Universal hardware sensory coupling module

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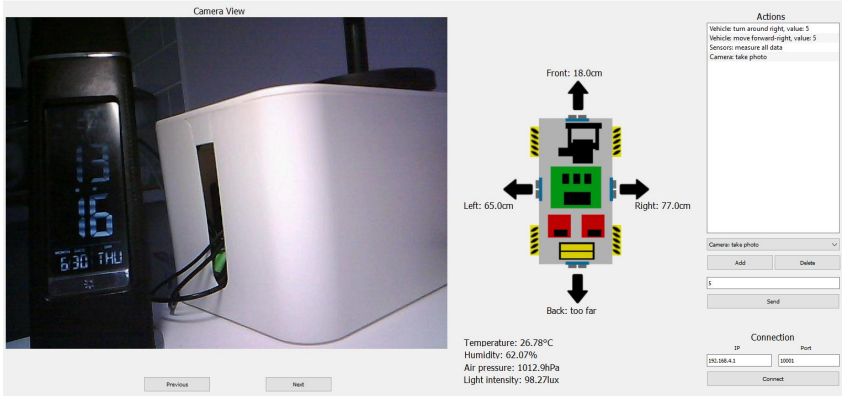
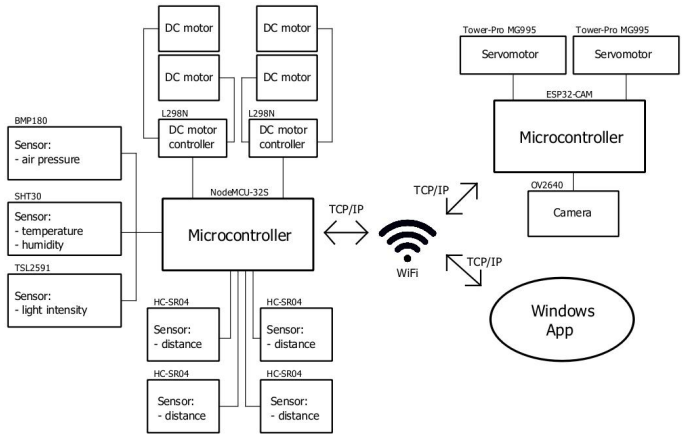
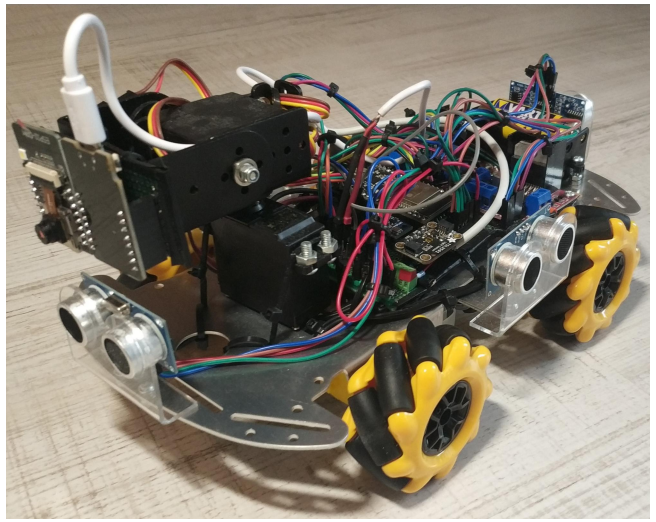
Abstract

Systems for remote exploration of terrain or utility rooms have various applications, such as Mars rovers or sapper robots. The information collected by such devices equipped with cameras can be used in a haptic control loop with sensory feedback between the environment (in which the machine is located) and the human operator (user). Such a connection is a source of information allowing the operator to make ongoing decisions (e.g. as to the further route of the robot).

The paper presents a control module that manages measurements and remote data exchange between the user and the machine. The whole is mounted on an electric vehicle with mecanum wheels. In this system, we take into account such measurement values as: temperature, humidity, atmospheric pressure, light intensity and distances from objects in four directions. Thanks to visual information, the vehicle operator can naturally interact with the environment and, for example, avoid obstacles.







Principle of operation

After starting the system, a WiFi access point is created, with which the camera and the person connect using dedicated software (which allows for quick data exchange). Commands in the form of a byte frame sent by the user panel are processed and decoded by the main microcontroller, which decides about getting values from sensors, turning on DC motors or taking pictures. After executing all commands, the collected data is decoded and sent back to the user.

Electric vehicle

The electric vehicle is powered by four brushed DC motors. Each of them has a set of gears reducing the rotational speed and a shaft to which the mecanum wheel is attached - i.e. a wheel whose construction allows the vehicle to move in any direction, and even around its axis (without the need for torsion axles). Two two-channel DC motor drivers are responsible for proper direction and speed control. The whole is powered by four AA batteries connected in series.

Conclusion

The module has great potential for development and expansion. Thanks to the use of the popular I2C data bus, it is possible to easily connect new sensors, and in addition, the existing data exchange procedure allows for trouble-free expansion. The resulting electronic design can be considered universal as it can also be used in water or air vehicles.