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DESIGN AND DEVELOPMENT OF CONTROLING ROBOTIC MODULE USING LEAP MOTION CONTROLLER

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Abstract

The main aim of this project is to control the robotic system or wheelchair designed for physically challenged people. Here we use leap motion controller to move their wheelchair by their own. Leap motion controller is a small device, which can control the robotic module by gesture recognition, It can control the robotic module in X,Y and Z direction. In the existing system, the robot can be controlled manually. Now, in our proposed system we can use leap motion sensor to control the robot automatically.

Index terms: Arduino, zigbee module, dc motor, gesture recognition, Leap motion controller.

1. Introduction

The great advantages by robotics in recent years, have made it possible that this discipline of knowledge, has been considered a technology available only to large companies or research centers with million dollars budgets, to be practically available to everyone. The emergence of robotic applications has increased exponentially. so, in this project an innovative and current application is presented. The objective has been the development and construction of a prototype of articulated robotic arm on a mobile platform and the implementation of control strategy for gestures recognition (leap motion sensor) through the natural movement of the forearm and hand[1],[2]. It has been chosen the use of recycled and reused materials in order to develop a prototype low cost. The robotic arm operates in 3D and during its development have been analyzed different motion transmission systems, simulating the degrees of freedom (DOF) of the human forearm. The idea has been to attempt that the system actions were similar to its real equivalent. Thus, several systems and new technologies have been integrated, such as the development of a control system based on the leap

Motion device, implementation of a hardware constituted and the manufacture of parts by means of 3D printing technologies; tools that sure will be relevant in the next years. Several examples of commercial devices to develop a control through gesture recognition Leap Motion devices[2]. By means of gesture control it has attempted to promote user-prototype relationship. The initial objectives has been resolved satisfactorily. The prototype developed has exceeded the initial expectations and at a low cost.

Embedded System

An embedded system is a special-purpose computer system designed to perform one are a few dedicated functions, often with real-time computing constraints. It is usually embedded as part of a complete device including hardware and mechanical parts. In contrast, a general-purpose computer, such as a personal computer ,can do many different tasks depending upon programming. Embedded systems have become very important today as they control many of the common device we use. Since the embedded system is dedicated to specific tasks, design engineers can optimize it, reducing the size and cost of the product, or increasing the reliability and performance. some embedded system are mass-produced, benefiting from economics of scale. Physically, embedded systems are range from portable devices such as digital watches and MP3 players, to large stationary installations like traffic lights, factory controllers ,or the systems controlling nuclear power plants. Complexity varies from low, with a single microcontroller chip, to very high multiple units, peripherals and networks mounted on a large chassis or enclosure.

In general, ”embedded system” is not an exactly defined term, as many systems have some element of programmability. For example, Handheld computers share some elements with embedded systems-but are not truly embedded systems, because they allow different applications to be loaded and peripherals to be connected.

2. DESIGN AND REQUIREMENTS

A. Leap motion sensor

The leap motion sensor is a small device which can control the robotic module by gesture recognition. It uses both optical sensor and infrared light to detect a user's hand movements. Their movements such as forward, backward, left, right, rotate are controlled by using hand gesture.

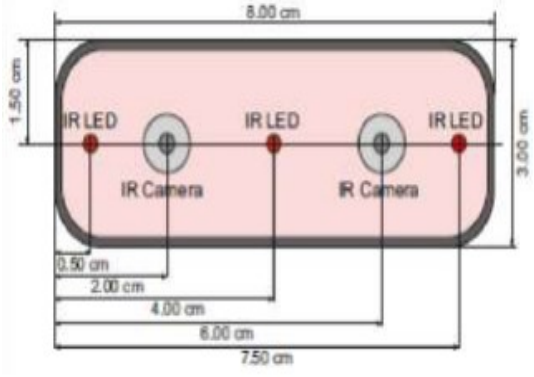
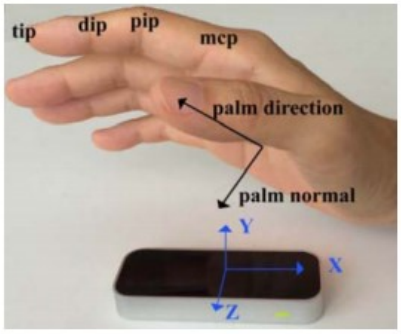


Fig 2.1 leap motion sensor

The leap motion controller is a consumer 3D gesture sensor. Using both sensor and infrared light, it detects hand gestures and position for a novel method of human computer interaction. The recognition of the different hand gestures is

developed through the leap motion device under peripheral equipped with infrared sensors. That recognizes the movement of the forearm, hand and fingers simultaneously. These variables are processed by the computer. Later this information sent to the robotic arm. This control is performed by an arduino controller, which receives the different command from the computer via serial communication. It transmits the information to each of the servomotors involved in the movement.



The arm prototype has been implemented with capacity of movement. Thus it can be handled by the user remotely through the wireless communication system. The objective has been to develop an arm through a gesture control strategy. That could be completely autonomous and wireless.

