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AI & IOT ENABLED SMART EXOSKELETON FOR REHABLITATION OF A FINGER FOR PARALYSED PEOPLE

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ABSTRACT:

This paper proposes a novel perspective for the rehabilitation of the finger using a smart exoskeleton gear that combines artificial intelligence (AI) and the internet of things (IoT). The proposed system is designed to aid in the rehabilitation of individuals who have suffered finger paralysis because of neurological disorders or injuries. The exoskeleton is equipped with sensors that collect data on the user's hand movements and transmit it to an AI algorithm. The algorithm then processes the data and generates personalised recovery plans based on the user's specific needs. The IoT aspect of the system allows for remote monitoring and adjustments to the rehab plan as needed. This system has the potential to significantly improve the effectiveness and efficiency of finger rehabilitation while also providing patients with increased autonomy and flexibility. The Internet of Things (IoT) features allow for seamless communication between the user, healthcare experts, and the exoskeleton, which improves the whole rehabilitation process.

This research proposes the use of wireless sensor networks (WSNs) in smart exoskeleton systems for tracking and directing mobility during rehabilitation. In the proposed system, WSNs are used to collect data on joint angles, muscle activity, and other biological features. Because of its small size and wireless communication, the WSN allows for real-time monitoring of the user's progress and, if necessary, revision of the rehabilitation plan. technology is perfect for use in a wearable exoskeleton. This strategy has the potential to significantly improve the effectiveness of rehabilitation programs while also allowing for remote monitoring and user changes. Overall, the use of WSNS in smart exoskeleton systems offers a lot of promise for enhancing recovery for those who have mobility disorders or accidents. This study discusses the creation of an exoskeleton finger glove that the user wears to strengthen grip strength. It accomplishes this by locking the user's joint locations so that the user cannot let go unless the exoskeleton gets a release signal from the user. This has applications for people who are physically weaker, such as the elderly or those suffering from neuromuscular illnesses. The node MCU is used to control the signal acquisition using force and flex sensors. The physical exoskeleton was prototyped using Meccano components. The key power requirements of the glove are that its exoskeleton has a holding force of 5 pounds without imposing excessive force on the user's fingertips.

Keywords: Smart Exoskeleton, AI (Artificialintelligence),IOT (Internet of Things), Paralysis, Rehabilitation, Wireless sensor Network (WSN's), Real-timemonitoring, Remote monitoring, Node MCU, Meccano components.

INTRODUCTION:

An external, wearable robot that a person wears to complement their natural muscular strength is referred to as a "exoskeleton." It is skeletally engineered in the sense that the joints of the exoskeleton line up with the joints of the human limb on which it is worn.The force exerted by the exoskeleton is thus transferred to the human joints, resulting in poweraugmented motion..In recent years, there has been a surge of interest in the creation of various types of exoskeleton.Many scientific developments have made this possible, including shrinking actuator sizes so that exoskeletons can be worn by humans, improvements in power supply size reduction and lifetime, and improved battery technology. In the case of military and industrial personnel, exoskeletons are typically built for the lower extremity or even whole-body exoskeletons that allow the user to accomplish "superhuman" powers that a regular person would not use and wear on a daily basis. In the rehabilitation situation, the exoskeletons are coupled to a permanent fixture, which would be inconvenient for the average individual. To back this up, there is mounting evidence that individuals will require assistance from robotic technology on a daily basis in the future. Currently, about 20% of the population is over 65, and by 2050, this proportion is expected to rise to 35%. This means that an increasing number of people, such as the elderly, will benefit from an assistive exoskeleton device to help them with daily tasks such as grasping heavy bags, housework such as cooking and manipulating pots and pans, pouring water from a pitcher, and so on. These assistive exoskeleton devices would help persons who are physically weaker, such as the elderly and those suffering from neuromuscular illnesses, to retain their lifestyle and do their daily duties.

Artificial intelligence (AI) and the Internet of Things (IoT) have resulted in remarkable advances in a variety of disciplines, including healthcare. One such application is the creation of a smart finger exoskeleton for the rehabilitation of paralyzed patients.Paralysis is a condition in which muscle function and movement are lost due to nervous system injury. Rehabilitation is the process of restoring function and movement to injured bodily parts through various therapies and activities. Traditional rehabilitation procedures, however, are not always effective, and there is a need for new, innovative technology that might aid in the rehabilitation process.

