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Design & Development of a Table Assisted Robotic Arm

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Abstract

Table Assist Robot Arm (TARA) is an innovative robotic system designed to automate and streamline the process of setting dining tables in various hospitality and food service establishments. This paper presents an overview of TARA, highlighting its key features, benefits, and potential applications. TARA is equipped with advanced robotic arms and sensors that enable it to perform a wide range of tasks related to table setting. These tasks include arranging cutlery, placing plates and glasses, folding napkins, and positioning condiments. The system is programmed with sophisticated algorithms that ensure precise and efficient table setting, while its modular design allows for easy customization to suit different table layouts and dining environments.

Introduction

In the ever-evolving world of robotics, a transformative innovation has emerged—a 3D Printed Robot Arm capable of precise, intuitive control through gesture- based interactions [11]. This remarkable creation represents the fusion of state-of-the-art technologies, harnessing the power of 3D printing and the sophistication of gesture control to execute a seemingly mundane yet intricately precise task: lifting small objects [1].

As we embark on this exploration, we venture into the heart of this groundbreaking invention, uncovering the multifaceted layers that make it a pivotal advancement in the realm of robotics. This one-page introduction will serve as our gateway into comprehending the significance of this 3D Printed Robot Arm, both in the context of technological achievement and its potential to reshape industries and human-machine interaction [2].

At the core of this robotic wonder lies the art of 3D printing, a revolutionary manufacturing technique that allows for the creation of complex, customizable structures with unprecedented speed and precision. The Robot Arm's genesis is a testament to the transformative potential of 3D printing technology, which enables the construction of intricate robotic components with a level of intricacy and cost-efficiency previously unimaginable [3].

But what truly sets this 3D Printed Robot Arm apart is its capacity for gesture-based control—a paradigm shift in human-robot interaction. No longer confined to traditional controllers or programming languages, users can effortlessly command the robot arm's movements with intuitive gestures, ushering in a new era of adaptability and

ease of use. This innovative interface not only simplifies the operation but also broadens its applications across diverse industries, from manufacturing and healthcare to assistive technology and entertainment [4].

Lifting small objects might seem like a straightforward task, but the intricacy lies in executing it with a level of finesse and precision that matches human dexterity. The 3D Printed Robot Arm accomplishes this with remarkable grace, showcasing its potential to excel in fields demanding meticulous manipulation, such as assembling delicate electronics or performing intricate medical procedures [5].

In the realm of robotics, the 3D Printed Robot Arm controlled by gesture commands stands as a symbol of human ingenuity and technological prowess. Through the marriage of 3D printing precision and gesture-based control, it offers a glimpse into a future where human- robot interaction is more intuitive and versatile than ever before [6].

As we conclude this exploration, it becomes evident that this groundbreaking creation has far-reaching implications. Its capacity to manipulate small objects with finesse not only streamlines industrial processes but also holds promise in fields as diverse as healthcare, manufacturing, and entertainment. The gesture-based control system, meanwhile, transcends the limitations of traditional interfaces, opening doors to a wider array of applications [7].

The 3D Printed Robot Arm underscores the potential of robotics to augment human capabilities, enhance efficiency, and elevate the quality of life. It exemplifies the relentless pursuit of innovation and progress that defines the field of robotics, pushing the boundaries of what is possible [8].

Scope & Objectives

In this section, the scope & objectives of the work is presented.

Scopes

Robot Arm Design: The mini project aims to design a compact and versatile Table Assist Robot Arm that can be easily integrated into various environments, such as homes, offices, and small-scale workplaces [9].

It should be capable of accurately grasping, moving, and arranging objects with precision.

Cost-Effective Design: Optimize the robot arm's design and materials to create an affordable and accessible solution, making it viable for various domestic and small-scale professional applications.

Safety Measures: Incorporating safety features to prevent collisions with objects and ensure the arm's movements are safe around humans, avoiding any potential hazards during operation.

Object Manipulation: The robot arm will focus on efficiently manipulating objects placed on a tabletop surface. It should be capable of accurately grasping, moving, and arranging objects with precision [10].

Objectives

- To provide security to all the users who are using it bridge
- To assist in day to day kitchen work
- It can also be used for small office duties such as stamping.
- Robotic arms are utilized in electronics manufacturing for precise placement of components on circuit boards.

Proposed methodology and block diagram

- Produce a 3D print of the model.
- Provide the Arduino code for arm movement.
- Assemble the circuit on a zero board.
- Complete Robot Arm which moves by hand gesture and holds on to objects is ready.

