International Journal of Research in Engineering, Science and Management
Volume-2, Issue-3, March-2019
www.ijresm.com | ISSN (Online): 2581-5792

Super Capacitor for Modern Metro's

Ajay M. Mendhe[1], Mitali Saratkar[2], Dipali Chourasiya[3], Pranali Kawle[4], Ajinkya Junghare[5], Arvind Amrute[6], Vipin Titarmare[7]

[1]*Professor & HoD, Dept. of Electrical Engineering, Priyadarshini J. L. College of Engineering, Nagpur, India*

[2,3,4,5,6,7]*Designation, Dept. of Electrical Engineering, Priyadarshini J. L. College of Engineering, Nagpur, India*

***Abstract*: These days on earth the electric power generation by using natural resources and fuels such as coal, water, wind, Solar energy, nuclear, diesel, etc. is increases rapidly with the increase in population and demands of consumers, which leads to more consumption of natural resources which could result in depletion of this same in future. So we need to conserve these resources to continue the demand and supply of electric power and Consumers which could be done by reducing the consumption of electric power or by optimum use of electric power. Energy consumption can be controlled by controlling the consumption of electric power by the appliances in homes, Industries, commercial shops, public transportation i.e. metro train, trains etc. Power consumption in Metro Train can be specifically control by running the metro train on a super-capacitor instead of battery or AC supply through overhead conductor. The removal or reduction in use of overhead conductors reduces the initial cost of the setup as well as the maintenance cost which automatically reduces the running cost. The super capacitor has a nature to charge quickly and discharge very slowly, so it can operate for a longer duration, as the distance between two metro station is much less i.e. between 1.5 km to 2.8 km and average speed of metro train is between 50 to 80 km per hour, so the time required for the metro train to cover this distance is very less and hence the super capacitor operating in this condition can be very efficient. So using the super capacitor in such applications can bring the drastic change in energy and money conservation.**

***Keywords*: super capacitor**

1. Introduction

In past few years the use of public transportation has increased due to the increase in mobility of peoples in urban areas, as the metro train is the best option to travel in urban areas for The either short or long of distance, metro is the best way to have a comfortable and safe journey for less or even more number of peoples. This makes metro train an important and inevitable part of public transportation. So the energy conservation in metro train is necessary which could help in energy conservation as well as money conservation. As a metro train running on overhead conductors consists of the conductor cost, maintenance of conductor which includes maintenance cost also increases, running cost also increase due to it. The supply through the overhead conductors may get disconnected in a faulty condition which could result in a stopping of train in middle of the somewhere or anywhere, so replacing the supply through conductors i.e. removing the overhead conductors and placing the super capacitor on metro train itself, helps in continuous running of the train as well as helps in reducing the maintenance, initial and running cost of the metro train, as the super-capacitor has the ability to charge rapidly and discharge very slowly, so covering the distance between the two metro station for a metro train running on super-capacitor is efficient, economical and to be the best option today and future also. Here the metro train running on super-capacitor has the function to detect any object i.e. obstacle while running as well as to detect the station. The station consists of an overhead line through which supply to the train is given, through which the super-capacitor bank get charged and as the train reaches the station the door of the train get opened, the passenger leaving the train gets out and the passengers to continue or start their journey from that station gets in the train and the door shuts after some interval of time, till the door is open and get closed, the train get charged in that interval of time through the pantograph located at the top of the train which raises to collect the supply and lower when done and the metro train can now continue the journey to the next station. In order to save more money the railway track are replaced with the concept of line follower which could help in reduction in the cost of the track and saving the resources such as iron, wood, fibers, etc. required to make the tracks.

2. Construction & working

As the project is based on the metro train, its construction must be very specific and clean. So the project consists of a bot running on wheels through the geared DC motor running in both clock and anticlockwise direction. The bot runs on line follower concept instead of track, the line follower concept requires IR sensor which detect and senses the line for proper and aligned run of it. 2 ultrasonic sensors one at the front of the train and the second at side of a train at placed, the first sensor detects the obstacles and the stop the train if any obstacle is sensed and the second sensors detect the station when it arrives the stopping of train is done through stopping of geared motors by simply cutting down the supply. Pantograph is placed at the top of the train which is raised and lowered by a servo motors, the pantograph is used to collect the supply through the overhead lines situated at the station. LCD displays the distance between the train and the object and between the train and the station.

A. Component

1) Motor driver IC

Fig. 1. Motor driver IC

- It is an IC which is used to control the operation of the motor. It acts as a communication system in between the µc and the motor.
- The IC receives the signal from µp and transmits the signals to the motor.
- The IC used here is L293D motor driver IC.
- The motor driver IC used here is L293D.
- L293D is a 16 pin IC with 8 pins on both side in which 4 ground pins, 4 input, 4 output, 2 enable & 2 voltage pins are there.
- It consists of 2 H Bridge configuration which is a simplest circuit to control a low current rating motor.
- It uses 2 H Bridge configuration to do so.
- It can drive the small and quite big motors also.