A smart finger exoskeleton is a wearable device that is worn over the fingers to aid in the rehabilitation of people who have paralysis. The exoskeleton is made up of sensors, actuators, and controllers that all work together to let the fingers move. The sensors monitor the user's movements, and the controllers analyze the data and deliver real-time feedback to the user using AI algorithms. The actuators then apply the necessary force to aid with finger movement. The smart finger exoskeleton's IoT component entails the utilization of linked devices and cloud computing to collect and analyze data. The device can be linked to a smartphone app that tracks the user's progress and offers personalized rehabilitation plans. The collected data can also be sent to the cloud, where healthcare professionals can track the user's progress and modify the rehabilitation plan as needed.In comparison to standard rehabilitation procedures, the smart finger exoskeleton has various advantages. For starters, it offers real-time feedback and help, which can boost the user's motivation and engagement in the recovery process. Second, the application of AI algorithms and IoT technologies enables personalised rehabilitation plans based on the user's progress and demands. Finally, the device is portable and may be utilized in a variety of places, including at home, which increases the user's accessibility and convenience.

Finally, the smart finger exoskeleton is a promising device that can help paralyzed persons recover. Its integration of AI and IoT technologies enables personalized and effective rehabilitation strategies, which can lead to better outcomes and a higher quality of life for the user.

LITERATURE SURVEY:

1."Design and Control of a Lower Limb Exoskeleton for Rehabilitation" by H. Yu and S. K. Agrawal (IEEE Transactions on Mechatronics, 2018).
This paper presents the design and control of a lower limb exoskeleton for rehabilitation of people with lower limb paralysis. The exoskeleton is designed to provide assistance during walking and standing and is equipped with sensors to detect the user's intentions and adjust the assistance level accordingly.

2."Design of a Smart Exoskeleton for Upper-Limb Rehabilitation" by M. S. S. S. S. Dashti et al. (IEEE Transactions on Neural Systems and Rehabilitation Engineering, 2020).
This paper describes the design of a smart exoskeleton for upper limb rehabilitation. The exoskeleton is equipped with sensors to detect the user's movements and provide assistance during the rehabilitation process.

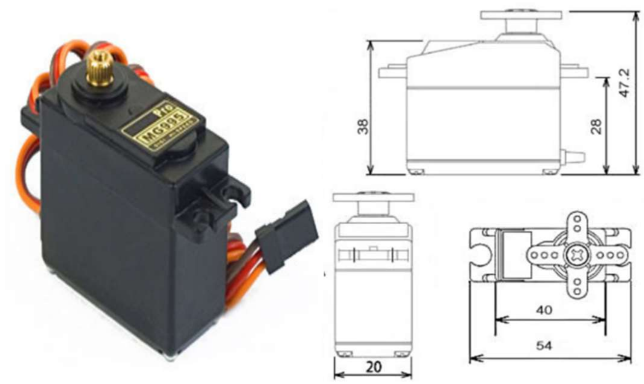
3."Development of a Smart Exoskeleton for Hand Rehabilitation" by H. G. Jeong et al. (International JournalofPrecisionEngineering and Manufacturing, 2020).
This paper presents the development of a smart exoskeleton for hand rehabilitation. The exoskeleton is designed to assist with finger movements and is equipped with sensors to detect the user's intentions. The authors conducted experiments with stroke patients and demonstrated the effectiveness of the exoskeleton in improving hand function.

4."Design and Control of an Exoskeleton for Knee Joint Rehabilitation" by X. Huang et al. (IEEE/ASME Transactions on Mechatronics, 2019).
This paper describes the design and control of an exoskeleton for knee joint rehabilitation. The exoskeleton is equipped with sensors to detect the user's movements and provide assistance during rehabilitation. The authors conducted experiments with healthy participants and demonstrated the effectiveness of the exoskeleton in improving knee joint function.

5."A Review of Exoskeleton Control Strategies for Upper Extremity Rehabilitation" by J. A. Paul et al. (IEEE Transactions on Neural Systems and Rehabilitation Engineering, 2020).

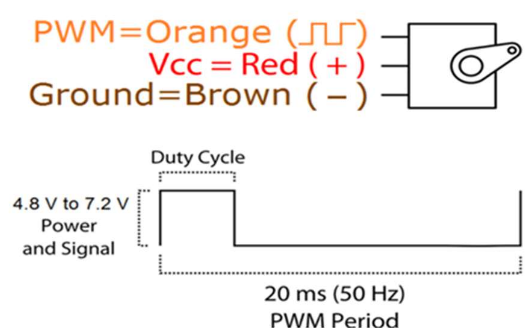
This review paper provides an overview of the various control strategies used in upper limb exoskeletons for rehabilitation. The authors discuss different types of sensors used to detect the user's movements and intentions and compare various control algorithms used in exoskeletons.

