

Invention Title: **AI Enabled Telescopic Rain Shield for Entrance and Exit Doors of Passenger Bus**

DESCRIPTION:

Field of Invention:

The present invention discloses features of Telescopic Rain Shield for Entrance and Exit Doors of Passenger Bus by using Artificial Intelligence (AI) Technology.

Background:

Using of umbrella while boarding or alighting a bus, during rain downpour is a challenging task for physically challenged persons with mobility aids, injured persons with walking sticks, mothers with baby stroller and/or hand carrying child and elderly persons. This makes them getting wet due to uncovered existing gap between the bus and the bus shelter. This is applicable to people and students those who are travelling without umbrella as well. The existing distance of uncovered gap between the bus and the bus shelter is 3 feet to 6 feet approximately.

Summary of Invention:

To overcome the above issue, the present invention discloses a solution by introducing AI enabled Telescopic Rain Shield for Entrance and Exit Doors of Passenger Bus to protect commuters from getting wet while boarding and alighting a bus during rain downpour.

AI Enabled Telescopic Rain Shield will be able to detect the existing uncovered gap between bus and bus shelter and deploy telescopic slides automatically to provide a roof kind of provision for passengers while boarding and alighting a bus during raining. Likewise, it will also be able to retract back all the telescopic slides and rotate them back to vertical position after boarding and alighting a bus. This operation will be performed automatically when a bus stops at a bus stop, as a first option or manually by a driver as a second option.

Various Sensors such as Rain Sensor, Proximity Sensors and Human Detection Sensors will be utilized to collect data from the surroundings of a bus stop and processed by Central Processing Unit to perform automatic operation of AI Telescopic Rain Shield. Control panel will also be used to set the choice of automatic operation or manual operation. Additional features such as CCTV, Red and Green Warning lights and Audio Speaker System will be added to enhance the operation for bus commuters.

A single Processing Unit will be able to handle multiple number of AI enabled Telescopic Shields installed at various doors. This includes deploying of telescopic rain shields with various lengths according to the various uncovered gap measured between bus and bus shelter at front and exit doors.

Remote Controller can be utilized to operate the Telescope Rain shield in addition to physical control panel.

Self-Lubricating Coating or bearing can be utilized to reduce the frictions during sliding of telescopic slides. Corrugated strips can also be added to avoid longitudinal deflection of sliding panels.

Explanation of symbols

DESCRIPTION OF SYMBOLS: 100 Central Processing Unit, 101 Telescopic Rain Shield Assembly, 102 Rain Sensor, 103 Proximity Sensor, 104 Human Detection Sensor, 105 Control Panel of Rain Shield System, 106 CCTV, 107 Green / Red Warning Lights, 108 Audio Speaker, 109 Left Side Servo Motor, 110 Right Side Servo Motor, 111 Common Spindle, 112 Slide Assembly Tilting Motor - Left Side, 113 Slide Assembly Tilting Motor - Right Side, 114 Slide Assembly Tilting Gear - Left Side, 115 Slide Assembly Tilting Gear - Right Side, 116 Base Slide, 117 Timing Belt Gear-1, 118 Timing Belt Gear-2, 119 Intermediate Gear-3, 120 Double Sided Timing Belt in Base Slide, 121 Second Telescopic Slide, 122 Timing Belt Gear-4, 123 Timing Belt Gear-5, 124 Double Sided Timing Belt for Second Telescopic Slide, 125 Timing Belt Clamp of Second Slide, 126 Third Telescopic Slide, 127 Timing Belt Clamp of Third Telescopic Slide, 128 Rain Water Collecting Pan, 200 Bus Stop Shelter, 300 Bus.

Brief Description of the Drawings

The disclosure is herein described, only through examples, with reference to the accompanying drawings. With specific reference now to the drawings in detail, it is stressed that the particulars shown are by way of example and for purposes of illustrative discussion of the preferred embodiments of the present disclosure only and are presented to provide what is believed to be the most useful and readily understood description of the principles and conceptual aspects of the disclosure. In this regard, no attempt is made to show structural details of the disclosure in more detail than is necessary for a fundamental understanding of the disclosure, the description taken with the drawings making apparent to those skilled in the art how the several forms of the disclosure may be embodied in practice. In the drawings:

Figure - 1 is an overall scenic view of Passenger Bus during raining, with AI Enabled Telescopic Rain Shield in fully deployed mode at the Bus Stop to pick up a physically challenged passenger and dad carrying a child.

Figure - 2 is the general arrangement view of AI Enabled Telescopic Rain Shield at initial position.

Figure - 3 is the general arrangement view of AI Enabled Telescopic Rain Shield at fully deployed position.

