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Synopsis of the Project

“DESIGN AND FABRICATION OF AUTOMATED PROSTHETIC ARM”

Submitted in partial fulfillment of the requirements for the award of the degree

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By

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1. ABSTRACT
This project involves the design and fabrication of an operational first prototype of the Automated Prosthetic Arm capable of autonomously determining the object and selecting the most appropriate method for grabbing the said object. Autonomy of the device is achieved using a unique software/App control system which takes input from module’s embedded in the arm to determine the object, the position of each finger, grip strength and the quality of grip. The intended use for this technology is in the medical field as a prosthesis. However, the hand could also be adapted to work on other robot platforms as a versatile gripper to perform various repetitive-monotonous work. The advantage of our system as a prosthesis is that its autonomous functions will allow the user to access a wide variety of functionality more quickly and easily than similar, commercially available products. This project covers a broad range of engineering disciplines. The root of the system is an innovative mechanical design for a 3D printed automated prosthetic arm. The Modern-day electronic actuators and circuitry enhance the device and allow for sophisticated control schemes. It is strongly believed that this work will be of great value to a diverse audience.

Keywords: 3D Scanning, Dynamixel AX-12A Motor, MG995 Servo motors, Arduino Nano, ESP8266.

2. INTRODUCTION
A prosthetic device can be characterized as a counterfeit expansion that replaces a missing body part, for example, an upper or lower arm’s furthest point. A counterfeit limb is a sort of prosthesis that replaces a missing furthest point, for example, arms (upper limb prosthesis) or legs (lower limb prosthesis). At the point when an individual turn into a limb amputee, the person faces staggering mental, emotional and financial lifestyle changes. It changes the quality of life wholly by diminishing such capabilities as grasping, stretching, reaching detecting through the feeling of touch or gesture communication. Prosthetic devices may lessen these impacts and thus make an actual existence of the individual simpler.

3. BACKGROUND RESEARCH
An estimated 10 million Indians live with some form of movement impairment according to government figures. It is common to see amputees begging at traffic stops or dragging themselves about wheeled carts. Due to the continuous growth in industrialization and lack of awareness in safety parameters, the cases of amputations are growing day by day. The search of safer, simpler and automated prosthetic arms for managing limbs is expected. Continuous efforts have been made to design and develop prosthetic arms ranging from simple harness actuated type to automated mechanisms with various control variables. However, due to the cost constraints, the automated prosthetic arms are still out of the reach of needy people. Recent times have however given way to enormous advancements in prosthetic devices. Focus is not only on the physical aspects of a device but also the control and biofeedback systems. As an inference it can be interpreted that there is a wide scope in designing an adaptive mechanism for opening and closing of the fingers using other methods of path and position synthesis. Automated Prosthetic arms are considered as biomedical devices and developing the same is interdisciplinary activity i.e. combination of mechanics and electronics. The selection of prosthetic arm depends upon type of the disarticulation the patient has undergone and the functionality that a patient need.

4. OBJECTIVES OF THE PROJECT WORK
- Design and develop a cost-effective prosthetic device for physically disabled individuals.
- Incorporating pick and place functionality and multiple gesture movements.
- Design and create a system that provides swift motion using Actuators.
- Write appropriate codes to operate the prosthetic device with accuracy & precision.
- Demonstrate assisted control through use of Software and Hardware.
- Avail the scope of using Bi-Actuation Mode i.e. Voice Command mode and Manual Mode.
- Integration and application of Internet of things (IOT) as an inherent property of the Arm.

5. METHODOLOGY
The mechanism used for arm actuation is flexible straight string mechanism. A feasible app is used to control the arm. This App was created using MIT open source App Inventor. It is a Bluetooth enabled App, which once paired with the Bluetooth module in arm circuit will allow the user to manually press the required button and actuate the motion. Actuation of individual fingers as well as multiple gestures are made possible using this app. This is known as Manual commanding mode of actuation. Another mode of actuation is carried out by oral commands using the aid of Google assistant. When the user switches from App to internet enabled Google assistant, the user will be able to feed in the commands by simply speaking in the inbuilt mobile mic. The actuation of arm will take place as per the command fed at that instant. This is known as Voice commanding mode of actuation. With these two commands the arm is actuated effectively by energizing the motion of fish strings passing through the fingers.

Description of materials/Components:
- Ultimaker 2+ 3D Printer
- PLA and ABS Materials
- Arduino Nano
- Bluetooth Module HC05
- NodeMcu V3 Lua WIFI ESP8266
- Dynamixel AX-12A motor
- MG995 Servo Motor
- SG90 Servo Motor
- Battery Pack
- Voltage Regulator

6. STEPS INVOLVED IN DEVELOPMENT OF ARM
The development of the Arm was achieved by step by step process. Following are the various steps involved in the completion of this work.

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7. VIEW OF THE MODEL

8. RESULTS/OUTCOMES
- It will replace missing body part and the void functionality.
- Provide a sense of independence to an individual.
- Improve mental performance.
- Improve Load carrying capacity.
- Enhance the quality and standard of living of an amputee.

9. CONCLUSION
The integration of a Prosthetic arm technology plays a vital role in human life and it has a potential to lead normal life to the amputees. The prosthetic device helps the amputees to do their daily tasks efficiently. Development and assembly of the arm calls for a short list of materials and tools that are anything but difficult to get to. With the accessibility of this innovation, amputees have the fundamental instruments to make their own customized prosthetics that will improve their personal satisfaction in addition to the prevention of the mental degradation that oftentimes comes with physical deformation and it additionally it is remoteless, so prosthetics created with this innovation might be effectively adjusted to various patients by accordingly altering the size and shape. An extraordinary consideration was given to grow such attributes as light weight, low cost and intuitive control - a significant qualities for the grown-up prosthetics, which ends up basic for youngsters. The recent advancements in additive manufacturing technologies played a pivotal role in accomplishments of proposed targets.

10. FUTURE SCOPE
- Linking of IOT to enable home automation.
- Increasing the degrees of freedom.
- Improve Swift motion and improve load carrying capacity.
- Making Use of Alternative material for development.
- Modes to Eliminate Electronic cables into embedded chip.
- Enable Arm with High speed internet for faster response.