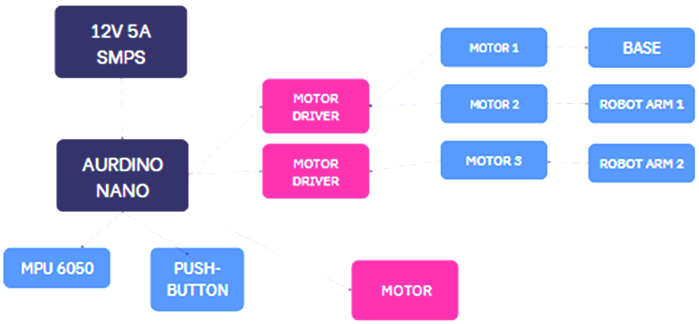

Fig. 1 : Block-diagram of the proposed system

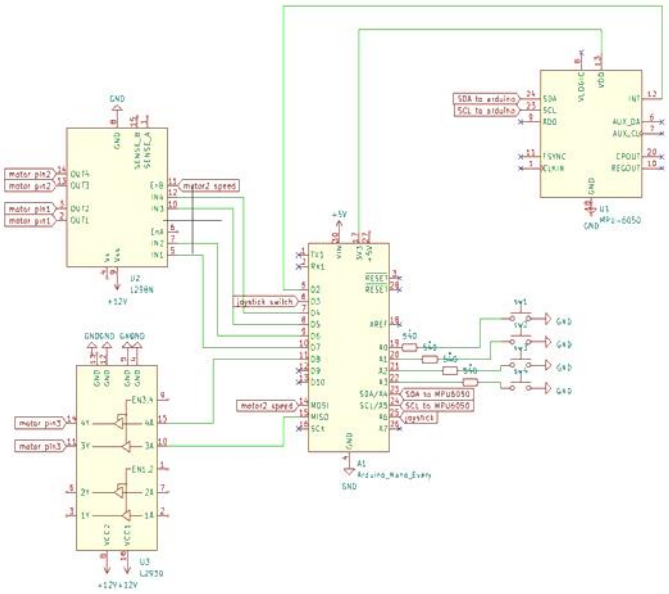

Fig. 2 : Circuit diagram of the proposed system

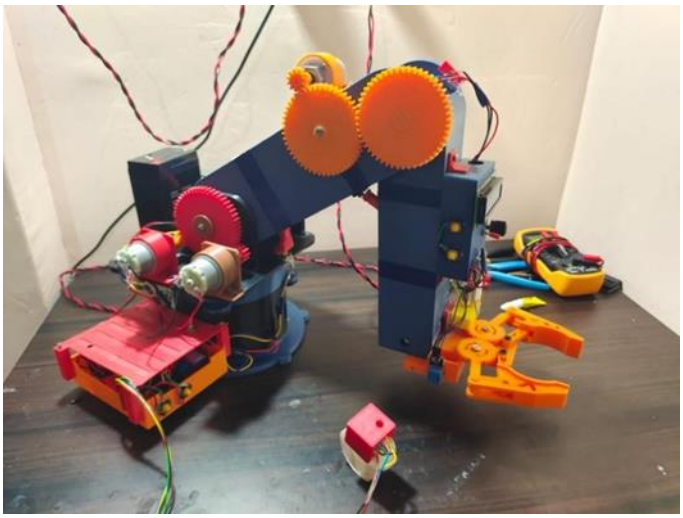

Fig. 3 : Pictorial representation of the developed robot arm – one view

Fig. 4 : Pictorial representation of the developed robot arm – other view

Experimental Results

- When the MPU6050 sensor is moved in + x and – x axis. The robot arm moves in that direction.
- When the MPU6050 sensor is moved in + y and – y axis. The robot arm moves in that direction.
- When the switches is pressed the motor in the base rotates clock wise and anti clock wise.
- The temperature is measured by DHT11 and displayed in the LCD display.
- When the push buttons in the second arm are pressed TARA (Table assistant robot arm) grabs or releases the object.

Advantages & Applications

- Robot arms are used for tasks such as assembly, welding, material handling, packaging.
- They enhance productivity, precision, and efficiency in daily processes
- Increased productivity and efficiency in repetitive and labour-intensive tasks.
- Enhanced precision, accuracy, and consistency in performing complex operations, leading to improved quality and reduced errors.

Conclusions

In conclusion, the Table Assistant Robot Arm has proven to be a valuable addition to various settings where small object manipulation and lifting tasks are required. Through its intuitive gesture control interface, it offers a user-friendly and efficient way to interact with the robot. During the project, we successfully designed, built, and tested the robot arm to perform tasks such as lifting objects, demonstrating its versatility and adaptability. The gesture control system allowed for precise and natural control, making it accessible to users with varying levels of technical expertise. Furthermore, this technology has the potential to be applied in a wide range of fields, including

manufacturing, healthcare, and research, where delicate and precise manipulation of objects is essential. It not only enhances productivity but also reduces the risk of workplace injuries. In summary, the Table Assistant Robot Arm represents a promising step towards automation and human-robot collaboration, showcasing the possibilities of gesture control in robotics and its potential to revolutionize how we interact with machines in our daily lives.

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