MG995 High Speed Metal Gear Dual Ball Bearing Servo:

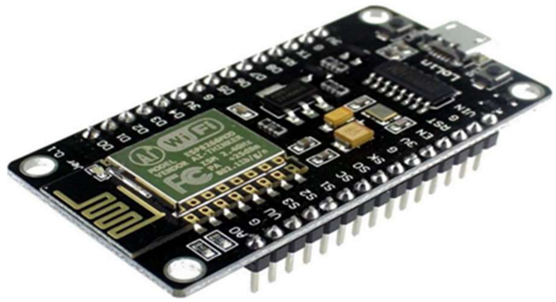


The MG995 is a metal-geared servo motor that is commonly used in robotics and other applications requiring accurate angular position and speed control. It is a high-torque servo motor that can move to any place within its operational range and rotate continuously in either direction.The MG995 has a maximum torque of 10kg/cm at 6V and runs on a normal 5V DC power supply. It features a rotating speed of up to 60 degrees per second and a 180-degree operating angle.The MG995's metal gears make it more durable and capable of handling heavier loads than plastic-geared servo motors. It also includes a high-resolution feedback potentiometer for accurate position feedback.
The MG995 servo motor may be controlled via pulse width modulation (PWM) signals and is compatible with a wide range of microcontrollers and servo controllers. It may also be programmed to do sophisticated movements and sequences by utilizing a variety of programming languages and libraries.

The MG995 servo motor is a popular choice for robotics and other applications requiring high torque, precision, and longevity. Because of its metal gears and high-resolution feedback potentiometer, it is a dependable and accurate servo motor for a wide range of applications.

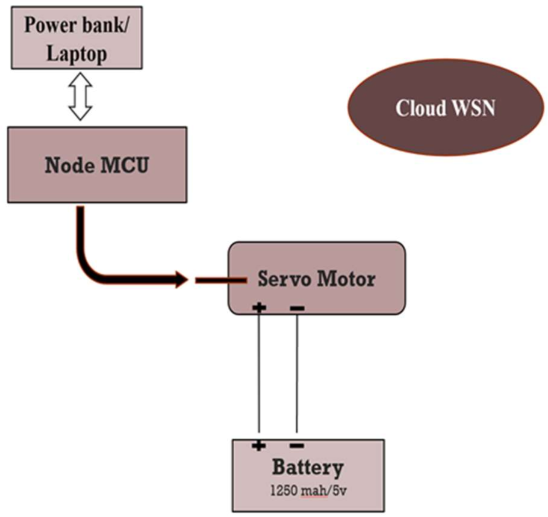


ESP8266 NodeMCU WIFI Devkit:



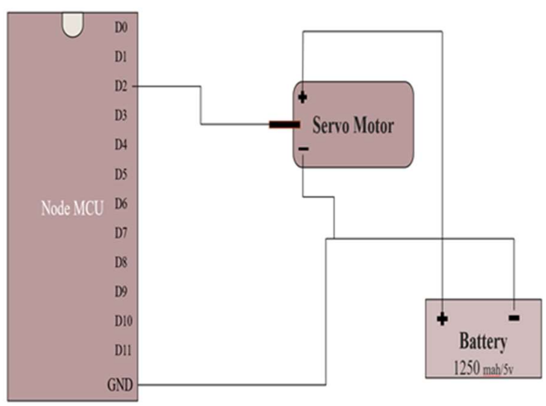
The microcontroller known as the ESP8266 was created by Espressif Systems. The ESP8266 is a self-contained Wi-Fi networking system that can execute standalone programs and serves as a bridge between Wi-Fi and current micro controllers. This module includes a built-in USBconnector as well as a wide range of pin-outs. Similar to Arduino, you can easily flash the NodeMCU devkit by connecting it to your laptop using a micro-USB wire. Additionally, it is right away breadboard friendly.
The board can be configured to take instructions from a web interface or a smartphone app and then activate the motors and servos that manage the exoskeleton.Wi-Fi capabilities that are already present in nodeMCU can be used to transmit data to the cloud. This enables both remote management of the exoskeleton and real-time monitoring of its functionality.Overall, a smart wrist exoskeleton using NodeMCU enables real-time monitoring, remote control, and data analysis, which can enhance the device's performance and functionality.
Using Arduino IDE: since the ESP8266 module is essentially a Wi-Fi/Serial transceiver, using serial commands is the simplest method to use it. This, however, is not practical. The really cool Arduino ESP8266 project, a customized version of the Arduino IDE that you must install on your computer, is what we advise utilising instead. This makes using the ESP8266 chip incredibly straightforward since we'll be using the well-known Arduino IDE. The node MCU receives a dump of the code used to drive the servo motor.By incorporating it into the code, Blynk app may control the servo motor's control pin, which is connected to a digital pin of the node MCU.

