TECHNOLOGY USED TO IMPROVE WALKING PATTERN

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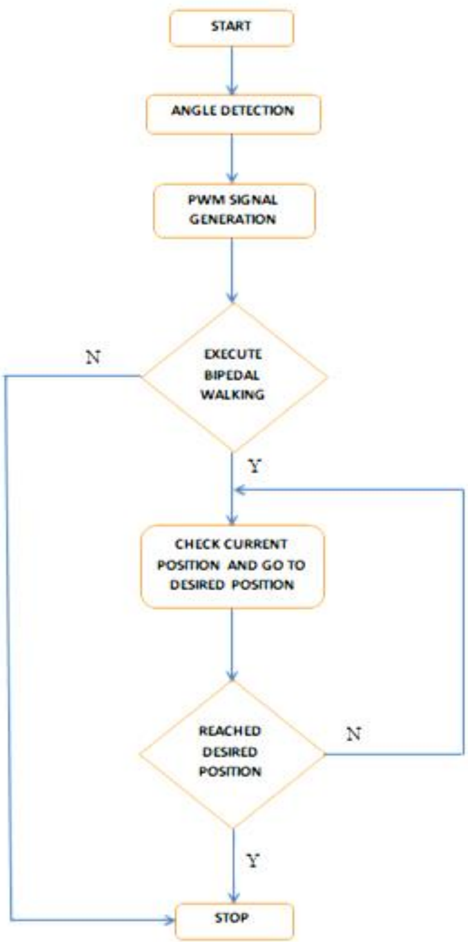
Abstract: Lower leg activity plays a vital role in daily life of human being. Due to uncertain accidents that are occurring in human life results in immobilization. For such cases, external or artificial supports are developed and this study is known as orthosis, which is a device added to the body to stabilize or immobilize a body part, prevent deformity or assist with function. Robotic devices have the potential to make therapy more affordable and thus more available for more patients and for more time. It is a training device that efficiently supports walking which is based on the inverted pendulum model, the theory for bipedal walking. In consideration of the motion pattern of the swinging phase, the Flexion/Extension rotations at the hip, knee have largest ranges, which are all on the sagittal plane. One of the main thing to make leg move forward, backward or to bend is the measurement of the angle at the hip, knee, and ankle. These angle measurements have been calculated using different sensors. Some of the sensors that are used to measure the angle are gyroscopes, accelerometers, electronic goniometer. Analysis of torque required at the joints, various actuators, drive technologies and power analysis is reviewed. People convert movement of the pelvis that uses the legs as pivot points into kinetic energy and potential energy in order to achieve smooth and efficient bipedal walking.

***Index Terms* – Component, formatting, style, styling, insert.**

I. INTRODUCTION

The main motivation of walk assist is to help a patient recovering from injury, illness or disease, to recover some locomotor abilities in order to promote as much independence as possible in activities of daily living tasks, and to assist the patient in compensating for deficits that cannot be treated medically. . However, the amount of hands-on therapy that patients can receive is limited, as economic pressures are inherent in the health care system. Therefore, worldwide efforts are being made to automate locomotor training. Robotic devices has the potential to make therapy more affordable and thus more available for more patients and for more time. In consideration of the motion pattern of the swinging phase, the Flexion/Extension rotations at the hip, knee have largest ranges, which are all on the sagittal plane. So basically, it uses electrical stimulation and force to recover walk pattern of patient. It looks like a bulky belt and hides compact motors inside that are driven by battery power. The rigid frame allows the device to help lit the legs of the user. It is designed as the device to help people walk that have limited or reduced mobility due to injury, illness, or other causes. The Walking Assist Device is expected to help stroke victims regain their mobility. The Walking Assist Device has a control computer inside the housing that uses data gathered from hip angle sensors while walking. The data that is gathered allows the internal computer to help improve the timing of each leg lifting from the ground and extending forward or backward to give the user a longer stride, making walking easier. The device attaches to the body using belts allowing it to be worn by people of varied body size. The battery inside the device is good for over an hour of use per charge.

