

PROJECT REFERENCE NUMBER: 46S_BE_3743

TITLE OF THE PROJECT: DESIGN AND DEVELOPMENT OF PROSTHETIC MODEL FOR DISABLED

NAME OF THE COLLEGE: Global Academy of Technology

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KEYWORDS: Prosthetic Leg, Disabilites, Lower Limb Disability, Accelerometer, Bluetooth.

INTRODUCTION:

In India, there are 14.9 million men and 11.9 million girls with disabilities, accounting for 56 and 44% of the total population, respectively. Nowadays, many people lose various limbs due to diseases that render them unable to use their limbs. Prosthetics provide an opportunity for people with lower limb disabilities to lead a regular everyday life. Prosthetic legs have various benefits, the most important of which is that they may considerably increase the wearer's mobility and freedom, allowing them to participate in activities that they previously felt were no longer feasible. The project is about developing a prosthetic leg that uses an accelerometer and a Bluetooth module to enable comfortable and intuitive movement for users with lower limb disability. The system detects changes in axis and orientation using the accelerometer and based on its orientation the movement of the prosthetic leg takes place. The Bluetooth module is to have a wireless interface using an app on the smart phone. The user can then make quick and efficient adjustments to the prosthetic leg or control the entire prosthetic leg using a button on the Bluetooth app on a smart phone. This system provides accurate detection and intuitive control, enabling users to move more comfortably and independently.

OBJECTIVES:

The objectives of the project are:

- Develop software to interface the accelerometer and motors to detect the user's motion and mimic human leg movement.
- Implement a wireless control mechanism using the Bluetooth module to enable remote control of the motors via a smart phone application.
- Conduct rigorous testing to validate the functionality and performance of the prototype, ensuring that it can replicate natural human movement as closely as possible.
- The device will be able to detect the user's motion using the accelerometer and respond by moving the motors in a way that replicates the movement of the legs.

Overall, the objectives of a prosthetic model project are to provide amputees with a functional, comfortable, durable, and affordable artificial limb, thereby improving their quality of life and sense of independence.

METHODOLOGY:

To create an artificial mechanical leg prototype, the project methodology involves using an Arduino Mega board, four MG966R motors, an HC-05 Bluetooth module, and an accelerometer. These components are strategically placed to simulate the hip joint, knee joint, and ankle joint of a human leg. The accelerometer measures the pitch angle, which is then displayed on the serial monitor. If the pitch angle is positive, meaning the leg is angled forward, the prosthetic leg prototype will move the motors in the correct order to simulate a walking motion. Conversely, if the pitch angle is negative, indicating the leg is angled backward, the prototype leg will return to its initial position resembling a stretched or standing position. The HC-05 Bluetooth module enables wireless operation, with a Bluetooth app designed to control the prosthetic leg. The app features buttons that allow the user to switch between accelerometer/automatic and Bluetooth/manual operation. Using these buttons, the user can initiate walking motion and switch between standing and sitting positions. The methodology involves writing code to read the pitch angle from the accelerometer, control the motors to simulate walking motion or standing position, receive commands from the Bluetooth app, and execute the appropriate actions on the Arduino board. The prototype is then tested and refined to ensure its smooth operation.

