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Gesture Controlled Robot for the Disabled using Arduino

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Abstract: ***The gesture-controlled robot project presents a novel approach to human-robot interaction, utilizing hand gestures as an intuitive and natural means of control. This project aims to develop a system where users can seamlessly communicate with a robot using simple hand movements.***

The project consists of two main components: a handheld device for gesture input and a robot equipped with sensors and actuators for movement. Through wireless communication, the handheld device transmits signals encoding the user's hand gestures to the robot's receiver module, which decodes the signals, processes them, and translates them into commands for controlling the robot's movements. Advantages of this system include intuitive control, wireless operation, real-time interaction, enhanced safety, adaptability, educational value, and versatility. However, challenges such as gesture recognition complexity and limited gesture vocabulary must be addressed to ensure the system's effectiveness. The project has numerous applications, including entertainment, assistive technology, industrial automation, education, home automation, IoT, security, and interactive exhibits. By leveraging gesture-controlled robotics, this project contributes to advancing human-robot interaction technology and fostering innovation in various domains.

Keywords: Gesture-controlled robot, Hand gestures, Wireless communication, Actuators Real-time interaction, Gesture recognition, sensors.

I. INTRODUCTION

Recent advances in robotics and assistive tech have fueled innovative solutions for enhancing the lives of individuals with disabilities. Among these, gesture-controlled robots offer a promising path to greater accessibility and independence. This project leverages Arduino-based systems to enable intuitive interaction with robots, addressing the challenges posed by traditional input devices. By allowing users to control movements through hand gestures, the project aims to empower individuals with disabilities to navigate their environments more effectively. With a focus on tailored design and real-time gesture interpretation, the project holds potential to significantly improve quality of life and promote inclusivity in robotics and assistive technology.

II. RELATED WORK

In recent times several initiatives have been explored in the intersection of gesture control and assistive robotics to enhance accessibility for individuals with disabilities. Projects such as the Myo armband system have demonstrated the potential of wearable technology in enabling gesture-based control of robotic devices. By capturing electromyographic signals from muscle movements, the Myo armband allows users to intuitively interact with computers, virtual reality environments, and robotic prosthetics, offering a versatile platform for assistive applications.

Additionally, research efforts have focused on developing gesture recognition algorithms tailored to the unique needs of individuals with disabilities. Studies have investigated machine learning techniques for interpreting a wide range of gestures, including those with limited dexterity or mobility. By refining gesture recognition models and incorporating adaptive features, researchers aim to create robust and inclusive interfaces that cater to diverse user abilities, thereby enhancing the usability and effectiveness of gesture-controlled systems in assistive contexts.

Furthermore, collaborative initiatives between academia and industry have yielded advancements in the design and implementation of gesture-controlled robots specifically tailored to the needs of individuals with disabilities. These projects emphasize user-centered design principles and participatory approaches to ensure that robotic systems align closely with user preferences and requirements. By integrating user feedback and incorporating accessibility features, researchers strive to develop assistive robots that empower individuals with disabilities to lead more independent and fulfilling lives.

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III. PROPOSED SYSTEM

The robot enables users to control its movements through hand gestures, leveraging an accelerometer and Arduino Nano microcontroller. Accelerometer detects hand movements, with Arduino processing the data and encoding it via an H12E encoder into a serial data stream. Commands are wirelessly transmitted to the robot's receiver section using a radio transmitter module, allowing real-time execution of gestures.

