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ZAMONAVIY INNOVATSION TADQIQOTLARNING DOLZARB MUAMMOLARI VA RIVOJLANISH TENDENSIYALARI: YECHIMLAR VA ISTIQBOLLAR

mavzusidagi Respublika ilmiy-texnik anjuman materiallari to‘plami

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Respublika miqyosidagi ilmiy-texnik anjuman materiallarida zamonaviy innovatsion tadqiqotlarning dolzarb muammolari va rivojlanish tendensiyalari sohasidagi innovatsion tadqiqotlar aks etgan.

Globallashuv sharoitida davlatimizni yanada barqaror va jadal sur’atlar bilan rivojlantirish bo‘yicha amalga oshirilayotgan islohotlar samarasini yaxshilash sohasidagi ilmiy-tadqiqot ishlariga alohida e’tibor qaratilgan. Zero iqtisodiyotning, ijtimoiy sohalarni qamrab olgan modernizatsiya jarayonlari, hayotning barcha sohalarini liberallashtirishni talab qilmoqda.

Ushbu ilmiy ma’ruza tezislari to‘plamida mamlakatimiz va xorijlik turli yo‘nalishlarda faoliyat olib borayotgan mutaxassislar, olimlar, professor-o‘qituvchilar, ilmiy tadqiqot institutlari va markazlarining ilmiy xodimlari, tadqiqotchilari, magistr va talabalarning ilmiy-tadqiqot ishlari natijalari mujassamlashgan.

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Mazkur to‘plamga kiritilgan ma’ruza tezislarining mazmuni, undagi statistik ma’lumotlar va me’yoriy hujjatlarning to‘g‘riligi hamda tanqidiy fikr-mulohazalar, keltirilgan takliflarga mualliflarning o‘zlari mas’uldirlar.

7. Nizametdinov A., Usmonova V., Abdusattorov D. OZIQ-OVQAT MUAMMOSI //Science technology&Digital finance. – 2023. – T. 1. – №. 5. – C. 139-143.
8. Luna A., Nizametdinov A., Xudayarov R. KORXONALAR FAOLIYATINI STRATEGIK BOSHQARISH SAMARADORLIGINI OSHIRISHNING CHORA TADBIRLARI //Science technology&Digital finance. – 2023. – T. 1. – №. 5. – C. 34-40.
9. Nizametdinov A. A. OLIY TA'LIM TIZIMINING AGRAR SOHASIDA INNOVATSION TEXNOLOGIYALAR QO'LLASH USTUVORLIGI //INTERNATIONAL CONFERENCES. – 2022. – T. 1. – №. 6. – C. 58-60.

IMPLEMENTING MOBILE ROBOT WALKING PATH CONTROL AND TRACKING IN C# WINDOWS FORM APPLICATION

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Abstract: This article explores the implementation of mobile robot walking path control and tracking within a C# Windows Form application. Mobile robots are integral across various industries, necessitating efficient navigation methods. The article begins by guiding readers through the setup of Visual Studio and the creation of a Windows Forms Application project. Subsequently, it delves into the design of a user interface conducive to user interaction, encompassing components such as textboxes, buttons, and canvas. Path planning algorithms, including A*, Dijkstra's, and RRT, are discussed for generating waypoints crucial for robot movement.

Keywords: Mobile Robot,Path Control, Path Tracking, C# Programming, Windows Form Application, Robotics, Path Planning Algorithm, Kinematics, Dynamics, Feedback Control, Sensor Integration, Obstacle Avoidance, PID Controller, User Interface (UI) Design, Simulation Environment, Waypoints, A* Algorithm, Dijkstra's Algorithm, Rapidly-exploring Random Trees (RRT), Sensor Data Processing.

