Designing a Automatic Wearable Device to Improve Gait Function

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***Abstract*—A newly developed wearable hip assist motor that uses an active assist algorithm to improve gait function, muscle effort, and cardiopulmonary metabolic efficiency in elderly adults.The experimental protocol consisted of overground gait at comfortable speed under three different conditions: free gait without motor assistance, motor-assisted gait with zero torque (RAG-Z), and full motor-assisted gait (RAG). Two motors will be placed near hip and ankle. This system uses gyro sensor to check the condition of the user.Although the hip assist motor only provides assistance at the hip joint, our results demonstrated a clear reduction in knee and ankle muscle activity in addition to decreased hip flexor anmotor and prevent fall. Current status will be displayed in the LCD display. Our findings suggest that this motor has the potential to improve stabilization of the trunk during walking in elderly adults.**

Keywords : Gait Funtion,Elderly Adults,Assistive Motor

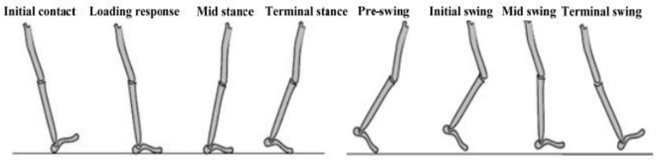
I. INTRODUCTION

Many ambulatory stroke survivors suffer alterations to their gait patterns as a result of the stroke. Unfortunately, in a majority of patients, self exercises without professional assistance in the chronic stages can result in the development of stubborn abnormal gait patterns, including stiff-knee gait limited or absent ankle dorsiflexion, impairment of loading ability on the paretic sid, and abnormal or insufficient muscle activation or contraction , which can greatly influence their quality of life. Experience-dependent plasticity, regarded as a potential mechanism of the neural networks, allows stroke survivors to recover motor function control and partially offset impairments . Recent technologies have made it possible for robotic devices to provide safe and intensive rehabilitation therapy using repeated motions. Studies have shown that robotic leg orthosis can improve patients' gait and walking ability.However, few researches have reported the effect of the robot-assisted training on the improvements of gait performance which integrated 3D motion gait analysis and the muscle activationanalysis. In addition, little is knownregarding the underlying mechanisms of gaitalternations after RLO training. In this case study, gait performance changes were investigated in three chronic stroke patients who received robot-assisted gait therapy (a new wearable robotic orthosis) at two speeds An attempt was made to explore the training effects and possible mechanisms of sensory-motor changes using gait and EMG analysis after three weeks of measuring body temperature using a wearable sensor device. Constantly wearing the sensor, however, forces a psychological burden on the elderly. Imranet al. proposed a system for monitoring temperature and humidity in a car and notifying dangerous situations to its owner via Wi-Fi network**.**This is a trial targeted at avoiding life-threatening situations for children and pets left in a car due to heat stroke.In this paper, we propose a method for monitoring indoor environment of the elderly in real time by the installed device and promptly notify them when it detects any dangerous states of heat stroke. An essential requirement for conveying such critical information to the elderly is to make the system easily be individualized according to each user's physical weakness. Therefore, we devised a new multi-sensory alert notification method for efficiently presenting the dangerous states to the elderly by combining visual, auditory and tactile information.We designed and implemented the system based on portable IoT devices with high scalability, enabling persistent danger notification to the elderly for reliably avoiding the crisis.

Basis of Human Gait Analysis

Introduction of the Gait Phases Generally, human walking is a periodic movement of the body segments and includes repetitive motions. To understand this periodic walking course better and easier, the gait phase must be used to describe an entire walking period. In the past, normal events were conventionally used as the critical actions of separated gait phases. However, this practice only proved to be appropriate for amputees and often failed to accommodate the gait deviations of patients impaired by paralysis or arthritis. For example, the onset of stance has customarily been called the heel strike . However, the heel of a paralytic patient may never be in contact the ground or may do so significantly later in the gait cycle. Similarly, initial floor contact may be made by the entire foot (flat foot), rather than having forefoot contact, which occurs later, after a period of heel-only support. To avoid these difficulties and other areas of confusion, the Rancho Los Amigos gait analysis committee developed a generic terminology for the functional phases of gait . Analysis of the human walking pattern by phases more directly identifies the functional significance of the different motions generated at the individual joints and segments.

