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RESEARCH ARTICLE

WIRELESS CONTROL OF A BOARD ROBOT USING A SENSING GLOVE

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ABSTRACT

In the proposal a sensing glove interface for the remote control of a board robot based on Wireless protocol (MIWI) communication. A board robot is a type of user controlled riding robot. The user can use the glove to remote control the robot's direction through Command based on different finger actions such as move forward, Right, Left, Start/Stop operation. The sensing glove uses flex sensor and and force sensor for recognizing the actions or directions of the robot. The commands are transmitted from the glove to the board robot through MIWI Protocolwireless communication. Experimental shows that proposed sensing glove can effectively control the board robot.

INTRODUCTION

Data gloves are sensor systems capable of encoding and reconstructing the posture and the movement of the human hand. Such devices were initially developed for animation and machine interaction purposes but they are now gaining attention for health monitoring and rehabilitation applications. Integrating multiple sensors based on thin and soft materials, such as textile, inorder to monitor joints position with minimal motion impediment is a desirable feature that has been recently investigated. Wearable sensing glove can also be used for measuring the flexion/extension motion of fingers, which consists of linear potentiometers and flexible wires, is proposed.

Flexible wires are tied to the glove to detect the finger motions. As the flexible wires are moved by the finger motions, the joint angles are calculated by a kinematic model of the finger and the displacement changes of the wires which are measured by the linear potentiometers. Thus far, board robots have been used for reconnoitering at domestic airports and by event companies. In other countries, such robots are frequently used at tourist destinations. However, the use of board robots is limited by their high cost. In the domestic market, studies are strongly focusing on commercializing personal robots. NT-Rex already manufactures robots of this type that are cheaper than the Seaway. Smart phones are small, and they can be easily used for wireless communications. Therefore, studies have focused on using smart phones for wireless control in various applications. However, a smart phone would be difficult to use if the user is standing on the robot to be controlled. This study proposes a sensing glove interface for the remote control of a board robot based on Bluetooth wireless communication. A board robot is a type of user-controlled riding robot. The user can use the glove to remotely control the robot's direction through five commands based on different finger actions. The sensing glove uses flex sensors and force sensor for recognizing these actions, which are ensured as analog signals. The commands are transmitted from the user to the board robot through wireless protocol (MIWI) communication. Experimental results show that the proposed sensing glove can effectively control the board robot.

The section (I) proposes about motions of wearable sensing gloves and measurements of fingers. In section(II) existing system, explains about Bluetooth communication method. In section (III) the proposed system of wireless control of board robot using wearable sensing glove method. Finally, section (IV) describes the experimental result of proposed system.

Existing System

We refer to channels of communication which link the user to various electronic appliances and computers as cognitive communication channels. One especially interesting research

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topic related to cognitive communication channels deals with a special application called sensory substitution, when information is conveyed through a channel other than the one that is normally used. Besides offering a glimpse of hope to those living with injured sensory organs, sensory substitution can have benefits when designing user interfaces in terms of cost-effectiveness, the reduction of network delays, as well as the prevention of channel overloading. One such application is single board robot control, could be these constitution of hap tic feedback gloves (which are costly, bulky and have relatively few vibration states) using parameter-rich audio interfaces. Smartphones are small, and they can easily be used for wireless communications.

Therefore, studies have focused on using smartphones for wireless control in various applications. However, a smartphone would be difficult to use if the user is standing on the robot to be controlled. Studies have instead focused on glove interfaces, in which control can be achieved through a variable resistance connected to a finger.

It is convenient to use the fingers for control through various signals. However, a user's unintentional finger actions could lead to control system errors, leading to a decrease in the precision of control. To overcome these problems, this study proposes a hand-movement-based control interface in which finger tough, but not finger bending, is used for control. The existing interface consists of CdS sensors and a light-emitting diode (LED), and it makes use of Bluetooth wireless communication. Digital values are changed and converted depending on finger touches. Control commands are then passed to the robot control board through Bluetooth wireless communication.

Fig A Cross Section of the Sensing Module

Proposed System

The proposed system "Wireless Control of Board Robot Using a Sensing Glove", by using gesture movements of hands action, the movement of the robot can be controlled. The wireless communication between the robot and human is by using MIWI protocol. Flex sensor is used for Robot moving direction like move forward, left, right. Force sensor is used for ON/OFF the robot. The robot works based on human hand gesture. The action of the five finger controls the robot to do the respective operation. In the robot section has passive infared sensor used for detecting any intruder, if intruder is detected the robot will be self-destroyed automatically.

