Design and fabrication of automatic scrap collecting vehicle

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Abstract. The main objective of this paper is eliminating the need to manually collecting the scrap in small scale industries. For the purpose, we are designing automatic scrap collecting vehicles running automatically. In the available methods of scrap collecting manpower, fuel power vehicle is used. By the end of 2020, fuel deposits in the world completely depleted. To avoid this type of problem and reduce manpower requirement we need another type of automation is called battery operated automatic scrap collecting vehicle. The rechargeable battery is supplying power to the automatic scrap collecting. The vehicle is having the A.C Blower which is used to collect the scrap automatically.

Keywords: Vehicle, A.C Blower, Rechargeable Battery, Manpower

1. Introduction
The machine is fitted with an FM remote control system, a motor driving mechanism and a battery. Power stored in the battery is used to drive the DC motor that allows the vehicle to move. Current vehicles, pallet trucks, trolleys use petrol or diesel as fuel for running and we use manpower to operate them. DC motors are an important machine in many control systems, such as domestic electrical systems, vehicles, trains and process control, and it is well recognized that the mathematical model is key to the design of the control system. [1]
An effort is made to co-relate the bending stresses and displacement of the spur gear tooth obtained analytically as well as by FEM. Recent advances in the field of mechanical engineering are requiring improved gear teeth in terms of loading power and the speed at which they can work. Static and dynamic study of the spur gear tooth helps to assess the maximum displacement, the maximum induced stress and the impact of time-related stress variation. The loading capacity and operating speed of the geared system can be achieved by reducing the maximum induced stress. [2]
Lead batteries are well known for both automotive and industrial applications and have been widely used for energy storage. Lead batteries are capable of long life cycles and calendar lives and have been designed in recent years to have a much longer life cycle compared to 20 years ago in scenarios where the battery is not regularly returned to a fully charged condition [3].
The general characteristics of the lead-acid batteries with two charging methods are utilized. The power source allows the amount of the battery voltage and the energy of the battery to be set. Intelligent Power Source uses a joint method and warning that indicates various
circumstances in the charging process. Another type of charging discussed in the paper is the use of a balanced power source at a constant voltage [4]. Battery charging is an element of the engineering technology in which the rectified filtered output of the transformer is fed to the battery to recover it to its fully charged state [5]. The battery charger is used to concentrate energy in a secondary cell by driving an electrical current through it [6]. An powerful battery charger requires a charge controller whose main role is to keep the batteries properly charged and secure for the long term and prevent them from being discharged deeply [7]. There are several models for DC motors that reflect machine behavior with good accuracy. The parameters of the model are also important, however, since the mathematical model cannot provide correct behavior without correct parameters in the model [8].

These types of vehicles use a liter of fuel for an hour. To solve this, we built a vehicle that is powered by a storage battery. Power stored in the battery is used to drive the DC motor that allows the vehicle to move [9]. The speed of the Dc motor rotated by the microprocessor controller is the velocity of the vehicle. The installed battery on the vehicle is easy to repair and can be removed and used for battery charging when the car is underneath the roof. The vehicle has an A.C blower that extracts the vacuum force from the waste [10]. It is a time of automation, when manual work in all degrees of automation is typically called mechanical power replacement. Function remains a key element of the device, while physical input needs to be modified with increased levels of process.

The main objective is to minimize human work and complete automation in that way, in order to increase the precision of the work with the automatically controlled handle. And for providing more space for full storage in the container. So that can increase the overall efficiency of the vehicle. The main objective is to improve the model, as per the requirement of the companies. And then we are looking forward, to apply the changes in the model. Develop it with the help of industries and then making it more user-friendly.

2. Components and Description

The motor D.C is 12V (volt) and the motor D.C (watt), 90W (watt) and operates at 60rpm. The battery used in this case is a 12V D.C and 40 A Hours output Acid-free Maintenance Battery. The material used for the bearing is a steel of size 20×45×12 mm. The blower works 12V D.C and 90 watts at 6000 rpm volts. The unit is 50.5 x 50.5 x 12 mm and 21 gm in size and weight. It uses IC at mega 644 PA piezo buzzer and 4, 8-6,0V input voltage. The Izod impact value should be at least 4.1 kg/m, Brinell Hardness (HB) should be 229. The term ‘mild steel’ is often used widely for carbon steels not protected by the standard requirements. The carbon content of this steel may range from relatively low levels to approximately 0.3 per cent. Commercial ‘mild steel’ can usually be considered to be easily welded able and to have fair cold bending properties, but defining ‘mild steel’ is technically insufficient and should not be used as a concept in engineering. Mild steel is the most widely used steel that is not brittle and cheap in price. Mild steel is not easily polished or hardened, but possesses enough strength.

2.1 Frame

The frame made of a mild steel material. All pieces are placed on this frame structure with an acceptable arrangement. Boring of bearing sizes and open bores was performed in one sitting so that the bearings would be correctly balanced when assembling. Provisions shall be made to coat the bearings with grease.

