Ultra Capacitor Operated Bus

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***Abstract*—**The ultra-capacitor operated bus is one of the most effective power drive system than that of general hybrid or electric systems. Chemical storage batteries however, present several difficulties in power management and control. These difficulties include, 1) inadequate life, 2) limited current delivery as well as absorption during regenerative braking, 3) inaccurate measurement of state of charge, and 4) stored energy safety issues. Recent advances in ultra-capacitor technology create an opportunity to address these concerns.

This research paper is for prototype of a city bus working on a ultra-capacitor, made from normal 3v motors.

***Keywords*—**Ultra capacitor bus, Electric bus, Supercapacitor bus, Hybrid Vehicle,

"Introduction"-

Supercapacitors are electronic devices which are used to store extremely large amounts of electrical charge. They are also known as double-layer capacitors or ultracapacitors. Instead of using a conventional dielectric, supercapacitors use two mechanisms to store electrical energy: double-layer capacitance and pseudo capacitance. Double layer capacitance is electrostatic in origin, while pseudocapacitance is electrochemical, which means that supercapacitors combine the workings of normal capacitors with the workings of an ordinary battery. Capacitances achieved using this technology can be as high as 12000 F. In comparison, the self-capacitance of the entire planet Earth is only about 710 μF, more than 15 million times less than the capacitance of a supercapacitor.

New environmental emission standards are a challenge and an opportunity for industry and governments who manufacture and operate urban transit vehicles. In addition, reduced federal support for regional transit authorities has heightened the need for buses with increased fuel economy and reduced operating costs. A bus incorporating a natural gas engine with an electric drive train and energy storage has the potential to offer large reductions in emissions and fuel consumption for urban transit buses. NASA Lewis in cooperation with government and industry in Ohio is developing a transit bus using this hybrid power technology approach.

Were the using of ultracpacitor in an electric bus instead of lithium-ion battery provides more efficiency for a city bus which can charge a ultracapacitor at several stations. Ultracapacitor bus is a silent, low-cost vehicle with zero-emissions, which complies with the European homologation certifications, the strict market requirements in EU, including the ECE R100 standard for energy storage devices.

As per the study by chariot buses shanghai, Ultracapacitor operated bus will also tends to cost cutting as working life of a ultracapacitor is one lakh cycles more than a normal lithium ion battery. Also harmful pollutants are emitted in the form of gases from the normal batteries.

"Need of these concept"-

Nowadays an option for diesel engine powered vehicles in a need, Electric vehicle is the option to the diesel engine powered vehicles which uses lithium ion batteries as power source. But Considering the Charging time for the ion lithium battery which is the fueling time of the vehicle it is much more, which decreases the efficiency of the vehicle. An alternative option for ion lithium battery is required which can provide a fast charge of battery, Ultracapacitor is a fast charging device and provides the slow discharge rate as compared to a normal capacitor. Ultracapacitor is a device which can be fitted as battery for an electric vehicle, which may provide slow discharge. According to the study and research of chariot buses shanghai the capacitor can work as battery for a public city bus which travels from station to station. These concept leads to reduction in pollution and saving of fossilfuel.

"Project Objectives and Team Approach":

The project objectives are to design, build, and demonstrate a hybrid electric transit bus. A cooperative of several organizations including industrial companies, federal and local government agencies, and academia are supporting this as a joint venture. The members of the group are providing components, systems, test facilities, and operational support to the project. The governmental bodies believe that this effort will make a significant contribution to addressing the national and state interests to reduce emissions in urban areas. They also believe it will reduce fossil fuel consumption and operating costs for the mass transit systems. In addition, this is an excellent opportunity to capitalize on, and transfer technology from the aerospace and military industries to a commercial venture. The industry partner's objective is to develop advanced transit buses and drive train products that can address the needs of the transit bus market with respect to emissions and operating cost. The vehicle must be competitive, in terms of initial capital cost as well as operating costs, with current low emission urban transit buses.

"Calculations for Motor and Capacitorselection":

I. Power calculation for Motor,

P (KW) =V*I/1000

= 9*(2/1000)

P =0.018KW.

II. Torque of Motor,

For, Speed=150rpm

Power=0.018 KW

Torque= (9.5488*P)/n

Torque= (9.5488*0.018)/150

Torque= 1.15 NM

Above is the torque obtained from a single motor.

III. Charge in capacitor in coulombs,

Capacitor specifications,

2.7 volts & 500 farads

Q=C*V

=500*2.7

Q =1350

IV. Time required to charge the capacitor,
Time=R*C
=220*500F
=110 sec.
Time required for a full charge,
1 time constant (1T) =110 seconds
Therefore, 5T=5*110
=550 Sec.