In the present paper, a normal walking gait cycle is divided into eight different gait phases, that is, initial contact, loading response, midstance, terminal stance, pre-swing, initial swing, mid-swing, and terminal swing Detailed definitions of the gait phases are described in the following



Initial contact: This phase comprises the moment when the foot touches the floor. The joint postures presented at this time determine the limb's loading response pattern.

Loading response: This phase is the initial double-stance period. The phase begins with initial floor contact and continues until the other foot is lifted for swing. Using the heel as a rocker, the knee is flexed for shock absorption. Ankle plantar flexion limits the heel rocker through forefoot contact with the floor.

Midstance: This phase is the first half of the single-limb support interval. In this phase, the limb advances over the stationary foot through ankle dorsiflexion while the knee and hip extend. Midstance begins when the other foot is lifted and continues until body weight is aligned over the forefoot. Terminal stance: This phase completes the single-limb support. The stance begins with the heel rising and continues until the other foot strikes the ground, in which the heel rises and the limb advances over the forefoot rocker. Throughout this phase, body weight moves ahead of the forefoot. Pre-swing: This final phase of stance is the second double-stance interval in the gait cycle. Pre-swing begins with the initial contact of the opposite limb and ends with the ipsilateral toe-off. The objective of this phase is to position the limb for swing. Initial swing: This phase is approximately one-third of the swing period, beginning with a lift of the foot from the floor and ending when the swinging foot is opposite the stance foot. In this phase, the foot is lifted, and the limb is advanced by hip flexion and increased knee flexion. Mid-swing: This phase begins as the swinging limb is opposite the stance limb and ends when the swinging limb is forward and the tibia is vertical The knee is allowed to extend in response to gravity, while the ankle continues dorsiflexion to neural. Terminal swing: This final phase of swing begins with a vertical tibia and ends when the foot strikes the floor. Limb advancement is completed as the leg moves ahead of the thigh. In this phase, limb advancement is completed through knee extension. The hip maintains its earlier flexion and the ankle remains dorsiflexed to neural. Each gait phase has a functional objective and a critical pattern of selective synergistic motion to accomplish its goal. The sequential combination of the phases also enables the limb to accomplish three basic tasks, namely, weight acceptance, single-limb support, and limb advancement. Weight acceptance begins the stance period through initial contact and loading response. Single-limb support continues the stance through the midstance and terminal stance. Limb advancement begins in the pre-swing phase and continues through initial swing, mid-swing, and terminal swing. Based on the above analysis of the gait phases and basic tasks of limb movement, the gait phases may be detected effectively after orientations of the leg segments are accurately obtained.. Wearable Sensors for Gait Analysis Gait analysis has used different types of motion sensors and systems, such as the accelerometer, gyroscope, magnetoresistive sensors, flexible goniometer, electromagnetic tracking system , sensing fabric, force sensor, and sensors for electromyography . Based on these sensors, a single type or a combined sensor system of multiple types of sensors may be used for various gait analysis applications. The basic principles and features of these motion sensors and systems are described in the following. Accelerometer, Gyroscope, and Magnetoresistive Sensors An accelerometer is a type of inertial sensor that can measure acceleration along its sensitive axis. Gait Analysis Methods Based on Wearable Sensors In the past two decades, a great deal of attention has been given to gait analysis using wearable sensors, and significant progress has been achieved in this area. The achievements of human gait analysis can be divided into three areas, namely, kinematics, kinetics, and EMG. The kinematics of the human gait describes the movements of the major joints and components of the lower extremity in the human gait. Gait kinetics focuses on the study of forces and moments that result in the movement of human segments, in which the orientation of all the leg segments obtained from gait kinematics is often required. The EMG of the human gait is used to detect and analyze muscle activity during human walking. In this chapter, gait analysis methods based on wearable sensors are reviewed separately based on these three research areas.