B. ARDUINO (ATMega328)

Arduino is 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 arduino Uno R3 is a microcontroller board based on a removable dual-in-line package(DIP) ATmega328 AVR microcontroller. It has 20 digital input or output pins. Programs can be loaded from the easy-to-use arduino computed program. The arduino has an extensive support community which makes it a very easy way to get started working with embedded electronics. The R3 is the third and latest, revision of the arduino UNO is a tool for making computers that can sense and control more of the physical world than your desktop computer.

Fig 2.2 Arduino

3.METHODOLOGY

The leap motion device is connected to the particular port of PC. The leap motion sensor sense the hand gestures and get the values from the movements of the hand. The values from the leap motion device will be given to the com port by using python. Then the value is sent to the controller (arduino) by serial transmission. The controller receives the values from the PC via UART. According to the values the robotic module will be driven.

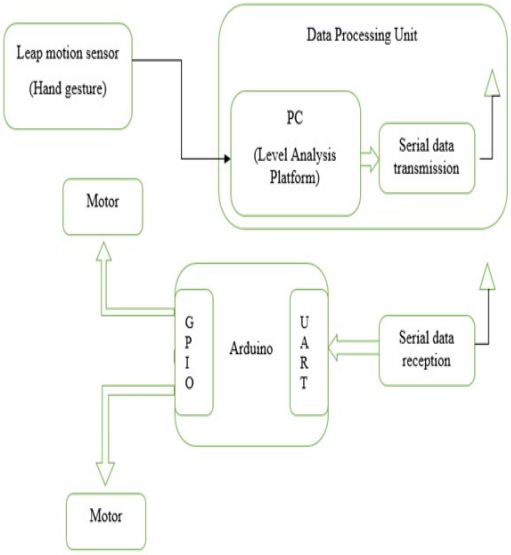


Fig 3 Block diagram

The leap motion controller is a small USB peripheral device which is designed to be placed on a physical desktop, facing upward. The leap motion sensor have two monochromatic IR cameras and three infrared LEDs, the device observes a roughly hemispherical area to a distance of about 1m. the LEDs generate almost 200 frames per second of reflected data. This is sent through a USB cable to the host computer. Leap motion device is connected to a particular port of PC.

The leap motion sensor sense the hand gestures and gives that data to the computer. The computer analyze the received data using python. Then the analyzed value is sent to the controller through serial transmission. The controller receives the value from the PC via UART (Universal Asynchronous Receiver Transmitter). According to the values the robotic module will be driven.

A.HARDWARE REQUIRED

- Arduino
- Leap motion sensor
- DC motor
- Zigbee module
- PC

B.SOFTWARE REQUIRED

- Arduino IDE
- Python IDLE

IV. RESULT AND GENERAL DISCUSSION

In this we have developed a prototype system to control the robotic module using leap motion controller. For persons of a

society in common, we believe the less interruption in their knowledge about how to interact with robots and social interaction is produced. That is to make the human agent communicates with a robot using just his natural ways. The main technology behind leap is natural user interface, gesture recognition and motion controller. The leap motion controller can control the robotic module up to 100m. the future scope is to increase the distance by using raspberry pi.

3. Experiments

Since the problem of mining URSTPs in document streams proposed in this paper is innovative, there are no other complete and comparable approaches for this task as the baseline, but the effectiveness of our approach in discovering personalized and abnormal behaviors, especially the reasonability of the URSTP definition, needs to be practically validated. In this section, we conduct interesting and informative experiments on message streams in Twitter datasets, to show that most of users discovered by our approach are actually special in real life, and the mined URSTPs can indeed capture personalized and abnormal behaviors of Internet users in an understandable way. In addition, we also evaluate the efficiency of the approach on synthetic datasets, and compare the two alternative sub procedures of STP candidate discovery to demonstrate the tradeoff between accuracy and efficiency.

4. Conclusions And Future Work

Mining URSTPs in published document streams on the Internet is a significant and challenging problem. It formulates a new kind of complex event patterns based on document topics, and has wide potential application scenarios, such as real -time monitoring on abnormal behaviors of Internet users. In this paper, several new concepts and the mining problem are formally defined, and a group of algorithms are designed and combined to systematically solve this problem. The experiments conducted on both real (Twitter) and synthetic datasets demonstrate that the proposed approach is very effective and efficient in discovering special users as well as interesting and interpretable URSTPs from Internet document streams, which can well capture users' personalized and abnormal behaviors and characteristics. As this paper puts forward an innovative research direction on Web data mining, much work can be built on it in the future. At first, the problem and the approach can also be applied in other fields and scenarios. Especially for browsed document streams, we can regard readers of documents as personalized users and make context-aware recommendation for them. Also, we will refine the measures of user-aware rarity to accommodate different requirements, improve the mining algorithms mainly on the degree of parallelism, and study on-the-fly algorithms aiming at real time document streams. Moreover, based on STPs, we will try to define more complex event patterns, such as imposing timing constraints on sequential topics, and design corresponding efficient mining algorithms. We are also interested in the dual problem, i.e., discovering STPs occurring frequently on the whole, but relatively rare for specific users. What's more, we will develop some practical tools for real life tasks of user behavior analysis on the Internet

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