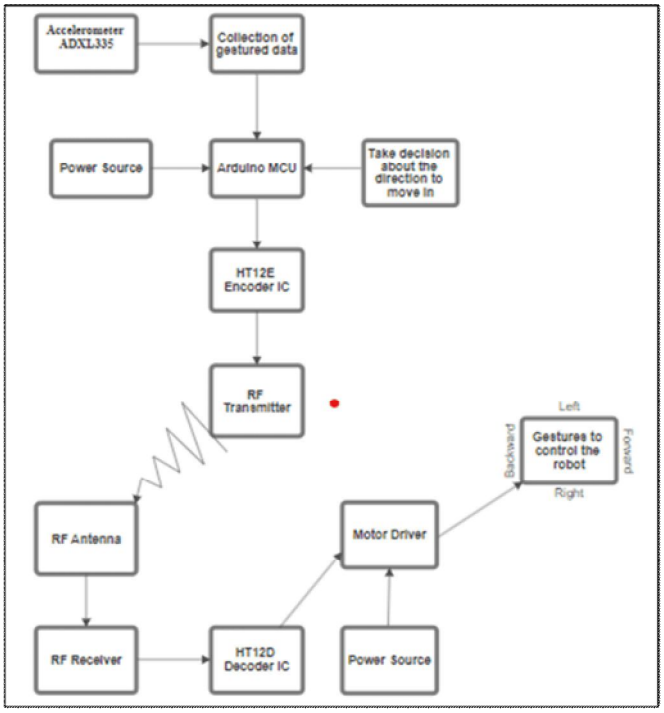


Fig.1 Block diagram for gesture control

In addition to gesture control, the robot integrates GPS and GSM modules for real-time location sharing upon user request. The GPS continuously tracks the robot's coordinates, while the Arduino communicates with the GSM module to transmit location updates via SMS commands. Receiver module captures and decodes signals transmitted by the handheld device, interfacing with a microcontroller to generate commands for the robot's movements. It may also facilitate communication with GSM and GPS modules, and manage power consumption for efficiency.

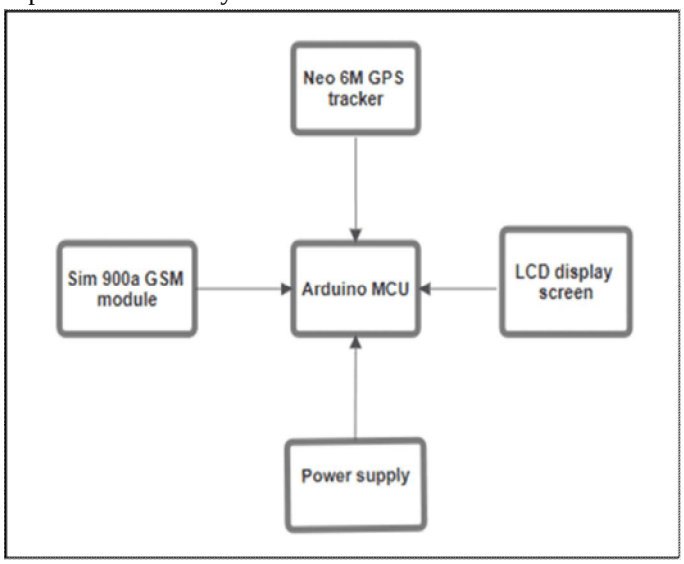


Fig.2 Block diagram for live location tracking

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IV. RESULTS

The gesture-controlled robot project demonstrated the feasibility and effectiveness of using hand gestures to control robotic systems. Through testing, it showed promising results, emphasizing its performance, usability, and real-world applicability. Key findings included successful implementation of gesture recognition algorithms, ensuring reliable control of the robot's movements. Wireless communication between the handheld device and the robot's receiver module proved robust, enabling smooth transmission of gesture commands within 2 seconds. The robot exhibited responsive and precise movement capabilities, showcasing its potential for dynamic environments.

