Super capacitor Based Electric Vehicle

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***Abstract*— This vehicle provides a review of the new technology being developed for electric urban public transport. The result was the development of electric transport systems that not only satisfy the primary aesthetic requirement, but are also less energy consuming.[2] In this work, implementation of super-capacitor powered electric bus based mass transit system (Electric Vehicle) has been analyzed. DC power source (SMPS) are placed at the bus stops and the charging of the super capacitors is done via SMPS whenever a bus stops at the bus stop. The Electric Vehicles will be used on a ring road for transportation.[5] External power supply is use as a input to SMPS. Hence, Electric Vehicle will work in harmony with the distribution network of the city and will serve the purposes transportation of people. In this project, analysis of implementing the Electric Vehicle and their utilization for the public transports demonstrated.[2] The technologies presented in this project are among the best to help providing future modalities for building more environmental public urban transport.[8]**

***Index Terms*—Supercapacitor, Arduino UNO, PMDC, Motor, Vehicle, Converter.**

I. INTRODUCTION

Super-capacitors represent one of the newest innovations in the field of electrical energy storage, and will find their place in many applications where energy storage can help to the smoothing of strong and short time power solicitations of a distribution network. In comparison with classical capacitors, this new components allow a much higher energy density, together with a high power density. However, electric vehicle have not enjoyed the enormous success of internal combustion (IC) engine vehicle that normally have much longer range and are very easy to refuel. Today's concern about the environment, particularly noise and exhaust emission, coupled to new developments in batteries and fuel cells may swings the balance back in future of electric vehicles. It is therefore important that the principle behind the design of electric vehicles the relevant technological and environmental issues are thoroughly understood.

II. METHODOLOGY

In this model a bus is designed which is an autonomous; it runs using energy stored by Super-Capacitor. The initially charged bus moves, due to the energy stored in it by means of the super-capacitor and after the bus reaches at bus stop.[1] The super-capacitor charged by using SMPS supply, which is placed at bus stop. The Super-capacitors are charged continuously by the use of charging circuit and are further connected to the pantograph which is placed at the roof of the Electric Vehicle. These pantographs collect the current from the overhead equipment. As the bus reaches at the bus stop and stops, the pantograph rises and collects current to charge the supercapacitor bank if required, at the same time passengers move outside the bus and the other passengers gets inside the bus.[4] The controller circuit decides according to voltage value of supercapacitor bank weather the charging is required or not when bus reaches at bus stop. To move on and the process repeats as the bus reaches the another bus stop. Supercapacitor bank is connected to buck converter. The input voltage applied to buck converter is 12v from supercapacitor bank and it will step down the input voltage to 5v. This 5v is required for TIP120 (Texas Instruments Power) transistor. This 5v is applied to TIP120. It will drive (control) motor speed as per according to PWM signal from controller. Controller generate PWM signal by reference of speed controlling potentiometer. Controller will also display distance cover in stored energy in capacitor bank by scaling.[10]

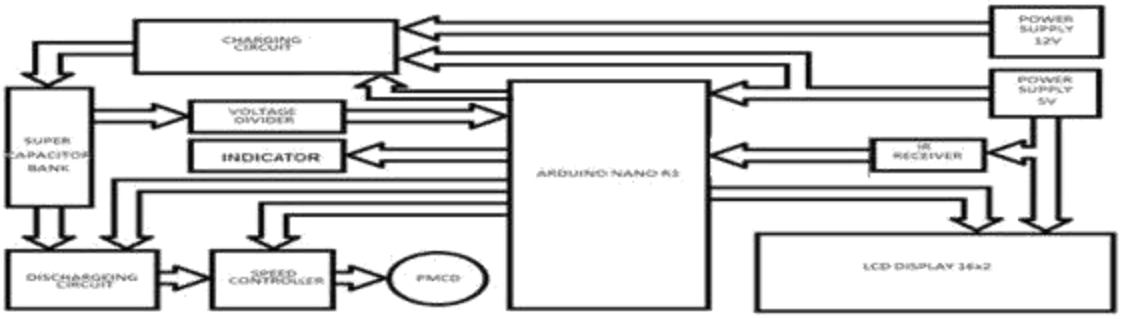

Fig.1- Block diagram

III. PROBLEM STATEMENT

Current vehicles use fuels like petrol, diesel, CNG etc. The nature of resources depleting day by day and there is an immediate need to find an alternative solution for powering up the vehicles which are eco-friendly in nature. We cannot use battery for energy storage instead of supercapacitor because of batteries have limitations in terms of life, low power density, environmental range, low energy density, shorter life. These limitations will be improve by using supercapacitor.[3]

IV. RESEARCH CONTAINED

Carbon Based Supercapacitor

The fabrication of the supercapacitor and the development of a power electronic interface for the proper utilization of SC will be done in parallel. The methodology that will be adopted can be summarized as seen in figure below.

