Contents

LIST OF USED ABBREVIATIONS

I2C – Inter-Integrated Circuit

PWM – Pulse-Width Modulation

INTRODUCTION

The modern drive towards the development of automation in manufacturing processes and the growth of automated factories has led to an increasing set of requirements for sorting systems and robotic process systems.

In addition, the desire to miniaturise the parts and components of each system is forcing the development of new methods to improve the efficiency of the process , taking into account the size of the parts. To solve the problem, it is necessary to choose the smallest solutions,Solutions must be simple, cheap and efficient components of the complex.

The problem of moving small parts is very important. In many areas, process improvements contribute to the reduction of system parts and components. Therefore, it is necessary to manipulate small parts in the manufacturing process, to place them in the right places at the right angle. Unfortunately, a large number of small parts in production and assembly lines are handled manually these days.

For tasks that require automated movements, robots are great, but robot arms are more logical. Smaller robotic arms that can be placed on a table can be used, but they require a large amount of space. This increases the space required for the task, so it is not quite reasonable to use these robots. It is also worth considering the table robots were developed to work with large objects, for accurate movement and location of small objects is not always possible due to the existence of backlash and the complexity of turning the long axis at a small angle. To increase the efficiency and reduce the size of the manipulator robot, it is necessary to develop a minirobot that will meet the above parameters. The development of any robot arm is a complex task that involves the interaction of complex systems. It is necessary to take into account the subtleties of design, hardware and software.Due to the complexity of the overall development of the theme of the bachelor's thesis will be concerned only with the control system of the mini robot manipulator itself.

The aim of the bachelor's thesis is a control system for a mini robot manipulator.

In order to achieve the set goal of the bachelor's thesis, it is necessary to:

- Determination of technical parameters, functions and modes of operation of an industrial minirobot
- Development of mechanical designs of industrial minirobot
- Determination of technical parameters, functions and modes of operation of the minirobot control system

- Development of the structural scheme of the minirobot control system
- Development of functional and circuit diagrams of the minirobot control system
- Development of algorithms and control programmes for the minirobot control system
- Testing of the minirobot control system

1. ACTUALITY OF DEVELOPING A CONTROL SYSTEM FOR A MINI-ROBOT

1.1. Purpose and classification of robot arms

Industrial robots, and in particular manipulating robots, have a wide range of applications in a variety of sectors and offer many advantages, including increased productivity, accuracy and safety. Certain types of robots may be better suited to a particular application than others.

- Welding
- Material Handling
- Assembly
- Painting and Coating
- Packaging
- Inspection and Quality Control
- Machine Tending
- Surgery and Medical Procedures
- Research and Development
- Education and Training
- Cleaning and Maintenance

Figure. 1.1. **Indusrial robot arm**

One of the main characteristics of any robot arm is the number of degrees of freedom(DoF), which is characterised by the set of motion axis parameters that the robot has. It describes the freedom of movement of the robot arm or manipulator in its workspace. The degrees of freedom of a robot arm are determined by the number of joints it has, each of which provides a specific axis of motion.

The degrees of freedom of the robot arm can be classified in one of two possible ways:

- Linear Motion (Translational DoF)
- Rotational Motion (Rotational DoF)

Manipulator robots can be classified on the basis of their structure and movement capabilities. Each type is suitable for each application, rotating joints and often the preferred choice for tasks that involve reaching, grasping and positioning objects, as they allow for more flexible movement in a variety of directions. In scenarios where precise linear motion is required, such as assembly lines where components need to be moved in a straight line, prismatic couplings can be used. But it is not uncommon to use two types of motion in a robot design and they have become widespread.

There is no strict dependency on which type of robot arm should be used in a particular case. The choice of robot arm will still get the job done, but the right robot is necessary to maximise productivity and cost savings.

2. TECHNICAL PARAMETERS OF MINIROBOT

2.1. Brief information about the robot arm

This chapter will provide a short description of the development of the minirobot control system.

The comparative characteristics of existing robot types are shown in the table 2..1

Table. 2.1

Various types of robots and their characteristics

	Speed	Accuracy	DoF
Robot Arm	Low	Middle	**High (6)**
Scara	Middle	**High**	Middle (4)
Delta	**High**	Low	Middle (4)

For the implementation of the robot control system was chosen ”Robot manipulator” because of the high degree of mobility of this type of robot, which contribute to a more convenient movement of objects in space.

2.2. Industrial minirobot arm functions

2.3. Industrial minirobot arm modes

3. MECHANICAL DESIGNS OF MINIROBOT ARM

4. FUNCTIONS AND MODES OF OPERATION OF THE MINIROBOT CONTROL SYSTEM

5. DEVELOPMENT OF THE STRUCTURAL SCHEME OF THE MINIROBOT CONTROL SYSTEM

6. DEVELOPMENT OF FUNCTIONAL AND CIRCUIT DIAGRAMS OF THE MINIROBOT CONTROL SYSTEM

7. DEVELOPMENT OF ALGORITHMS AND CONTROL PROGRAMMES FOR THE MINIROBOT CONTROL SYSTEM

8. TESTING OF THE MINIROBOT CONTROL SYSTEM

REFERENCES