II. EXISTING SYSTEM

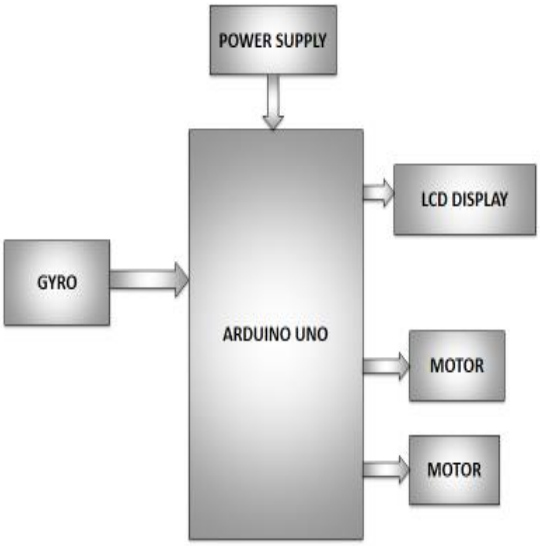
This system uses flex sensor to monitor the fall. Depending on this the system will alert the user through the buzzer. This system also display the status in the lcd display. Traditional rehabilitation therapies are very labor intensive especially for gait rehabilitation, often requiring more than three therapists together to assist manually the legs and torso of the patient to perform training. This fact imposes an enormous economic burden to any country's health care system thus limiting its clinical acceptance. Furthermore, demographic change (aging), expected shortages of health care personnel, and the need for even higher quality care predict an increase in the average cost from first stroke to death in the future. All these factors stimulate innovation in the domain of rehabilitation [7] in such way it becomes more affordable and available for more patients and for a longer period of time. Gait analysis using wearable sensors is an inexpensive, convenient, and efficient manner of providing useful information for multiple health-related applications. As a clinical tool applied in the rehabilitation and diagnosis of medical conditions and sport activities, gait analysis using wearable sensors shows great prospects. The current paper reviews available wearable sensors and ambulatory gait analysis methods based on the various wearable sensors. After an introduction of the gait phases, the principles and features of wearable sensors used in gait analysis are provided. The gait analysis methods based on wearable sensors is divided into gait kinematics, gait kinetics, and electromyography. Studies on the current methods are reviewed, and applications in sports, rehabilitation, and clinical diagnosis are summarized separately. With the development of sensor technology and the analysis method, gait analysis using wearable sensors is expected to play an increasingly important role in clinical applications.

III PROPOSED SYSTEM

This system uses gyro sensor to monitor the gait or movement of the user.

If the system detects fall, the system will automatically tight the belt with the help of two motors placed on hip and ankle. The status will be monitored in the LCD display. Two motors will be placed near hip and ankle. This system uses gyro sensor to check the condition of the user. Although the hip assist motor only provides assistance at the hip joint, our results demonstrated a clear reduction in knee and ankle muscle activity in addition to decreased hip flexor and extensor activity. Depending on the sensor value the system will turn on the motor and prevent fall. Current status will be displayed in the LCD display. Our findings suggest that this motor has the potential to improve stabilization of the trunk during walking in elderly adults.

BLOCK DIAGRAM



IV HARDWARE DESCRIPTION

POWER SUPPLY CIRCUIT:

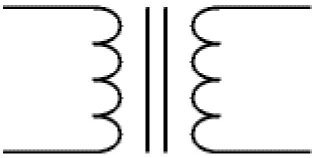
Power supply is a reference to a source of electrical power. A device or system that supplies electrical or other types of energy to an output load or group of loads is called a power supply unit or PSU. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others.