Figure - 4 is the sectional view (Section A-A) of Servo Motor with Base Shield, Second Telescopic Rain Shield, Third Telescopic Rain Shield, Double sided timing belts, Timing Belt Clamp and enlarged view (Section B-B) of telescopic mechanism at the left side of the assembly.

Figure – 5 shows the functional sequence of AI Enabled Telescopic Rain Shield from the initial position to fully deployed position.

Figure – 6 shows the plan view of the Bus with AI Enabled Telescopic Rain Shield in fully deployed mode at the Bus Stop, to visualize the uncovered existing gap between the bus and the roof of the bus stop.

Figure - 7 is the overall scenic view of Passenger Bus with AI Enabled Telescopic Rain Shield at the initial position and fully deployed position in the bus stop.

Figure - 8 is the overall scenic view of Passenger Bus during rain at the bus stop, a physically challenged passenger is getting wet while boarding due to uncovered gap between the bus and the bus shelter. It also explains the raindrops trajectory angle study.

Figure – 9 shows the System Diagram of AI Enabled Telescopic Rain Shield for Entrance and Exit Doors of the Passenger Bus.

Figure – 10 shows the Functional Flowchart of Manual Mode of Telescopic Rain Shield for Entrance and Exit Doors of the Passenger Bus.

Figure – 11 shows the Functional Flowchart of Automatic Mode of AI enabled Telescopic Rain Shield for Entrance and Exit Doors of the Passenger Bus.

Detail Description of Preferred Embodiments

The following description provides the modus operandi of AI enabled Telescopic Rain Shield for Entrance and Exit Doors of the Passenger Bus.

Figure-1 shows the Telescopic Rain Shield Assembly [101] in a fully deployed mode just above the front door of a passenger bus [300]. The figure also depicts a physically challenged passenger and a dad carrying a child waiting for bus during raining. It also shows the bus waiting in the bus stop during rain. The telescopic assembly provides a roof kind of provision to save the bus commuters from getting wet during the rain.

Figure-2 shows various views of Telescopic Rain Shield Assembly at its initial position. This is to understand the compactness and volume of the assembly during its idle mode. Two Servo Motors [109 & 110] are used at both the ends of the common spindle [111] to power up the telescopic mechanism. Base Slide [116], Second Telescopic Slide [121], Third Telescopic Slide [126] are shown in vertical direction for effective utilization of space while the bus running on the road. Rainwater Collecting Pan [128] is added at the bottom of the assembly to avoid direct dripping

on passengers from the top of telescopic slides. As shown in the figure, Casing of Servo motors [109, 110] will have room to accommodate Slide Assembly Tilting Motor [112, 113] and Slide Assembly Tilting Gears [114, 115] for the function of rotating the slide assembly to horizontal direction prior to its deployment mode. Angular Tilting Motor will have self-locking mechanism to position and retain the slides at a required angle with a maximum slope to drain off the rainwater. Slide Assembly tilting gears [114, 115] are an integral part of Base Slide [116] and has a hollow bore in center to allow common spindle to run without touching. Telescopic Sliding mechanism has been shown at both ends of the Base slide, Second and Third slides [116, 121, 126] for deployment / retraction function.

Figure-3 shows the plan view of fully deployed telescopic slides and the location of most of the components of the assembly in deployed mode. Telescopic Sliding mechanism has been shown at both side of Base, Second and Third slides [116, 121, 126] for deployment / retraction function.

Figure-4 shows the sectional View A-A to understand the telescopic linear motion of rain shields assembly. It also shows another sectional view B-B to understand the arrangement of timing belt gears and inner side of telescopic slides.

To begin with the telescopic mechanism for deployment process, Timing Belt Gear-1 [117] is directly mounted with Common Spindle [111] and both will be getting clockwise rotatory motion through the Servo Motors. Timing Belt Gear-1 [117] acts as a Driver. Another Timing Belt Gear-2 [118] is installed at the other end of base slide and it will act as the Driven. Both gears [117 & 118] are connected through Double-Sided Timing Belt [120]. A Timing Belt Clamp [125] which is rigidly mounted with the body of Second Telescopic Slide [121] at the left end is buckled with Double-Sided Timing Belt [120] as shown in the figure. So, when the Double-Sided Timing belt [120] moves from left side to right side through the clockwise rotary motion of Driver and Driven gears, Timing Belt Clamp [125] will also travel along with Second Telescopic Slide [121] from left side to right side. Thus, the telescopic motion can be achieved to the Second Telescopic Slide.

