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Automated Guided Vehicle for Efficient Transportation

Thana Lakshmi.D.[1], E.Velvizhi[2], S.SivaRanjani[3], T.Tamilarasi[4], V.Vanitha[5], S.Narendran[6]

U.G.Scholars, Department of ECE, Francis Xavier Engineering College, Tirunelveli[1,2,3,4,5]

Assistant Professor, Department of ECE, Francis Xavier Engineering College, Tirunelveli [6]

***Abstract*— In our project we are eliminating the need of conveyers, pallet trolley, etc to handle material transfer in heavy industries. For purpose we are designing automated guided vehicle controlled by microprocessor controller. In the available methods of material handling manpower, fuel power is used. By the end of 2020, fuel deposit in the world completely depleted. To avoid this type of problems and reduce manpower requirement we need other type of automation is called automated guided Vehicle. The microcontroller is used to control the vehicle path automatically. The rechargeable battery is supplying power to the automated guided vehicle.**

Index Terms—Conveyors, AGV, Microcontroller

I. Introduction

The existing AGVs, pallet trucks, trolley use petrol or diesel as fuel for running and for operating them we use the manpower. These types of vehicles consume liter of fuel for a period of one hour. For overcoming this we designed AGV which is drawn power from the storage battery. The power stored in the battery is used to drive the DC motor that causes the movement to AGV. The speed of rotation of DC motor i.e., velocity of AGV is controlled by the microprocessor controller.

Battery assembled on the AGV is easily replaceable and detachable, used for charging the battery, while the AGV is under roof. Path programmed for the AGV in a micro controller chip can be altered when required.

Components of AGV include

(1) Battery
(2) D.C. motor
(3) Trough
(4) L-angle frame
(5) Gear drive
(6) Wheel
(7) Microcontroller

A. BATTERY UNIT:

In isolated systems away from the grid, batteries are used for storage of excess solar energy converted into electrical energy. The only exceptions are isolated sunshine load such as irrigation pumps or drinking water supplies for storage. In fact for small units with output less than one kilowatt. 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. It is necessary that the overall system be optimized with respect to available energy and local demand pattern. To be economically attractive the storage of solar electricity requires a battery with a particular combination of properties:

(1) Low cost
(2) Long life
(3) High reliability
(4) High overall efficiency
(5) Low discharge
(6) Minimum maintenance
  (A) Ampere hour efficiency
  (B) Watt hour efficiency

We use lead acid battery for storing the electrical energy from the solar panel for lighting the street and so about the lead acid cells are explained below.

Battery is the heart of the electrical systems in a AGV. The battery supplies the essential current. It is an electrical device used for storing energy in chemical form, which can be released as electricity as and when required. The battery supplies the current for starting the motor and the driving motor.

B. Battery rating:

The fully charged battery is maintained at room temperature and the discharge is adjusted at the rate of 5% of the specified ampere-hours capacity. The battery discharge at a rate of 7.5 Amps it will withstand 20 hours.

C. Battery capacity:

The capacity of the battery is defined as the amount of current depends upon number of plates, area of the plates, and quantity of the electrolyte, temperature. 6 Volts battery requires 15, 17, 19, 21 plates per cell.

D. Battery life:

Battery life is defined as the time for which it can serve without any damage. Overcharging caused by the overheating and the excessive gas bubbling reduces the battery life. The battery life greatly depends on materials workmanship and maintenance.

E. Lead acid battery:

The positive and negative electrodes of a lead acid battery are immersed in dilute sulfuric acid. When the battery

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is fully charged, there is lead peroxide on the positive plate and the negative plate as the active materials.

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 (H_2SO_4). In the application of battery power to start the engine in an auto mobile, for example, the load current to the starter 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 shortends the useful life to about 3 to 5 years for an automobile battery. Of the different types of secondary cells, the lead-acid type has the highest output voltage, which allows fewer cells for a specified battery voltage.

II. PROPOSED SYSTEM

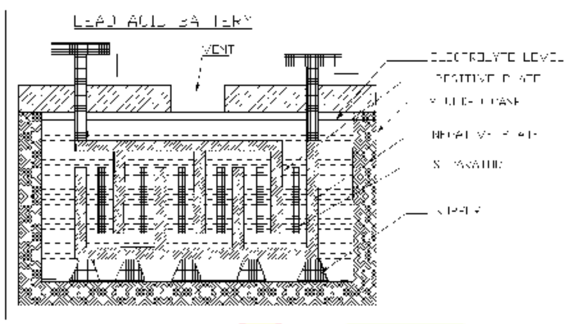

Fig.1. BLOCK DIAGRAM OF PROPOSED SYSTEM

Sulfuric acid is a combination of hydrogen and sulfate ions. When the cell discharges, lead peroxide from the positive electrode combines with hydrogen ions to form water and with sulfate ions to form lead sulfate. Combining lead on the negative plate with sulfate ions also produces he sulfate. There fore, the net result of discharge is to produce more water, which dilutes the electrolyte, and to form lead sulfate on the plates.