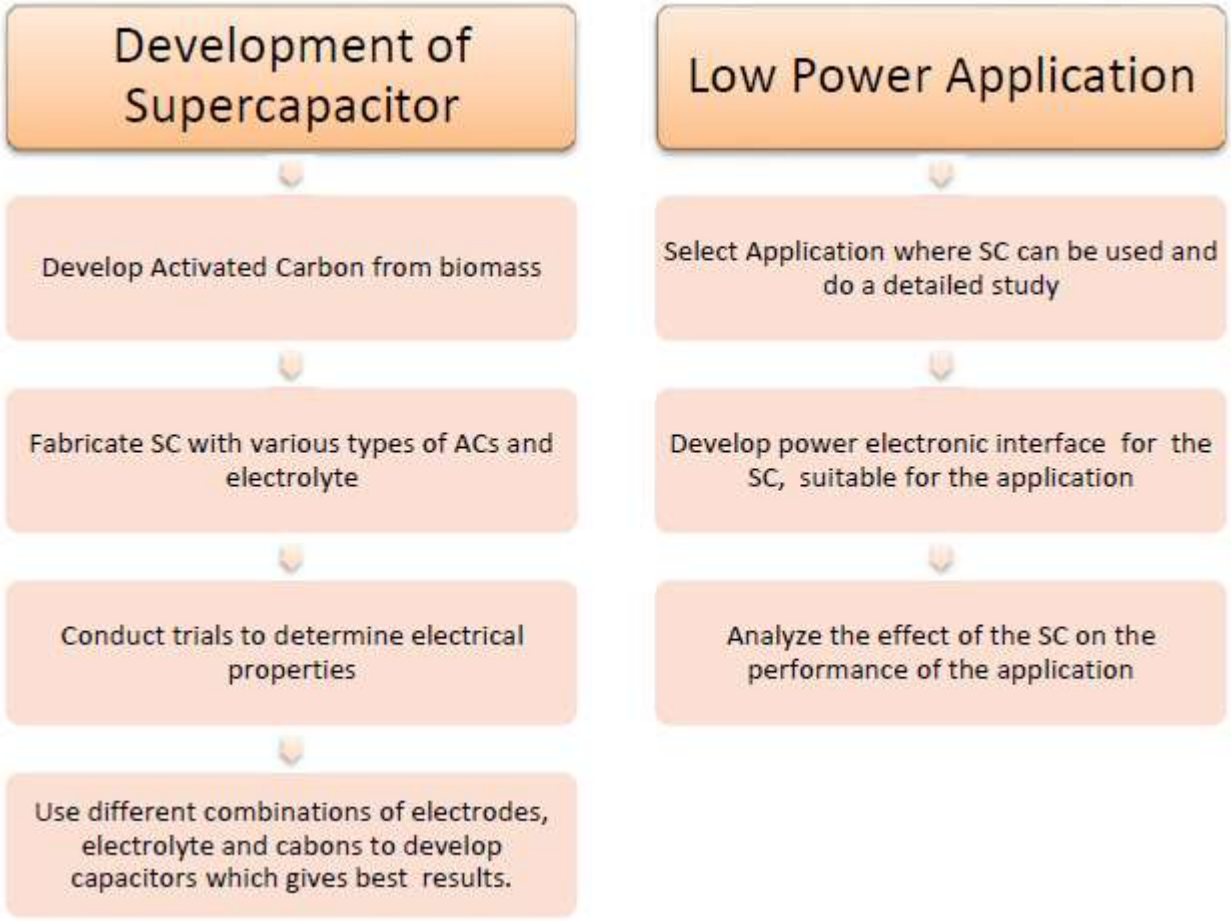

Fig. 2 – Carbon Based Supercapacitor

Design Aspects of Caron Based Supercapacitor

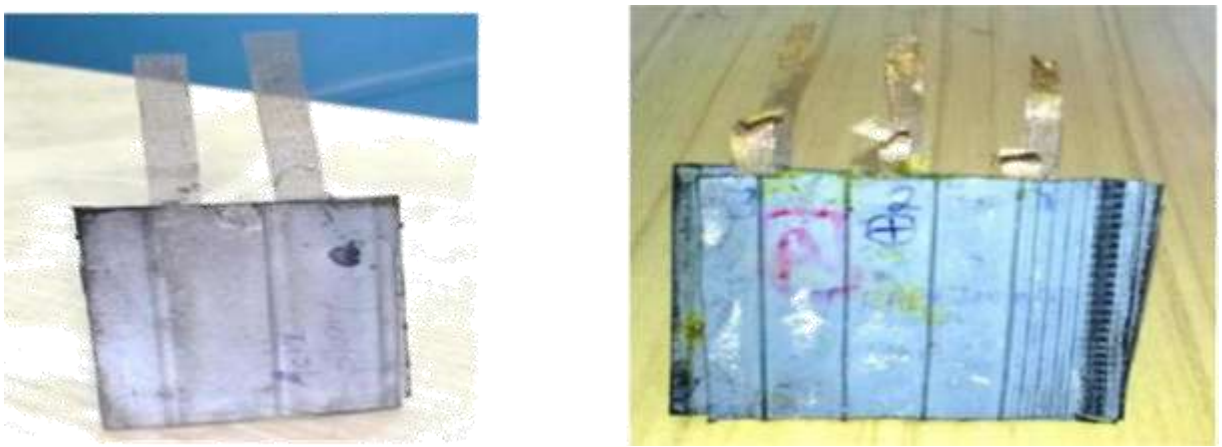

Fig.3- Design Aspects of Carbon Based Supercapacitor

V. SYSTEM DESCRIPTION

Flowchart

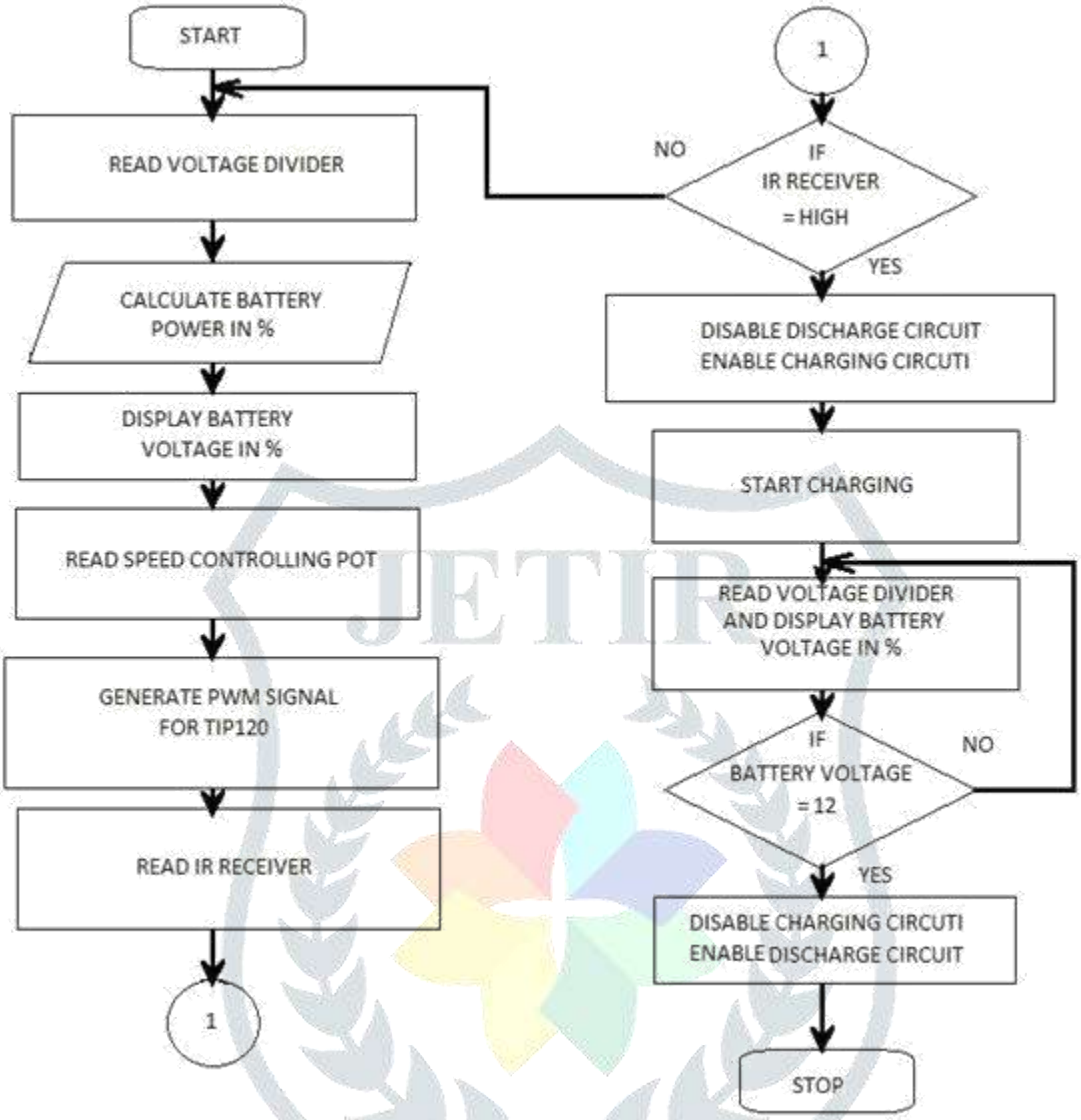

Fig. 4- Flowchart

Requirements

SR.NO.	COMPONENT NAME	RATINGS
1	POWER SUPPLY	12V , 3A , 36W
2	SWITCH MODE POWER SUPPLY (SMPS)	12V, 3A
3	POWER SUPPLY	5V
4	RELAY	5V
5	SUPERCAPACITOR'S	10F,2.5V
6	BUCK CONVERTER	(I/P 4.5 – 35V) (O/P 1.3-30V) (3A)
7	ARDUINO UNO CONTROLLER	
8	PERMANENT MAGNET DC MOTOR (PMDC)	6V
9	RESISTANCE	3.9Ohm,1kOhm
10	LCD DISPLAY	
11	TRANSMITTER	
12	RECEIVER	
13	TIP120 TRANSISTOR	

Table 1 Requirements

VI. HARDWARE IMPLEMENTATION

Calculations for Hardware Implementation

Rating of super capacitor:-

10f, 2.5v,	0.180Ω ESR	----	(For single capacitor)