Power supplies for electronic devices can be broadly divided into linear and switching power supplies. The linear supply is a relatively simple design that becomes increasingly bulky and heavy for high current devices; voltage regulation in a linear supply can result in low efficiency. A switched-mode supply of the same rating as a linear supply will be smaller, is usually more efficient, but will be more complex.

Linear Power supply:

An AC powered linear power supply usually uses a transformer to convert the voltage from the wall outlet (mains) to a different, usually a lower voltage. If it is used to produce DC, a rectifier is used. A capacitor is used to smooth the pulsating current from the rectifier. Some small periodic deviations from smooth direct current will remain, which is known as ripple. These pulsations occur at a frequency related to the AC power frequency (for example, a multiple of 50 or 60 Hz).

III. Transformer:



IV.

Transformer

V. Transformers convert AC electricity from one voltage to another with little loss of power. Transformers work only with AC and this is one of the reasons why mains electricity is AC.

VI. Step-up transformers increase voltage, step-down transformers reduce voltage. Most power supplies use a step-down transformer to reduce the dangerously high mains voltage (230V in UK) to a safer low voltage.

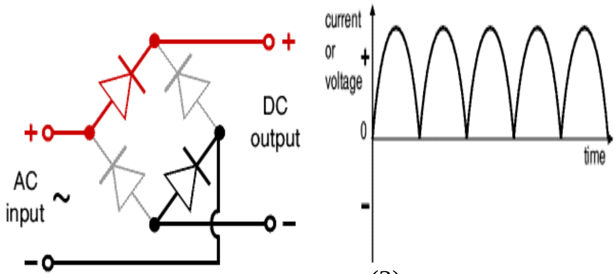
The input coil is called the primary and the output coil is calledcalled the secondary. There is no electrical connection between the two coils; instead they are linked by an alternating magnetic field created in the soft-iron core of the transformer. The two lines in the middle of the circuit symbol represent the core.

(1) Transformers waste very little power so the power out is (almost) equal to the power in. Note that as voltage is stepped down current is stepped up.

The ratio of the number of turns on each coil, called the turn's ratio, determines the ratio of the voltages. A step-down transformer has a large number of turns on its primary (input) coil which is connected to the high voltage mains supply, and a small number of turns on its secondary (output) coil to give a low output voltage.

Bridge rectifier:

A bridge rectifier can be made using four individual diodes, but it is also available in special packages containing the four diodes required. It is called a full-wave rectifier because it uses the entire AC wave (both positive and negative sections). 1.4V is used up in the bridge rectifier because each diode uses 0.7V when conducting and there are always two diodes conducting, as shown in the diagram below. Bridge rectifiers are rated by the maximum current they can pass and the maximum reverse voltage they can withstand (this must be at least three times the supply RMS voltage so the rectifier can withstand the peak voltages). Please see the DIODES page for more details, including pictures of ridge rectifiers.



(2)

Bridge rectifier
Alternate pairs of diodes conduct, changing over the connections so the alternating directions of AC are converted to the one direction of DC.

Output: full-wave varying DC: (using the entire AC wave):

Smoothing:
Smoothing is performed by a large value electrolytic capacitor connected across the DC supply to act as a reservoir, supplying current to the output when the varying DC voltage from the rectifier is falling. The diagram shows the unsmoothed varying DC (dotted line) and the smoothed DC (solid line). The capacitor charges quickly near the peak of the varying DC, and then discharges as it supplies current to the output.

