DESIGN OF THE STRUCTURAL OPTIMIZATION FOR THE UPPER LIMB REHABILITATION ROBOT

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ABSTRACT--In this paper, we are going to propose a therapy machine by gesture learning interface for simulated robot path with help of human assistant to give movements commands through zigbee. The command is processed to move the hand model as per the command is given, so that we can do physiotheraphy by robot, We are even keeping Blood pressure sensor & heart beat sensor, so that we can measure blood pressure and pulse rate and monitored the values in PC via ZIGBEE, Main aim is to provide physiotherapy at patient house itself.

Keywords: Rehabilitation, MEMS, UART, ZIGBEE.

1.INTRODUCTION:

Recognition of human gestures is an active area of research integral for the development of intuitive human-machine interfaces for ubiquitous computing and assistive robotics. In particular, such systems are key to effective environmental designs that facilitate aging in place. Typically, gesture recognition takes the form of template matching in which the human participant is expected to emulate a choreographed motion as prescribed by the researchers. A corresponding robotic action is then a one-to-one mapping of the template classification to a library of distinct responses. A stroke affected patient will lose the functioning of one side arm and leg. For that recovering process doctor advice him to take physiotherapy treatments. In physiotherapy the therapist will bend the affected arm and leg everyday. There is always demand in therapist appointment. For that purpose, human guided robotic therapy based arm is designed to implement physiotherapy by naive user, It is simple so that naive user can recognize the working of therapy machine himself. We have presented a new approach toward the development of a gesture-based human–machine interface. An end-to-end approach is presented which maps arm-scale gesture by a human user to a learned response by a robotic agent through repeated applications of user-provided reward. One way of addressing these issues is to detect the human intention by monitoring the user's muscular activities. The principle and applications of the proposed sensing method are introduced in this paper. The performance of the proposed method is evaluated in terms of linearity, repeatability, wear-comfort, etc.

2.LITERATURE SURVEY

1. Robot manipulator teaching techniques with use of hand gestures

In this paper it is said that Robot manipulator teaching is a time consuming procedure where qualified operator programs the execution path. In this paper we introduce and discuss the improvement of traditional teaching method with application of hand gesture recognition system. The paper presents the most common robot programming and hand gesture recognition issues and presents the possibility of joining this two research fields.AUTHOR: Tomasz Grzejszczak, Adrian Legowski and Michale Niezabitowski.

2. Robot-Aided Neurorehabilitation

A new approach to apply robotics and automation technology to assist, enhance, quantify, and document neurorehabilitation. This paper reviews a clinical trial involving 20 stroke patients with a prototype robot-aided rehabilitation facility developed at the Massachusetts Institute of Technology, Cambridge, (MIT) and tested at Burke

Rehabilitation Hospital, White Plains,NY. It also presents our approach to analyze kinematic data collected in the robot-aided assessment procedure. In particular, we present evidence 1) that robot-aided therapy does not have adverse effects, 2) that patients tolerate the procedure, and 3) that peripheral manipulation of the impaired limb may influence brain recovery. These results are based on standard clinical assessment procedures. We also present one approach using kinematic data in a robot-aided assessment procedure.AUTHOR: Hermano Igo Krebs,Neville Hogan, Mindy L. Aisen, and Bruce T. Volpe

3. Passivity and Stability of Human–Robot Interaction Control for Upper-Limb Rehabilitation Robots

The paper presents a theoretical framework that establishes the passivity of the upper-limb rehabilitative robotic systems and allows rigorous stability analysis of human–robot interaction. Position-dependent stiffness are employed to resolve the possible conflicts in motions between patient and robot. The proposed method also realizes the “assist-as-needed” strategy. In addition, it handles human–robot interactions in such a way that correct movements are encouraged and incorrect ones are suppressed to make the training process more effective. The proposed controller allows parameter adjustment to provide flexibility for therapists to adjust and fine tune depending on the conditions of the patients and the progress of their recovery.AUTHOR: Juanjuan Zhang and Chien Chern Cheah.

3.EXISTING SYSTEM

In the existing system, if any person needs Physiotherapy, he has to wait for the doctor appointment, in countries like India and China; there is a great demand for physiotherapist. When the physiotherapist has given appointment and the patient has come, in the last minute, the physiotherapist cancels the appointment. The theory states that capturing momovements from camera and learning their gestures, In this case, patients may spend some amount to come to town for physiotherapy treatment. For this purpose, electromyography (EMG) is noteworthy. The EMG sensor is commonly used to recognize the human intention because it measures the electric potential to activate the muscle by electrodes attached on the skin. Theoretically, the EMG signals are measured in advance to the muscular activation, which renders a huge advantage of EMG in various applications, in particular assistive robotics.

