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Hand Gesture Controlled Car Using Bluetooth Modules And Accelerometer Sensor

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Abstract:
This project work demonstrates the usefulness of an accelerometer sensor and how it can be used to move an object using hand gestures. The existing system involves using Remote-controllers to interact with robot car. Remote- controlled cars typically have multiple channels and buttons on the controller, which might be difficult to operate for some users, but Hand gesture controlled car, if designed properly, can simplify the interaction by translating natural hand movements into vehicle commands, making it more user-friendly. The device uses microcontroller, one as the transmitter and other as the receiver. The functioning of the device is based on the serial data transmitted and received through the Bluetooth modules. The data to be transmitted and received is produced by the accelerometer sensor. Based on the data received, the motors run to produce the desired movements. The device can communicate within a range of ten meters. Such a device can be used as a gesture-controlled wheelchair for handicapped people. The code for functioning is uploaded to the Microcontroller software. The major challenge that was faced during the preparation of the model was the connection of the Bluetooth modules. Each module sends and receives data at different baud rates. If the baud rates were not same, communication will not be established. One module serially transmits the data and another module serially receives it. Different prototypes are already available with slight variations.

KeyWord*: Accelerometer sensor, Hand Gestures, Serial data, Baud rates*

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I. Introduction

Robotics is the field that is rapidly taking over every single discipline of human activities. The developments in this field have been going on for decades, however the 21st century particularly has seen immense growth pertaining to this field of technology. Gestures, as stated, can be explained as instinctive actions having a symbolic meaning that are used by a person to express an idea or thought. Robots are electro-mechanical (a portmanteau, reflecting technologies from the disciplines of electronic and mechanical) devices or systems that can perform any tasks without needing any human supervision or else requiring very little of it. These systems perform their tasks based on the logical operations stated in their computer programs that's loaded in their processing unit or microcontroller, taking decisions based on inputs received or read from its environment. Robots primarily fall into two categories: that of being autonomous, and the other being semi-autonomous robots. Autonomous robots are widely used in factories, at industry sites and in manufacturing units as these activities are very high speed operations requiring great accuracy. These kind of robots do not require any human assistance and as the name implies, are fully self-sufficient. On the other hand, semiautonomous robots are used where the decision can not be made by the robots independently, such as in case of tactile controlled, voice controlled and gesture controlled device, where the inputs are touch, audio and movement dependent, thus requiring human assistance in terms of requiring input to facilitate further decision to produce the desired output

II. Proposed System

This project work demonstrates the usefulness of an accelerometer sensor and how it can be used to move an object using hand gestures. The device uses microcontroller, one as the transmitter and other as the receiver. The major challenge that was faced during the preparation of the model was the connection of the Bluetooth modules. Each module sends and receives data at different baud rates. If the baud rates were not same, communication will not be established. One module serially transmits the data and another module serially receives it.

III. System Design

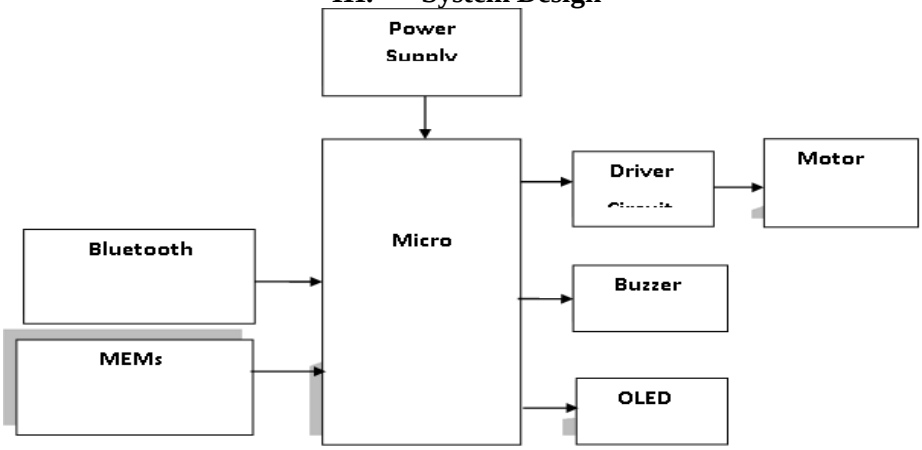

Fig.1. Block Diagram

Components description

Bluetooth

Fig.2. Bluetooth

Bluetooth is a wireless technology standard for exchanging data over short distances(using short-wavelength UHF radio waves in the ISM band from 2.4 to 2.485 Ghz) from fixed and mobile devices and building personal area networks(PANs).

Mem Sensor

Fig.3. Gas Sensor

An accelerometer is a micro-electromechanical device that measures acceleration forces. These forces may be static, like the constant force of gravity pulling at our feet, or they could be dynamic-caused by moving or vibrating the accelerometer.