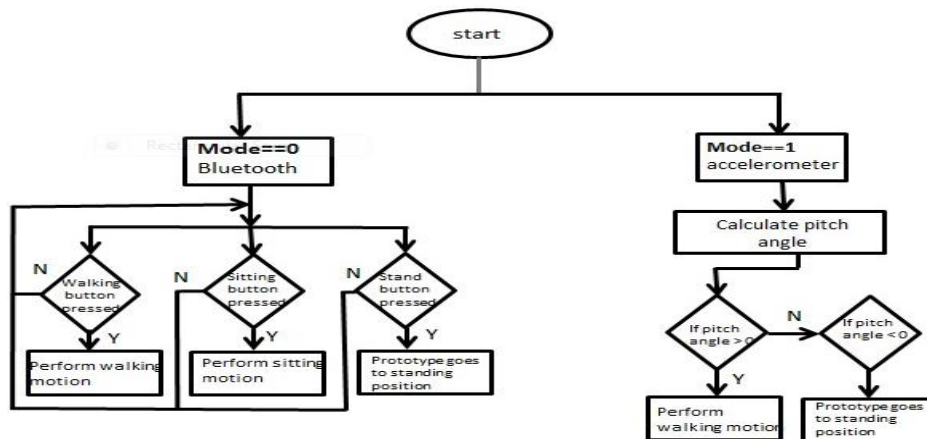


Fig 1: Flow Chart

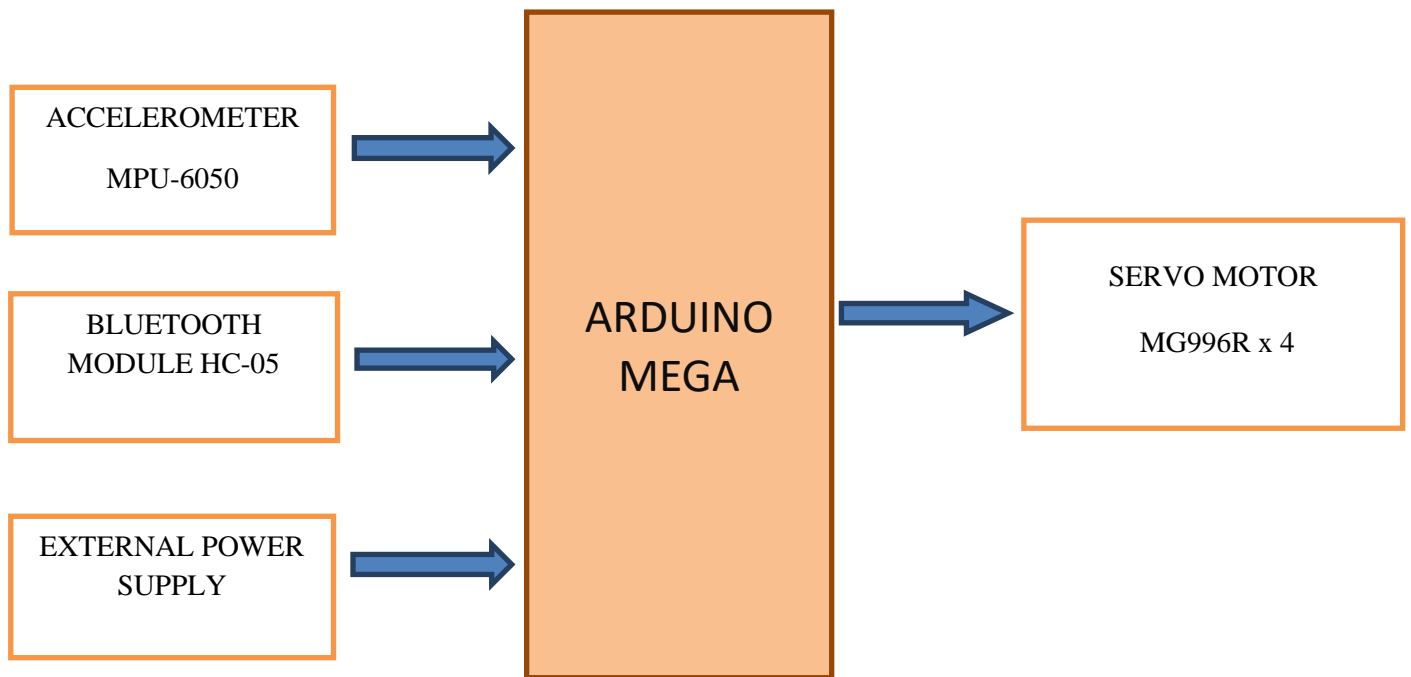


Fig 2: Block Diagram of Proposed Prototype

RESULTS AND CONCLUSION:

The prosthetic leg prototype project using an Arduino Mega, four MG966R motors, HC-05 bluetooth module, and an MPU-6050 accelerometer has been designed and programmed to mimic the movement of a human leg. The accelerometer senses the user's movements and sends signals to the microcontroller, which in turn activates the appropriate motors to move the prototype leg joints in sequence to simulate walking, sitting, and standing positions. The Bluetooth module allows for wireless operation and control of the motors through a mobile application. This project has the potential to benefit individuals with mobility impairments, and with further development, it could provide a cost-effective solution for prosthetic limbs. Overall, the use of prosthetic models in the design and development process can be a valuable tool for prosthesis and healthcare professionals to create customized and effective prosthetics for their patients, but it should be combined with other evaluation methods to ensure the final product is functional and meets the patient's needs.

SCOPE FOR FUTURE WORK:

Some potential future improvements could include:

- **Adding more sensors:** The addition of more sensors, such as pressure sensors, could provide more accurate readings of the user's movements and allow for better control of the mechanical leg.
- **Customization:** The addition of customization features would allow users to adjust the mechanical leg to fit their specific needs and preferences, such as adjusting the joint angles and range of motion.
- **Enhanced user interface:** Improving the user interface of the mobile application could make it more intuitive and user-friendly, allowing for easier control of the mechanical leg.

- Adding GPS feature: Incorporating GPS will allow the user to share their location to their family members etc.
- Adding more operations: The addition of more operations like climbing a staircase, running etc would improve the quality of life for the disabled people.

Overall, the future scope of this project is promising, and with further development, it has the potential to provide a practical solution for individuals with mobility impairments.