High reliability hybrid power supply systems for PON passive and AON active optical communications networks

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Motivation and Description of Work

Starting from the simplified block diagram of the system (figure 1) a modular architecture was developed, ie the possibility to easily add and remove modules, depending on the needs of the communications node. The system also contains the orientation of the solar cell so that the efficiency of conversion of optical energy into electricity to be maximum.

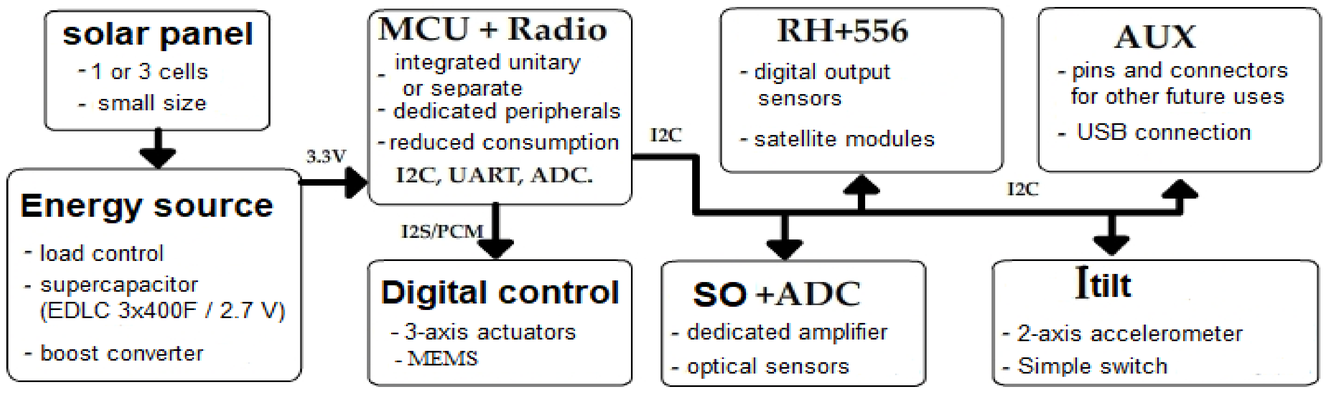

Figure 1. Simplified block diagram of the system.

Approach

The power supply of a node is done with a hybrid power supply system of the type illustrated in Figure 3. Usually the power supply network provides the necessary energy. In case of network interruption, the microcontroller system starts to supply the circuits in the respective node through the converter. The energy is taken from the EDLC. The EDLC load is optimized by moving the platform on which the solar cell is installed (see Figure 7).The expressions were made with a circuit illustrated in Figure 7. The results are illustrated in Figure 8.

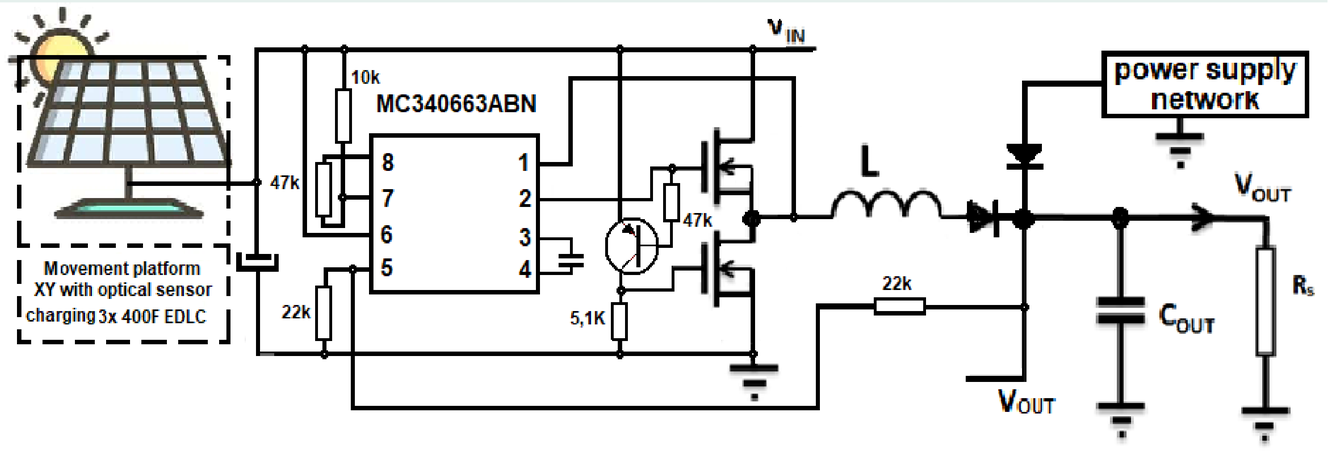

Figure 7. Experimental circuit with high reliability hybrid power supply

Results

Before the experiment, a simulation was performed in the Proteus Design Suite 8.3 program. The illustration of the simulation is presented in Figure 8.