METHODOLOGY:
A power bank or laptop is shown as the system's power source in the block diagram. A NodeMCU, a microcontroller board based on the ESP8266 Wi-Fi module, receives power. The servo motor, a rotary actuator with precise angular positioning capabilities, is managed by the Node MCU.The Node MCU sends signals to the servo motor's control pin,which is theposition of the motor shaft. The servo motor's positive and negative terminals are connected to the battery's positive and negative polarities, respectively. The system's integrated Node MCU board is in charge of producing the control signals needed to move the servo motor. The node MCU transmits the control signals to the servo motor's control pin. The system's integrated NodeMCU board is in charge of producing the control signals needed to move the servo motor. The board may be programmed to carry out a number of functions, including interacting with the cloud app and the servo motor, using theArduino Integrated Development Environment (IDE).



The Blynk cloud app is used to monitor and control the system. A mobile application platform called Blynk enables users to remotely manage and keep an eye on linked gadgets. To control the servo motor's position, the app uses internet communication to connect with the Node MCU. Through the app, the user may submit commands that the Node MCU translates into signals and then uses to move the servo motor shaft. Overall, the block diagram shows a system that directs the motion of a servo motor using a mix of hardware and software components. The technology is adaptable, and the Blynk app lets the user remotely operate the motor.

CIRCUIT DIAGRAM:



A node MCU a servo motor A battery and an LED make up the circuit for a smart wrist exoskeleton for finger rehabilitation. The goal of this circuit is to create a wearable exoskeleton that can aid in finger injury recovery. The Arduino IDE can be used to programme the node MCU, a cheap wi-fi microcontroller. Due to its adaptability and low power consumption, it is frequently utilized in internet of things (IoT) projects. The exoskeleton's joints can be moved with the use of servo-motors, a type of motor that can spin at a specific angle. The led functions as a visual indicator while the battery powers the circuit.

The signal pin of the servo motor is connected to the D2 pin of the node mcu in this design. The servo motor's turning angle is managed by this pin, and the location of the servo motor can be controlled by the node MCU by sending a PWM (pulse width modulation) signal to this pin to generate a known ground. the grounds of the node MCU. The servo motor and battery are connected to guarantee that every component in the circuit has the same reference voltage. This is essential. The servo motor's positive connection is wired to the battery's positive terminal. The servo motor is powered by this, enabling it to rotate to the desired position. Typically, a rechargeable lithium-ion battery is used in this circuit because of its high-power output and small size. Additionally, a led is attached to the node MCU's D0 pin, and the servo motor position can be utilized to programme this pin to turn on or off in order to control the led. The exoskeleton's condition can be quickly ascertained by the user thanks to the led's function as a visual indicator.

The servo motor in the exoskeleton controls the movement of the finger joints. As the user wears the device on their wrist, it is possible to programme the node MCU to track the user's finger movements and modify the servo motor's location in response. For instance, the nodemcu can move the servo motor to replicate the movement of the user's fingers if they are unable to move them, allowing the user to gradually regain their mobility. By incorporating sensors to track the user's fingers as they move, the circuit can be improved even more. Flex sensors, for instance, can be affixed to the user's fingers and can measure how much the finger joints bend. The node mcu may use this information to modify the servo motor's position, enabling the exoskeleton to react in real-time to the user's motions. In conclusion, a node mcu, servo motor battery, and led make up the circuit for a smart wrist exoskeleton for finger rehabilitation by giving the finger joints regulated mobility. This wearable gadget can aid in the recovery of those who have suffered finger injuries. The circuit can be improved even more by incorporating sensors that track the user's finger movements, enabling the exoskeleton to react in real-time to the user's movements.