As the discharge continues, the sulfate fills the pores of the grids, retarding circulation of acid in the active material. Lead sulfate is the powder often seen on the outside terminals of old batteries. When the combination of weak electrolyte and sulfating on the plate lowers the output of the battery, charging is necessary.

On charge, the external D.C. source reverses the current in the battery. The reversed direction of ions flows in the electrolyte result in a reversal of the chemical reactions. Now the lead sulfates on the positive plate reactive with the water and sulfate ions to produce lead peroxide and sulfuric acid. This action re-forms the positive plates and makes the electrolyte stronger by adding sulfuric acid.

III. SYSTEM DESIGN

To understand how an electric motor works, the key is to understand how the electromagnet works. An electromagnet is the basis of an electric motor. You can understand how things work in the motor by imagining the following scenario.

Say that you created a simple electromagnet by wrapping 100 loops of wire around a nail and connecting it to a battery. The nail would become a magnet and have a North and South pole while the battery is connected.

Now say that you take your nail electromagnet, run an axle through the middle of it, and you suspended it in the middle of a horseshoe magnet as shown in the figure below. If you were to attach a battery to the electromagnet so that the North end of the nail appeared as shown, the basic law of magnetism tells you what would happen: The North end of the electromagnet would be repelled from the north end of the horseshoe magnet and attracted to the south end of the horseshoe magnet. The South end of the electromagnet would be repelled in a similar way. The nail would move about half a turn and then stop in the position shown.

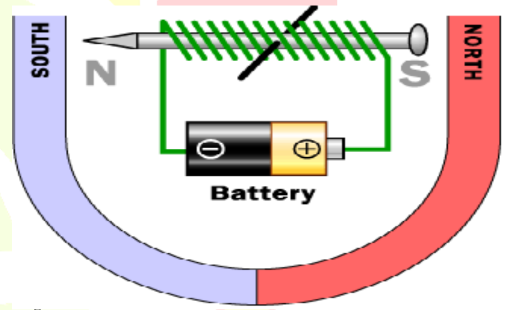

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Fig.2. Electromagnets and motors

You can see that this half-turn of motion is simple and obvious because of the way magnets naturally attract and repel one another. The key to an electric motor is to then go one step further so that, at the moment that this half-turn of motion completes, the field of the electromagnet flips. The flip causes the electromagnet to complete another half-turn of motion.

You flip the magnetic field simply by changing the direction of the electrons flowing in the wire (you do that by flipping the battery over). If the field of the electromagnet flipped at just the right moment at the end of each half-turn of motion, the electric motor would spin freely.

The armature takes the place of the nail in an electric motor. The armature is an electromagnet made by coiling thin wire around two or more poles of a metal core. The armature has an axle, and the commutator is attached to the axle. In the diagram above you can see three different views of the same armature: front, side and end-on. In the end-on view the winding is eliminated to make the commutator more obvious. You can see that the commutator is simply a pair of plates attached to the axle. These plates provide the two connections for the coil of the electromagnet.

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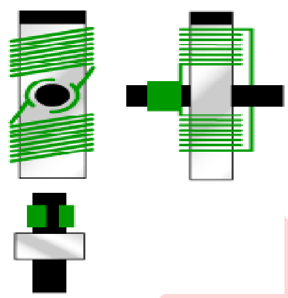

Fig.3. Armature

The "flipping the electric field" part of an electric motor is accomplished by two parts: the **commutator** and the **brushes**. The diagram at the right shows how the commutator and brushes work together to let current flow to the electromagnet, and also to flip the direction that the electrons are flowing at just the right moment. The contacts of the commutator are attached to the axle of the electromagnet, so they spin with the magnet. The brushes are just two pieces of springy metal or carbon that make contact with the contacts of the commutator.

