SOFTWARE MANAGEMENT OF INTEGRATED CIRCUITS IN THE MANAGEMENT OF SYSTEMATIZED XARM ROBOTS

F.F Salohiddinov
Andijam machine building institute assistant
Email:Salohiddinovfayzulloh60@gmail.com
Phone: +998 (99)326-09-88
Tojidinov Abduxalim Murojon o‘g‘li
Andijan machine building Institute 4rd year student of "Intelligent Management Computer Systems"
Faculty "Mechatronics and Robotics"
Phone: +998934491207
a-mail: tojidinovabduxalim12@gmail.com

Annotatsiya. *Ushbu maqolada Tizimlashgan XArm robotlarni boshqarishda integral mikrosxemalarni energiya taminotlarini loyihalash hamda dasturiy boshqarish , ularni bosqarish usullari tashkiliy qismlar boshqaruvchi mikrokontrollerlar, boshqaruvchi dasturdan to’g’ri foydalanish, dasturni to’g’ri ishga tushirish, hamda xArm 6 robotinin boshqa robotlardan avfzalikklari haqida malumotlar beriladi.*

Annotatio. *This article provides information on the design and software management of integrated circuits in the management of systematized xArm robots, methods of their suppression organizational parts control microcontrollers, the correct use of the control program, the correct launch of the program, as well as the advantages of the xArm 6 robot from other robots.*

Аннотация. *В данной статье приводится информация о проектировании и программном управлении блоками питания интегральных схем при управлении систематизированными роботами xArm , методах управления ими, микроконтроллерами, управляющими частями организации, правильном использовании управляющей программы, правильном запуске программы, а также о преимуществах робота xArm 6 перед другими роботами.*

Kalit so‘z: *xArm, integral mikrosxemalar, garmonik reduktor, cho'tkasiz servo, 17-bitli ko'p burilishli mutlaq enkoder, ochiq kodli ESP32, APP dasturlash , jonli boshqaruv, yozib olish.*

Ключевые слова: *xArm, интегральные схемы, гармонический редуктор, бесщеточный сервопривод, 17-битный многопоточный абсолютный энкодер, ESP32 с открытым исходным кодом , Программирование приложений , управление в реальном времени, запись*

Keywords: *xArm, integrated circuits, harmonic reducer, brushless servo,17-Bit multi-turn absolute encoder, open source ESP32, APP programming, live control, recording*

Introduction. Today's modern technologies are developed, it is difficult to imagine production, industry and other areas without robots, manipulators, automatic devices. If we look at the history of automatic devices. Since the invention of the water wheel 6,000 years ago, humans have used the automation of tools to help them in their lives. As workers navigate new workplaces with the Internet, robotics, virtual reality (VR), and artificial intelligence (AI), it's important that the workforce understands today's automation and industrial robotics. Whenever a tool does the work instead of a human doing the task manually, it can be considered a form of automation. It could be as simple as a human turning an apple peeler into a fully automated circuit board assembly line. Different types of automation include: mechanization, rigid-rigid automation, programmable automation, flexible systems. Mechanization: The automation of tools and the Industrial Revolution have evolved and changed

over the years. The oldest type of automation is called mechanization. This type of automation occurs when a machine helps produce a product. A current example of this type of automation can be found in a machine shop. A simple example can be seen when a lead screw drives a spindle in a milling machine. Screw process mechanization automation. Fixed Hard Automation: The next level of automation is called hard-hard automation. This happens when a series of mechanisms are arranged in a certain order to create a product. Once the system is installed, it remains in a fixed sequence. Robotic arms can be equipped with any type of tools. These tools are used with precision, accuracy, speed, and repeatability unmatched by humans. These robotic arms may have multiple sensors and vision systems capable of viewing images to aid in their computer-based control. This sensor and vision feedback can be used to make decisions about the robot arm's behavior with the help of artificial intelligence. Industrial robots and automation are an important part of the production of many products manufactured in today's world. The main components of industrial robots. The four main parts of an industrial robot are the manipulator, the controller, the human interface device, and the power supply. The manipulator is a hand that can move in different directions. In the V5 Workcell, the arm is powered by the V5 Smart Motor, which acts as the actuator that provides the power to move the arm. In an industrial robot, power can come from electric motors, air pressure in pneumatic cylinders, or fluid pressure in hydraulic cylinders. The hand has a controller that is the "brain" of the system. The controller holds the programming code and receives signals from the system (input), processes the signals, and then sends signals to the system (output) to control the robot. One type of input may come from a human interface device, such as a teaching pendant. These devices can be used to program the arm and control its movement. The last component is the power source from which the industrial robot receives its energy for the controllers and actuators. This is usually in the form of electricity. While it's true that robots are becoming increasingly popular, some industries are being impacted more than others. Either way, it's nothing to worry about. Most knowledgeable industry commentators agree that robots aren't doing business. In fact, adding robots to a company is likely to create new jobs. If your industry is on this list, it's something to celebrate. Workers are even starting to trust robots more than in the past. According to a recent survey by the World Economic Forum, two-thirds of employees say they trust a robot boss more than they actually do. But it just shows that people don't trust their boss.

