DEVELOPMENT OF DRAW BRIDGE IN TRAIN FOR PHYSICALLY DISABLED PEOPLE

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Introduction

Considering the elderly, children and the disabled people find it difficult to board and deboard the train with their luggage. In the conventional railway station platforms are in much lower height than the train bogie's stairs [1]. So, we decided to make sliding ramp for train such as low floor trains which can operate automatically, quickly & also it must have high strength capability to withstand on heavy load.

Fig 1: Handicap persons boarding the train

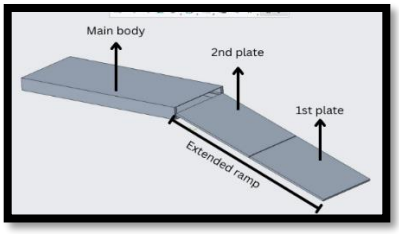
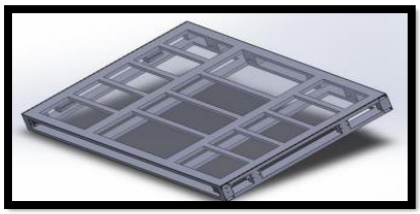
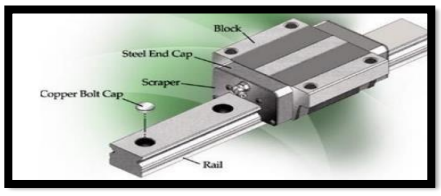
Objectives

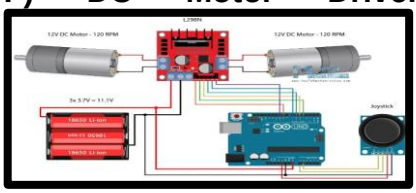
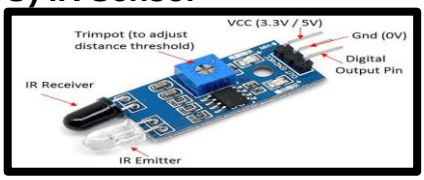
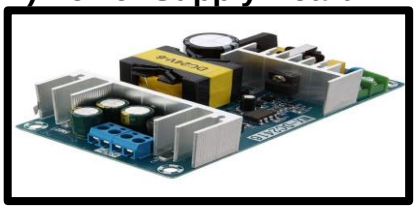
1.To facilitate boarding and deboarding for those with disabilities.
2. To reduce the need for outside assistance while moving a wheelchair Inside the coach.
3. To create a well-thought-out system that includes an aluminum slant sheet that can easily provide a track for wheelchair mobility.
4. To implement rack and pinion technology with IR sensor in an automated ramp system for board and getting off on Indian trains.

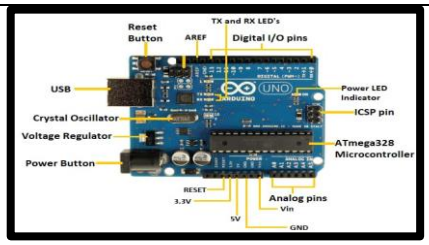
Methodology:

The ramp will be made up of three main structural components and other minor elements for the movement of these structural elements. When the door is open, passengers stand before the IR sensor will be send the signals to Arduino Uno the ramp automatically extend and wait until passengers to board to the train after some time automatically goes to original position. These three components namely main body, second plate & first plate. First plate and second plate are moving components of ramp where they both can slide linearly with in the main body. Both the main plate and second plate consist of rack & pinion mechanism for the movement of the second plate and first plate. Guideways are provided for smooth sliding of the plates. For the second plate motion, the pinion is mounted on the motor which is enclosed by housing attached to the bar inside the main plate which is hinged to second plate. For the sliding of second plate in the main body, the pinion which is coupled with motor is moving and rack is stationary. For the motion of first plate, the motor is fixed at front right end of second plate. The first plate is moving smoothly into the second plate because of the guideways and the first plate has rack attached to it at right end, which is then attached with pinion of motor. So, when the motor starts rotating the pinion which is stationary, the rack will move in linear direction. So, the first plate will start sliding forward. When the door is open, passenger disabled people when enters the train to door then IR Sensor will detect the persons, automatically the ramp will extend and retract. The sensor which is place beside the door. when train will stop then ramp on platform level some time then it will automatically go backward direction. which is place to move the ramp from its retracted position to extended position. Motors which is enclosed in the housing rotate the pinion on the rack to slide the second plate forward. Same will happen with first plate as it will start coming out from the second plate. But the only difference in the mechanism is that for the second plate motion the rack is stationery and motor hub have linear motion and for the first plate motion the motor or pinion is stationery and rack have linear motion. When the both plates are at extended position, they are supposed to be certain angle with the ground. So, for this tilt, hinges are provided on second plate. Now to retract the plate same process will

happen in reverse direction as motor will rotate in reverse direction. Also included IR sensor components

Components used	
 **A) CAD Model**	The first plate of the assembly is installed into the second plate. With linear motion within the second plate, the first plate is also moveable The second plate was installed within the assembly's main body. Within the main body, the second plate is moveable and has linear motion. With the aid of a rack and pinion mechanism housed inside the primary plate, the second plate advances. Here the rack is stationary & pinion is moving.
 **B) Main Body**	The main body means supporting structure of our overall Assembly. The main body does not have any motion in it, it is stationary which is fixed to the lower part of low floor train door. It helps to hold the moving plate of our assembly. Main body consists of rack and pinion mechanism in it. Guideways are also provided in the main plate for smooth linear motion of second plate.
 **C) Rack and Pinion**	A rack & pinion mechanism is a type of linear actuator that consists of a circular gear (the pinion) engaging with a linear gear (the rack), to give linear motion by conversion of rotational motion. Here the rack & pinion mechanism is used for extension & retraction of ramp.
 **D) Guideways**	Linear Guideways are the mechanism which is used for smooth movement of the wheelchair ramp. These are used to slide the first plate inside the second plate & second plate inside main body smoothly.

 **E) Motor**	Motor is generally used to covert electrical energy into mechanical energy. In our project, motor is used to give the rotational motion to the pinion in order to move the plates in forward & backward direction also. Here we used the servomotor for bidirectional motion
F) DC Motor Driver 	A DC motor driver is an amplifier or power module that connects a controller to a DC motor. It converts the controller's step and direction input into currents and voltages that the motor can use. The motor driver is responsible for providing the voltage, current, directionality, and protection needed to operate robotic parts or devices efficiently DC motors are electromechanical devices that rotate a shaft by passing an electric current through them.
G) IR Sensor 	An IR sensor board, or IR sensor module, is a device that detects and processes infrared (IR) signals. It usually contains an IR receiver LED, a signal amplifier, and a demodulator circuit. The IR receiver LED detects IR signals, while the signal amplifier and demodulator circuit amplify and process the signals, respectively.IR sensors are photodiodes that detect infrared light. When infrared light hits the photodiode, the resistances and output voltages change in proportion to the magnitude of the IR light
H) Power Supply Board 	A power supply board is an electrical device that supplies power to connected components. It converts electric current from a source to the correct voltage, current, and frequency to power the load. Power supply boards may have protection against short circuit, over-voltage, over-current, under-voltage, and over-temperature

 **I) Arduino Uno**	The Arduino Uno is a popular microcontroller board based on the ATmega328P chip. It's widely used in hobbyist projects and prototyping due to its simplicity, versatility, and extensive community support. It has 14 digital input/output pins, 6 analog inputs, a USB connection, a power jack, and ICSP header for programming. It's great for beginners and experienced makers alike for creating various electronic projects.