Introduction: Mobile robots play a crucial role in various fields such as manufacturing, healthcare, and logistics. One of the fundamental tasks in mobile robotics is path planning and control, where the robot navigates through its environment efficiently while avoiding obstacles. In this article, we will explore how to implement mobile robot walking path control and tracking in a C# Windows Form application.[1]

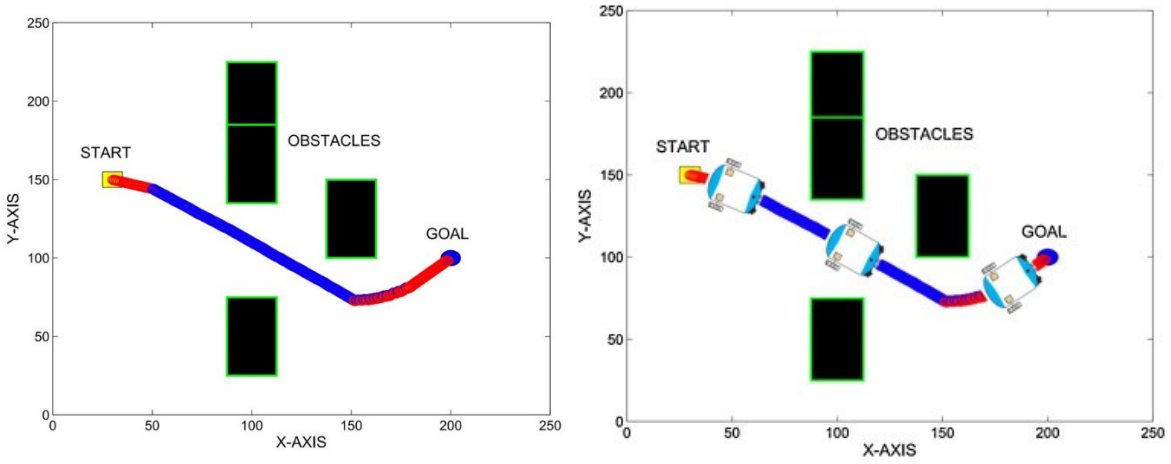
Setting Up the Environment: Before diving into the implementation, ensure you have Visual Studio installed on your system. Create a new Windows Forms Application project in Visual Studio and name it accordingly.[1]

Designing the User Interface: Design the user interface (UI) to provide controls for setting the robot's destination and initiating the path tracking process. Include components such as textboxes, buttons, and a canvas for displaying the robot's movement.[2]

Implementing the Path Planning Algorithm: Choose a suitable path planning algorithm based on your requirements and implement it in C#. Popular algorithms include A*, Dijkstra's algorithm, and Rapidly-exploring Random Trees (RRT). This algorithm should generate a sequence of waypoints that the robot will follow to reach its destination while avoiding obstacles.[3]

Simulating Robot Movement: Create a simulated environment where the robot can move within the UI canvas. Define the robot's kinematics and dynamics to simulate its movement accurately. You can represent the robot as a simple point or a more complex shape depending on your application.

Integrating Path Control and Tracking: Integrate the path planning algorithm with the simulated robot movement. Implement a control loop that continuously updates the robot's position based on the planned path. Ensure the robot follows the path smoothly and adjusts its trajectory to avoid collisions with obstacles. [1]



Implementing Feedback Control: To enhance tracking accuracy, implement feedback control mechanisms such as PID controllers. These controllers adjust the robot's speed and direction based on feedback from sensors or the environment. Fine-tune the controller parameters to achieve optimal performance.[2]

Handling Sensor Data (Optional): If your robot is equipped with sensors such as LiDAR or cameras, integrate sensor data processing into your application.

Use sensor data to update the robot's position, detect obstacles, and refine the path planning in real-time.[3]

Testing and Optimization: Test the application thoroughly to ensure the robot can navigate complex paths accurately and efficiently. Optimize the code for performance and reliability, considering factors such as computational resources and real-time constraints.[2]

Deployment and Further Development: Once the application is working satisfactorily, deploy it to the target platform (e.g., a physical robot or a simulation environment). Consider further development to add advanced features such as multi-robot coordination, dynamic obstacle avoidance, or remote control capabilities.