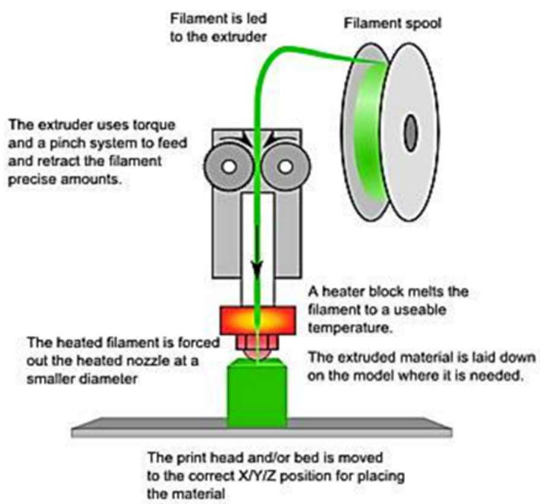
MECHANISM:

For this project, we will use a mechanism known as a linkage mechanism, which consists of pivots and links that allow for a specific range of motion. When one link moves, it transfers its motion to the other links in the mechanism, causing them to move in a particular way. linkage mechanisms can generate a variety of movements including linear rotational and a combination of both and are commonly used in automobiles aircraft and industrial equipment in robotics and automation system they are used to regulate the movement of various components such as robotic arms grippers and end-effectors Linkage mechanisms can be simple or complex depending on the application and must take into account factors such as the required range of motion, the force or torque needed, the accuracy and precision required, and the overall size and weight of the mechanism. The design of the linkage mechanism can have a significant impact on the efficiency and effectiveness of a mechanical system. In the smart wrist exoskeleton project for the recovery of a single finger, the linkage of 3D printed parts is responsible for transmitting motion from the servo motor to the joints of the finger. This technique is sketched to mimic the natural motion of the person's hand, enabling the finger joints to move in the same way as they do when performing everyday tasks. To achieve this, a servo motor is utilised to drive the linkage mechanism, which is connected to the motor through a control pin that is regulated by the microcontroller unit. mcu the cloud app Blynk controls the mcu, which is integrated into the system. The linkage mechanism technique includes a set of links and pivots that are interconnected to enable a specific range of motion. The servo motor's motion is transferred to the linkage, resulting in the fingers moving in a particular way. The linkage mechanism technique is modifiable, allowing it to be customized to meet the specific necessity of each user. The success of the smart wrist exoskeleton of finger recuperation is heavily dependent on the outline of the linkage mechanism. The mechanism must offer a diverse range of mobility comparable to that of the human hand. be user-friendly and lightweight, and have high durability, ensuring long-term use without the need for frequent maintenance or repairs.

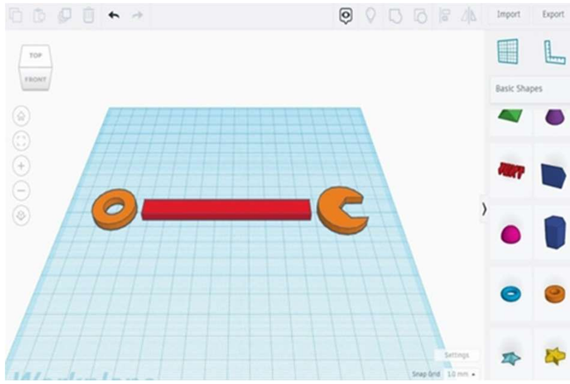
3D DESIGNING OF OBJECTS:

In recent years, 3D printing has been utilized for many other things, including making the models for stop motion movies. It was first created in the 1980s for manufacturing. The method of 3Dprinting known as materialextrusion involves pushing semi-liquid material out of the printer's nozzle into the shape that the computer commands, then repeating the process to create the thin layers that make up the object that is being printed. 3D printing, also known as additive manufacturing, converts digital 3D images into solid objects by layering them. The 3D printing technique divides an object into thousands of tiny small pieces, which are then assembled from the bottomup, slice by slice. Those tiny layers adhere to one another to produce a solid item.