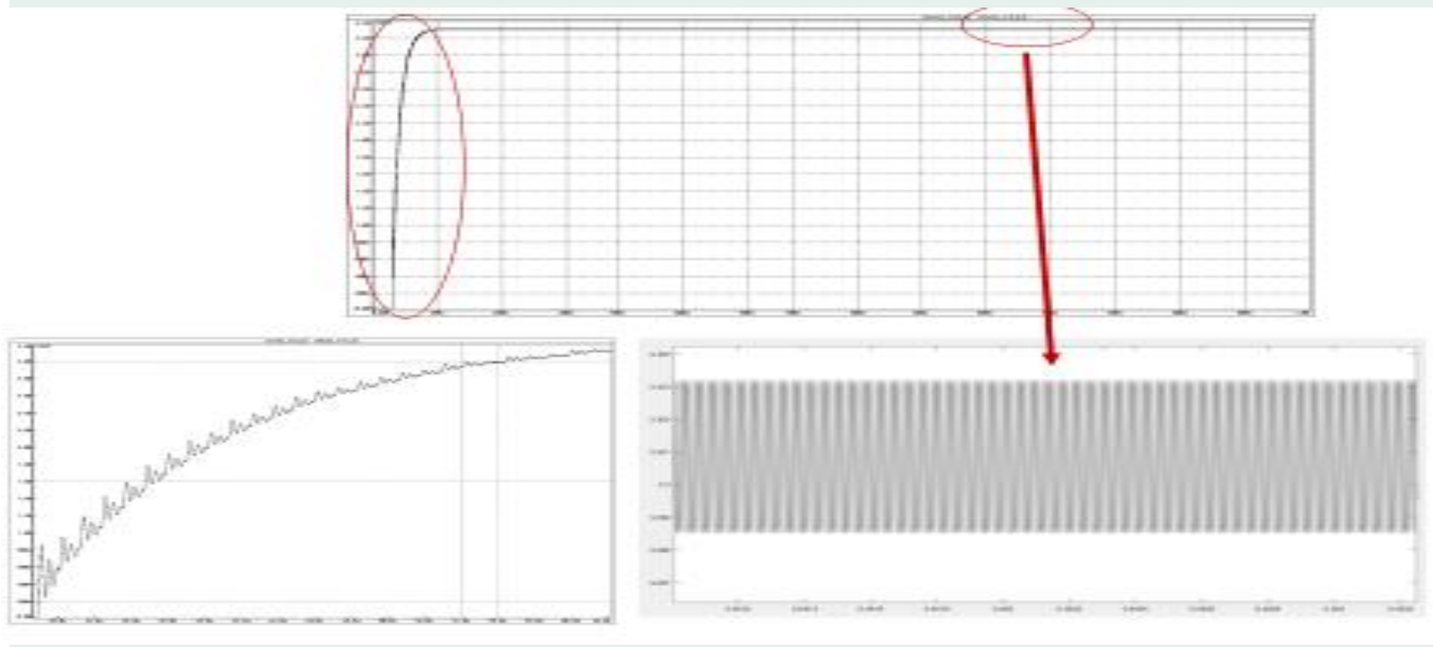

Figure 8. Charging the supercapacitor at a medium light intensity

With a minimal communications system in an optical communications node, the voltage at the EDLC terminals was tracked over a period of time with overcast skies. the result is illustrated in Figure 9.