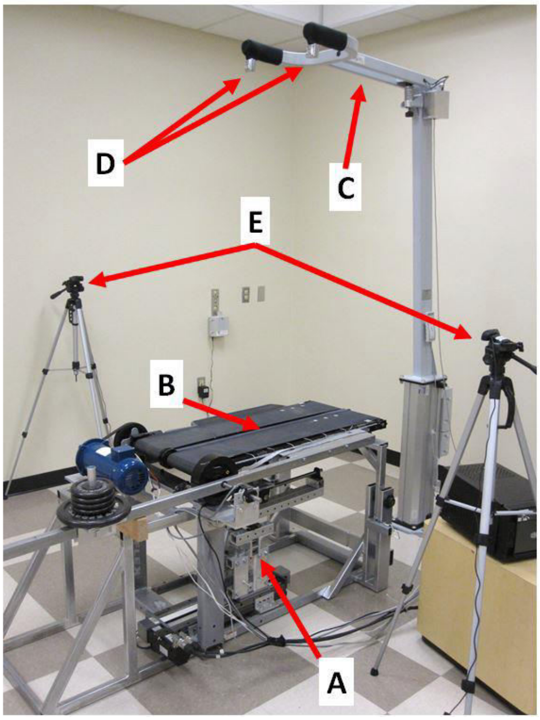

FIG 1.1

The VST setup. Subsystems shown include: A) Variable stiffness mechanism, B) Split-belt treadmill, C) Custom-made harness-based body-weight support, D) BWS Loadcells, E)Motion capture system.

3.2 DRAWBACKS

- Complicate to understand the concept, efficiency is low.
- The system is just to monitor muscle activity and limb movements.

4.PROPOSED SYSTEM

It’s a new approach toward the development of a gesture-based human–machine interface. An end-to-end approach is presented which allows a human user to a learned response by a robotic agent through repeated applications of user-provided movements. Physiotherapy is done by robotic arm under control of commands given by an assistant. Also an application is developed to send movements command an to monitor pressure, heartbeat of patient. MEMS are introduced to detect the movement of patient hand weather hand movements are normal. MEMS can also be used to send position data where it will operate the hand model so that the therapy is done. The performance of the proposed method is evaluated in terms of simplicity, repeatability, wearcomfort, etc.

4.2 ADVANTAGES OF PROPOSED SYSTEM

- Easy monitoring and controlling of the system.
- Efficient therapy system and cost effective.

5. WORKING DESCRIPTION:

An application is developed by visual basic version 6.0 to send movements commands and to monitor pressure, heartbeat of patient, MEMS are introduced to control the movement of patient hand. the MEMS are accelerometer which detects the motion by axis change in MEMSensor to give the direction command for hand movements, the manual command is also given from pc are parallel in nature where UART is used to convert the data into serial data and is transferred to ZIGBEE where the data is transmitted to other ZIGBEE in receiver side will pass the command to at89s52 microcontroller and will process the command and would send the movements commands to hand model where patient will place his arm to perform therapy.

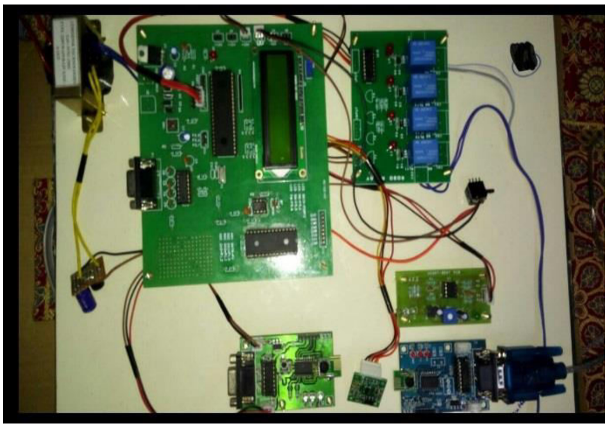

Fig 2.1

5.1. ARCHITECTURE:

This architecture explains the work of how the data flows from PC to wireless transmission to the receiver kit.

