Introduction:

Indian Railway (IR) being the eighth largest organization in the world with more than 1.4 million plus employees. It has a total track length of around 67,368 kilometers making it one of the longest in the world. The recent figures also show that by the end of the financial year 2017-18 IR had carried about 8.26 billion passengers and transported about 1.16 billion tons of freight. Being such a huge organization make life very much difficult for the employees to maintain a hygiene environment at railway stations and tracks. Many necessary steps have been made to tackle such problems and awareness camps are being made at various places. In addition to it, the railways have installed various track cleaning machines located at different places. They are huge and would require an entire line to be cleared for them to proceed with their cleaning actions, which is a hectic process. The main disadvantage was that it was impossible to use it very frequently as it had to follow a very tight schedule. Considering all such factors we have come up with an idea to design a working prototype that could be mounted to the underside of the wagon/coach which would perform the same action of cleaning without hustling of a railway line and other factors. Keeping this a base, we have gone through various research papers on autonomous track cleaning machines which were built and used from the early 1980s. Drawing inspirations from each of them, we have designed a system that can be mounted to the underside of the coach/wagon in a neat manner without disturbing the existing nearby equipment. A collector tank of decent size with the suction system mounted to it is placed ahead of the bogie where the pollutants will be stored. The dust on the track will be picked up with the help of a rotating cylindrical brush. The brush will be covered up appropriately to aid the dust to circulate within a closed environment. The entire system will be powered up two 12V 35AH batteries.

Objectives:

Considering the necessity of a clean and healthy environment, we intend to maintain a hygienic environment on a railway track. Indian railways being one of the largest rail networks in the world is taking serious steps to maintain a hygienic environment. There are existing railway track cleaning machines which require a periodic time allotment of a line to perform the cleaning action. The scope of the project is to design and fabricate a machine with similar moto but on a miniature scale. The machine will be directly mounted to the railway coach or wagon. A rotating cylindrical brush is lowered in order to make contact with the ground which helps to pull out the pollutants from the track. A blower fan is placed beside the brush to suck in the dirt into the collector tank. The dirt collected is compressed into cakes and disposed of periodically.
Methodology:-

Initially, the cad drawings of the coaches and wagons were collected and analyzed to place our system without the need for any alterations on the existing equipment. Then a chassis was built according to the dimensions of the underside of the coach, with tires mounted to it. A wooden plank was placed on top of the chassis to provide a flat surface. A collecting tank was made from sheet metal of thickness 2mm. All the mounting points were marked earlier and the entry and exit points were fabricated. A metal paste along with silicone adhesives was used to seal off the complete tank. The cylindrical brush was fabricated by placing a metal disc of 200mm diameter at 350mm apart. The brush was mounted on the rods connecting the two discs. The brushes are placed at 45° to the connecting rods. A 24V DC motor was placed above the cylindrical brush to reduce the vibrations during the rotation. This also helps to easily check the efficiency of the brush at various speeds. To balance the forces the batteries and the motor are placed on either end of the chassis. The collector tank is placed at the rear end as a counterweight to the cylindrical brush. A suction unit is placed above the tank and the particles raised from the brush is sucked into the tank. The impeller fan and the tank are separated by a metallic mesh to prevent dust particles damaging the impeller blades.

Fig-1 : Railway Track Cleaning Machine
Results and Conclusions:-

On a fine path surface, the amount of dust collected is less because of the slippage of the brush. On a medium rough and fully rough surface which are the similar conditions to that of a railway track, the efficiency of the brush is much higher. The brush helps to pull out the dirt from the deeper parts of the rough surface. Since the brush is in continuous contact with the ground, it helps to pickup dust to the maximum extent. The hood also helps to contain that dust, which makes it easier for the suction. The motor placed over the tank helps to create suction easily and also occupy less space.

Scope of development:-

Use of CVT (Controlled Variable Transmission) to regulate the speed of the brush. A direction sensor can be used to detect the direction of motion of the train and change the rotation of brush accordingly. A pneumatic system can be inducted to lift the brush at greater speeds. The brush can be placed to clean the space outside the track. An AC motor can be used with inverter circuit for much better suction. An electromechanical actuator can be used to retract the brush whilst the train is moving at much higher speeds.