Block Diagram

Transmitter

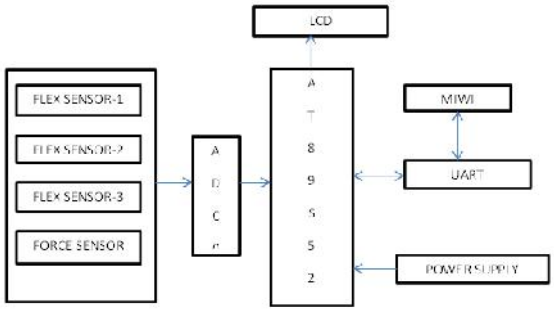


fig1

In transmitter section fig1,there are three flex and one force sensor is used to control the board robot. Power supply of 12v is taken from step down transformer where it is rectified to 5v for microcontroller, since microcontroller operates in range of (4-5.5v).Analog signals from sensor is converted into digital form by using analog to digital converter and the digital data is stored in Atmel microcontroller.

Sensing Actions

1. Force sensor(ON/OFF).
2. Flex sensor (1)-Right direction.
3. Flex sensor(2)-Left direction.
4. Flex sensor(1&3)-Forward direction.
5. Flex sensor(1&2)-Backward direction.

The digital data from A/D converter is transmitted by serial communication using UART. A universal asynchronous receiver/transmitter is a type of "asynchronous receiver/transmitter", a piece of computer hardware that translates data between parallel and serial forms. UARTs are commonly used in conjunction with other communication standards such as EIA RS-232.

The Universal Asynchronous Receiver/Transmitter (UART) controller is the key component of the serial communications subsystem of a computer. MIWI is a specification for a suite of high level communication protocols using small, low-power digital radios based on the IEEE 802.15.4-2003standard for Low-Rate Wireless Personal Area Networks (LR-WPANs), such as wireless light switches with lamps, electrical meters with in-home-displays, consumer electronics equipment via short-range radio needing low rates of data transfer. The LCD in transmitter section is placed just to testing purpose during designing process since the receiver robot section is an autonomous. So, LCD is optional in transmitter section.

Receiver

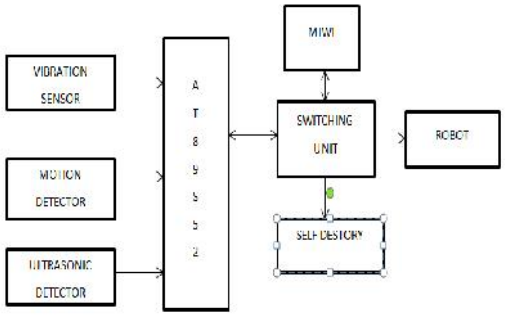


Fig2

In receiver section fig2, the transmitted data is received by MIWI protocol using serial communication. Then, the digital data is stored in Atmel microcontroller. Here, vibration sensor, motion detector and ultrasonic sensor is used. The motion detector is mainly used to detect the humans. Ultrasonic sensor is to detect the obstacles. Ultrasonic sensors (also known as transceivers when they both send and receive) work on a principle similar to radar or sonar which evaluate attributes of a target by interpreting the echoes from radio or sound waves respectively. Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor. Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object.

Vibration sensor used to detect vibrations. If any vibration occurs the DC motor starts to run by generating back EMF. Despite the advances made in vibration monitoring and analysis equipment, the selection of sensors and the way they are mounted on a machine remain critical factors in determining the success of any monitoring program. Money saved by installing inferior sensors is not a prudent investment since the information provided about the machine of interest often is not accurate or reliable. Poor quality sensors can easily give misleading data or, in some cases, cause a critical machine condition to be completely overlooked.