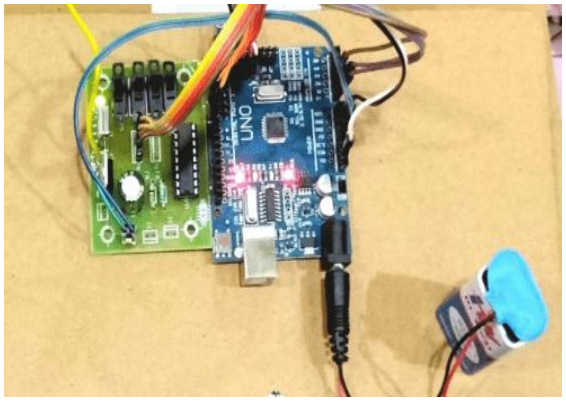
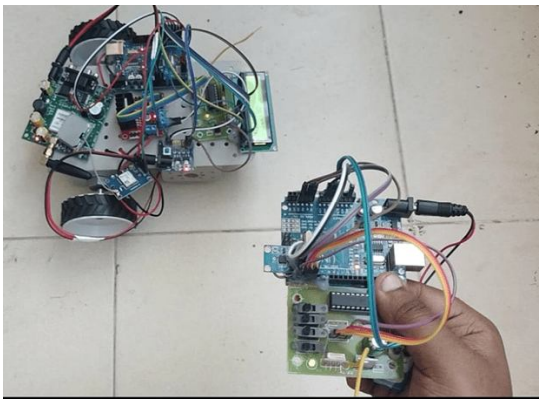
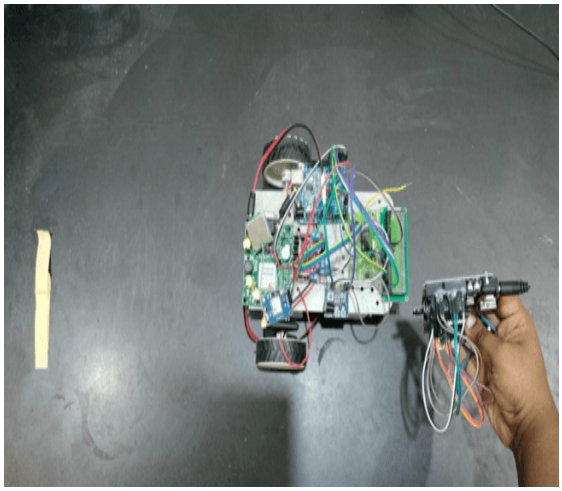
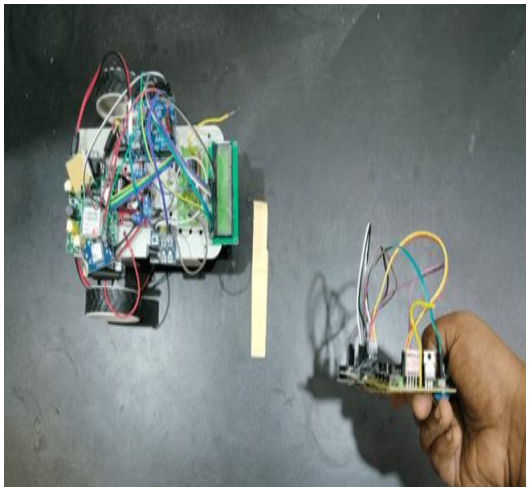
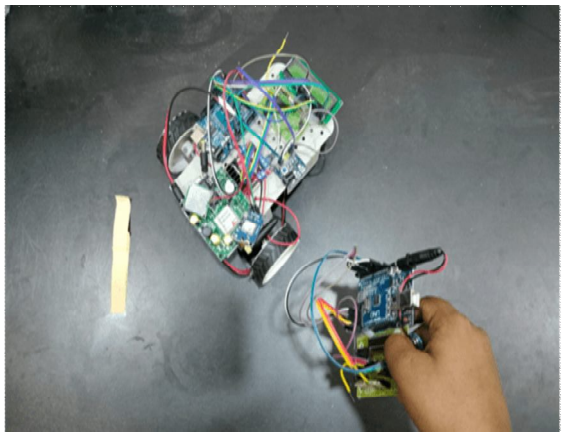


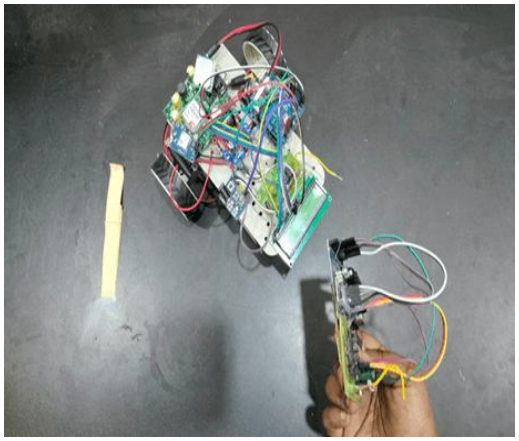
Fig.3 Transmitter module


Fig.4 Receiver module


Fig.5 Forward movement


Fig.6 Backward movement


Fig.7 Left movement


Fig.8 Right movement

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Fig.9 Starting message



Fig.10 Number registration



Fig.11 Live location latitude and longitude



Fig.12 Communication between

Upon activation, the robot displays a message on the LCD screen, signalling readiness. It then sends a message with a designated phone number, awaiting acknowledgment denoted by "reg". Subsequently, a request message (*s#) is dispatched to obtain the live location. Finally, the system responds with a message containing the current location, completing the operational sequence. This systematic approach ensures efficient communication and real-time location updates.