Robots are becoming more popular now. One thing is certain, the demand for industrial robots is increasing. According to a July 2019 McKinsey report, the industrial robot market has been growing "at a record rate of around 19% per year since 2012/13". Partially improved robot technology. However, broader economic changes have increased the need for industrial robots in many industries. After the global financial crisis of 2008, corporations had to look for ways to become more efficient and competitive. Robots provided a way to achieve this, and they continue to bring these benefits to businesses.

The manufacturing sector has suffered the most from robotics and automation. This makes sense because industrial robots used in manufacturing have been around for much longer than, say, the harvesting robots that are entering agriculture.

There are many different specific industries in manufacturing, some of which use robots more than others. Top 5 Industries Using Industrial Robots: The International Federation of Robotics (IFR) publishes its annual World Robotics report. A recent report released in September 2019 found that the following industries have installed the most industrial robots over the past three years.

Food Compared to other industries on this list, the food industry has relatively few industrial robots, with fewer than 20,000 robots installed in 2018. However, it is definitely a growing industry with applications such as picking and placing,

slicing and slicing, and distribution of raw and processed foods. Plastics & Chemicals With nearly 20,000 new robots installed in 2018, the plastics and chemicals industry is seeing many industrial robots being used for tasks such as material handling, distribution, assembly and recycling. By 2021, the market is expected to grow by more than 10 percent.

As metal and mechanical robot manufacturer KUKA states on its website, "The metal industry is one of the most versatile industries and is therefore predestined for robot-based automation solutions." As the third largest market with nearly 50,000 new industrial robot installations in 2018, the data certainly backs that up. Robots are used in many applications in this industry, such as welding, painting, and loading. Electrical and electronics is the second leading industry using robots with more than 100,000 new robots installed in 2018, a decline from last year due to lower demand for electronic devices. Despite the recent decline, electrical and electronics companies have been increasing their adoption of robots for several years. Robots are particularly useful for cleanroom environments because they are non-polluting and are often used for pick-and-place tasks or assembly.

Automotive - Unsurprisingly, the leading industry in robotics is the automotive industry, accounting for nearly 30% of all industrial robot installations. Since Unimate, the first industrial robot, was introduced in General Motors factories in 1959, it has been a driving force for robotics in the industry. About 130,000 new robots were installed in the automotive industry in 2018.

Common robotic applications in the automotive industry include assembly, welding, painting, parts transfer, logistics, and material removal. Other industries that use industrial robots a lot. The above list is taken from the latest IFR World Robotics report. However, there are a few important areas where robotics will have a major impact: warehouse logistics and the pharmaceutical industry. Warehouse - According to a recent market report, the warehouse robotics industry is projected to grow 11.7% to reach $6,471 million by 2025. There are warehouses that don't require any human workers (except for robot maintenance, I guess). It's no wonder that warehouse robots are on the rise. The pharmaceutical industry is one of the top industries listed in McKinsey's 2019 Industrial Robot report, with investment in the industry enabling companies to reduce costs, improve quality and increase efficiency. xArm robot. The XArm 6 is a versatile, 6-degree-of-freedom robotic arm that uses high-performance harmonic gears and brushless motors to achieve a 5kg load capacity and +/- 0.1mm repeat position accuracy. A built-in harmonic reducer, brushless servo, and 17-bit multi-turn absolute encoder make xArm joints durable and precise enough to perform in long-term precision applications. xArm Studio is 100% compatible with multiple operating systems. Perfect for MacOS, iOS, Windows and Android. The xArm SDK includes Python, ROS, and C++. In the launched robot program, the main page will show the number of axes currently connected to the robot arm, Controller IP, Robot Status, TCP Load, Collision Sensitivity, Robot Setup and Motion Enable. Unlike an industrial robotic arm, which is heavy and difficult to move, the xArm is light and comfortable. The entire range is made of carbon fiber and aluminum, reducing weight by at least 50%. Intuitive and quick setup allows the device to be used for any process in any conditions. Model 6 includes a built-in collision detector that immediately stops a collision when it occurs. The xArm robot consists of these main parts.