2.2 Bearing

The bearings are pressed easily to fit into the shafts, as cracks may form as the bearing is hammered. The bearing is made of steel and the bearing cap is of mild steel. Ball and roller bearings are commonly used in equipment and devices to reduce friction and power loss. This technology has only been brought to its present state of maturity after a long time of research and development. The advantages of such advanced study can be extracted where a generic bearing of the appropriate size and form can be used. Such bearings cannot, nevertheless, be used indiscriminately without close analysis of loads and working conditions. In addition, it must be carrying
2.3 Battery
In science and technology, the battery is a device that stores chemical energy and makes it usable in an electrical form. It consists of one or more voltaic cells, each of which consists of two half cells bound in series by conductive electrolyte. Batteries seem to be the only technically and economically available storage means. Since both the photo-voltaic system and batteries are high in capital costs. Where high values of load current are necessary, the lead-acid cell is the type most commonly used. The electrolyte is a dilute solution of sulfuric acid (H₂SO₄). In the application of battery power to start the engine in an automobile, for example, the load current to the starter the motor is typically 200 to 400A. One cell has a nominal output of 2.1V, but lead-acid cells are often used in a series combination of three for a 6-V battery and six for a 12-V battery. The lead-acid cell type is a secondary cell or storage cell, which can be recharged. The charge and discharge cycle can be repeated many times to restore the output voltage, as long as the cell is in good physical condition. However, heat with excessive charge and discharge currents shortens the useful life to about 3 to 5 years for an automobile battery.

2.4 DC motor
An electric motor is a mechanism that transforms electrical energy to mechanical energy. Its function is based on the principle that when a current-carrying conductor is put in a magnetic field, it encounters a magnetic force whose orientation is determined by Fleming’s left-hand law. When a motor is in operation, it increases the torque. This torque could generate a mechanical rotation. DC motors are also generators known as shunt-wound or series wound or composite wound motors.
The basic motor has 6 parts, the armature or the rotor, the lever, the brushes, the axle, the field magnet. The electric motor is all about magnets and magnets: the engine uses magnets to generate motion. If you have ever worked with magnets, you know the universal law of all magnets. Opposites bind and tend to repel. So if you have two bar magnets with their ends numbered north and south, then the north end of one magnet will repel the south end of the other. In the other side, the north end of one magnet will repel the north end of the other magnet (and thus the south end will repel the south). Within the electric motor, these attracting and repulsing forces generate rotational motion.

2.5 Control Unit
The Electronic Control Unit is the generic term used in automotive electronics for any embedded system operating one or more of a motor vehicle’s electric systems or subsystems. Types of ECU include Electronic/Engine Control Module (ECM), Power train Control Module (PCM), Transmission Control Module (TCM), Brake Control Module (BCM or EBCM), Central Control Module (CCM), Central Timing Module (CTM), General Electronic Module (GEM), Body Control Module (BCM), Suspension Control Module (SCM), control unit, or control module Taken together, these devices are often referred to as the car computer. Technically, there are no single computers, but numerous ones. Often a single assembly contains multiple control modules. Some new motor vehicles have a capacity of ECU 80. Embedded software in ECUs continues to increase line count, complexity and sophistication.

2.6 Blower
A centrifugal blower that works at a speed of 600 rpm is the blower used here. We can get a 12 V DC output from the blower. It has a capability of 90 W.

2.7 Gear Drive Wheel
Four wheels are used; two are made of nylon with a diameter of 100 mm. And the other two are made of rubber with a diameter of 147 mm. Nylon wheels are front wheels, and the other two are known as rear wheels. The gear wheel is used to drive the rotor of the automated scrap collecting vehicle.
3. Results and Discussion

The product design included a chassis, DC generator, battery, blower, spur gear and control panel. The DC motor is mounted to the rear shaft of the scrap collecting vehicle for the straight line movement push. The DC motor receives the battery power. The power stored in the battery helps to drive the DC motor allowing the vehicle to travel. We use the fuel for running the existing vehicles, pallet trucks, trolley and petrol or diesel.

This type of vehicle is use a liter of fuel for one hour. To overcome this, we built a vehicle that was powered by a storage battery. The power stored in the battery is used to drive the DC motor that allows the vehicle to move. The speed of rotation of the DC motor, i.e. the velocity of the vehicle, is controlled by the controller of the microprocessor. The battery mounted on the vehicle is easily accessible and portable, used to charge the battery when the car is under the roof. The vehicle has an A.C blower that is used to extract the scrap in the vacuum machine is shown in figure 1.

When the DC motor is ON, vehicles collecting scrap are pushed to collect scrap. The control unit is used mainly to control the process mentioned above.

![Figure 1 Product design in 2D drawing](image1)

![Figure 2 Finished Product](image2)

The components used in the Automated Scrap Collecting Project Vehicles are as shown in fig 2. An automatic system is assembled to extract waste or small metal objects. This decreases human efforts and risks and increases quality of work and time usage. The battery is the source
of the electricity. It is pollution-free and works at a low cost. It assumes the direction automatically. It can also be used indoors, and the battery can also be replaced. It can be found both in domestic and commercial applications. It refers to open fieldwork.

For the development and perfecting of advanced computer programming, editing techniques, software diagnostics and the complex sharing of knowledge on different levels of hierarchy, a large, multi-disciplinary team with a good technical base is required. This project work has provided us with an excellent opportunity and experience to use our limited skills. We have acquired a lot of practical knowledge about organizing, purchasing, assembling and machining while working on this project.

We are proud to have successfully completed the work for a short period. The "automatic scrap vehicle" works on an optimal basis. The problems with maintaining tolerances and consistency are understandable as well. We have done our utmost to use the equipment we have at our disposal. Finally In this paper, therefore, I built an "automatic scrap vehicle." They can be updated and improved based on the applications by using additional techniques.

4. Conclusion

To reduce manpower requirements we need another type of automation is called battery operated automatic scrap collecting vehicle. In this vehicle, we used a rechargeable battery for supplying power to the automatic scrap collecting. The vehicle which we designed, it has the A.C blower is used to collect the scrap automatically. We can redesign this scrap collecting vehicle for the different kinds of attachment. Like the separate compartment for the different scrap vehicle for example plastic and different types of metal. We can also use the hydraulic mechanism for the compacting of scrap inside the bin. We can use the heavy-duty hydraulic system for the reduction of fuel consumption in the operation of the mechanism.

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