MINESWEEPER

Dworzyński Filip
Secondary School Degree, Zespół Szkół Elektrycznych im.T.Kościuszki w Opolu
E-mail: fil20005@o2.pl

Szyroki Paweł
Secondary School Degree, Zespół Szkół Elektrycznych im.T.Kościuszki w Opolu
E-mail: paw_szy@o2.pl

Matejuk Rafał
Secondary School Degree, Zespół Szkół Elektrycznych im.T.Kościuszki w Opolu
E-mail: matejukrafal@zwm.punkt.pl

Supervised by: Michał Podpora
E-mail: ravyr@klub.chip.pl

ABSTRACT

The aim of this project is to describe a mobile robot, which can cut wires. The robot is controlled by LPT port, which is responsible for controlling the movement of the robot, especially its arm and a wire cutter. On the top of the arm, we put an USB camera. The mechanics and electronics are also described. Moreover, software was written in C++ and installed on a notebook to be in control of all moves of the robot.

1.INTRODUCTION

Nowadays, there are more and more robots in the world. People use them for many jobs, especially to those, which they cannot do themselves, are too time-consuming for them or too dangerous. The robots often are constructed to be controlled them from a distance and used in unreachable areas e.g. for cleaning and checking pits. We have decided to build a robot that can do precise tasks in various conditions.

2.ROBOT'S ARCHITECTURE

2.1.CONTROL

Our robot is controlled by a computer, using parallel port – LPT as well as data is used as an 8-bit Data Port (D0-D7). The control application is written in C++. A library is used, so applying it under Windows XP is possible [1]. Firstly, a simple signal is sent with a help of individual pins of LPT, and it is analysed by the electronics (mounted on the robot) to run a specific motor.

Secondly, a stepping-motor is used for controlling purposes, namely it controls the robot's arm. However, the steering signal differs from the signal that is utilized for monitoring the movement of the robot. The Stepping motors need more impulses, which should be sent in

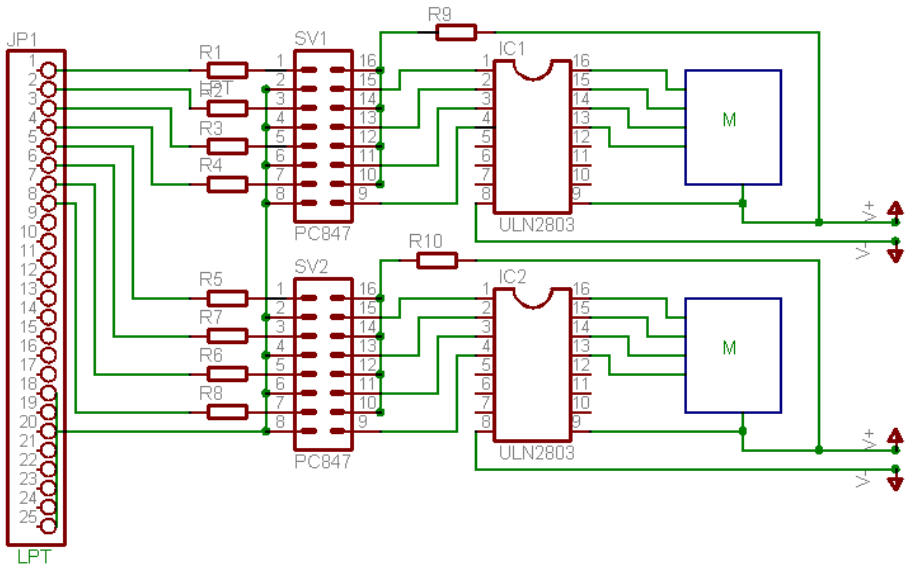
a specified sequence. In addition, for one full turn it needs a specific quantity of steps. The robot is constructed in a flexible way, what causes further development (and to remove limitations of applying only one kind of motor) - the application's transmission is fully re-configurable.

Thirdly, the application can also show the image from a camera mounted on the top of the arm in 320x240 resolution. It also checks whether objects in front of are the same colour as the user had chosen. The algorithm has three predefined colours: blue, red and green.