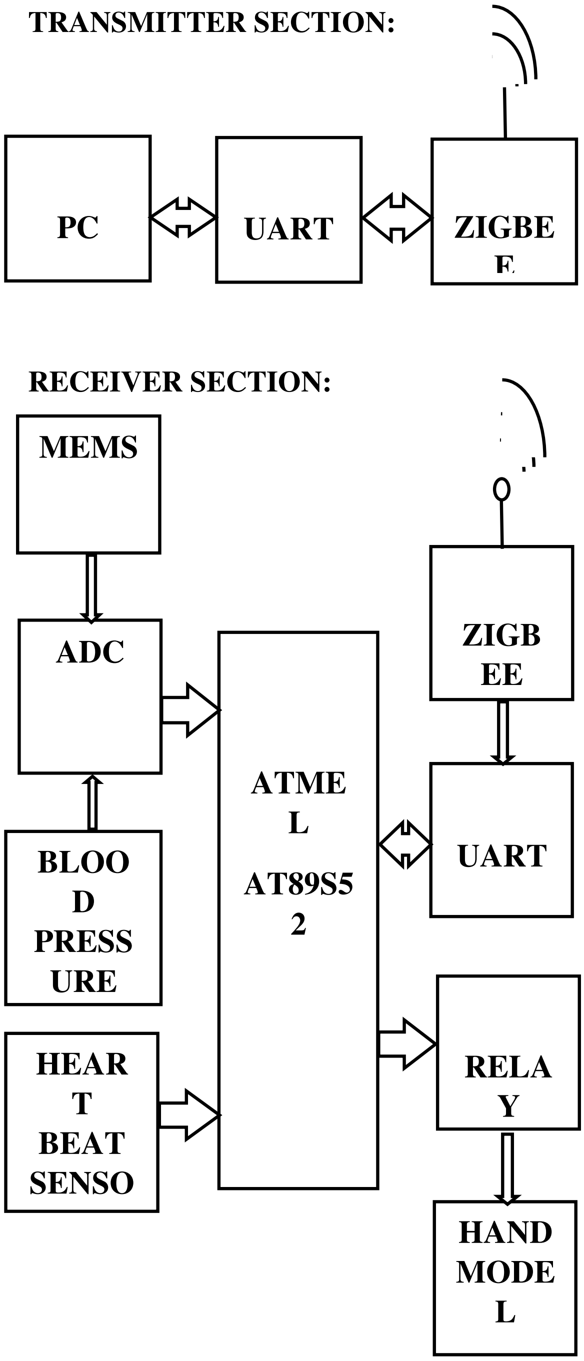

FIG2.2. Architecture diagram

5.1 SENSOR INTERFACING:

Interfacing sensors with AT89S52 microcontroller is done in this module.

3 SENSORS heartbeat sensor, mems and blood pressure sensor is interfaced. In heart beat sensor LM358 ic is used along with light detector and high intensity red led.The MEMS will measure the position and movement of patient hand. The digital output can be connected to microcontroller directly to measure the Beats Per Minute (BPM) rate.

PULSE OXIMETER SENSOR is to give digital output of heat beat when a finger is placed on it. It works on the principle of light modulation by blood flow through finger at each pulse. The output is seen in the 16*2 lcd display were bpm must be 60-100 per minute if not therapy is canceled.

5.2 HEART BEAT SENSOR PRINCIPLE:

The sensor consists of a super bright red LED and light detector. The LED needs to be super bright as the maximum light must pass spread in finger and detected by detector. Now, when the heart pumps a pulse of blood through the blood vessels, the finger becomes slightly more opaque and so less light reached the detector. With each heart pulse the detector signal varies. This variation is converted to electrical pulse. This signal is amplified and triggered through an amplifier which outputs +5V logic level signal.The output signal is also indicated by a LED which blinks on each heart beat.

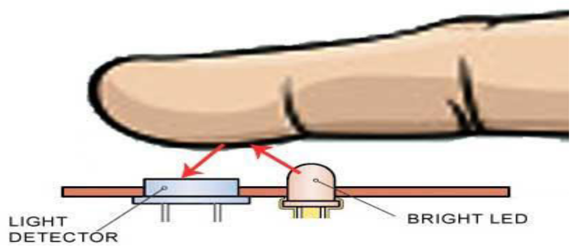

Fig 2.3

5.3 NEED FOR ADC:

ADC is mainly used here because it converts the analog signal from the sensors.

The ADC0808, ADC0809 data acquisition component is a Monolithic CMOS device with an 8-bit analog-to-digital converter, 8-channel multiplexer and microprocessor compatible control logic. The 8-bit A/D converter uses successive approximations the conversion technique. The converter features a high.

Impedance chopper stabilized comparator, a 256R voltage divider with analog switch tree and a successive approximation register.

Microcontroller it doesn't have an On chip ADC to accept the digital input, it will not accept analog input, so we need a ADC to process the analog signal. For interfacing ADC 0809 we require 8 data lines. So ADC 0809 is an 8 bit ADC has 8 channels works on successive approximation conversion technique.