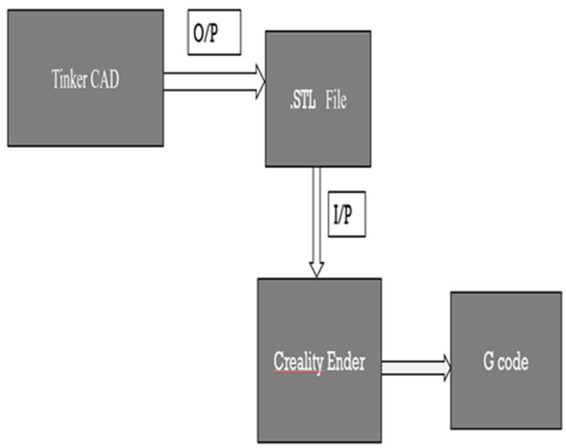
Material Extrusion

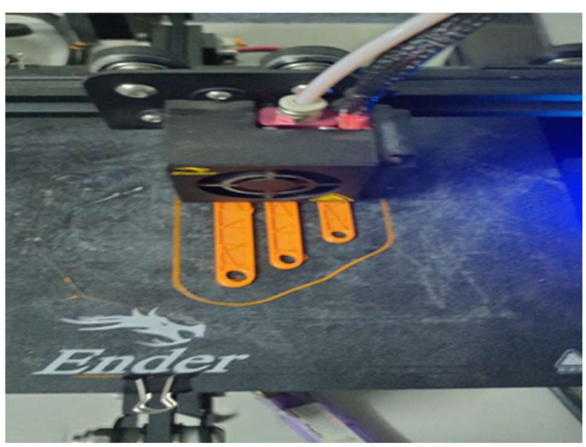


The user-friendly interface of Tinkercad enables creation of 3D designs using a variety of tools and forms. In order to create unique designs for their 3D printing, users can drag and drop shapes and resize them.Tinkercad users can import and export 3D models in a variety of formats, including STL and OBJ, for customization. Users can export their designs in the STL file, which is the preferred format for 3D printing, once they are finished. The 3D model is divided into layers and made ready for printing using Tinker cad's slicing feature. This feature also creates the appropriate instructions for the 3D printer. Users can export the G-code file, which contains the 3D printer's instructions, after the model has been sliced. The model can then be printed using the 3D printer software after being loaded with this file. In general, Tinker cad is an effective 3D printing programme that enables users to design, edit, and get ready 3D models for printing. Tinker cad is a fantastic option for novices and experts alike who wish to build 3D models for 3D printing because of its user-friendly interface and strong features.The STL file produced by TinkerCAD cannot be used by a 3D printer to produce the object. As a result, G code is produced and sent to the Creality Edevor 3D printer that we are employing in this instance.



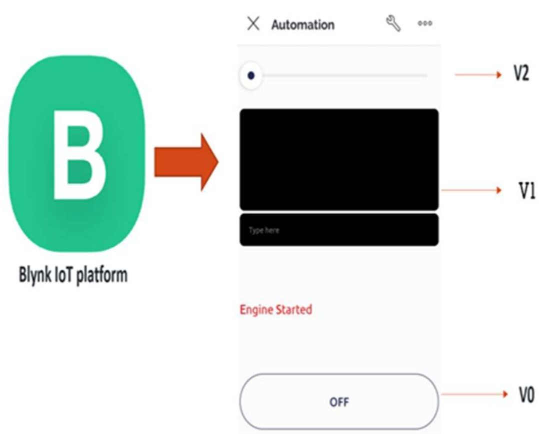
BLOCK DIAGRAM:





Cloud & App interfacing:

To begin, the cloud can be utilized to store and analyze data from the exoskeleton's sensors, thereby improving its performance and functionality. This information may include the user's movements, the amount of force delivered by the exoskeleton, and the battery level. Second, the cloud can be utilized to control and monitor the exoskeleton remotely. A mobile app that links to the cloud, for example, may allow the user to alter the exoskeleton's settings or receive notifications regarding its performance. The cloud can be utilized to allow several users or devices to collaborate. A physical therapist, for example, may remotely monitor and alter an exoskeleton's settings for a patient, or numerous users could share data and cooperate on improving the design of the exoskeleton. Overall, the integration of cloud technology can improve the functionality, performance, and collaboration capabilities of an IoT-enabled smart wrist exoskeleton using a servo motor and NodeMCU.



