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## USING THE GRABBER ROBOT BASED ON THE ARDUINO IN THE LEARNING PROCESS

*У зв'язку з постійним розвитком технологій, технічні спеціалісти повинні безперервно розвивати свої навички та кваліфікацію. Роботизовані технології активно використовуються в промисловості (роботизовані руки на автомобільних заводах), медицині (хірургічний робот da Vinci Xi) та повсякденному житті (роботизовані пилососи). Використання таких механізмів може бути широким, і ця область має великий потенціал.*

*The ongoing advancement of technology necessitates constant skill and qualification development for professionals in the technology sector. Robotic technologies are rapidly finding applications in industries such as automotive manufacturing (utilizing robotic arms), healthcare (as seen with the da Vinci Xi surgical robot), and even everyday life (evident in the use of robotic vacuum cleaners). The potential applications of these technologies are wide-ranging, and the field holds significant promise for those engaged in this area.*

***Keywords:*** *Robotic technologies, "The Grabber", "The Fischertechnik", Arduino, Cartesian coordinates, Sensors.*

The objective of this project is to familiarize ourselves with the arm robot manufactured by "The Fischertechnik" company and subsequently program it for operational tasks. For this project, we utilized a scaled-down version of an industrial robot manipulator referred to as an "arm." This robotic arm is mounted on a base and engineered to execute repetitive tasks.

Using "The Grabber" robot based on Arduino in the learning process can be an engaging and educational experience. "The Grabber" is a robotic arm from the "Fischertechnik" company capable of performing various tasks, including identification, gripping, and sorting of objects. When combined with Arduino, a popular microcontroller platform, it opens up a world of opportunities for students to explore robotics, automation, and programming.

"The Grabber" is a robotic arm developed by "Fischertechnik," designed to carry out tasks like object recognition, grasping, and object sorting. Moreover, this robotic arm can be effectively utilized in automating a wide range of production processes. The microcontrollers offered by "Fischertechnik" stand out in the market due to their prominence when compared to competitors. Nevertheless, alternative microcontrollers, such as Arduino, are also noteworthy, especially for those seeking to learn microcontroller programming [2, p. 13].


Fig. 1. Arduino Uno

Arduino is a simple microcontroller board equipped with both analog and digital inputs and outputs, functioning at a 5V voltage level. It can be programmed within its dedicated environment, like the Arduino IDE, which will be employed to manage the robot. "The Grabber" comprises a diverse range of components, encompassing sensors, mechanical components, actuators, electronic control systems, and software [1, p. 71].

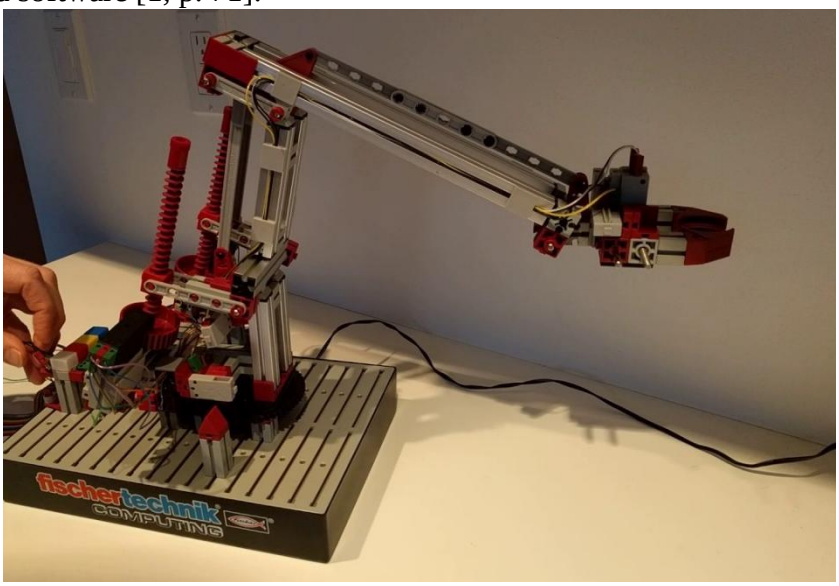


Fig. 2. "The Grabber"

The software development process for Arduino can differ based on the type of control employed, for instance, the initial approach using a potentiometer. In this method, we input the desired potentiometer values into the data input line, separating them with commas. When the program is initiated, the robot will adjust to the corresponding values within an acceptable tolerance. However, this control method has limitations as it can be challenging to precisely position the robot using these values. Hence, a more practical alternative is to utilize Cartesian coordinates for control. This type of control is provided in the Arduino IDE, where there is a «go-to» function, in which three coordinates x, y, and z can be entered. After entering the data, the arm will move to the specified point in its coordinate system. This allows for more precise and efficient control of the arm. In addition, to improve the efficiency and accuracy of "The Grabber," additional sensors such as cameras or distance sensors can be used. For example, installing a camera allows the robot to determine the location of objects on the work surface and automatically perform gripping and sorting operations [3, p. 71-72] [4, p. 49].

Utilizing the Grabber robot based on Arduino in the educational context enhances the learning experience by combining practical robotics with programming skills. The Grabber, a versatile robotic arm produced by Fischertechnik, and Arduino, a widely used microcontroller platform, create an ideal synergy for educational purposes. Here's a detailed exploration of how using the Grabber robot with Arduino enriches the learning process:

- Hands-On Learning: The Grabber, when paired with Arduino, offers students a tangible, hands-on experience with robotics. Learners can assemble, control, and program the robot, bridging the gap between theoretical concepts and real-world applications.
- Programming Proficiency: Arduino is renowned for its user-friendly programming environment. Students can grasp fundamental coding concepts while writing code to control the Grabber's movements. This experience equips them with valuable coding skills that extend beyond robotics.
- Interdisciplinary Knowledge: Using the Grabber and Arduino encourages the development of interdisciplinary skills. Students explore mechanics, electronics, programming, and robotics, fostering a holistic understanding of STEM (Science, Technology, Engineering, and Mathematics) subjects.

- Problem-Solving: Robotics inherently involves troubleshooting and problem-solving. Students encounter challenges, debug code, and refine their solutions, nurturing critical thinking and analytical abilities.
- Creativity and Innovation: The Grabber-Arduino combination allows for customization. Students can design and implement their robotic solutions, stimulating creativity and innovation. They experiment with various control methods and functionalities, fostering inventive thinking.
- Real-World Relevance: The Grabber can simulate real-world scenarios, such as automation in manufacturing or robotic assistance in healthcare. This practical exposure helps students appreciate the applicability of robotics in diverse industries.
- Collaborative Learning: Robotics projects often entail collaboration, promoting teamwork and communication skills. Students work together, share ideas, and leverage collective expertise to achieve project objectives.
- Career Readiness: Proficiency in robotics and Arduino programming opens doors to career opportunities in fields like robotics engineering, automation, and IoT (Internet of Things) development. Students gain valuable skills sought after by employers.
- Problem-Based Learning: Integrating the Grabber with Arduino facilitates problem-based learning. Students define challenges, design solutions, and apply their knowledge to address real-world problems, which is a powerful pedagogical approach.
- Project-Based Assessments: Robotics projects serve as dynamic assessments. Educators can assess students' understanding, problem-solving abilities, and creativity through project outcomes [4, p. 71-72].

In summary, using the Grabber robot based on Arduino in the learning process transforms education into an engaging, practical, and multidisciplinary experience. Students acquire essential skills, explore innovative ideas, and prepare themselves for a technology-driven future. This combination empowers educators to inspire the next generation of innovators, engineers, and problem solvers.

## REFERENCES

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