V. Voltage across the capacitor after 100 seconds,
$VC=5(1-e^{-nt/RC})$
$VC=5(1-e^{-100/4})$
VC=2.98 volts

VI. Discharge time for a single capacitor for 3v motor is 0.02 v at 60 sec.(Physically test)

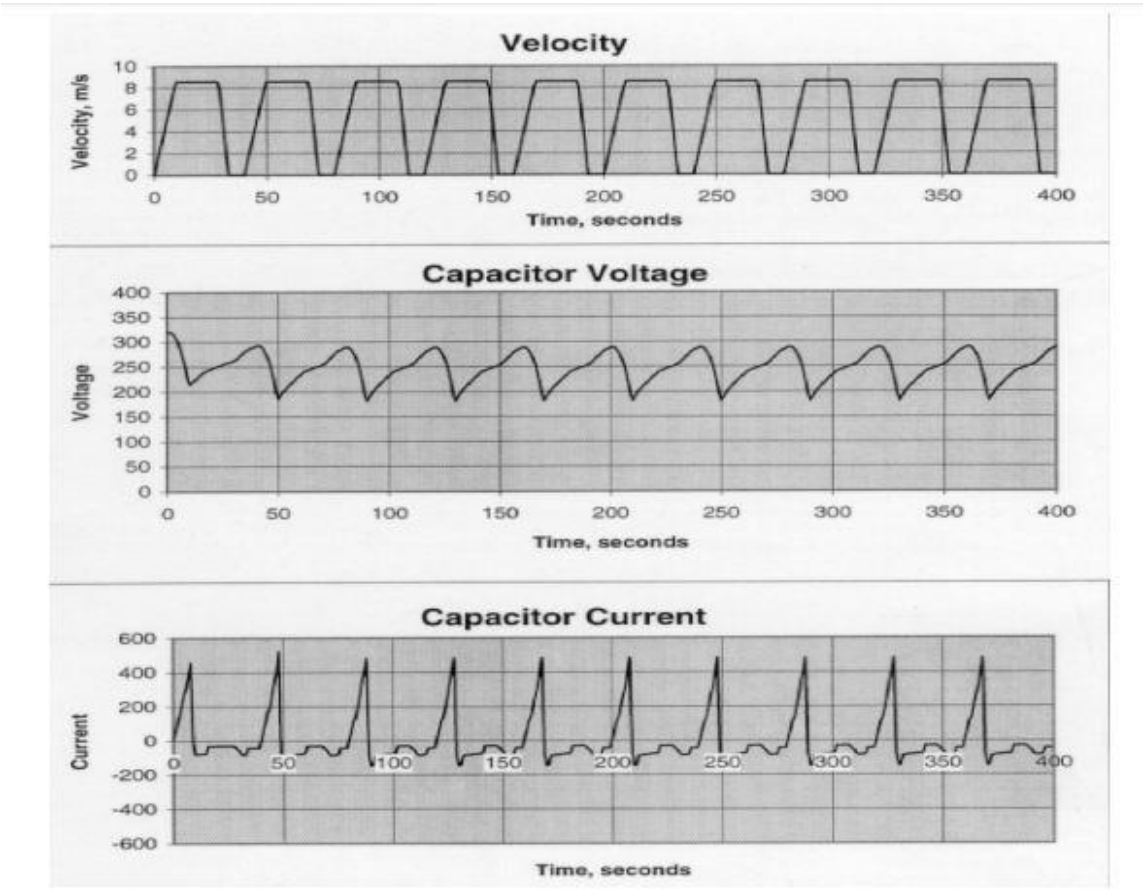

Figure 1 - Expected Capacitor System Behavior

"Main Component used and its specifications"*:*

1) 2.7V 500 Farads Capacitor.

A **capacitor** is a passive two-terminal electronic component that stores electrical energy in an electric field. The effect of a capacitor is known as capacitance. While some capacitance exists between any two electrical conductors in proximity in a circuit, a capacitor is a component designed to add capacitance to a circuit. The capacitor was originally known as a **condenser** or **condensator**. The original name is still widely used in many languages, but not commonly in English.

The physical form and construction of practical capacitors vary widely and many capacitor types are in common use. Most capacitors contain at least two electrical conductors often in the form of metallic plates or surfaces separated by a dielectric medium. A conductor may be a foil, thin film, sintered bead of metal, or an electrolyte. The non-conducting dielectric acts to increase the capacitor's charge capacity. Materials commonly used as dielectrics include glass, ceramic, plastic film, paper, mica, air, and oxide layers. Capacitors are widely used as parts of electrical circuits in many common electrical devices. Unlike a resistor, an ideal capacitor does not dissipate energy.

2) DC to CD Booster

XL 6009 dc-dc booster is used to increase the output current from capacitor of 2.7V to 9-12 Volts which can run four motors of 3 volts.

3) 3 volts Single Shaft Geared motor

3 Volts single shaft geared motor is used as hub motor for prototype made. This motor as 150 rpm at no load condition. This motors operate at 3v-9v.

"Conclusion"*:*

Automotive industry is using advanced power technology in a city transit bus that will offer double the fuel economy, and emissions, one tenth of government standards. A unique aspect of the vehicle's design is its use of "super" capacitors for recovery of energy during braking. Calculations can be made for a actual city bus at multix of our prototype.

"Reference"*:*

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