2) Display

Fig. 2. Display

- LCD display mentions or shows the current conditions or situations of the metro and modes of the operation of the Motors i.e. direction of rotation of motor, Running-F, turning, i.e. left turn (L), right turn (R), etc.
- Also show the distance between metro and obstacles if any occurs and the distance between the metro and station when coming nearby.

3) Controller

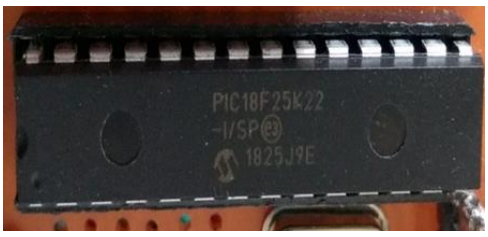

Fig. 3. Controller

- A µc is a small programmable controller. It is same as a single chip computer and they are in embedded in other system to act as a processing or controlling the unit.
- The µc performs decoding and other controlling functions when used in remote control which we are using.
- The µc is also used in automobile, washing machines, microwaves ovens, etc. where the automation is needed.
- Microcontroller is a small computer on single integrated circuit.
- Here PIC (Peripheral Interface Controller) µc is used
- The PIC 18F25K22 is used here.
- It is a 28 pin IC with 3 input-output ports, 3 power pins, master-clear or reset pin. It works on 3.3V to 5V.

4) Super-capacitor

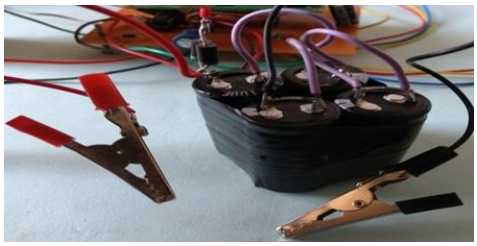

Fig. 4. Super capacitor

- 4 super-capacitors of 100 Farad 2.7 volt 10 ampere are connected in series with each other called as super-capacitor bank.
- It is charged through a 12 V DC supply.
- Super-capacitor is an electrochemical capacitor that has higher energy density as compared to the other capacitor.
- It has very high rates of rate of charge and discharge i.e. it charges quickly and discharges very slowly.
- It also has high cycle efficiency.

5) Ultrasonic sensors

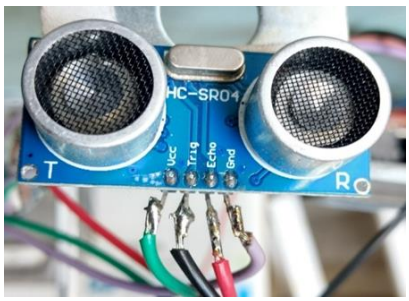

Fig. 5. Ultrasonic sensors

- Sensor is an electronic instrument consisting of a transmitter and a receiver, used to sense or detect any object according to the applications.
- Here 2 ultrasonic sensors are used.

- First sensor is used to sense the distance between station and the metro so the train could slow down before the station comes and stop at the station.
- Second one is used to sense the distance between the obstacles and the metro if any found on the route of the metro.
- The Ultrasonic sensor consist of 4 terminals i.e. Vcc, Trig, Echo, Gnd.
- When the Trig terminal is high, sensors is transmitting the signal and when the sensor starts receiving the signal the Echo terminal is high.

6) Infra-red sensors

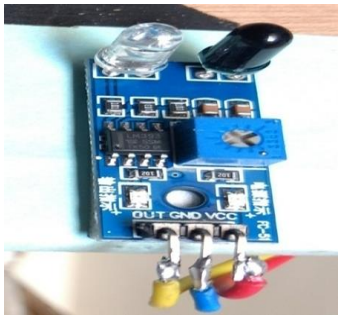

Fig. 6. Infra-red sensors

- The Infra-red sensor is an electronic instrument which is used to sense the surrounding objects.
- It is done by the emitting or detecting the IR radiation.
- Here 2 IR sensors are used on which the liner follower concept is used and operated.
- The Infra-red sensors consist of 2 led lights which radiates and absorbs the signals.
- It consists of 3 terminals i.e. V_{cc}, Ground and Output.
- It helps the metro to run properly on the line.

7) Objectives

- The main objective is to give a better alternative for the overhead conductor to be used in a metro train which can be fulfilled by using the super-capacitor.
- Using the super-capacitor can help in reducing the running & maintenance cost, maintenance work, need of conductor material.
- Using super-capacitor also helps in reducing the consumption of natural resources required to generate electrical energy.

8) Merits

- Requires less maintenance.
- Overhead lines are avoided.
- Many electric components are also eliminated.

9) Demerits

- As the components required are more, so the system is bulky.
- As system is bulky, so space required is more.

3. Conclusion

This paper presented the implementation of super capacitor for modern metro's.

References

[1] Howlett P.G. "Optimal strategies for the control of train", Automatica, 32, 519-532, 1996.
[2] Liu. R., Golovitcher "Energy efficient operation of rail vehicles" Transportation Research Part A, 2003.
[3] Kotz, R. and M. Carlen (2000). "Principle and application of electrochemical capacitors." Electrochimica Acta 45(15-16): 2483-2498.
[4] Max Lu, and Elzbieta Frackowiak, "Super-capacitors: Materials, System and Applications," April 2013.