Setting Up the Environment

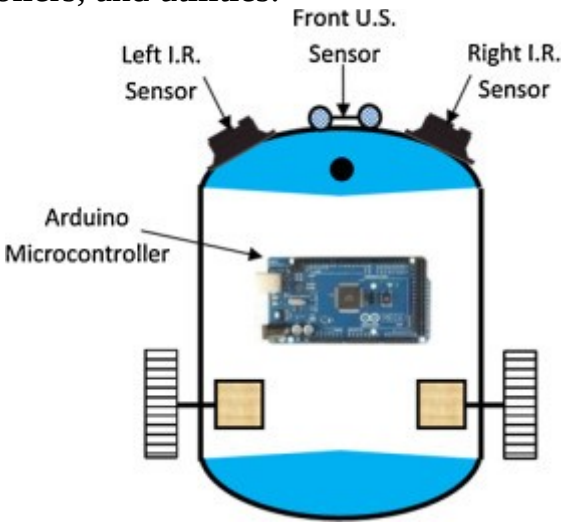
To embark on implementing mobile robot walking path control and tracking in a C# Windows Form application, it's crucial to establish the development environment first. Here's a step-by-step guide to get started:

Choose Windows Forms Application: In the "New Project" dialog, select "Windows Forms App (.NET Framework)" under the "Visual C#" category. Give your project a meaningful name and click "OK" to proceed.[2]

Configure Project Settings: In the project configuration window, you can specify additional settings such as the target framework, location, and solution name. Adjust these settings according to your preferences and click "Create" to create the project.[1]

Set Up User Interface: Once the project is created, you'll be presented with the default Windows Form designer. Use this designer to design the user interface (UI) for your application. Add components such as textboxes, buttons, labels, and a canvas where the robot's movement will be visualized.[1]

Organize Your Solution: As your project grows, it's essential to keep it organized. Create separate folders for different components of your application, such as UI, algorithms, controllers, and utilities.

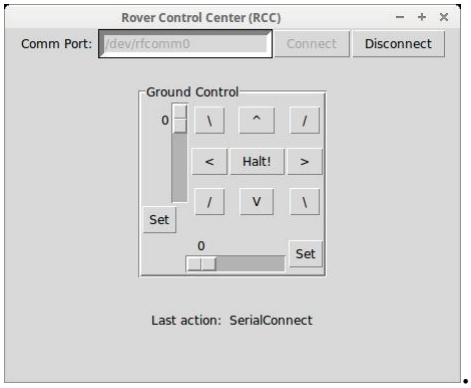


Install Necessary Packages: Depending on the specific requirements of your project, you may need to install additional packages or libraries via NuGet Package Manager. For instance, if you plan to use external libraries for path planning algorithms or sensor data processing, install them using NuGet.

Set Up Version Control (Optional): Consider setting up version control for your project using Git or another version control system. This allows you to track changes, collaborate with team members, and revert to previous versions if needed.

Familiarize Yourself with C# and Windows Forms: If you're new to C# programming or Windows Forms development, take some time to familiarize yourself with the language syntax, object-oriented programming concepts, and the Windows Forms framework. There are plenty of online tutorials, documentation, and resources available to help you get started.

Start Coding: With the environment set up and the project created, you're ready to start coding! Begin by implementing the core functionalities of your application, such as path planning algorithms, robot movement simulation, user interface interactions, and integration of feedback control mechanisms.



By following these steps, you'll have a solid foundation for implementing mobile robot walking path control and tracking in a C# Windows Form application. Stay focused, keep learning, and don't hesitate to seek help from online communities or forums if you encounter any challenges along the way.

Conclusion

Implementing mobile robot walking path control and tracking in a C# Windows Form application requires integrating path planning algorithms, simulated robot movement, and feedback control mechanisms. By following the steps outlined in this article, you can develop a robust and efficient solution for navigating mobile robots in various environments.

Remember to continuously iterate on your design and implementation to address any issues and improve performance over time. Mobile robotics is a dynamic field with endless possibilities for innovation and advancement.