Microcontroller

Fig.4. Microcontroller

A microcontroller is a tiny, all-in-one chip designed to manage specific tasks within a system. It contains a processor, memory, and input/output components, making it perfect for controlling different devices and systems. Microcontrollers are used in a wide range of applications, from everyday gadgets to advanced

industrial machinery.

OLED

Fig.5.OLED

An OLED is a type of flat display technology that emits light when an electrical current passes through organic thin films sandwiched between two conductors. Unlike LCD displays, OLEDs don't need a backlight, making them thinner and more energy-efficient. They offer superior image quality and can be made transparent, flexible, and even rollableor stretchable in the future, marking them as the future of display technology.

DC Motor

The DC motor, short for Direct Current Motor, is a widely used device for generating continuous movement. It's favored for its ability to easily control rotation speed, making it suitable for applications where precise speed control or positioning is necessary. A DC motor comprises two main parts: the stationary stator and the rotating rotor. This setup allows for three main types of DC motors to be utilized depending on the specific requirements of the application.

Fig.6. DC Motor

Driver Circuit

Fig.7. Driver Circuit

In electronics, a driver acts as a conductor directing and controlling the operation of other circuits or components, ensuring they function properly and efficiently

Buzzer

Fig.8. Buzzer

A buzzer or beeper is a small electronic gadget found in various devices like cars, microwaves, or game shows. It's designed to make a noise, often a buzzing or beeping sound, to grab attention or indicate something important, like the end of a timer or pressing a button. It works by connecting switches or sensors to a central control unit, which triggers the sound based on certain conditions, like pushing a button or reaching a

set time. Typically, it also lights upto show which button was pressed or to draw attention to the control panel.

IV. Working

The bluetooth modules establish a wireless connection between microcontroller and user's handheld device, and enables communication and transmission of hand gesture data to the car. A MEMs(Micro-Electro-Mechanical Systems) sensor, provides input to the microcontroller, allowing it to interpret the gestures and control the car accordingly. The microcontroller processes the input from the sensors to control the motor and other components and connects to driver circuit. Next, the driver circuit controls the motor of the car based on the signals received from the microcontroller. Then, the motor receives the control signals from the microcontrollers via the driver circuit and converts them into mechanical motion, propelling the car forward, backward, or in any desired direction.

V. Implementation And Design

Implementing an innovative hand gesture controlled car system using a microcontroller like the Raspberry Pi Pico involves several crucial steps. First you need to connect Bluetooth and integrate mems sensor to detect hand gestures to the circuit. These sensors will provide the necessary data for the systems to operate effectively. Next, the Raspberry Pi Pico will process this real - time data to detect hand gestures. This processing capabilitity is essential for making quick and accurate decisions for movement of car. The microcontroller process the input from the sensors to control the motor and other components and connect to driver circuit. Next, the driver circuit controls the motor of the car based on the signals received from microcontroller. Then, the motor receives the control signals from the microcontrollers via the driver circuit and converts the into mechanical motion, propelling the car forward, backward or in any desired direction. Additionally, a buzzer is included in the hardware setup to provide audio feedback alerts to the user. Finally, Efficient power management system is also crucial to sustain the system's operation for long periods.

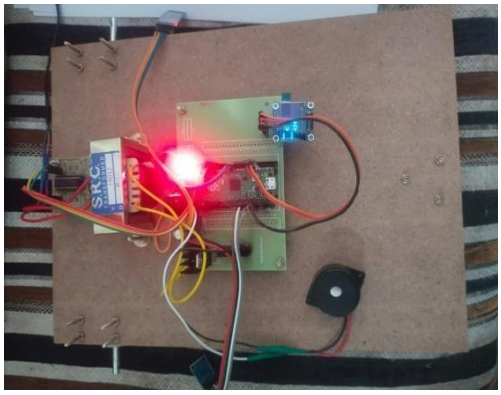

Fig.10. Implementation And Design

VI. Conclusion

We accomplished our goal with no obstacles i.e. Controlling a robot car with gestures rather than remote controlled devices. Our car is indicating legitimate reactions at whatever point we move our hand. The output from the four pre-defined hand motions to make the robot move in desired directions : flexion for forward motion, extension for backward motion, tilt right for right turn and tilt left for left turn.

VII. Future Scope

The implemented system successfully demonstrates the possibility of hand gesture control using accelerometer sensors. The device operates within a ten-meter range, showcasing it's potential for practical applications. The prototype serves as a gesture controlled wheelchair, offering a hands-free alternative for individuals with physical disabilities.

The system is easy to use, wireless and accessible, making it suitable for various applications such as education, entertainment, and accessibility.

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