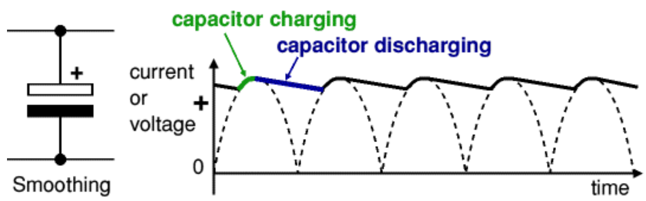


Fig.4.27.Smoothing

Note that smoothing significantly increases the average DC voltage to almost the peak value (1.4 × **RMS** value). For example 6V RMS AC is rectified to full wave DC of about 4.6V RMS (1.4V is lost in the bridge rectifier), with smoothing this increases to almost the peak value giving 1.4 × 4.6 = 6.4V smooth DC.
Smoothing is not perfect due to the capacitor voltage falling a little as it discharges, giving a small ripple voltage. For many circuits a ripple which is 10% of the supply voltage is satisfactory and the equation below gives the required value for the smoothing capacitor. A larger capacitor will give fewer ripples. The capacitor value must be doubled when smoothing half-wave DC.

Smoothing Capacitor for 10% ripple, C=5*10/vs.*f
C = smoothing capacitance in farads (F)
Io = output current from the supply in amps (A)
Vs = supply voltage in volts (V), this is the peak value of the unsmoothed DC
f = frequency of the AC supply in hertz (Hz), 50Hz UK.

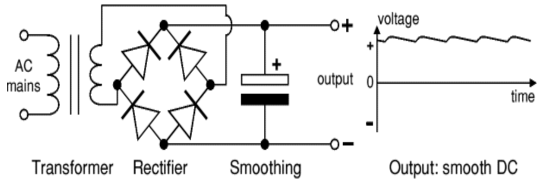


Fig. 4.28 power supply circuit

The smooth DC output has a small ripple. It is suitable for most electronic circuits.
Regulator:
Voltage regulator ICs are available with fixed (typically 5, 12 and 15V) or variable output voltages. They are also rated by the maximum current they can pass. Negative voltage regulators are available, mainly for use in dual supplies. Most regulators include some automatic protection from excessive current ('overload protection') and overheating ('thermal protection').
The LM78XX series of three terminal regulators is available with several fixed output voltages making them useful in a wide range of applications. One of these is local on card regulation, eliminating the distribution problems associated with single point regulation. The voltages available allow these regulators to be used in logic systems, instrumentation, HiFi, and other solid state electronic equipment. Although designed primarily as fixed voltage regulators these devices can be used with external components to obtain adjustablevoltages and current.
Many of the fixed voltage regulator ICs has 3 leads and look like power transistors, such as the 7805 +5V 1A regulator shown on the right. They include a hole for attaching a heat sink if necessary.

1. Positive regulator
1. input pin
2. ground pin
3. output pin
It regulates the positive voltage

2. Negative regulator
1. ground pin
2. input pin
3. output pin
It regulate the negative voltage

The regulated DC output is very smooth with no ripple. It is suitable for all electronic circuits.
ARDUINO UNO:
ARDUINO is an open-source computer hardware and software company, project and user community that designs and manufactures microcontroller-based kits for building digital devices and interactive objects that can sense and control objects in the physical world.The project is based on microcontroller board designs, manufactured by several vendors, using various microcontrollers. These systems provide sets of digital and analog I/O pins that can be interfaced to various expansion boards ("shields") and other circuits. The boards feature serial communications interfaces,

including USB on some models, for loading programs from personal computers. For programming the microcontrollers, the Arduino project provides an integrated development environment (IDE) based on the Processing project, which includes support for the C and C++ programming languages. The first Arduino was introduced in 2005, aiming to provide an inexpensive and easy way for novices and professionals to create devices that interact with their environment using sensors and actuators. Common examples of such devices intended for beginner hobbyists include simple robots, thermostats, and motion detectors.

ARDUINO:

An Arduino is a PCB containing an Atmel AVR microcontroller and usually providing a set of connectors in a standard pattern. The microcontroller is typically preprogrammed with a "bootloader" program that allows a program (called a "sketch") to be loaded into the microcontroller over a TTY serial connection (or virtual serial over USB connection) from a PC.