References:

1. Norqo’ziyev , Q. (2023). MOBIL ROBOTLAR UCHUN YO’LNI REJALASHTIRISH ALGORITMI. *Research and Implementation*. извлечено от https://fer-teach.uz/index.php/rai/article/view/746

2. Норкозиев, К., & Тоджиев, А. (2023). Использование искусственных нейронных сетей при разработке алгоритма поиска оптимального пути мобильных роботов в динамических средах. Информатика и инженерные

технологии, 1(1), 25–29. извлечено от https://inlibrary.uz/index.php/computer-engineering/article/view/25025

3. Тоджиев, А., & Норкузиев, К. (2023). The role of artificial intelligence technology in individualized teaching . Информатика и инженерные технологии, 1(2), 153–156. извлечено от https://inlibrary.uz/index.php/computer-engineering/article/view/25014

4. Toxir, A., & Lobar, A. (2023). MOBIL ILOVALAR ORQALI YOSH BOLALARDA UCHRAYDIGAN NUTQ BUZILISHLARINI BARTARAF ETISH. In Uz-Conferences (Vol. 1, No. 1, pp. 906-911).

5. Toxir Turg'un o'gli, A. (2023). C# DA FAYLAR ORQALI MA'LUMOTLARNI SARALASH VA FAYLLAR BILAN ISHLASH ALGORITMLARINING XUSUSIYATLARI. In Uz-Conferences (Vol. 1, No. 1, pp. 139-141).

6. Toxir Turg'un o'gli, A. (2023). O 'RINLARNI ALMASHTIRISH USULLARI. In Uz-Conferences (Vol. 1, No. 1, pp. 133-138).

7. Sodiqov Diyorbek, Aspandiyorov Ilg'or, Raxmonjonov Ibrohim, & Sharipova Sadoqat Fazliddinovna. (2023). MATRITSALAR YORDAMIDA IQTISODIY MASALALARNI YECHISH . ОБРАЗОВАНИЕ НАУКА И ИННОВАЦИОННЫЕ ИДЕИ В МИРЕ, 19(9), 124–127. Retrieved from http://www.newjournal.org/index.php/01/article/view/5467

8. Рустамов, М., & Иргашева, У. (2022). Задача наблюдаемоста в процессе диффузии. Современные инновационные исследования актуальные проблемы и развитие тенденции: решения и перспективы, 1(1). извлечено от https://inlibrary.uz/index.php/zitdmrt/article/view/5132

9. Рустамов, М., & Иргашева, У. (2022). Задача наблюдаемоста в процессе диффузии. Современные инновационные исследования актуальные проблемы и развитие тенденции: решения и перспективы, 1(1).

10. Choryorqulov G'.H., & Qosimov N.S. (2023). ELEKTRON JADVAL MODELINING TAVSIFLANISHI. PEDAGOGS Jurnali, 30(3), 67–73.

11. Роль анализа текстовых связей в электронных документах в информационной безопасности Г Чорркулов, Н Норматов, А Мамараимов Информатика и инженерные технологии 1 (1), 67-71

12. Mamatkulovich B. B., Shuhrat o'g'li M. S., Jasurjonovich B. J. SPECIAL DEEP CNN DESIGN FOR FACIAL EXPRESSION CLASSIFICATION WITH A SMALL AMOUNT OF DATA //Open Access Repository. – 2023. – Т. 4. – №. 3. – С. 472-478.

13. Mamatkulovich, B. B., Dilshod o'gli, Y. A., & Akmal o'g'li, A. A. (2023). Predicting daily energy production in a blockchain-based P2P energy trading system. Texas Journal of Engineering and Technology, 18, 7-11.

14. Мустафоев, Е., & Холматов, Ж. (2023). Brayl matn tasviri sifatini oshirish usullari. Информатика и инженерные технологии, 1(2), 23-27.

15. Mustafoyev, E. M., & Maydonova, Z. N. (2023). MOBIL ILOVA YARTISHDA FOYDALANILGAN ONLAYN APP INVERTOR PLATFORMASIDAN FOYDALANISH. Лучшие интеллектуальные исследования, 10(6), 23-28.