Results and Conclusions

Working Model

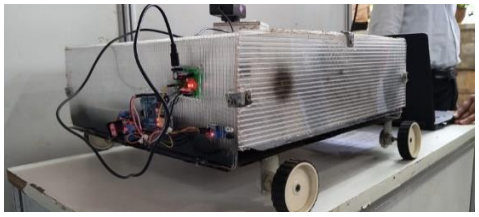


Fig 2: Ramp at rest position (prototype)

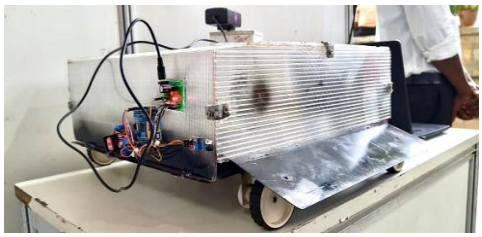


Fig 3: Ramp at extended position (prototype)

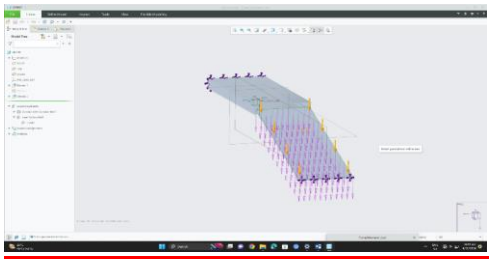


Fig 4: Force and constraints

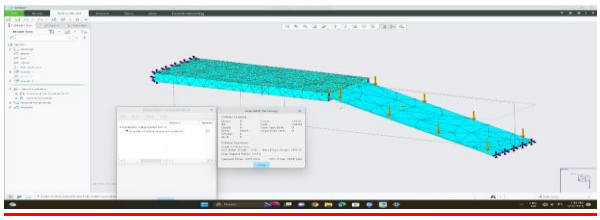


Fig 5: Meshed model

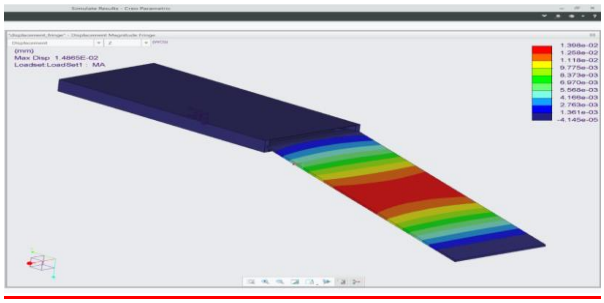


Fig 6: Maximum deformation obtained is 0.014865 mm

Sl. No.	Parameters Considered	Theoretical Results	FEA Results obtained in CREO V6
1	Load Applied	980 N	980 N
2	Total deformation	0.01658 mm	0.014865 mm
3	Maximum principal strain	7.59 × 10-6	5.444e-06 MPa
5	Maximum principal stress	0.52406 MPa	3.811e-01 MPa

Table :1 Comparison of results

The above results show that the maximum deformation is 0.014865 mm, which is very small. So, the design of the system is safe.

Conclusion

The structural analysis of the system is done, and it shows that the design of the ramp is safe and it can take the loads without much deformation. A simple and powerful ramp system is designed and the objectives of the work are realized. There is no complex mechanism to maintain a slant angle which is ensuring adequate ergonomics and comfort. Industrial application of rack and pinion is used to automate the system. By this work, we can ensure the easy movement of wheel chair into the train for differently abled

What is the innovation in the project

This Innovation to help disabled people, elderly people and children to easily board and deboard in to the train bogie

Scope for future work (about 20 lines).

• Design the automatically operated drawbridge door, that would open like a ramp on stations and make travel by train easier for the elderly & physically disabled people.

• Prioritize passenger safety by implementing features such as non-slip surfaces, handrails, reducing the risk of accidents or injuries during the boarding & deboarding process.

• The present developed project will be discussed with Indian railways to implement practically this concept in Indian railway.

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