2f, 12.5v,	0.9Ω ESR	----	(For 5 Capacitors in series)

Energy Stored by Supercapacitor Bank when fully charged:-
E=1/2 C V^2
=½ *2* 12^2
=156.25 J

Time required to full charge from 0v
Cv = V (1-e^-t/)
=R* C =0.9*2 =1.8

Assume battery charge till 11.999v 11.999=12(1-e^-t/1.8)
t =16.906
t ≅ 17
Maximum current flowing during 17 sec is
I = V/ R ……. (Where R is the internal resistance of capacitor bank)
I = 12/0.9
I = 13.33 A
External resistance in series to limit current up to 2.5 A is V/R = I
12 / (0.9+X) = 2.5
X = 3.9 Ω

Wattage of Resistor is
2.5 * 12
30 W
External Resistance = 3.9 Ω, 40 W Standard

New Charging Time:-
11.999 = 12 (1- e^ -t/)
= R*C
= (3.9 + 0.9) * 2
= 90.16 sec ≅ 90 sec
Maximum Current is Limited up to 2.5 As
Power Supply used 3A , 12 V

Rating of Motor:-
BDR-32-20-6.0V-3734
Operating voltage Range 2-15v
Nominal Voltage - 6 v
Speed - 3734 rpm
No load current - 0.020 A

Time required to discharge:-
Total energy stored insuper capacitor E=156.2 Wh
E = VIT
Where I is current drawn by motor at load condition and is equal to 0.030 A for 100gm load. 156.2 = 5* 0.030*T
T = 1041.33 sec

= 17.35 min.

VII. BENEFITS

- Cheaper in cost.
- Light in weight.
- It is pollution free bus transportation system, which keeps the environment healthy.
- Newer technology.
- Simple in design.
- High efficiency.

VIII. CONCLUSION

SUPERCAPACITORS ARE THE WAVE OF THE FUTURE, RELATIVE TO ENERGY STORAGE FOR TRANSPORTATION VEHICLES. PUBLIC TRANSPORTATION IS THE APPLICATION WHERE WE CAN USE BENEFITS OF SUPERCAPACITOR PROPERTIES SUCH AS HIGH ENERGY DENSITY AND POWER DENSITY, WHICH GIVES US FASTER CHARGING FACILITY. FAST CHARGING IS HELPFUL FOR INCREASE OPTIMUM USE OF RUNTIME FOR PUBLIC TRANSPORTATION FACILITY.

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