled to said seat frame.

43. The assembly of claim 42, wherein said sensor means includes a ring that is coupled to the latch of the child safety seat.

44. The assembly of claim 42, wherein said sensor means includes a first housing member, and a second housing member that moves relative to said first housing member, and a biasing spring that is coupled to said first and second housing members.

45. The assembly of claim 42, wherein said sensor means includes a magnet and a Hall Effect sensor.

46. The assembly of claim 42, wherein said sensor means includes a switch that is coupled to said second housing member.

47. The assembly of claim 44, wherein said first housing member includes a flange mounted to said seat frame.

48. The assembly of claim 44, wherein said first housing member includes a stop that limits the movement of said second housing member.

49. A sensor system that is coupled to a latch of a child safety seat that is placed on a seat assembly, comprising:

a sensor that is mounted to the seat assembly and coupled to the latch of the child safety seat; and,
an airbag that is disabled when the latch of the child safety seat is coupled to said sensor.

50. The system of claim 49, further comprising a controller that receives an input signal from said sensor and provides an output signal to disable said airbag when the latch of the child safety seat is coupled to said sensor.

51. The system of claim 49, wherein said sensor includes a ring that is coupled to the latch of the child safety seat.

52. The system of claim 49, wherein said sensor includes a first housing member, and a second housing member that can move relative to said first housing member, and a biasing spring that is coupled to said first and second housing members.

53. The system of claim 49, wherein said sensor includes a magnet and a Hall Effect sensor.

54. The system of claim 49, wherein said sensor includes a switch.

55. The system of claim 52, wherein said first housing member includes a flange adapted to be mounted to a seat frame of the seat assembly.

56. The system of claim 52, wherein said first housing member includes a stop that limits the movement of said second housing member.

57. A sensor system that senses when a latch of a child safety seat is placed on a seat assembly, comprising:

sensor means for sensing when the latch of the child safety seat is coupled to the seat assembly; and,

an airbag that is disabled when the latch of the child safety seat is coupled to said sensor means.

58. The system of claim 57, further comprising a controller that receives an input signal from said sensor means and provides an output signal to said disable said airbag when the latch of the child safety seat is coupled to seat assembly.

59. The system of claim 57, wherein said sensor means includes a ring that is coupled to the latch of the child safety seat.

60. The system of claim 57, wherein said sensor means includes a first housing member, and a second housing member that can move relative to said first and second housing member and a biasing spring that is coupled to said first housing members.

61. The system of claim 57, wherein said sensor means includes a magnet and a Hall Effect sensor.

62. The system of claim 57, wherein said sensor means includes a switch.

63. The system of claim 60, wherein said first housing member includes a flange mounted to a seat frame of the seat assembly.

64. The system of claim 60, wherein said first housing member includes a stop that limits the movement of said second housing member.

65. A method for sensing when a latch of a child safety seat is coupled to a seat assembly, comprising:

- coupling the latch of the child safety seat to a sensor that is mounted to the seat assembly; and,

- disabling an airbag when the latch of the child safety seat is coupled to the sensor.

66. The method of claim 65, wherein the sensor provides an input signal to a controller that provides an output signal to disable the airbag when the latch of the child safety seat is coupled to the sensor.

67. The method of claim 66, wherein the input signal has a varying amplitude.

68. The method of claim 66, wherein input signal has one of two values.

69. A sensor system that is coupled to a latch of a child safety seat that is placed on a seat assembly, comprising:

- a sensor that is mounted to the seat assembly and coupled to the latch of the child safety seat; and,

- a seat movement device that is disabled when the latch of the child safety seat is coupled to said sensor.

70. The system of claim 69, further comprising a controller that receives an input signal from said sensor and provides an output signal to disable said seat movement device when the latch of the child safety seat is coupled to said sensor.

71. The system of claim 69, wherein said sensor includes a ring that is coupled to the latch of the child safety seat.

72. The system of claim 69, wherein said sensor includes a first housing member, and a second housing member that can move relative to said first housing member, and a biasing spring that is coupled to said first and second housing members.

73. The system of claim 69, wherein said sensor includes a magnet and a Hall Effect sensor.

74. The system of claim 69, wherein said sensor includes a switch.

75. The system of claim 72, wherein said first housing member includes a flange adapted to be mounted to a seat frame of the seat assembly.

76. The system of claim 72, wherein said first housing member includes a stop that limits the movement of said second housing member.

77. A sensor system that senses when a latch of a child safety seat is placed on a seat assembly, comprising:

sensor means for sensing when the latch of the child safety seat is coupled to the seat assembly; and,

a seat movement device that is disabled when the latch of the child safety seat is coupled to the seat assembly.

78. The system of claim 77, further comprising a controller that receives an input signal from said sensor means and provides an output signal to disable said seat movement device when the latch of the child safety seat is coupled to seat assembly.

79. The system of claim 77, wherein said sensor means includes a ring that is coupled to the latch of the child safety seat.

80. The system of claim 77, wherein said sensor means includes a first housing member, and a second housing member that can move relative to said first and second housing member and a biasing spring that is coupled to said first housing members.

81. The system of claim 77, wherein said sensor means includes a magnet and a Hall Effect sensor.

82. The system of claim 77, wherein said sensor means includes a switch.

83. The system of claim 80, wherein said first housing member includes a flange mounted to a seat frame of the seat assembly.

84. The system of claim 80, wherein said first housing member includes a stop that limits the movement of said second housing member.
85. A method for sensing when a latch of a child safety seat is coupled to a seat assembly, comprising:
   coupling the latch of the child safety seat to a sensor that is mounted to the seat assembly; and,
   disabling a seat movement device when the latch of the child safety seat is coupled to the sensor.

86. The method of claim 85, wherein the sensor provides an input signal to a controller that provides an output signal to disable the seat movement device when the latch of the child safety seat is coupled to the sensor.

87. The method of claim 86, wherein the input signal has a varying amplitude.

88. The method of claim 86, wherein input signal has one of two values.