

INVESTIGATION OF LIFE SUPPORT IN MOBILE VEHICLES

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In scope of this article we want to investigate the problem with providing and controlling life-needed communications for autonomous vehicle-house(camper). In this article were investigated problems of electricity control, such as control batteries capacity, batteries voltage, batteries commutating, controlling of batteries temperature, water supply control, such as filtering and delivering drink water and recycling amounts of used water, central heating, using LPG liquid heater and LPG sensors to prevent gas leakage. Also we will describe common control system of camper.

For project building was used an VanHool Alizee 1,5 floor tourist bus, 14 m length, 2,5 m width and 3,3 m height. The common square is 35 m². Space for water tanks – 2 holes for 500 liter tanks. Also the bus has space for 8 pcs 12 v 200 Ah batteries and 1 pcs 120 liter LPG tank.

The main power system is 24 v DC, which consists of 8 pcs 12 200 Ah Lead-Acid batteries, 2 invertors 24-220 v DC-AC, 4 solar panels, 150 w each and electrical LPG generator with 2,8 kW output. Batteries are connected in pairs to produce 24 V and every pair has an individual voltage and current sensor to control the life status of battery. Each controller is connected via RS-485 and Modbus to the central controller. The battery box has 3 hydrogen sensors and FAN to prevent collecting of hydrogen. Light, heater turning is duplicated with central controller and hard switches; each device is controlled manually or remotely over Wi-Fi or GSM. Water system contains 2 tanks 500 liter capacity for clean and used water. In each tank the water level sensor is located. In the clean water tank there is a pump installed. This pump is pushing water under pressure to dish washer, shower, etc. At the end of the water system we have a digital pressure sensor, to control the main pressure in system, to avoid damage of pipes and pump. Used water is collecting in the special tank with 3-way valve. For preventing ice in water tank we have temperature sensor in each tank and heating radiator.

Heating system is represented by LPG central heater with 2 circuits for heating liquid to radiators and for heating water in water system. In LPG tank box we have 3 sensors to prevent LPG leakage, the sensors are connected to FAN and central controller. Bus temperature is regulated by PID regulator in central controller, which regulates the valves and allows you to control each section temperature. The central controller based on Orange-Pi Win Plus Board. The board is extended with 6 RS-485 interfaces, GSM and GPS modem and has 15" LCD with touchscreen. The power source is duplicated from main DC source and allows controller to work up to 120 hours in stand-by. The software is Linux-based and written in .Net Xamarin, C, Python, JS and has GUI and Web GUI to control the life system.