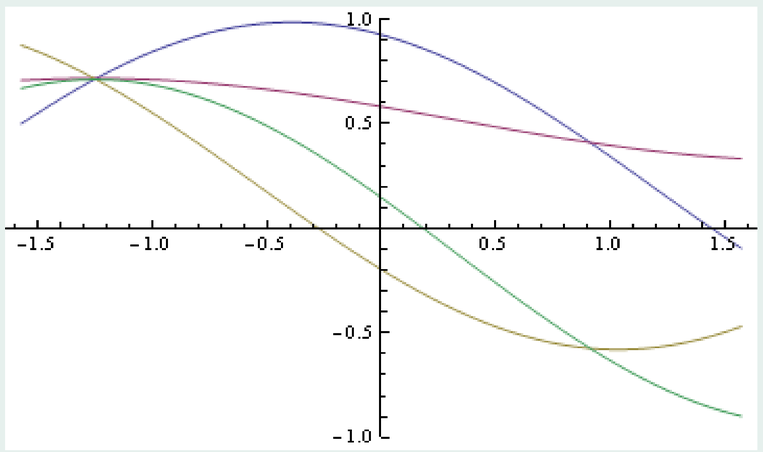

Figure 9. The scalar product between normal vector of each detection cell and the vector of a solar ray in condition of full rotation of one motor; because in some point the 4 curves are intersecting that point represent the optimal position.

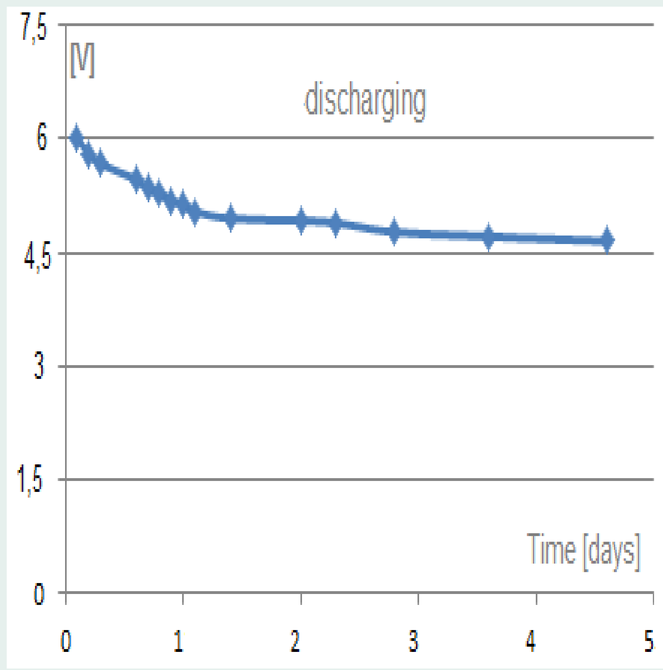

Figure 10. Discharge the 3 EDLC battery

In the Figures 11 shows the 400 F EDLC discharge diagram in case of lack of power supply. It is observed that the system provides enough power for 100 minutes to remedy the energy system.

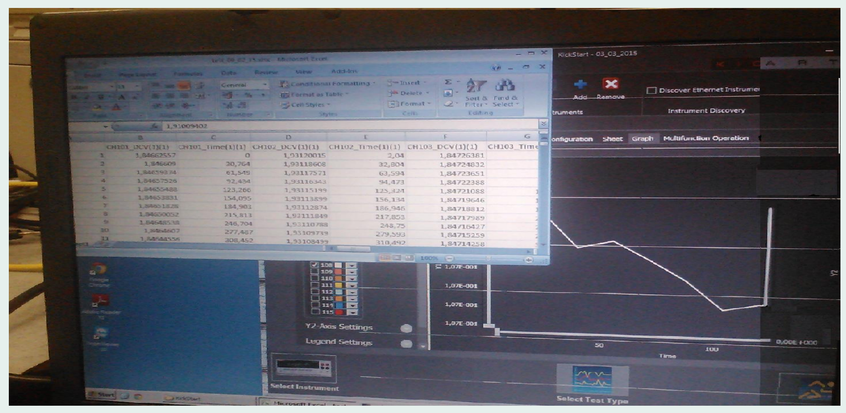

Figure 11. Discharge the superconductor battery for 100 minutes for medium traffic

Conclusion

The use of a supercapacitor battery in the hybrid power supply system of a fiber optic communication network is done with the help of electronic control circuits, which automatically switch through a circuit OR between the power supply of the building in case of damage and powering through a converter circuit the electricity stored in a supercapacitor battery. The EDLCs are permanently charged from a solar cell mounted on a platform that is oriented after the maximum incidence of light rays. The circuit OR separates the moments when the system consumes energy from supercapacitors or from the network Automotive systems can be implemented using BLDC motors as demostrated in this case with a windscreen wiper system