Likewise, the secondary telescopic slide [121] has Timing Belt Gear-4 [122] as a Driver at the left end and Timing Belt Gear-5 [123] as the Driven at the right end. Both Driver and Driven Gears [122 & 123] are connected through the Double-Sided Timing Belt [124] and gets rotary motion through the Intermediate Gear-3 [119] which is mounted directly in the Base Slide [116]. The intermediate Gear-3 [119] gets rotary motion from the Double-Sided Timing Belt [120] which is coupled with common spindle. A Timing Belt Clamp [127] which is rigidly mounted with the body of Third Telescopic Slide [126] at the left end is buckled with Double-Sided Timing Belt [124] as shown in the figure. So, when the Double-Sided Timing belt [124] moves from left side to right side through the clockwise rotary motion of Driver and Driven gears, Timing Belt Clamp [127] will also travel along with Third Telescopic Slide [126] from left side to right side. Thus, the telescopic motion can be achieved to the Third Telescopic Slide.

Based on the above deployment motion of Second and Third Telescopic Slides, retraction motion can be achieved from both Servo Motors [109, 110] when they rotate anti-clockwise. The running duration of both servo motors can be controlled through the CPU based on the input from the Proximity Sensor [103] after sensing the available space in between the Bus and the Bus Shelter.

The telescopic slides will have self-lubricating coating and/or bearings mechanism to reduce friction between telescopic slides, corrugated strips for reinforcement, metallic or non-metallic and anti-corrosion properties.

Quick return mechanism can be utilized for both Servo Motors to retract the telescopic slide immediately when there is an unexpected obstruction during deployment operation.

Based on self-weight of the entire assembly [101], wind load and rain load, diagonal bracing and Angle Stopper will be added to the Base Slide for structural integrity purpose at a later phase.

During Tilting of the entire assembly [101] from vertical to horizontal direction prior to starting of deployment process, it can be stopped at 75° to 85° horizontally. This will help to get sufficient slope backward to drain off the rainwater from the roof of telescopic slides quickly. The required angle can be achieved through the Slide assembly tilting motors [112 and 113] based on the output data from CPU and proximity sensor.

The mechanism of Telescopic Rain Shield assembly can also be configured and operated with one of the other conventional mechanisms such as Rack and Pinion, Steel Rope, Pneumatic, Hydraulic, Spring and Linear Motors or any other mechanism accordingly, to suit the industrial needs.

The Telescopic mechanism can be configured with one or multiple Servo Motors to meet the loads and one or multiple Telescopic Slides to meet the required length to fill the uncovered gap between the bus and roof of the bus shelter, and to operate either with AI Enabled mode or manual mode.

Idler pulleys for tensioning the timing belts can be added in the system during detailing phase.

Figure 5 shows the operational sequence of AI enabled Telescopic Slides from its initial position to the fully deployed position.

Stage 1 shows the slide assembly [101] at initial position with all the slides in vertical direction.

Slide 2 shows the slide assembly [101] tilting simulation from vertical to horizontal position. Slide Assembly Tilting Motors [112 & 113] and Slide Assembly Tilting Gear [114 & 115] are used to perform this process. Casing of Servo motors [109, 110] will have room to accommodate Slide Assembly Tilting Motor [112, 113] and Slide Assembly Tilting Gears [114, 115] for the function of rotating the slide assembly to horizontal direction prior to its deployment mode. Angular Tilting Motor will have self-locking mechanism to position and retain the slides at a required angle with a maximum slope to drain off the rainwater. Slide Assembly tilting gears [114, 115] are an integral

part of Base Slide [116] and has a hollow bore in center to allow common spindle to run without touching. Telescopic Sliding mechanism is utilized at both side of the Base slides, Second and Third slides [116, 121, 126] for deployment / retraction function.

During Tilting of the entire assembly [101] from vertical to horizontal direction prior to starting of deployment process, it can be stopped at 75° to 85° horizontally. This will help to get sufficient slope backward to drain off the rainwater from the roof of telescopic slides quickly. The required angle can be achieved through the Slide assembly tilting motors [112 and 113] based on the output data from CPU and proximity sensor.

Stage 3 shows the telescopic slides are ready to start their deployment process. To begin this function, both Servo motor should be started [109, 110] at first. And then, the processes will begin as stated in the description of Figure-4.

Stage 4 shows the telescopic slides are on the deployment mode. CPU will control the operation of both Servo motors [109, 110] to deploy the telescopic slides based on the available clash free volume between the bus and the bus shelter.

Stage 5 shows the telescopic slides in fully deployed mode. As shown in the Figure. L1 is the initial length of Base Slide. L2 is the Length of Second Telescopic Slide and L3 is the Length of Third Telescopic Slide. Total Length to be deployed will be calculated based on the input of Proximity Sensor and this can be adjusted within L2 and L3. Speed of deployment for L3 will be much faster than the speed for L2.