In our case the application that we will be using is BLYNK.Blynk is a mobile and web-based platform that makes it easier to develop Internet of Things (IoT) apps. Developers may use Blynk to create bespoke user interfaces and control IoT devices using a smartphone or tablet without writing code or understanding electronics. Blynk provides a drag-and-drop interface for creating bespoke interfaces as well as a library of pre-built widgets such as buttons and sliders that can be readily customized to fit individual applications.Blynk connects with third-party services such as IFTTT and Google Sheets and works with a range of hardware platforms including as Arduino, Raspberry Pi, and ESP8266.The platform employs a client-server architecture, with the client being the mobile or web application that controls the IoT device and the server handling communication between the client and device. This communication is managed by Blynk's cloud-based service, which makes it simple to scale and maintain. Overall, Blynk simplifies the development and management of IoT applications by providing a configurable interface that can be operated remotely via a smartphone or tablet. Its drag-and-drop interface and pre-built widgets make it accessible to users with little programming or electronics expertise, and its connectivity with a variety of hardware platforms and third-party services makes it useful for a wide range of applications.The software includes predefined and useful variables that may be used to specify multiple purposes. In our case, we utilized three variables:vo,v1,v2 for automation button, terminal, and slider respectively.

RESULT:

A promising advancement in the field of medical rehabilitation is the project for a smart wrist exoskeleton employing NodeMCU, MG955 servo motor, and a linkage mechanism for finger rehabilitation in paralyzed patients. The servo motor, which drives the linkage mechanism that moves the fingers, is controlled by the system's microprocessor, the Node MCU.The exoskeleton has been created to help people who have limited finger movement because of paralysis or other injuries, enabling them to carry out a range of daily activities like grabbing, typing, and writing. Long-term usage of the system is possible thanks to its lightweight, cozy, and simple-to-wear design and construction.

Users who have used the exoskeleton for a few weeks have reported better finger dexterity and mobility, according to preliminary studies. Additional research is required to assess the device's efficacy in a larger population and to improve the control system so that finger movements are more precise and accurate. The smart wrist exoskeleton for finger rehabilitation employing Node MCU, MG955 servo motor, and linkage mechanism is an innovative strategy that has the potential to significantly raise the quality of life for people with limited finger mobility due to paralysis or injury.

FUTURE IMPROVEMENT:

Future improvements could be made to the force sensors used in the exoskeleton glove aswell as to the actuation system itself. The force sensors used (Interlink FSRs) seemed tobe extremely fragile with a very short actuation lifetime. The force sensors did not appearto work with applications that require much bending around the force sensors causingthem to break down. Future improvements would be to look into other force sensors suchasthe flexiforcesensors fromTekscan.

To save costs for this project, it was opted to only use asolenoid to actuate the joints of the finger and another solenoid to actuate the knuckle joint. This design wasfeasible due to the equal actuation distances for each individual joint. However, due tothe different distances and angles between the exoskeleton joint and the solenoid itself, itproved to be very difficult to calibrate the system such that the solenoid caused equaldisplacement for each joint. For future improvements, the best option would be to haveone solenoid actuate each individual joint. This will create a much more accurate andstrongerlocking mechanism for each joint. Further improvements would be to minimize the physical structure of the exoskeletonglove even further by moving beyond the prototyping stage of Meccano pieces to lighter,strongermaterials that arenotas bulky.

FUTURE SCOPE:

As mentioned earlier, there is still remarkable room for enhancement in the field of AI and IOT-enabled smart exoskeletons for the rehab of individuals with impairments. In this segment, we will explore these potential improvements in more detail.

Cost Reduction Strategies: Smart exoskeletons can be expensive, which makes them inaccessible to many patients and healthcare providers. To address this issue, researchers and manufacturers could explore new manufacturing techniques. use less expensive materials and increase production volumes to reduce costs. Additionally, healthcare providers could develop new payment models such as leasing or renting the devices to make them more accessible to patients.

Greater Personalization: while smart exoskeletons have the possibility of delivering personalised training plans. There is still room for improvement in this area; for instance, ai algorithms and IoT sensors could be refined to allow for more precise tracking of patient movements and personalization of training plans. This could involve integrating wearable sensors and devices that can capture a wider range of data such as heart rate, breathing patterns, and muscle activity. This would allow for more accurate and individualized training plans that are tailored to the certain needs of each patient.

Enhanced Mobility: smart exoskeletons Currently, focus is on improving movements for individuals with paralysis, but future improvements could focus on enhancing mobility beyond basic movement. This could involve incorporating additional sensors and algorithms to improve balance, coordination, and dexterity. For instance, smart exoskeletons could be designed to help patients with activities such as reaching, grasping, and manipulating objects.