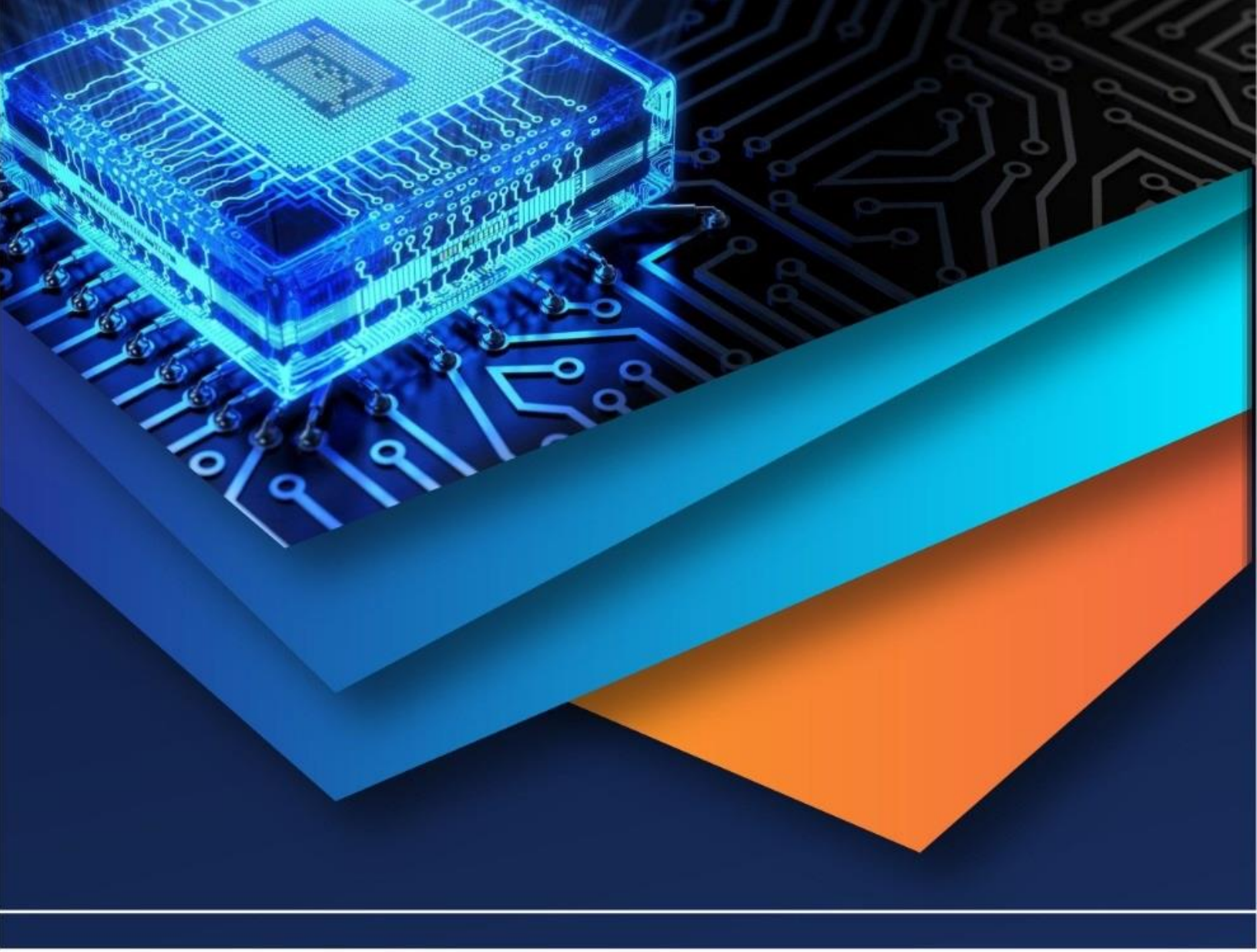
V. CONCLUSION

The gesture-controlled robot project marks a breakthrough in human-robot interaction, offering intuitive control via hand gestures. Utilizing gesture recognition and wireless communication, it facilitates natural interaction across entertainment, assistive tech, and education. Despite challenges like gesture complexity, refinement promises a transformative impact on automation, paving the way for a future where gesture-controlled robotics enrich our daily experiences.

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