The entire assembly [101] is kept in vertical position just above the front and exit doors of the passenger to avoid unnecessary obstruction with other objects or running vehicle on the roads.

The assembly can be installed externally on the existing bus body subject to the availability of head room of bus shelter for clash free operation. Otherwise, this can be installed at the roof of the existing bus. The current design shows that the telescopic assembly is installed externally on the existing wall of the bus, but it can be embedded within the wall structure of the newly built bus to achieve a good aesthetic look.

Figure 6 shows the plan view of the passenger bus at the bus stop to get an idea of the existing gap between the bus and the bus shelter. It also shows Rain Sensor[102], Proximity Sensor[103], Human Detection Sensor [104], CCTV [106], Green / Red Warning Lights [107] and Audio Speaker [108] with the AI Enabled Telescopic Rain Shield in deployed mode at the front and rear doors of the passenger bus. Control Panel [100] will be installed within the bus chamber and Remote Controller [105] will be placed near the main control panel of the bus near the driver. Rain Sensor [102] will be installed at the roof of the bus. It also depicts the protruding length of Deployed Telescopic Rain Shield into the bus shelter to avoid rainwater flashing and dripping during passenger boarding. Proximity Sensors [103] will collect all the data around the bus shelter once

the bus is stopped at the bus stop and send signals to CPU for automatic deployment of telescopic shield. The distance of uncovered existing gap between the bus and the bus stop will be 3 feet to 6 feet and the Telescopic Rain Shield will be designed to fill this gap during rain.

Figure 7 shows the scenic view of AI Enabled Telescopic Rain Shields installed at the bus front and rear doors in initial and deployed mode.

Figure 8 depicts the scenario of a passenger getting wet during rain downpour, due to the uncovered existing gap between the bus and the bus shelter. It also shows the simulation of Raindrops trajectory angle during raining. In general, the trajectory angle can go up to 30 degrees into the bus shelter based on the gravity of rain drops and wind speed.

Figure 9 shows Overall System Diagram of AI enabled Telescopic Rain Shield for automatic mode. This can also be configured for manual mode of operation by removing some of the features of the system.

Figure 10 shows the functional flow diagram of Manual mode.

Figure 11 shows the functional flow diagram of Automatic Operation of AI Enabled Telescopic Rain Shield for Entrance and Exit Doors of Passenger Bus.

Claims:

In this Invention on **AI Enabled Telescopic Rain Shield for Entrance and Exit Doors of Passenger Bus**, Claims are as follows:

1. AI enabled Telescopic Rain Shield for Entrance and Exit Doors of Passenger Bus comprises of Telescopic Rain Shield Assembly with Servo motors, Angular Reduction motors, Double sided Timing Belts, Timing Belt Gears, Timing Belt Clamps, Central Processing Unit, Control Panel including Remote Controllers, Rain Sensor, Human Proximity Sensors, CCTV, Warning Lights and Audio Systems and Power Connections to perform a function to protect bus passengers getting wet from uncovered existing gap between the bus and the roof of bus shelter during rain downpour. It also claims to detect raining, to self-deploying and retracting of telescopic slides at Bus Stops, to detect human movements at the Entrance and Exit Doors of Passenger Bus at bus stops, to detect the distance of uncovered gap between bus and roof of bus shelter, to detect the elevation level of Bus Shelter Roof, to calculate the length to be deployed for telescopic slides during boarding and to retract after alighting of bus commuters automatically.
2. The device as claimed in Claim 1 wherein the mechanism of Telescopic Rain Shield assembly can also be configured and operated with one of the other conventional mechanisms such as Rack and Pinion, Steel Rope, Pneumatic, Hydraulic, Spring and Linear Motors or any other mechanism accordingly, to suit the industrial needs.
3. Claim 1 can be configured with one or multiple Servo Motors to meet the loads and one or multiple Telescopic Slides to meet the required length to fill the uncovered gap between the bus and roof of the bus shelter, and to operate either with AI Enabled mode or manual mode.
4. The device as claimed in Claim 1 wherein the Telescopic Rain Shield assembly can also be installed and operated from the roof of the bus and within the body wall just above the Entrance and Exit Doors of newly built bus. It can also be configured and operated in all other type of vehicles, Boats, Trains and Buildings as a Rain Shield or Sunshade with or without AI assistance.
5. The device as claimed in Claim 1 wherein the telescopic slides will have self-lubricating coating and/or bearings mechanism to reduce friction between telescopic slides, corrugated strips for reinforcement, metallic or non-metallic and anti-corrosion properties.