II. ALGORITHM



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III. WALKING PATTERN

The main design requirements and development complications are identified and the various approaches used in past robots are reviewed. It begins with a survey of existing human rehabilitation devices designed for use in human assistance and treatment. Gait Analysis: gait analysis is the human walking pattern of human lower limbs. Gait cycle is categorized into two phases. 1) In Stance phase, the foot is contact with ground. 2) In Swing phase, the foot is not completely in contact with ground. Different phases of gait can be seen and inferred from the below. Recently some technological devices have been developed and used as rehabilitation training tools: among these the Functional Electrical Stimulation (FES), based on the application of electrical current to nerves and muscles using surface or implanted electrodes, represents a promising rehabilitation technique. By using FES, action potentials in neurons that are missing in paralyzed muscles can be raised and this may cause an activation of muscular contraction. Currently over ground robotic exoskeletons are also used in gait rehabilitation training in order to improve mobility limitations and consequently contribute to significant changes in quality of life. Improvements in muscle cross-sectional area, strength and composition have been outlined in response to FES-cycling training. Our hypothesis is that the combination of FES-cycling and robot-assisted gait training may provide significant gait outcomes. Functional electrical stimulation (FES) is a treatment that applies small electrical charges to a muscle that has become paralyzed or weakened. It is mostly used as a treatment for foot drop, where disruptions in the nerve pathways between the legs and brain mean the front of your foot cannot be lifted to the correct angle when walking. FES was first developed in the United States in the 1960s, where it was initially tested in stroke patients.

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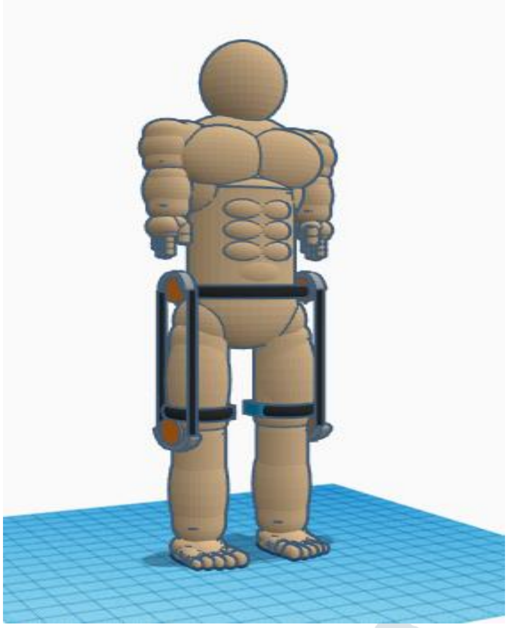
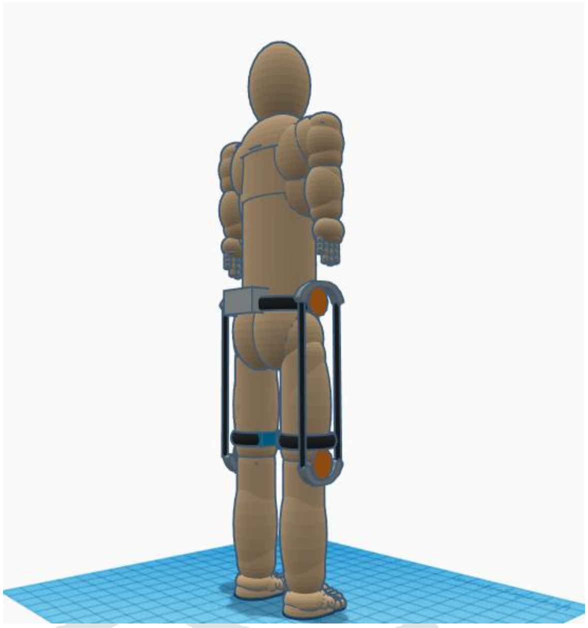
IV. DESIGN CONCEPT





Our device consist of controller that generates signal which drives the motors and respective torque is generated by the motor which is transfer to thigh with the help of pulleys and belts assembly which move leg forward or backward. The proposed model will look like above figure.

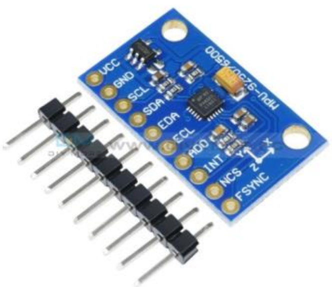
V. HARDWARE

The Arduino UNO is an open-source microcontroller board based on the microchip atmega328p microcontroller and developed by Arduino.cc. The project goal was to create simple, low-cost tools for creating digital projects by engineers. The Uno differed from all preceding boards by featuring the ATmega328P microcontroller and an ATmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

