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CONTROL OF MOBILE ROBOT USING WEB INTERFACE

RIADENIE MOBILNÉHO KOLESOVÉHO ROBOTA PROSTREDNÍCTVOM WEB ROZHRANIA

Abstract

This contribution deals with the control wheel mobile wireless system. It describes the theoretical knowledge from the mentioned field and also the practical implementation of the whole system. This realization consists of creating the appropriate hardware and software. Contribution shows the possibilities of wireless control equipment using wireless communications and a large number of Internet options.

Abstrakt

Článok sa zaoberá ovládaním bezdrôtového mobilného kolesového systému. Opisuje získané teoretické poznatky z uvedenej oblasti a taktiež praktickú realizáciu celého systému. Táto realizácia pozostáva z tvorby príslušného hardvéru a softvéru. Článok ukazuje možnosti bezdrôtového ovládania zariadení s využitím bezdrôtovej komunikácie a veľkého počtu možností siete internet.

Keywords

Mobile wheel system, Wireless communication, WEB interface, Remote control, Xbee

1 INTRODUCTION

Wireless networks have become an integral part of our lives. In the past decade, wireless technologies have advanced significantly to allow numerous devices to be connected with each other via a wireless communication medium. Using wireless devices penetrates into various areas, whether on the area of industry or a simple application designed to end users for use in the home for the day to day use. Wireless local area networks are currently poised to supplement or replace wired networks in many businesses and campuses. Many new applications, including wireless sensor networks, automated highways and factories, smart homes and appliances, and remote telemedicine, are emerging from research ideas to concrete systems.

The main advantages for using a wireless solution in industrial applications are the following: greater mobility and possibility to move devices and connect to smartphones and tablets freely

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without constraining cables, elimination of expensive and maintenance heavy transmission media such as flexible cables, swivels, etc., bypassing long distances and areas where cables cannot physically fit, fast and easy installation and commissioning, high flexibility if there is a need to modify an installation, increased personnel safety by not having to be physically close to a device during configuration and/or maintenance, flexible Human Interface Devices (HID), easy integration of devices into the network [1].

Industrial plants consist of multiple devices interconnected in different ways. These varied types of devices consist of the following: simple data collection units (I/Os) without built-in intelligence, intelligent devices such as sensors with built-in intelligence, single-loop, controllers or programmable controllers, supervisory systems used as Human Machine Interface (HMI), data logging and supervisory control.

All these types of devices are interconnected using different communication protocols and media types that in some cases can be replaced by wireless technologies to achieve the above listed advantages.

The purpose of the presented article is to describe of wheeled mobile system that can remotely communicate with the control computer. The control computer at the same performs the function of the server that can be accessed via the website. Mobile wheeled system can be controlled via the website from almost any location with access to Internet. For controlling the movement of the mobile platform it is necessary to provide the feedback for user of application. Feedback is realized by a camera that detects the movement of the mobile wheel system [2], [3].

The phrase mobile system represents mobile robot. One of the criteria the division of robots is the ability to move. According to this criterion robots we can be divided into stationary and non-stationary, therefore mobile. This article deals with the design of mobile wheeled robot. In recent years the area of mobile robots has become very active in both research and development. Are being developed a new, technically more sophisticated robot design, increases in which the right to sophisticated control systems which are already established, for example, the fuzzy logic or neural networks [5], [6].

Mobile robots can be categorized by several aspects:

- Degree of autonomy:
  - an autonomous robot - a device which on the instructions can autonomously perform a given task,
  - remote controlled robot - a robot that generally does not have the intelligence or higher control algorithms and decision making.

- Working environment:
  - indoor robots,
  - Outdoor robots.

- Chassis Type
  - wheeled robots,
  - tracked robots,
  - robots used legs for mobility.

2 IMPLEMENTATION OF MOBILE PLATFORM WHICH IS MANAGED THROUGH A WEB INTERFACE

In constructing the chassis of our mobile platform, we decided to Ackermann steering geometry. Simple drawing program used is shown in Fig. 1. Turning of the front wheels is provided by DC motor (M1). If we connect voltage to the motor, wheel rotates. Upon termination voltage to the motor wheels are put back under the action of the spring. The rear wheels rotating DC motor (M2). From the rotor is brought rotary motion to the gearbox and from here to the rear axle. The gearbox is used to adjust the speed of rotation of the rotor of DC motor and the speed of rotation of the rear wheels, that is, of the whole rear axle. Both motors are DC motors with permanent magnet.
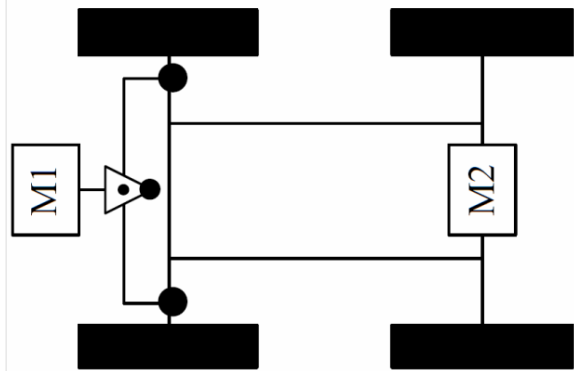