When you put all of these parts together, what you have is a complete electric motor:

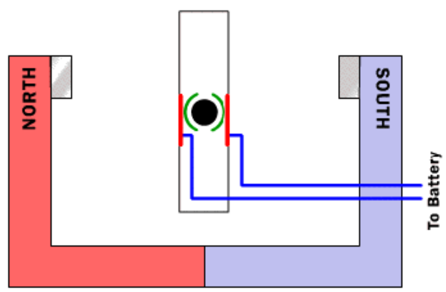

Fig.4.Electric motor

In this figure, the armature winding has been left out so that it is easier to see the commutator in action. The key thing to notice is that as the armature passes through the horizontal position, the poles of the electromagnet flip. Because of the flip, the North pole of the electromagnet is always above the axle so it can repel the field magnet's North pole and attract the field magnet's South pole. If you ever take apart an electric motor you will find that it contains the same pieces described above: two small permanent magnets, a commutator, two brushes and an electromagnet made by winding wire around a piece of metal. Almost always, however, the rotor will have three poles rather than the two poles as shown in this article. There are two good reasons for a motor to have three poles:

It causes the motor to have better dynamics. In a two-pole motor, if the electromagnet is at the balance point, perfectly horizontal between the two poles of the field magnet when the motor starts; you can imagine the armature getting "stuck" there. That never happens in a three-pole motor.

Each time the commutator hits the point where it flips the field in a two-pole motor, the commutator shorts out the battery (directly connects the positive and negative terminals) for a moment. This shorting wastes energy and drains the battery needlessly. A three-pole motor solves this problem as well.

It is possible to have any number of poles, depending on the size of the motor and the specific application it is being used in.

A. TROUGH :

This is the part where the materials to be handled are stored in. It is made of plastic. A material does not get affected or the handling of materials is easy by this specific equipment.

B. L –ANGLE FRAME:

The frame is constructed in mild steel. The frame shape is as like a letter “L”, so that is called L-angle frame.

C. GEAR WHEEL:

The gear wheel is used to drive the wheel movement of Automated Guided Vehicle (AGV). It is made up of cast iron.

D. WHEELS :

Four wheels are used, two are made of nylon having 100 mm diameter. And other two are made of rubber having 147 mm diameter. Nylon wheels are front wheels and other two are used as rear wheels.

E. PIC 16F84 EEPROM 8-BIT MICROCONTROLLER

- 1000 erase/write cycles Enhanced Flash program memory
- 1,000,000 typical erase/write cycles EEPROM data memory
- EEPROM Data Retention > 40 years
- In-Circuit Serial Programming (ICSP™) - via two pins
- Power-on Reset (POR), Power-up Timer (PWRT), Oscillator Start-up Timer (OST)
- Watchdog Timer (WDT) with its own on-chip RC oscillator for reliable operation
- Code-protection
- Power saving SLEEP mode
- Selectable oscillator options
- Low-power, high-speed technology
- Fully static design
- Wide operating voltage range:

- Commercial: 2.0V to 5.5V
- Industrial: 2.0V to 5.5V

- Low power consumption:

- < 2 mA typical @ 5V, 4 MHz
- 15mA typical @ 2V, 32 kHz
- < 0.5 mA typical standby current @ 2V

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Only 35 single word instructions to learn
All instructions single cycle except for program branches which are two-cycle
Operating speed: DC - 20 MHz clock input DC - 200 ns instruction cycle
1024 words of program memory
68 bytes of data RAM
64 bytes of data EEPROM
14-bit wide instruction words
8-bit wide data bytes
15 special function hardware registers
Eight-level deep hardware stack
Direct, indirect and relative addressing modes
Four interrupt sources:

- External RB0/INT pin
- TMR0 timer overflow
- PORTB<7:4> interrupt on change
- Data EEPROM write complete

IV.FABRICATION

All the materials & components for our project are bought from the respective markets. Mild steel l-angles, sheet metals, bearings, d.c motor, trough, battery, nylon & rubber wheels, cast iron gear, mild steel shafts.

L-angle are cut into required number of pieces as per the dimension and welded together 7 the sheet metal is welded over it to form the base of the AGV. Wheels are joined to the AGV by using suitable methods.

Battery and d.c motor are fixed with the base of the AGV by using the bolts and nuts. Gears are mounted on the output shafts of the d.c motor & they are coupled with the gears that are mounted on the shafts of the front & rear wheels respectively. Trough is also placed on the base of the AGV by using nut & bolt arrangement.

V. CONCLUSION

In our project we are eliminating the need of conveyers, pallet trolley, etc to handle material transfer in heavy industries. For purpose we are designing automated guided vehicle controlled by microprocessor controller. In the available methods of material handling manpower, fuel power is used. By the end of 2020, fuel deposit in the world completely depleted. To avoid this type of problems and reduce manpower requirement we need other type of automation is called automated guided Vehicle. The microcontroller is used to control the vehicle path automatically. The rechargeable battery is supplying power to the automated guided vehicle.

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