Embedded Control System for Smart Walking Assistance Device

Abstract

In society many health issues are going on where people are facing so much of difficulties so among them old people and physically disables persons cannot move their body easily, to overcome this designed a Smart walking assistance device. With thisMovement of walking device can be controlled by the hand movement. The paperdesigns a smart walking assistance device by using MEMS sensor and ARM7.By using MEMS sensor, we can control the devicethrough DC motor with the help of arm7.The paper contains an overview of the complete system, MEMS sensor is placed at the rods of the handle of the walking device and just by moving the rods we can control the walking device. MEMS sensor is one of the simplest but also most applicable micro-electromechanical systems. They became indispensable in automobile industry, computer and audio-video technology.

1. Introduction

This paper presents the design and implementation of a unique control system for a smart hoist, a therapeutic device that is used in rehabilitation of walking. The control system features a unique human-machine interface that allows the human to intuitively control the system just by moving or rotating its body.

In this paper MEMS sensor is used as the input to the ARM7 lpc2148 microcontroller in order to control the walking device. The output of the MEMS sensor is given to the PID microcontroller. MEMS sensor data is fed to the PID microcontroller and the analog data will be serially sent to the lpc2148 MICROCONTROLLER. Depending on the output from the MEMS sensor, microcontroller decides the direction of movement of wheels (either forward, backward, left or right and also stop). With this the person can move in the desired direction he needs.

2. Literature Survey

[1]In this paper, we develop an active walker system for standing, walking and seating operation continuously which cooperates the developed standing assistance system with safety and stability. For realizing these conditions, our walker coordinates the assisting position cooperating the standing assistance manipulator according to the posture of the patient.

[2] In this paper they described a motorized device and corresponding adaptive control strategy for dynamic balance training during over ground walking. The device provides adjustable level of supporting forces at the pelvis whereas adaptive control strategy periodically adjusts the training difficulty by adjusting gait velocity with respect to selected performance criterion. But it is a high cost and high-power consumption.

[3] In this paper, the lower limb rehabilitation robot, which has eight degree of freedoms, is studied. The motion data of the lower limb rehabilitation robot are got by the great number of models provided by OpenSim motion simulation.

3. Implementation:

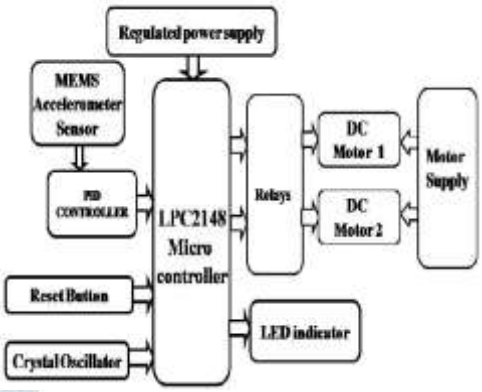

Figure: 1 Block diagram

Microcontroller forms the controlling module and it is the heart of the device. MEMS sensor data is given to the PID microcontroller, so that the analog data will be serially sent to the LPC2148Microcontroller.PID microcontroller, Relay, reset button, crystal oscillator, LED indicator are interfaced to microcontroller. DC motors are connected to microcontroller through relays. DC motor supply is given to the DC motors.

4. Related Work:

A. MEMS sensor MMA 7260 Q:

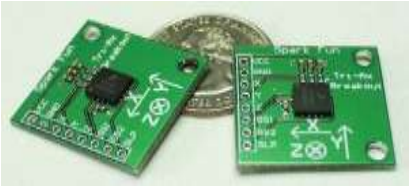

Figure:2 MEMS sensor MMA7260Q

The MMA7260Q is 3-axis accelerometer. An accelerometer measures acceleration (change in speed) of anything that it's mounted on. Single axis accelerometers measure acceleration in only one direction. Dual-axis accelerometers are the most common measure acceleration in two directions, perpendicular to each other. Three-axis accelerometers measure acceleration in three directions. Accelerometers are very handy for measuring the orientation of an object relative to the earth, because gravity causes all objects to accelerate towards the earth. A two-axis accelerometer can be used to measure how level an object is. With a three-axis accelerometer, you can measure an object's acceleration in every direction.

B. Relay:

Figure: 3 Relay

A relay is an electrically operated switch. Many relays use an electromagnet to operate a switching mechanism, but other operating principles are also used. Relays find applications where it is necessary to control a circuit by a low-power signal, or where several circuits must be controlled by one signal. A type of relay that can handle the high power required to directly drive an electric motor is called a contactor. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called "protection relays".

C. DC MOTOR:

Figure: 4 DC motor

A DC motor uses electrical energy to produce mechanical energy, very typically through the interaction of magnetic fields and current-carrying conductors.

The DC motor has two basic parts: the rotating part that is called the armature and the stationary part that includes coils of wire called the field coils. The stationary part is also called the stator.

The current carrying conductor is placed in a magnetic field perpendicularly, and then the conductor experiences a force in the direction mutually perpendicular to both the direction of field and the current carrying conductor. Fleming's left-hand rule says that if we extend the index finger, middle finger and thumb of our left hand perpendicular to each other, in such a way that the middle finger is along the direction of current in the conductor, and index finger is along thedirection of magnetic field i.e. north to south pole, then thumb indicates the direction of created mechanical force.

D. LPC2148 Microcontroller:

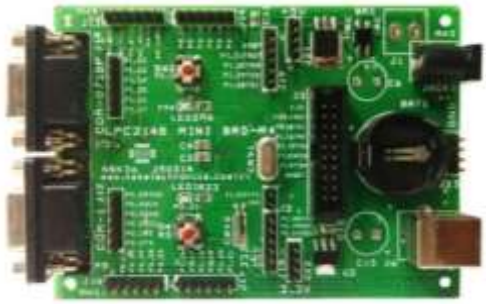

Figure: 5 LPC2148 microcontroller

ARM LPC2148 is a 64 pin Micro Controller which comes under ARM 7 version of ARM processors. It comes under the processor core architecture ARM7TDMI-S.It is a 32 bit Micro Controller .This is intended for high end applications involving complex computations. It follows the enhanced RISC architecture. It has high performance and very low power consumption. It has serial communications interfaces ranging from a USB 2.0 Full Speed device, multiple UARTS, SPI, and I2Cs. Various 32-bit timers, dual 10-

bit ADC(s), single 10-bit DAC, PWM channels and 45 fast GPIO lines with 9 interrupt pins.

E. Crystal oscillator:

A crystal oscillator is an electronic oscillator circuit that uses the mechanical resonance of a vibrating crystal of piezoelectric material to create an electrical signal with a very precise frequency. This frequency is commonly used to keep track of time (as in quartz wristwatches), to provide a stable clock signal for digitalintegrated circuits, and to stabilize frequencies for radio transmitters and receivers. The most common type of piezoelectric resonator used is the quartz crystal, so oscillator circuits incorporating them became known as crystal oscillators, but other piezoelectric materials including polycrystalline ceramics are used in similar circuits.

4. CONCLUSION:

The existing model presents an Integrating feature of the hardware components which has been used and developed in it with LPC2148 Microcontroller. The Presence of each and every module has been reasoned out and placed very carefully. Hence the contributing to the best working unit for “Embedded Control System for Smart Walking Assistance Device” has been designed perfectly. Thus, the project has been successfully designed and tested.

5. ACKNOWLEDGEMENT

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