Fig. 1 Ackermann steering

Permanent magnet DC motor is structurally the simplest DC motor. The field poles of this motor are essentially made of permanent magnet. A motor mainly consists of two parts. Stator is permanent magnet and rotor consists of an electromagnet with poles. An electrical current is supplied into the coils of the rotor via a rotary switch, thus commutator.

2.1 Transmitter module

The task of transmitter module (Fig.2) is to receive information from the control program that is running on your computer. Then with using a USB / UART converter which the voltage levels used in universal serial bus converts to voltage levels compatible with TTL logic.
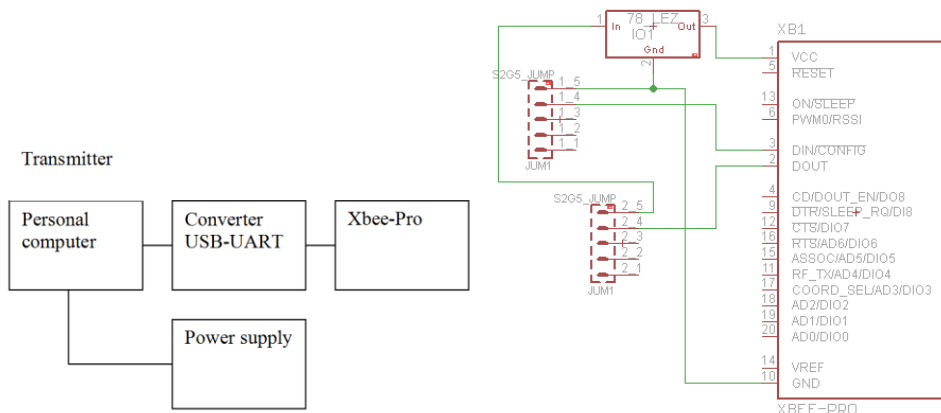

Fig. 2 Transmitter module

Finally, it should send the information to the receiver module via a suitable wireless communication medium, which in our case is the radio frequency module XBee PRO. Wireless communication module XBee and XBee-PRO are designed to comply with the requirements for

IEEE 802.15.4. These modules provide wireless communication between modules and allow you to create wireless sensor networks and in achieving a low acquisition cost and low electric energy consumption in the operation of these modules. Communication module XBee and XBee-PRO operate in the communication frequency band 2.4 GHz, which is free and not subject to registration.

2.2 Receiving module

Block diagram of the platform receiving module is shown in Fig (Fig.3). The basic fundaments of scheme (Fig.4) are microprocessor Atmega8, module XBee Pro and voltage stabilizer. The supply voltage of the battery is brought to terminal block K1. From this terminal block is over the switch powered the 5V voltage stabilizer (IO1), which regulates the supply voltage to the microprocessor IC1 and voltage stabilizer to 3.3V (IO2). Voltage stabilizer supplies the Xbee module. Behind of button is connected terminal block K2, from which will be supplied the energy to motor controller with their own PCB. Voltage stabilizer IO1 provides power supply of LED indicator. To

