Super capacitor based electric bus (Capabus)

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***Abstract*- Now-a-days transport buses are running on a conventional fuel, has limited resources also causes pollution to the environment. Fuel consumption itself adds maintenance, fuel costs, it greatly affects the efficiency and air by polluting it. We are proposing a "super capacitor based electric bus (capabus)"system have an optional system for fuel consumption that uses the electrical energy along with "super capacitor" as a power point for the vehicles. The Super Capacitors are essential energy point to run the motor engine eco-friendly. 'Super capacitor' has property to charge instantly, and low discharge rate, which will gives efficient and better performance than conventional fuel base vehicle. Hence, Capabus 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 Capabus and their utilization for the public transports demonstrated. The technologies presented in this project are among the best to help providing future modalities for building more environmental public urban transport.**

I. INTRODUCTION

All components reuired

1. Power Supply
2. Switch Mode Power Supply (Smps)
3. Relay (In Charging Circuit)
4. Supercapacitor's
5. Buck Converter (Discharging Circuit)
6. Arduino Uno (Controller)
7. LCD Display
8. Permanent Magnet Dc Motor (PMDC)
9. Resistance
10. Fuse
11. Transmitter
12. Receiver

II. BLOCK DIAGRAM

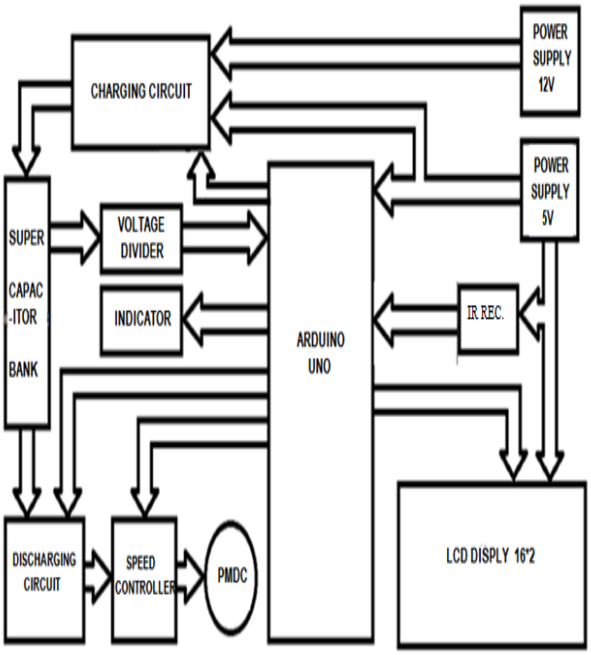

Fig.1 Block Diagram of Super capacitor based electric bus

1. 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. 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 capabus. These pantograph collect the current from the overhead equipment.

2. As the bus reaches at the bus stop and stops, the pantograph rises and collect 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. The controller circuit decides according to voltage value of super capacitor 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.
3. 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.
4. It will drive (control) motor speed as per according to PWM signal from controller. Controller generate PWM signal by reference of speed controlling potentiometer.
5. Controller will also display distance cover in stored energy in capacitor bank by scaling.

III. EQUATIONS

Energy Stored by Super-capacitor Bank when fully charged:-

$$E=1/2\ C\ V^2$$

Time required to full charge from 0 volt

$$Cv = V(1-e^{-t/\tau})$$

$$\tau=R*C$$

Time required to discharge

Total energy stored in super capacitor

$$E = VIT$$

$$T = E/VI$$

IV. FLOWCHART

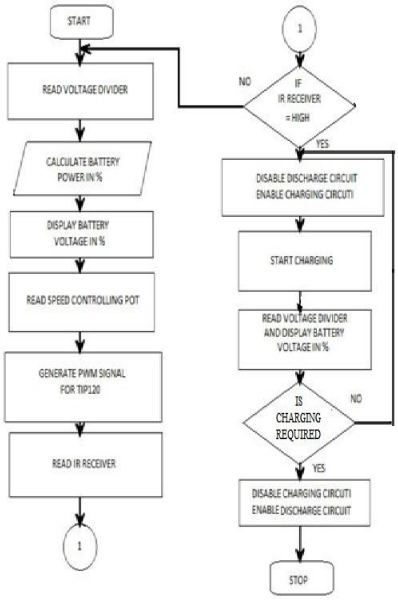

Fig.2 Flowchart of Capabus

V. TESTING

1 Charging of supercapacitor bank.

2 While discharging supercapacitor bank is connected to buck converter. The input voltage applied to buck converter from supercapacitor bank.

3 It will step down the input voltage to desire value of voltage .
This is given to tip120 transistor. It will drive the motor.

VI. RESULT

During starting condition motor takes very large current, this may damage the motor or other devices in the circuit so it is require to insert appropriate resistor .
This external resistance control starting large current. it is present for short.
After motor takes normal current at that time external resistance does not require in circuit and also to reduce IR drop in the resistor, it bypass the external resistance from circuit and supercapacitor bank starts

charging without resistor. Capabus stops during charging.

Bank stops the charging when supercapacitor bank fully charges. At the time of discharging from supercapacitor bank delivers the power to motor through buck converter and motor starts rotating and ultimately capabus moves.

Charging time of supercapacitor bank.

Total charging time of supercapacitor bank is
Dependent on number of capacitor, their rating and connection.

Discharging time dependent on motor rating and load.

VII. CONCLUSION

Super capacitors 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 helpful for increase optimum use of run time for public transportation facility.

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