MICROPROCESSOR:

A microprocessor is an IC that contains only a central processing unit (CPU). The IC does not contain RAM, ROM or other peripherals. The IC may contain cache memory but it is not designed to be usable without any external memory.

Microprocessors cannot store programs internally and therefore typically load software when powered on, this usually involves a complex multi-stage "boot" process where "firmware" is loaded from external ROM and eventually an operating system is loaded from other storage media (e.g. hard disk).

It is typically found in a personal computer.

MICROCONTROLLER:

A microcontroller is an IC that contains a CPU as well as some amount or RAM, ROM and other peripherals. Microcontrollers can function without external memory or storage.

Normally, microcontrollers are either programmed before being soldered to a PCB or are programmable using In-System-Programming (ISP or ICSP) connectors via a special "programmer" device attached to a personal computer.

Typical microcontrollers are much simpler and slower than typical microprocessors but I believe the distinction is mostly one of scale and application.

It is found, for example, in simple appliances such as basic washing machines.

ATMEGA328:

The high-performance Atmel 8-bit AVR RISC-based microcontroller combines 32KB ISP flash memory with read-while-write capabilities, 1KB EEPROM, 2KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts,serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts. By executing powerful instructions in a single clock cycle, the device achieves throughputs approaching 1 MIPS per MHz, balancing power consumption and processing speed. The ATmega328 is a single chip micro-controller created by Atmel and belongs to the megaAVR series.

The Atmel 8-bit AVR RISC-based microcontroller combines 32 KB ISP flash memory with read-while-write capabilities, 1 KB EEPROM, 2 KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts. The device achieves throughputs approaching 1 MIPS. Today the ATmega328 is commonly used in many projects and autonomous systems where a simple, low-powered, low-cost micro-controller is needed. Perhaps the most common implementation of this chip is on the popular Arduino development platform, namely the Arduino Uno and Arduino Nano models.

The name says it all on this one. An ATmega328 in DIP package, pre-loaded with the Arduino Optiboot (Uno 16MHz) Bootloader. This will allow you to use Arduino code in your custom embedded project without having to use an actual Arduino board. To get this chip working with Arduino IDE, you will need an external 16MHz crystal or resonator, a 5V supply, and a serial connection. If you are not comfortable doing this, we recommend purchasing the Arduino Uno board that has all of these built into the board. Atmel's ATMega328 8-Bit Processor in 28 pin DIP package. It's like the ATmega168, with double the flash space. 32K of program space. 23 I/O lines, 6 of which are channels for the 10-bit ADC. Runs up to 20MHz with external crystal. Package can be programmed in circuit. 1.8V to 5V operating voltage!

This is the new Arduino Uno R3. In addition to all the features of the previous board, the Uno now uses an ATmega16U2 instead of the 8U2 found on the Uno (or the FTDI found on previous generations). This allows for faster transfer rates and more memory. No drivers needed for Linux or Mac (inf file for Windows is needed and included in the Arduino IDE), and the ability to have the Uno show up as a keyboard, mouse, joystick, etc.

The Uno R3 also adds SDA and SCL pins next to the AREF. In addition, there are two new pins placed near the RESET pin. One is the IOREF that allow the shields to adapt to the voltage provided from the board. The other is a not connected and is reserved for future purposes. The Uno R3 works with all existing shields but can adapt to new shields which use these additional pins.

Arduino is an open-source physical computing platform based on a simple i/o board and a development environment that implements theProcessing/Wiring language. Arduino can be used to develop stand-alone interactive objects or can be connected to software on your computer (e.g. Flash, Processing, MaxMSP). The open-source IDE can be downloaded for free (currently for Mac OS X, Windows, and Linux).

Note: The Arduino Uno R3 requires the Arduino 1.0 drivers folder in order to install properly on some computers. We have tested and confirmed that the R3 can be programmed in older versions of the IDE. However, the first time using the R3 on a new computer, you will need to have Arduino 1.0 installed on that machine. If you are interested in reading more about the changes to the IDE, check out the officialArduino 1.0 Release notes!

