iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 **Issue:** XI **Month of publication:** November 2023

DOI: https://doi.org/10.22214/ijraset.2023.56462

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue XI Nov 2023- Available at www.ijraset.com

Pick and Place an Object with Robot Gripper Using Arduino

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***Abstract:** This paper presents an automatic system that picks an object from one location and places it in another location. A rover features with special type of wheels called Mecanum wheels. A pre-defined path is designed, and the rover is programmed to move the rover in the desired path. The Arduino IDE software tool is used to write the program and the program is being dumped into the microcontroller. A gripper with two arms is used to pick and place objects that are functionally similar to a hand.*

***Keywords:** RoverC.pro, Arduino IDE, IoT, Mecanum wheels, Gripper*

I. INTRODUCTION

Advanced technology has made everything easier and more comfortable. Human efforts and involvement are being eliminated in their day-to-day activities. Automation has become an attractive feature in the industry and daily routine work. The use of robotic systems and technology to perform tasks without direct human intervention to lead a comfortable life is referred to as automation with robots. A system that reduces human work and human intervention to get more precise work and enable industries to use automated solutions with improved efficiency, reduced production costs, for lifting objects from one place to another is developed.

The significance of developing an Arduino-controlled pick-and-place system can have implications for a wide range of industries, including manufacturing, logistics, and healthcare. Arduino Uno provides real-time control capabilities, which are crucial for robots that require quick response to changing environmental conditions. To implement custom algorithms and logic for their robots, users find flexibility in programming Arduino which makes it suitable for a wide range of applications.

[1] In the 2019 publication titled 'Mobile Controlled Pick and Place Robot using Arduino' in the International Journal of Advance Research and Innovative Ideas in Education (IJARIIE) [112 p. ISSN(O)-2395-4396], D. R. P. Rajarathinam, R. Arunbabu, M. Danujan, B. Jasper Fernando, S. Vinoth Kumar, and T. Sethupathi have asserted that their proposed approach enables individuals without advanced technical skills to easily connect with a range of engineering robotic devices.

[2] In the 2001 paper 'Implementing a Robotic Arm for Object Manipulation Using Bluetooth,' published in the International Journal of Engineering Research & Technology (IJERT) [81 p. ISSN: 2278-0181], Anandh B A, Sakthivel R, and Shankar Ganesh explored the potential uses of a robot arm controlled via Bluetooth, including scenarios like the safe handling of explosives, the relocation of dangerous chemicals, and situations where human involvement is not feasible. Robots find their applications in many fields such as in the bottle filling industry, packing industry, food manufacturing industry, pick and place robots are designed and implemented.

II. WORKING PRINCIPLE

The mobile pick and place robot works on the principle of mechanics and forward & inverse kinematics. There is one such system created to provide flexibility for the movement of the robot in all directions. First, the path for the robot to move from one location to another location is to be decided. Later the robot is allowed to pick the required object for which the gripper is needed. For the robot to move in all directions we chose a model called RoverC.Pro comprises Mecanum wheels which allow the robot to move in all directions that is Forward, Backward, Sideways, Rotate on its axis, and so on. The directions in which the robot can move can be programmed as the model RoverC.Pro is a programmable device. The robot can be moved in the desired direction which may vary according to the user. The user can make changes to get to their target location. Since the RoverC.Pro is a programmable device, one can modify the program and commands using the platform ARUDINO IDE. The IDE platform includes certain libraries that are to be installed and the program is written, compiled, and run. The entire program written can be dumped into the microcontroller, which belongs to the ESP32 family series and an extended model of M5STACK. It follows the name M5STICK C PLUS.