xArm 6 robotic arm

- AC control box (DC optional)
- Robotic arm signal cable
- Robotic arm power cable
- Control box power cable
- Network cable
- Robotic arm end effector adapter cable

The company also offers a set of optional extras

- Handle
- Sucker
- Camera module

The xArm 6 comes in white with light gray trim. Its modern appearance makes it ideal

for service automation, artificial intelligence research, photography, etc. The footprint of the robot is Ø 126 mm (Ø 5 inches); it weighs 12.2 kg (26.9 lb). The UFACTORY xArm 6 is priced at $8,899.00, which is reasonable considering its functionality and expandability.

Methods. Robot control can be done in 4 ways:

1.Live Control: provides the ability to control the position of the arm and control it in real time by adjusting its position. The live control panel has the following functions. The "stop" button in Emergency StopXArm Studio is different from the button on the control box. The "stop" button in XArm Studio allows you to stop the flow to the robot arm. Action and clears all Cache commands immediately. This will stop the software and the power will still be on. And the Emergency stop button in the control box: sends a stop command, turns off the power supply of the robotic arm, from there the position of the roboticarm is slightly braked and returns to the initial position.

Real Robot Mode / Simulation Mode

It can control the movement of the real robot arm in the interface of xArmStudio, and the virtual robot arm reflects the state of the real robot. It can control the movement of the virtual robot arm in the interface of xArmStudio. Note: the robot arm can only be in one mode Real Robot Mode or Simulation Mode.

2.Blockly: allows users to perform the desired action by simply taking blocks of code, at the same time passing the desired code through the blocks to the Python programming language.

3.Python IDE: A Python integrated development environment that directly uses the Python-SDK API name and has the ability to view Python code created by the Blockly project.

4. Recording: it is possible to record the trajectory of the robot arm in manual mode and then repeat the movement, the maximum recording time is 5 minutes.XArm robotida ESP32 dasturlashtiriladigan mikrokontroleri.

- Powered by open source ESP32 microcontroller.
- Supports MicroPython programming and works with the Python editor.
- Includes Hiwonder sensors for secondary development.
- Supports multiple control methods.
- Visual application interface and graphic computer programs are available.
- ESP32 Python programmable microcontroller works with Wi-Fi and Bluetooth wireless communication.
- It not only offers classic desktop robot arm operations, but also has expansion ports for users to develop more functions with the sensor expansion kit and Python editor