5.4 HAND MODEL INTERFACING:

Hand model is a support in which the patient hand is placed and strapped for treatment.

Hand model is designed by two servo motors one for wrist movement other for elbow movement.

Servo motor are capable of rotating both clockwise and anticlockwise direction, so that patient hand moves in up and down direction.

Both servo motors contain relay switches operate when the voltage is high on 5V and goes off on 0V.

The hand model can be enhanced so that the commercial version of reliable hand support would be designed for user comfort and easy useability.

Actual hand model will move in four ways one for wrist up and down movement and elbow up and down movement. The patient will rest their arm at hand model when the movement command is done then the patients hand will move.

Wrist up and down is controlled by one servo motor and elbow up and down is controlled by another servo motor.

Fig2.4

5.5 RELAY SWITCHES:

There are four relay switches which control the hand model, they are marked as L1,L2,L3,L4 respectively, each relay will take the only it's respective command as below

L1-elbow down movement

L2-elbow up movement

L3-wrist down movement

L4-wrist up movement.

6. COMMAND APPLICATION:

In this module the command for movement of hand model is designed as application with 4 commands.

commands are: wrist up, wrist down, elbow up, elbow down. The application is developed on visual basic software.

The application holds two modes:

1. Manual mode.
2. MEMS mode.

Manual mode: here the command application is used to give hand movements to microcontroller so that hand model will move as per commands until patient is recovered.

MEMS mode: the accelerometer sensor is used as MEMS here which would operate the hand model just by moving the accelerometer in different direction which would cause the capacitance change in the sensor resulting in producing the command for movements her MEMS are tiny gear system integrated to detect the change in device position. By the calculation of x and y axis.

The command application holds two mode buttons, four hand model control buttons, and those x,y,z are the readings we get from MEMS about position.

The heart beat is measured and sent to pc which is monitored in this application for each 30 seconds the reading updates.

Even the graph form is available to monitor heartbeats, MEMS, blood pressure of the patient under therapy.

6.1 APPLICATION OUTPUT:

As soon the user clicks the START command all the data will be received from sensor and microcontroller data is seen in laptop.

The output of the MEMS is seen as graph in FIG 5.1, for all three x,y,z axis.

The blood pressure and heart beat reading is seen at dialog box and also as a Graph in this command application.

The graphical representation is also shown for each sensor reading, initially the data is send as random numbers which is difficult for us to identify the normality ratio so we need this graphical representation.

A USB port is assigned for transferring the commands from laptop to hand model.

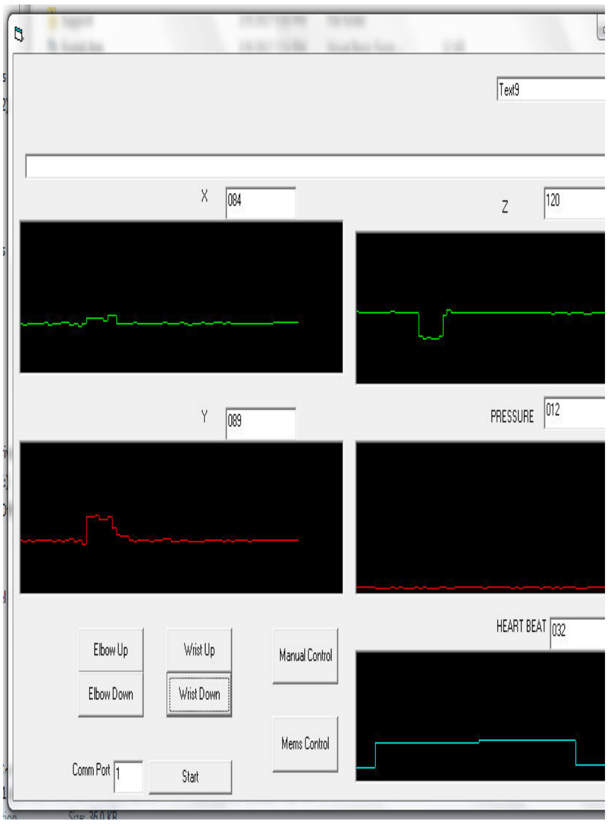

Fig 3.1

CONCLUSION:

This paper presents the new approach to do physiotherapy for stroke patients, the rehabilitation robot as been developed only for upper limb rehabilitation only, the study has provided that therapy would stimulate the damaged brain of the patient which would recover the brain and patient can able to move his arm by himself.

This rehabilitation robot would be easy to give therapy at patient home itself with some guidance of relatives and assistants.

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