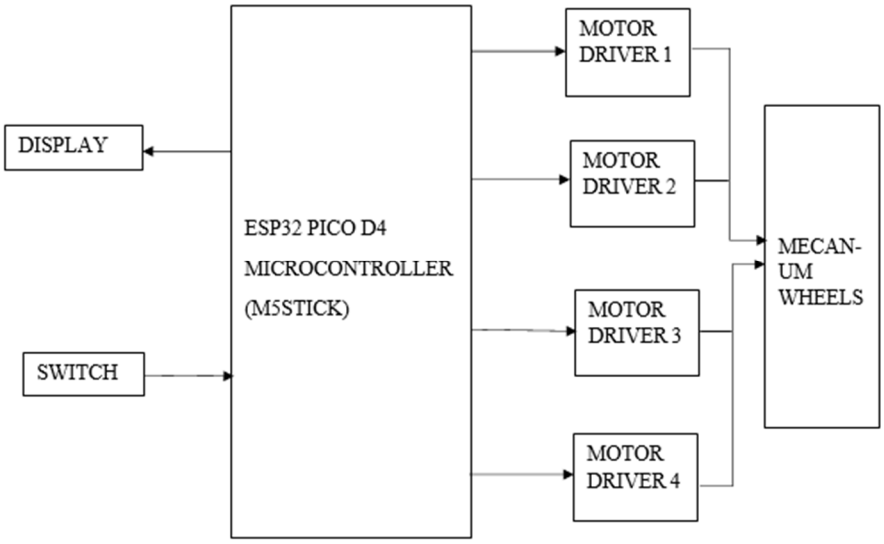

Fig: 2.1 Block Diagram

The wheels of the RoverC.Pro are connected to the motors which miniaturised servo motors are called N20 Worm Gear Motors. These motors are rotated according to the program that has been written. The gripper helps the robot to pick the object identified just like a human hand. The advantageous feature of the Rover is that it can allow the other devices to interface at its peripherals. Here, the major roles are played by the Gripper, ESP32 Microcontroller, Mecanum wheels, and Servo Motors which drive the robot that is Rover C Pro accordingly as per the given set of instructions written on the IDE platform.

The block diagram consists of a microcontroller that connects with the four motor drivers to which four N20 worm gear motors are connected. The gear motors are also directly connected to the mecanum wheels. The switch present on the rover, when it is on, triggers the microcontroller and makes it ON. The ESP32 controller triggers the motor drivers to make the motors rotate.