5.1. CONTROLLER

The controller is the heart of the system. Arduino UNO is used to control the motors. Arduino UNOReV-3 has been used in the project

5.2. MPU6050 SENSOR



The MPU-6050 is the world's first and only 6-axis motion tracking devices designed for the low power, low cost, and high performance requirements of smartphones, tablets and wearable sensors. It is used for posture maintenance of the exoskeleton. The MPU-6050 devices combine a 3-axis gyroscope and a 3-axis accelerometer on the same silicon die, together with an onboard Digital Motion Processor™ (DMP™), which processes complex 6-axis Motion Fusion algorithms. The device can access external magnetometers or other sensors through an auxiliary master I²C bus, allowing the devices to gather a full set of sensor data without intervention from the system processor.

5.3.MOTOR

As per torque requirements suitable motors were chosen for the knee movement. The motors were purchased with the specification of 12V, 20 kg-cm torque geared DC motors have been used for prototyping purposes. The fig. given below shows the high torque heavy duty motor.

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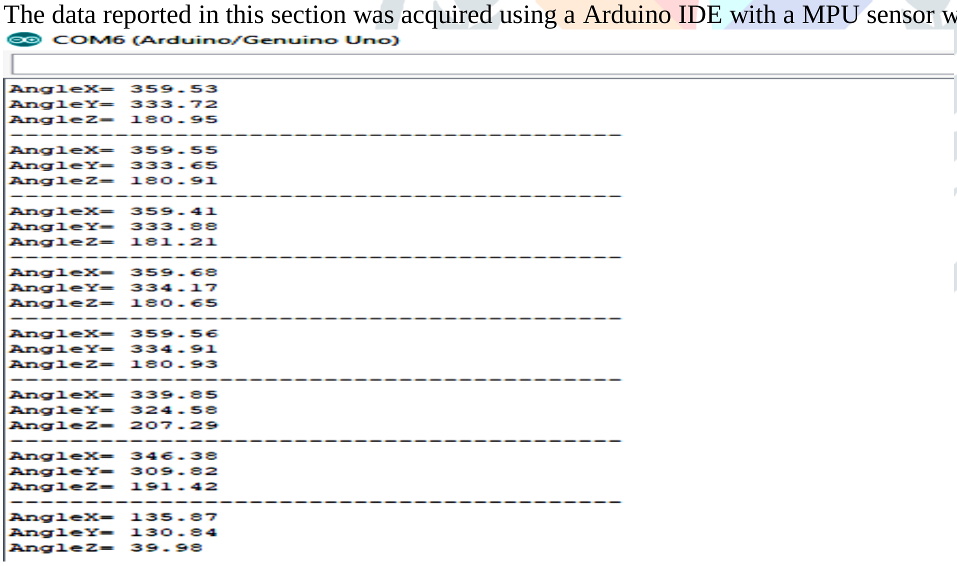
5.4. MOTOR DRIVER

The L298N is a dual H-Bridge motor driver which allows speed and direction control of two DC motors at the same time. The module can drive DC motors that have voltages between 5 and 35V, with a peak current up to 2A.

5.5.RESULT

The data reported in this section was acquired using a Arduino IDE with a MPU sensor which detects angle of the knee.



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COM6 (Arduino/Genuino Uno)

AngleX= 359.53
AngleY= 333.72
AngleZ= 180.95
----------------------------------------
AngleX= 359.55
AngleY= 333.65
AngleZ= 180.91
----------------------------------------
AngleX= 359.41
AngleY= 333.88
AngleZ= 181.21
----------------------------------------
AngleX= 359.68
AngleY= 334.17
AngleZ= 180.65
----------------------------------------
AngleX= 359.56
AngleY= 334.91
AngleZ= 180.93
----------------------------------------
AngleX= 339.85
AngleY= 324.58
AngleZ= 207.29
----------------------------------------
AngleX= 346.38
AngleY= 309.82
AngleZ= 191.42
----------------------------------------
AngleX= 135.87
AngleY= 130.84
AngleZ= 39.98
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5.6.FUTURE SCOPE AND CONCLUSION

In conclusion with our proposed model we can improve walking pattern with the help of inverted pendulum principle and bipedal walking. We can implement sensor for checking limb strength. It can be modified as IOT Based device. We can make it more compact and light weight by using thin motors and a control system. It can be modified more to give more support to our lower extremities. We can try to make it more adoptable and flexible.

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