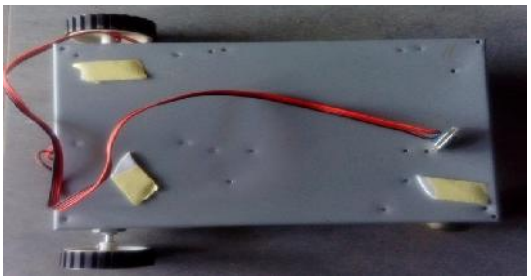
Board Robot

The proposed project consisting of sensors making use of serial communication for the remote control of a board robot. This glove has special functions that conveniently enable control. In the system, a 5-V electric supply is provided to the Atmega128 analog-to-digital convertor (ADC), wireless module(MIWI), relay, and control board. Initially, power is not supplied to the relay and control board. If the board robot is operated by the sensing glove through wireless communication, power is supplied to the relay and control board. The sensing glove can also be used to turn the relay off. A board robot tilts forward and backward when moving in these respective directions. Furthermore, its left and right turns are controlled by the sensing glove.

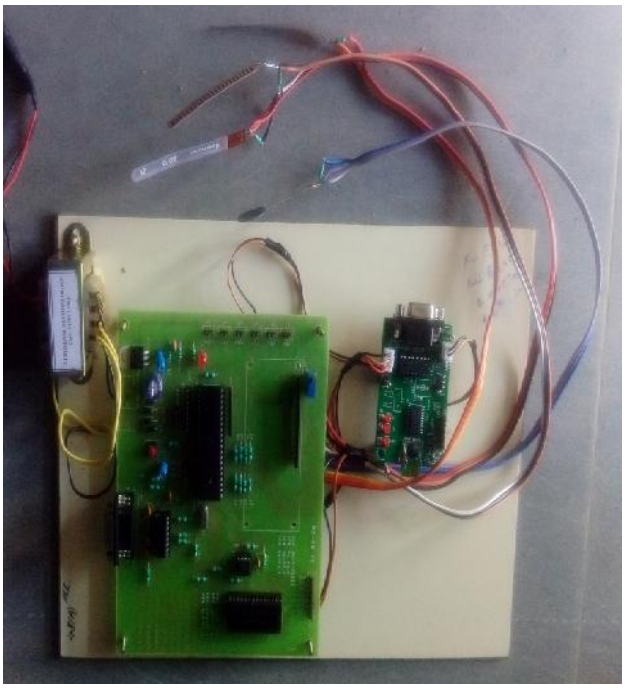
Experimental results

The experimental result shows us about the control of single board robot using sensing glove, which can be used for the border security purpose and surveillance purpose. If in case of the robot is caught by any illegal person it seems to self-destroy.

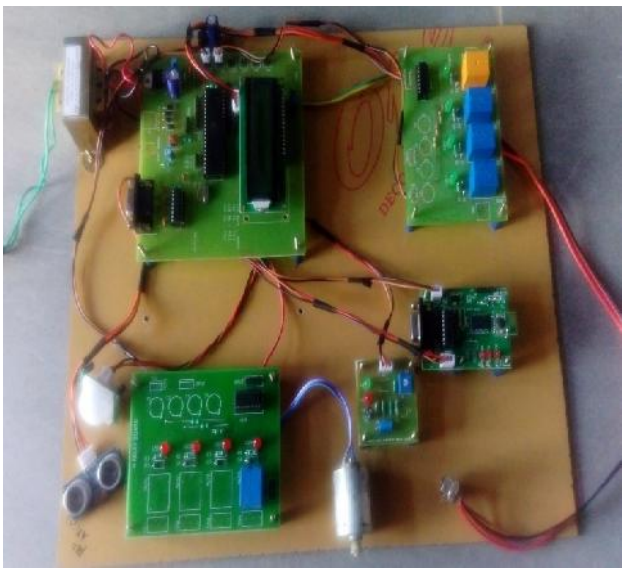
This experimental result shows the control of board robot using wireless protocol communication(MIWI).



Robot



Transmitter



Receiver

CONCLUSION

Hence, this project explains all about the wireless control of board robot using wearable sensing glove by measuring the gesture moment of human fingers. This project implements a wireless protocol (MIWI) communication between the glove and the robot.

Application

It is most widely used for the surveillance purpose and used in the border region.

Future Enhancement

In the future project, we are going to develop a virtual hand for disabled persons by using gesture movement of hand. The virtual hand is controlled by gesture movement of wearable glove in other hand of a person(i.e. either right or left hand).This makes the disabled person to work as like that of normal humans.

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