Not sure which Arduino or Arduino-compatible board is right for you? Check out our Arduino Buying Guide!

Features:

- ATmega328 microcontroller
- Input voltage - 7-12V
- 14 Digital I/O Pins (6 PWM outputs)
- 6 Analog Inputs
- 32k Flash Memory
- 16Mhz Clock

right ears, respectively. This setup is illustrated in Fig. 3.

FEATURES:

• High Performance, Low Power AVR® 8-Bit Microcontroller

• Advanced RISC Architecture – 131 Powerful Instructions – Most Single Clock Cycle Execution – 32 x 8 General Purpose Working Registers – Fully Static Operation – Up to 20 MIPS Throughput at 20 MHz – On-chip 2-cycle Multiplier

• High Endurance Non-volatile Memory Segments – 4/8/16/32K Bytes of In-System Self-Programmable Flash progam memory (ATmega48PA/88PA/168PA/328P) – 256/512/512/1K Bytes

EEPROM:

(ATmega48PA/88PA/168PA/328P) – 512/1K/1K/2K Bytes Internal SRAM (ATmega48PA/88PA/168PA/328P) – Write/Erase Cycles: 10,000 Flash/100,000

EEPROM – Data retention:

20 years at 85°C/100 years at 25°C(1) – Optional Boot Code Section with Independent Lock Bits In-System Programming by On-chip Boot Program True Read-While-Write Operation – Programming Lock for Software Security

• Peripheral Features – Two 8-bit Timer/Counters with Separate Prescaler and Compare Mode – One 16-bit Timer/Counter with Separate Prescaler, Compare Mode, and Capture Mode – Real Time Counter with Separate Oscillator – Six PWM Channels – 8-channel 10-bit ADC in TQFP and QFN/MLF package

Temperature Measurement – 6-channel 10-bit ADC in PDIP Package Temperature Measurement – Programmable Serial USART – Master/Slave SPI Serial Interface – Byte-oriented 2-wire Serial Interface (Philips I2 C compatible) – Programmable Watchdog Timer with Separate On-chip Oscillator – On-chip Analog Comparator – Interrupt and Wake-up on Pin Change

• Special Microcontroller Features – Power-on Reset and Programmable Brown-out Detection – Internal Calibrated Oscillator – External and Internal Interrupt Sources – Six Sleep Modes: Idle, ADC Noise Reduction, Power-save, Power-down, Standby, and Extended Standby

• I/O and Packages – 23 Programmable I/O Lines – 28-pin PDIP, 32-lead TQFP, 28-pad QFN/MLF and 32-pad QFN/MLF • Operating Voltage: – 1.8 - 5.5V for ATmega48PA/88PA/168PA/328P • Temperature Range: – -40°C to 85°C • Speed Grade: – 0 - 20 MHz @ 1.8 - 5.5V

• Low Power Consumption at 1 MHz, 1.8V, 25°C for ATmega48PA/88PA/168PA/328P: – Active Mode: 0.2 mA – Power-down Mode: 0.1 µA – Power-save Mode: 0.75 µA (Including 32 kHz RTC)

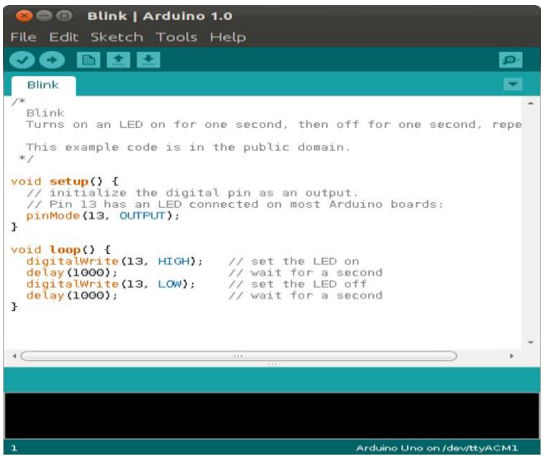
SOFTWARE REQUIREMENTS

5.1 ARDUINO IDE

Arduino is an open source, computer hardware and software company, project, and user community that designs and manufactures microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical world. The project's products are distributed as open-source hardware and software, which are licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL), permitting the manufacture of Arduino boards and software distribution by anyone.