Fig. 3 Block diagram of the receiving module

the microprocessor is connected 7.3728MHz crystal oscillator to speed up the implementation of instructions. To pin header connectors JUM2 are output terminals which are need to upload the program to the memory of the microprocessor. The pin header are attached the pins JUM1, PC0 and PC3 which are configured as outputs and are used to control the motor. On this same pin header is even led out the outlets marked as OC1A, OC1B. On this same pin header is even led out the outlets marked as OC1A, OC1B. These are the outlets T1 timer, in which there is the pulse width modulated signal (PWM) [4].
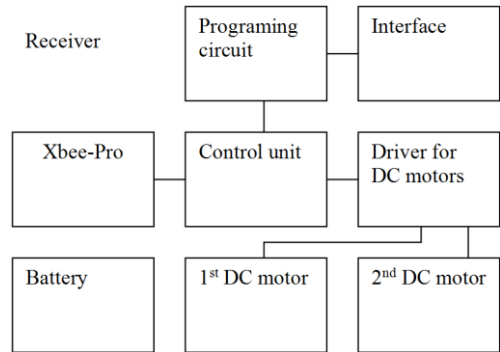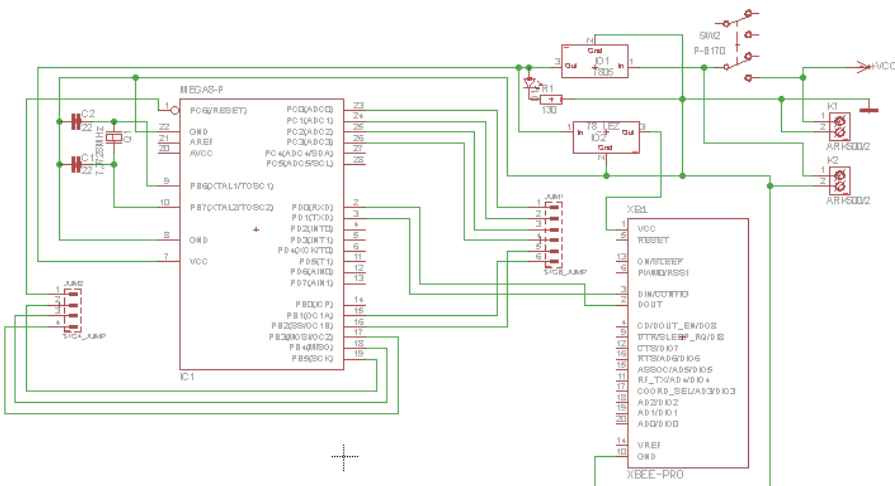

Fig. 4 Scheme of transmitter module

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3 CONTROL SOFTWARE

The control software of wheeled mobile system is realized on different levels of control Fig. 5:

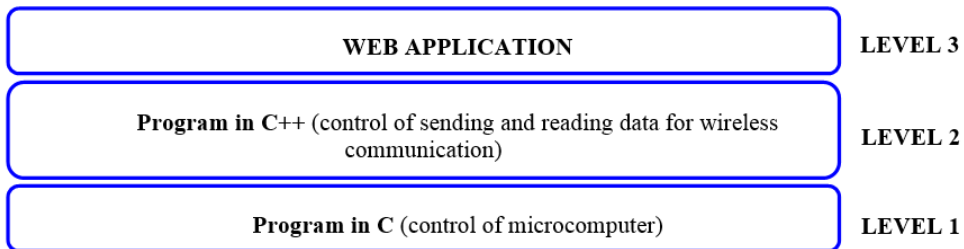**Levels of software of control for wheeled mobile system**

WEB APPLICATION	LEVEL 3
Program in C++ (control of sending and reading data for wireless communication)	LEVEL 2
Program in C (control of microcomputer)	LEVEL 1

Fig. 5 Levels of software

- The lowest level of control software consist of program in C programming language. The program provides motor control and receiving data from asynchronous UART lines by setting the various ports of the microcomputer. The program was created through AVR Studio 4 from firm ATMEL, which is useful for programming microprocessors.

- The second level of control software performs a program in C ++ language. Program both ensures obtaining of control data from web pages and connection to the wireless communication system. The program is running on the server and reads data from file at regular time intervals, evaluates commands and sends them to COM port of the computer. Command is sent via wireless communication device in a wheeled mobile system where will be executed.

- The third level of control software make up Website (Fig. 6) which is the user interface to control wheeled mobile system via the internet. Website communicate via PHP scripting language with web server. The script in PHP evaluates the commands of the user and saved them in a file relevant data. Web page also provides visual information on the movement of a wheeled mobile system via cameras.

Fig. 6 Website of this control software

The most important part of control software is a program in C ++language running on the server. Program cyclically reading information from a text file "smer.txt" and sends to serial COM port of server. Wireless communication module XBee Pro is connected to this serial port of PC. Other roles of the program is to write to a text file "povel.txt" information on the activity of wheeled mobile system and type movement of system. Information from file "povel.txt" are posted on a website. Third tasks of program is setting of the COM ports, for example: port number, transmission speed and parity. Graphical interface between the user and the software shown in Figure 6.

IP Camera AirLive WL-2600CAM is used to provide feedback in the control of movement wheeled mobile system.

3 CONCLUSIONS

This article aims to introduce the concept of solutions wheeled mobile system and his control program at each level of control.

Mobile wireless system is formed on the selected chassis Ackerman with two DC motors. The control of the wireless information transfer was proposed scheme transmitting and receiving module and according to this scheme were made a board of printed circuit. he control software of wheeled mobile system is realized on three levels of control: program in C language for receiving and sending data to the control microcomputer and control of motors, program in C ++ provides connectivity through wireless communication with a mobile wheel system with computer, third level consists of a website that is user interface for remote control of the system.

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