A PROJECT REPORT

ON

**“Robotic Arm”**

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DIPLOMA IN

# COMPUTER SCIENCE & ENGINEERING

SUBMITTED BY

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**DRIEMS POLYTECHNIC, TANGI, CUTTACK ACADEMIC YEAR**

**2024-2025**



# DRIEMS, POLYTECHNIC

***CERTIFICATE***

This is to certify that the work in this Project Report entitled

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**Er. Jyoti Ranjan Nayak**

# (Project Guide)

***ACKNOWLEDGMENT***

This project is done as a semester project, as a part course titled

# “PROJECT WORK PHASE -I”.

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We also thank **Er. Jyoti Ranjan Nayak** for giving this opportunity to explore into the real world and realize the interrelation without which a Project can never progress. In our present project we have chosen the topic- **“Robotic Arm”.**

We are also thankful to parents, friend and all staff of **Department of Computer Science & Engineering** for providing us relevant information and necessary clarifications, and great support.

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# ABSTRACT

This project centers on the design and development of a 3D-printed robotic arm, incorporating advanced IoT capabilities for wireless control and task automation. The robotic arm was designed Blender, a versatile 3D modelling tool, which allowed us to refine the structural details and ensure an efficient design optimized for real-world applications. This process highlights our proficiency in 3D modelling and the ability to convert creative designs into functional prototypes. The robotic arm’s functionality is powered by the ESP32 microcontroller, which serves as the core of the system. Known for its reliability and versatility, the ESP32 provides a robust platform for seamless wireless communication and precise control of the robotic arm’s movements. To enable intuitive and efficient user interaction, the ESP32 is configured as a Wi-Fi Access Point, eliminating the need for an external router. Users can connect directly to the robotic arm through a custom-built web interface accessible on any Wi-Fi-enabled device. This interface is built using WebSocket technology, which ensures low-latency communication and real-time control. As a result, users can issue commands and receive instant feedback, making the robotic arm’s operation both smooth and responsive. This real-time control is particularly useful in scenarios where precision and timing are critical.

The robotic arm is equipped with 4 servo motors, each dedicated to controlling a specific joint or axis. These include the base, shoulder, elbow, and gripper, which collectively allow the arm to perform a wide range of movements. The precision offered by the servo motors ensures that even sensitive tasks can be executed with ease. To further enhance the arm’s functionality, the system features a motion recording and playback capability. This allows users to record a sequence of movements and replay them repeatedly, making the arm ideal for tasks that require consistency, such as assembly line operations or pick-and-place applications.

Our project draws on an interdisciplinary approach, combining knowledge and skills from microcontroller programming, servo motor control algorithms and robotics. The ability to wirelessly control the robotic arm and automate tasks demonstrates the seamless integration of IoT and robotics technologies. This integration opens up practical applications in various fields, including industrial automation, prototyping, and educational robotics. For instance, the robotic arm could be used in factories for repetitive assembly tasks, in laboratories for precise handling of samples, or in educational settings to teach students about the principles of robotics and automation. Beyond its practical applications, this project showcases our ability to tackle complex engineering challenges. The design and implementation process required a deep understanding of both hardware and software systems. From designing the arm in Blender to programming the ESP32 for real-time communication and control, every aspect of the project demanded a high level of technical skill and attention to detail. The challenges we encountered during development, such as ensuring the smooth operation of servo motors and achieving reliable wireless connectivity, provided valuable learning experiences that have further enhanced our problem-solving abilities.

In summary, this project is a comprehensive demonstration of our technical proficiency and innovative thinking. It exemplifies our ability to bridge the gap between theoretical knowledge and practical application, resulting in a functional system that addresses real-world needs. By leveraging IoT and robotics technologies, the robotic arm serves as a testament to the potential of automation to improve efficiency and productivity in various domains. This project not only highlights our technical skills in design and programming but also underscores our commitment to exploring the possibilities of emerging technologies in robotics and IoT.

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