Arduino boards are available commercially in preassembled form, or as do-it-yourself kits. Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers.

The microcontrollers are typically programmed using a dialect of features from the programming languages C and C++. In addition to using traditional compiler toolchains, the Arduino project provides an integrated development environment (IDE) based on the Processing language project. The Arduino project started in 2005 as a program for students at the Interaction Design Institute Ivrea in Ivrea, Italy, aiming to provide a low-cost and easy way for novices and professionals to create devices that interact with their environment using sensors and actuators. Common examples of such devices intended for beginner hobbyists include simple robots, thermostats, and motion detectors.



Hardware

Arduino is open-source hardware. The hardware reference designs are distributed under a Creative Commons Attribution Share-Alike 2.5 license and are available on the Arduino website. Layout and production files for some versions of the hardwardare also available. The source code for the IDE is released under the GNU General Public License, version 2.

Nevertheless, an official Bill of Materials of Arduino boards has never been released by Arduino staff. Although the hardware and software designs are freely available under copyleft licenses, the developers have requested that the name Arduino be exclusive to the official product and not be used for derived works without permission. The official policy document on use of the Arduino name emphasizes that the project is open to incorporating work by others into the official product. Several Arduino-compatible products commercially released have avoided the project name by using various names ending in –duino.

An Arduino board consists of an Atmel 8-, 16- or 32-bit AVR microcontroller (ATmega8, ATmega168, ATmega328, ATmega1280, ATmega2560), but other makers' microcontrollers have been used since 2015. The boards use single-row pins or female headers that facilitate connections for programming and incorporation into other circuits. These may connect with add-on modules termed shields. Multiple, and possibly stacked shields may be individually addressable via an I²C serial bus. Most boards include a 5 V linear regulator and a 16 MHz crystal oscillator or ceramic resonator. Some designs, such as the LilyPad, run at 8 MHz and dispense with the onboard voltage regulator due to specific form-factor restrictions. Arduino microcontrollers are pre-programmed with a boot loader that simplifies uploading of programs to the on-chip flash memory.

The default bootloader of the Aduino UNO is the optiboot bootloader. Boards are loaded with program code via a serial connection to another computer.

SOFTWARES

A minimal Arduino C/C++ sketch, as seen by the Arduino IDE programmer, consist of only two functions:

setup:

This function is called once when a sketch starts after power-up or reset. It is used to initialize variables, input and output pin modes, and other libraries needed in the sketch.

loop:

After setup has been called, function loop is executed repeatedly in the main program. It controls the board until the board is powered off or is reset. Most Arduino boards contain a light-emitting diode (LED) and a load resistor connected between pin 13 and ground, which is a convenient feature for many tests and program functions

IV CONCLUSION

We are conclude that wearable hip assist motor that uses an active assist algorithm to improve gait function, muscle effort, and cardiopulmonary metabolic efficiency in elderly adults. The experimental protocol consisted of overground gait at comfortable speed under three different conditions: free gait without motor assistance, motor-assisted gait with zero torque (RAG-Z), and full motor-assisted gait (RAG). Two motors will be placed near hip and ankle. This system uses gyro sensor to check the condition of the user. Although the hip assist motor only provides assistance at the hip joint, our results demonstrated a clear reduction in knee and ankle muscle activity in addition to decreased hip flexor and extensor activity. Depending on the sensor value the system will turn on the motor and prevent fall. Current status will be displayed in the LCD display. Our findings suggest that this motor has the potential to improve stabilization of the trunk during walking in elderly adults is completed successfully.

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