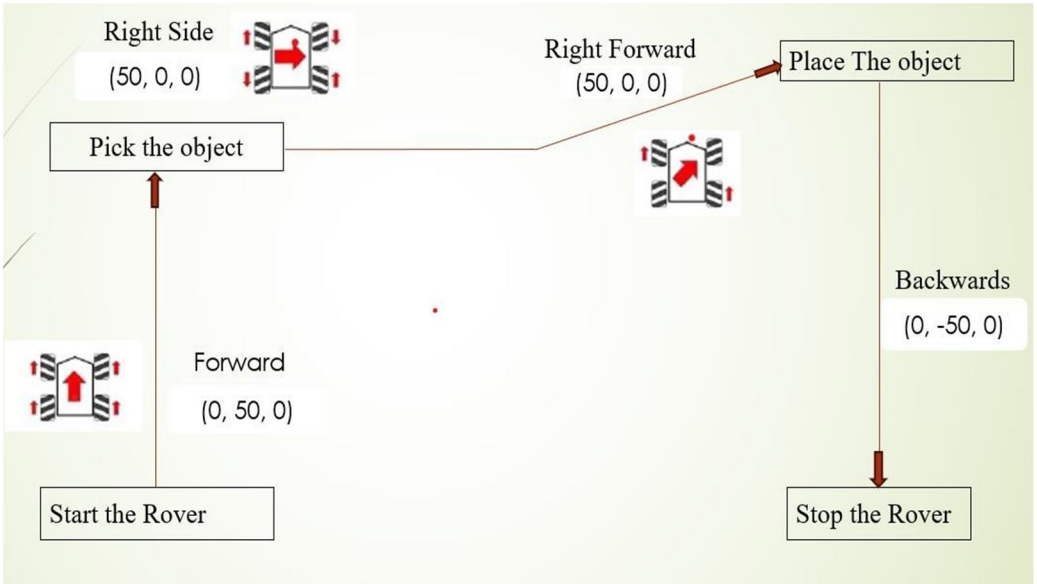

Fig: 2.2 Pre-defined Path

The rotating motors will automatically change the axes of the wheels and ultimately the wheels start moving. The servo motors on both ends are connected to the respective pins on the motor drivers. Each motor is connected to one of the motor drivers. The motors may rotate the wheels in a circular motion or towards right or left or, make them move forward or backward.

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue XI Nov 2023- Available at www.ijraset.com

To achieve this the rover has to be programmed, which can be done by dumping the code into the microcontroller through the USB Cable. The wheels are connected to a metallic base on which the entire circuit is built and connections are done using the connecting wires, on top of which insulation is made to avoid direct contact with the base. Everything is based on the ESP32 Microcontroller. We connect the positive side of the motor power to the motor drivers. We connect the negative side of the motor power to each of the H bridges.

III. RESULTS

The system developed to pick and place an object is done successfully. We have seen the rover picking up an object moving from the given location to the desired destination location in the predefined path of the user.

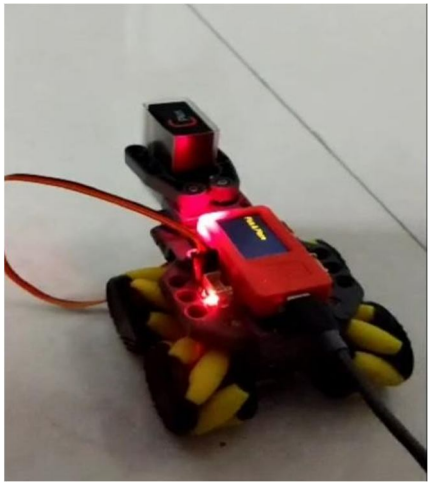

Fig:3.1 Holding the object

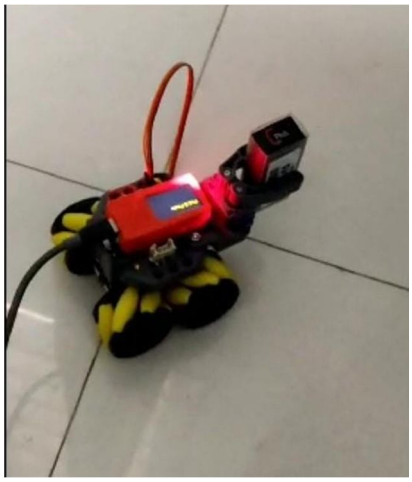

Fig:3.2 Moves towards the right

Fig: 3.3 Releases the object

The Fig3.1 shows that as soon as the program is run, the rover picks the object. The Fig3.2 depicts the movement of the rover towards the right side to place the object at its destination. The Fig3.3 shows that according to the instructions given to it, the device places or in other words releases the object that it is holding.

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IV. CONCLUSIONS

In conclusion, the integration of RoverC.pro and Arduino Uno in a pick-and-place system represents a significant step toward accessible and affordable automation. We successfully designed and implemented a versatile system that showcases the potential of these platforms in real-world applications.

The key takeaway from our project is the efficiency and adaptability of the pick-and-place system. It exhibited accurate object manipulation, which is crucial for manufacturing, logistics, and warehouse automation. By combining the mobility of RoverC and the computational power of Arduino Uno, we achieved a system capable of performing precise tasks with reliability.

However, our project is not without its limitations. Further refinement is needed to enhance the system's robustness. Additionally, while we have demonstrated the system's scalability, customization for specific industrial needs will require further research and development. Future work should focus on optimizing the control algorithms, improving object recognition techniques, and expanding the system's capabilities to handle a broader range of objects and scenarios.