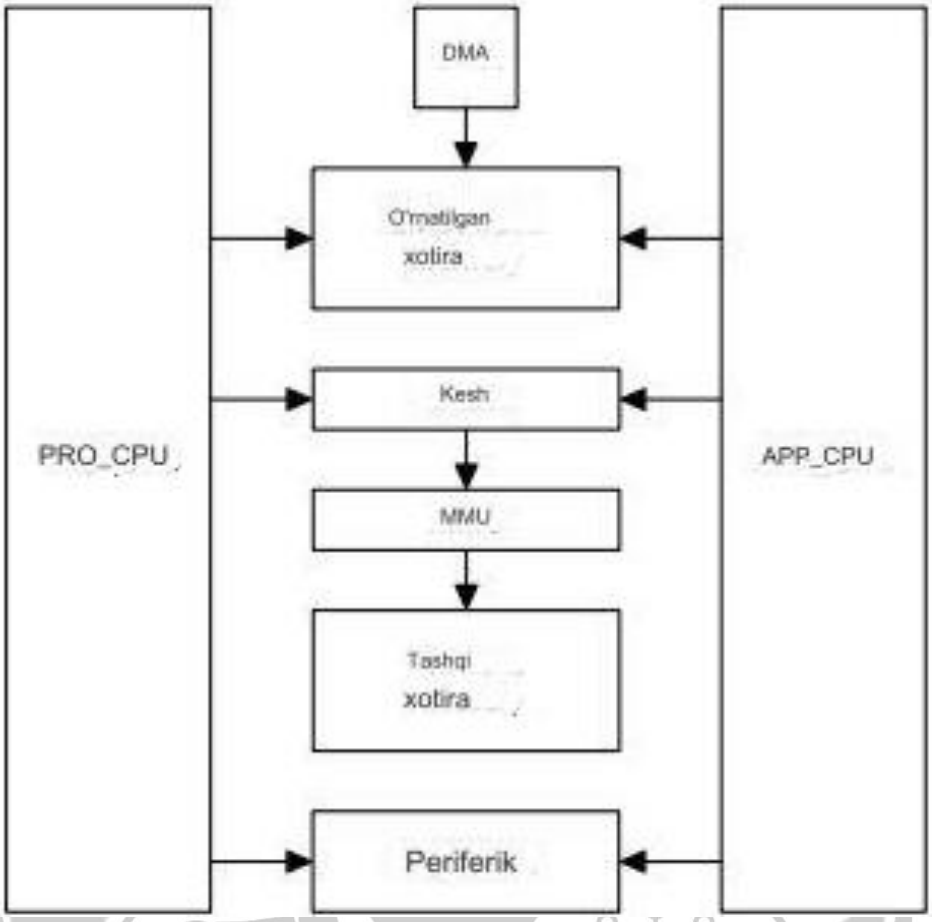

Figure 1. ESP32 main control system

The ESP32 open source controller adopts a simple modular design consisting of an ESP32 core board and a multi-function expansion board. It is equipped with onboard servo ports, signal, LED, USB interface and many other electronic components, as well as several expansion interfaces that allow users to directly connect other sensors and actuator modules for secondary development. With Wi-Fi and Bluetooth capabilities, the ESP board is very convenient for developing wireless data transmission applications.

Support for multiple control methods:

- Computer software programming:
- The provided graphics PC software allows users to drag the sliders to adjust the servo angle of the Xarm ESP32.
- APP programming:
- Easy-to-use software allows users to revise the rotation angle or manually adjust the position when adding movements.
- Synchronization controller programming:
- The robot arm can be "learned" and "one-click activated" using two buttons on the synchronization controller.

Conclusion. The xArm robot is an easy-to-use, easy-to-programmable manipulator. Compared to other robots, it is easy to learn and can be used in laboratory applications and production areas. The model is designed with a powerful X86 chip to easily control the control algorithm and ensure precise movements. In addition, it uses a compact power transmission, a self-designed external rotor brushless motor, and an integrated harmonic mechanism to ensure high repeatability and torque capability. The xArm has a programmable

handle. It can perform various tasks effectively, you can control its position, speed and power. It also includes suction cups with a load capacity of 4 kg and a maximum vacuum level of -90 kpa. The device can be used for placement operations, packaging, sorting, etc. xArm robots are produced by Ufactory. You can get more information about the robot at https://www.ufactory.cc/. Basic information is provided in English.

References

1.Иванова Г.В. Автоматизация технологических процессов основных химических производств. -С.Пб.: Петербургский ГТУ, 2003,- 238с.

2. Клим Ю.М. Типовые элементы систем автоматического управления. Учебник для студентов учреждений среднего профессионального образования. -М.: ФОРУМ: ИНФРА-М, 2004. -384 с.

3. Андреев, В. А. Релейная защита и автоматика систем электроснабжения: учебник для студентов высших учебных заведений, обучающихся по специальности "Электроснабжение" /В. А. Андреев. - 5-е изд., стер. - Москва: Выссшая школа, 2007.-639с.

4. Гороськов, Б. И. Автоматическое управление: учебник для студентов учреждений среднего профессионального образования / Б. И. Горосъков. - Москва:ИРПО: Академия, 2003 -304 с

5.Баубеков С.Д. “ Механика роботов и манипуляторов”

6.Е.И. Юревич “Основы робототехники”

7.С. Л. Зенкевич, А. С. Ющенко “управление роботами”

8.A.Q.Haydarov Mashinasozlik texnologiyasi.

9.E.I. Yurevich Robototexnika asoslari.

10.V. G. Xomchenko Robotik tizimlar.

11.A. G. Kravtsov, K. V. Marusich Sanoat robotlari.

12. https://www.ufactory.cc/

13. https://medium.com/

14 . https://top3dshop.com/