Finally, the application takes a screen shot from the camera and saves it to a file. It reads this file, and checks pixel by pixel in order to find the most suitable colour. If such a pixel is found, the application informs the operator about the positive result, and enables him to control the robot's tongs.

2.2. MECHANICS

The robot's construction must be light, so that's why it is made of aluminium. It allows to treat this material easily. It has also an additional metal plaque, which is attached for better stability. The robot moves on two bands so it is supposed to navigate on different types of groundwork with possible encumbrances. The propulsion is build of two electric motors with nominal voltage 12V DC. Their task is to spin aluminium wheels of the bands. Turning the robot is possible when engines are controlled separately.



Obrázek 1: Electronics of the robot.

The arm of the robot is moved by a steeping motor, which allows very precise moves. At the end of the arm, sharp tongs are fixed for cables cutting. The servo drive opens and closes the tongs. Everything can be observed remotely on a laptop by which the robot is controlled. [2]

2.3. ELECTRONICS

The stepping motor driver is controlled by LPT port. For optical separation a PC847 transoptor is used. In that way it offers full optoisolation. The transoptor consists of a transmitter and a light detector. The signal is sent between the separated circuits. Industrial soldering of transoptors is an easy issue, and they are better than transformers, because they don't have the borderline frequency.

The electronics is assembled on a universal board because in the future this project will be modified. The ULN2803 is a monolith circuit (high-voltage and high-current) of Darlington configuration transistors. It contains eight Darlington NPN pairs with high-voltage outputs together with the maximal current of the collector and every transistor pair in this circuit is limited to 500mA. It is compatible with TTL i CMOS and it enables to use it in the future.

In every circuit a 2.7 kΩ resistor is implemented, basing on a Darlington pair. The scope temperature of the circuit is from -20ºC to 85ºC.

The problem of powering is solved by using a gel battery. This kind of battery is compact and capacious enough so that is why it is much safer than acid battery. [3][4]

3.CONCLUSIONS AND FUTURE WORK

The robot constructed by us, can work as a police robot used for decommission of bombs, to inspect ventilation canals, air-condition units in buildings or to repair different kinds of machines in areas people cannot obtain accessibility. All robotic construction is light, which makes the components easy to transport.

Because we believe that simple is best; the robot characteristics are constructed with premium technological integrity that utilizes simple circuitry, mechanics and metallic composites for easy and inexpensive repair.

Currently the robots on the market are somewhat limited in actions for specific detailed objectives. Future modes of the robot will be revamped as new technology like WiFi is implemented. For example, images acquired by the camera can allow remote controlling - that would be much safer in cases of police work for search and rescue or decommission of bombs. Another example, the arms will be fitted with attachable components such as a carbine-diamond drills to gain access through concrete and metallic barriers, or custom hydraulics and tongs to better grasp and move objects. An automated warning system will allow the robot to travel in any direction while avoiding obstacles and damage. These hindrances will be avoided by use of both a simple radar frequency controlled through a simple manual radio frequency or a highly developed remote computer program sent via WiFi, thus this computer system will be programmable for independent functions and custom use. If the robot becomes static, the operator or the remote computer will automatically provide a solution to the problem. As an example, via the receipt of the information by imagery of sensor, an automated or manual command will be sent to adjust the elevation of the robot’s hydraulics so that the tracks or wheels can compensate for the terrain.

We understand that robotics is changing rapidly and it will be necessary to invent technological advances to remain competitive with its market.

REFERENCES

[1] Logix4u.net, “A versatile Dynamic Link Library for parallel port interfacing”, available on-line: http://logix4u.net ,

[2] Olszewski, M., "Podstawy Mechatroniki", REA, Warszawa, 2006,

[3] Szpakowski, Z., "Układy scalone w zastosowaniach", WKŁ, Warszawa, 1977,

[4] Piórko, B., Piórko, M., "Podstawy Elektroniki", WSiP, Warszawa, 2005