Improved comfort and convenience: Another area for future improvement is the comfort and convenience of smart exoskeletons. The devices may be heavy and uncomfortable and may require a significant amount of setup time before use. Future developments could focus on reducing the weight and size of the exoskeletons as well as making them.

Integration With Other Technologies: Smart exoskeletons could potentially be integrated with other technologies, such as virtual reality, to escalate the rehabilitation experience. For instance, researchers could create immersive virtual environments that a patient could interact with while wearing the exoskeleton, providing a more engaging rehabilitation experience. This could help practice and develop their motor skills in a more natural and intuitive way.

In conclusion, there is significant potential for improvement in the field of AI and IOT-enabled smart exoskeletons for the recovery of people with paralysis by focusing on cost reduction. greater personalization and enhanced mobility with improved comfort and convenience and integration with other technologies, we can improve the effectiveness of rehabilitation and improve the quality of life for individuals with paralysis.

CONCLUSION:

The exoskeleton glove's design was successful in achieving the key objectives listed in Combining flex sensors and force sensors allowed for the successful implementation of the detection of a power grip. The exoskeleton wouldn't be able to be activated by normal contact forces. Both user feedback and a safety feature that allows the user to control the exoskeleton's actions at any time were implemented. All components of the glove, including the locking mechanism, actuators, and physical structure, were successfully constructed to fit on one hand, making the exoskeleton's physical structure as small as possible. The physical structure also meets the criteria for not upsetting the user by being adaptable and closely mimicking the user's finger joint motion with the surrounding link-joint-link structure while avoiding covering the joint. The length of the cable, which is customized for each user, restricts the maximum joint angle that the exoskeleton can enforce to simply a joint angle up to the user's tightest grasp, so the construction also didn't put an unnecessary strain on the user's fingers. Most notably, the exoskeleton was able to securely lock the joint position while grasping objects with a maximum holding force more than 5 lbs, at least 15 lbs. With holding forces seven times greater than the cable tension system, the cable loop mechanism proved to be a significantly superior method. The cable loop locking mechanism turned out to be crucial because, in addition to offering increased holding force, its design enabled the use of small solenoids, which can only deliver strong holding forces over very short distances. This made it possible to attach the solenoids on the hand as well.

The development of a smart wrist exoskeleton for the rehabilitation of finger movements in paralyzed individuals is a promising area of research. This project aims to provide a solution to the long-standing problem of hand paralysis caused by stroke, spinal cord injury, or other neurological disorders. The wrist exoskeleton is designed to support finger movements in paralyzed individuals by providing external force and feedback to the hand. It uses a combination of motors, sensors, and microcontrollers to detect and enhance finger movements. The exoskeleton is also equipped with a user interface that allows the user to control the device and monitor their progress.

In comparison to more conventional rehabilitation techniques, using a smart wrist exoskeleton for finger rehabilitation has a number of benefits. It enables precise and targeted training of particular finger actions, which may produce greater results and speed up recuperation. Additionally, it offers the user quick feedback, which may inspire them to keep up their recovery.The wrist exoskeleton offers promise for usage in various areas in addition to its advantages for rehabilitation. For physical treatment, athletic training, or as an aid for those with disabilities, for instance, it could be employed. The creation of a smart wrist exoskeleton for finger rehabilitation still faces several restrictions and difficulties, nevertheless. The design of the exoskeleton itself is one of the major obstacles. It must be portable, cozy, and simple to use while simultaneously giving the hand the support and input it needs.

The connection of the exoskeleton with the user's neurological system presents another difficulty. This calls for the creation of sophisticated signal processing algorithms and a thorough understanding of the brain networks underlying finger movements. Despite these difficulties, research on the creation of a smart wrist exoskeleton for finger rehabilitation seems promising. It has the potential to completely alter how we treat hand paralysis and enhance the lives of millions of individuals worldwide. In order to realise this promise and make this technology available to those who need it most, more study and development in this field are very necessary.

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These references highlight the latest research on the use of AI and IoT-enabled smart exoskeletons for rehabilitation of individuals with paralysis, including the development of real-time monitoring systems, adaptive fuzzy control algorithms, and reinforcement Here are some of the latest references (published in 2022 and 2023) on AI and IoT-enabled smart exoskeleton rehabilitation of paralyzed people: learning-based control.Additionally, these studies explore the effectiveness of these devices in improving gait rehabilitation outcomes, as well as patient satisfaction and quality of life.