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DEVELOPMENT OF ARCHITECTURE FOR MOBILE ROBOT CONTROL BASED ON RASPBERRY PI MODEL 3 B+

Modern robotics is impossible without the use of high-performance single-board computers, on the basis of which complex control systems can be implemented using computer vision, sensing systems, which make it possible to implement complex decision-making algorithms in a stochastic environment of a mobile robot using neural networks. The works of Stelian-Emilian Oltean and Muhammad Rivai show examples of solving problems of developing laboratory mobile robots based on Raspberry Pi Model 3 B+ [1-2]. Analyzing these publications, it can be seen that the authors use a combination of Raspberry Pi Model 3 B+ and Arduino Nano to control a mobile robot, which complicates the control system and the amount of program code, which in total makes the algorithms heavier and increases their processing time. Based on this, it is proposed to implement a Raspberry Pi Model 3 B+ direct control system with an L298N motor driver module [3].

The developed architecture for controlling a mobile robot based on Raspberry Pi Model 3 B+ with an L298N motor driver module is shown in Figure 1.

The mobile robot consists of a Raspberry Pi Model 3 B+ board that features: Broadcom BCM2837B0 SoC; 64-bit quad-core ARMv8 Cortex-A53 processor, clocked at 1.4 GHz; Video Core IV® Multimedia 2-core graphics coprocessor; 1GB LPDDR2 SDRAM memory; Gigabit Ethernet up to 300 Mbps; 2.4 GHz and 5 GHz

IEEE 802.11.b/g/n/ac WI-FI + Bluetooth 4.2 Low Energy (BLE) [4]. It also consists of a power system that includes 18650 batteries - 4pcs, a button, an L298N motor control driver and an X14015 DC / DC buck converter - to supply power to the Raspberry Pi. The developed experimental layout of the mobile robot is shown in Figure 2.

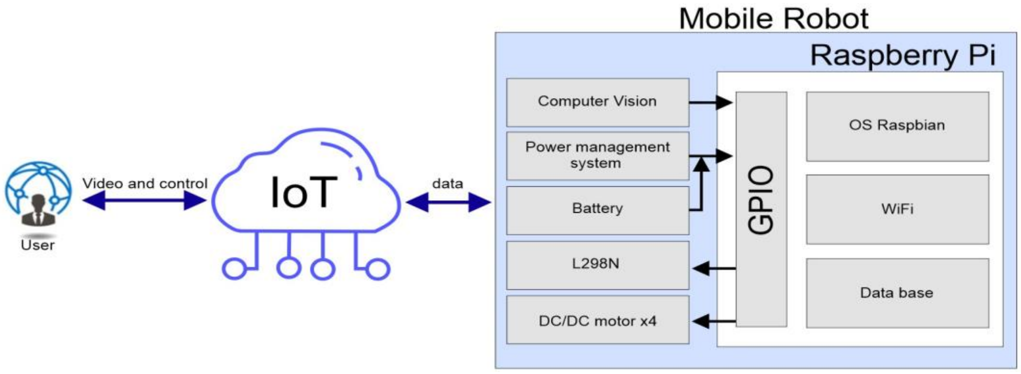

Fig. 1. **The architecture of the control of a mobile robot based on Raspberry Pi Model 3 B+**

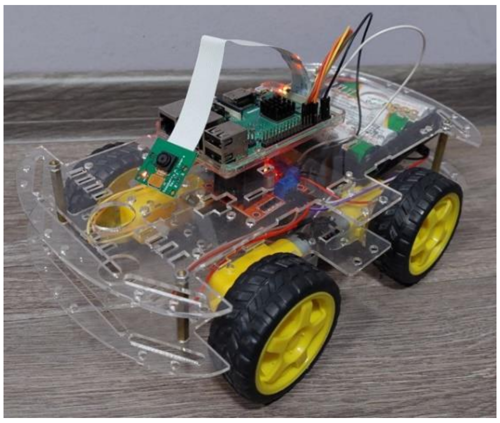

Fig. 2. **Model of a mobile robot**

Computer vision and servo motors are used to control the mobile robot. For the movement of servomotors, a program was written in Python. Computer vision consists of a video camera and the OpenCV library [5]. The video camera will broadcast streaming video, and the OpenCV library will help recognize objects on the way.

The mobile robot control architecture allows the user to control the mobile robot through the Wi-Fi built into the board, as well as through the use of the

PostgreSQL database [6] and using the developed C# application [7].

This application works on the principle of connecting to a database at an IP address [7], which is located on the Raspberry Pi, and executing a program that was written to implement movement based on DC motors [8]. Also, this program will receive the broadcast of the video and display it in the appropriate window. An example of the developed control program is shown in Figure 3.

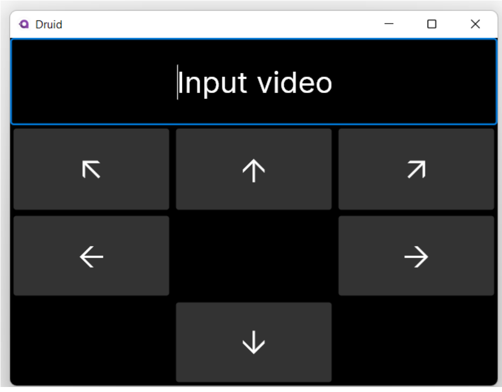

Fig. 3. **Program for controlling a mobile robot in C#**

The next step is the development of a system for recognition and identification of objects in the working area of a mobile robot and the development of decision-making algorithms based on neural networks to implement the functions of autonomous operation of a mobile robot. In the future, the authors consider the expansion of the functions of a mobile robot, due to the integration of a manipulator with a gripping device into it.

References:

1. Stelian-Emilian Oltean. (2019). Mobile Robot Platform with Arduino Uno and Raspberry Pi for Autonomous Navigation. *Procedia Manufacturing*. Volume 32, 2019, Pages 572-577. DOI: 10.1016/j.promfg.2019.02.254
2. Muhammad Rivai, Dony Hutabarat, Zishwa Muhammad Jauhar Nafis. (2020). 2D mapping using omni-directional mobile robot equipped with LiDAR. *Telkomnika Telecommunication, Computing, Electronics and Control*. Vol. 18, No. 3, pp. 1467-1474. DOI: 10.12928/TELKOMNIKA.v18i3.14872
3. L298N Motor Driver Module. [Type of medium]. Available: https://components101.com/modules/l293n-motor-driver-module.

4. The most powerful Raspberry Pi. Ever. [Type of medium]. Available: https://www.newark.com/buy-raspberry-pi
5. OpenCV-Python 4.5.5.64. [Type of medium]. Available: https://pypi.org/project/opencv-python/
6. PostgreSQL: The World's Most Advanced Open Source Relational Database. [Type of medium]. Available: https://www.postgresql.org/
7. Chapter 52. Frontend/Backend Protocol. [Type of medium]. Available: https://www.postgresql.org/docs/13/protocol.html
8. Arduino-DC Motor. [Type of medium]. Available: https://arduinogetstarted.com/tutorials/arduino-dc-motor