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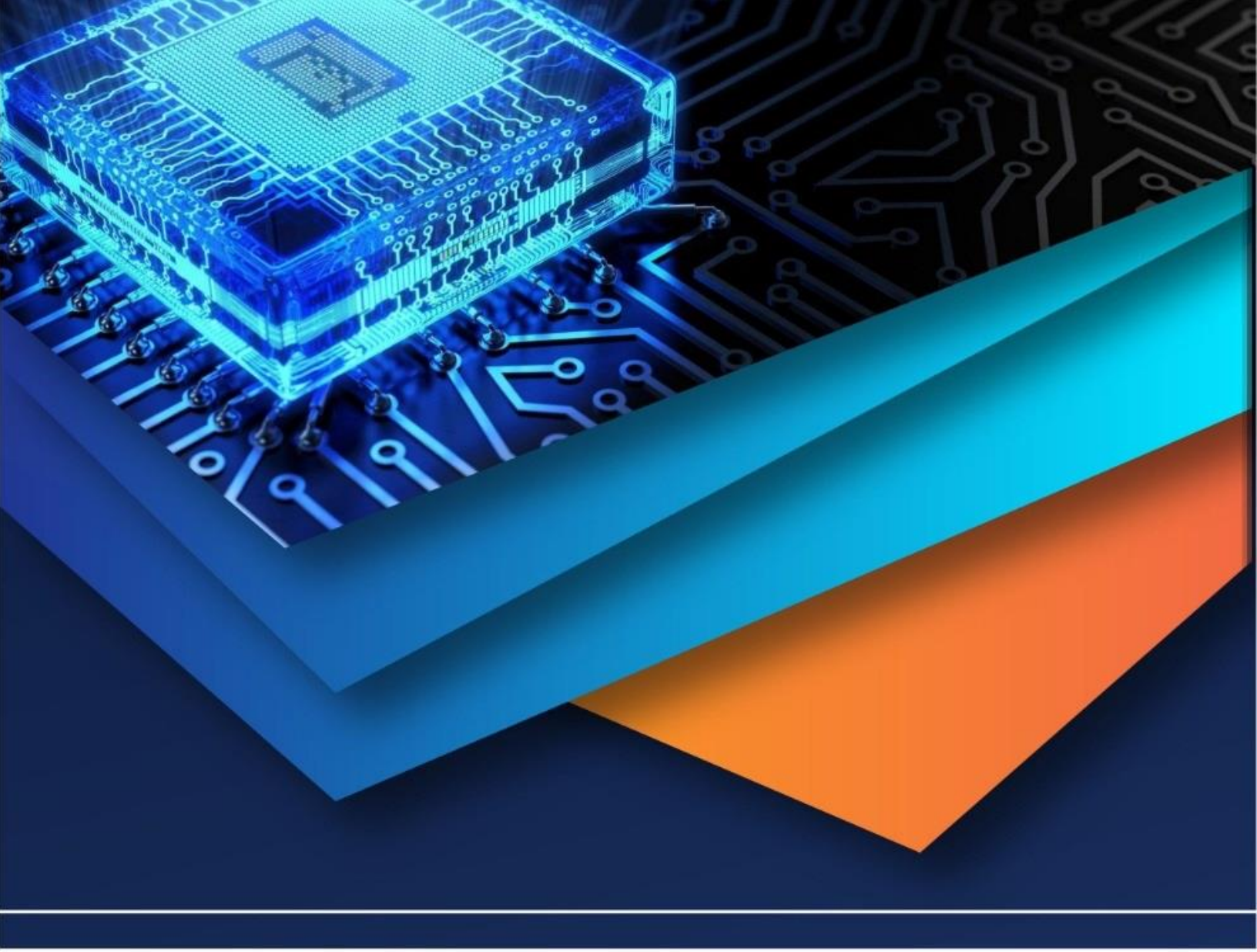

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