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Microcontroller Based Robotic Arm Control Using Hall Effect Sensors

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ABSTRACT:The objective of the paper is tosense the hand movements of the human arms using Hall Effect sensors. Initially the Rover motion program is being implemented in Microcontroller using KEIL software. Once the robot detects the movements from the human hand, it recognizes the actions and implements the movements according to the human gesture. This robot is useful for, where the human interaction is difficult (or) impossible like, bomb diffusing, to taking the reading from volcano and it is useful for the handicap people in their daily activities.

KEYWORDS: Hall Effect Sensor, RF Transmitter, RF Receiver, Micro controller, Drivers.

I.INTRODUCTION

In Human life there is two types of communication “Speech” and “Gesture”. Nowadays gesture is used as Human-Computer Interaction (HCI). In the view of human communication, the use of speech and gestures is completely coordinated. The Hardware devices are used to get the positions of Hand movements.However, getting the data is the first step. The second step is detecting the motion and implement it accordingly. In this system data are gathered from glove to detect the motion.

In war field robots are highly useful, they are using for the critical situations. It is impossible to control the robot in the hazardous condition by using normal methods. A remote glove was created for communications in these extreme environments where other controlling methods are not effective. Remote based robots have been used in environments where humans cannot survive. A glove was used to control a motion using robotic technology.This paper deals with the working of the robot with the Hall Effect sensors are used for the motion detecting process. The signals from the sensors converted into binary signals. The gesture signal is encoded by encoder and transmitted in a particular frequency using RF transmitter. The RF receiver circuits receives the signal and the driver circuits are used to covert the voltage in correct range. Microcontroller controls the robotic arm and wheel motion, the program is loaded in microcontroller to send the signal to the motor driver and arm driver. Motor driver controls the rotation of the robot. The arm driver produces the action using end effector.

II.SYSTEM MODEL AND ITS COMPONENTS

HALL EFFECT SENSOR: The Hall Effect sensor is a device which is activated by the external magnetic field. There are different types of magnetic movements, such as head-on detection, sideways detection, and positional detector. In its simplest form, the sensor operates as an analog transducer. The Linear type Hall Effect sensors have internal amplification.

TRANSMITTER: The RF transmitter module can be used to transmit the gesture control signal to the receiver in the frequency range of 434MHz.Figure-1 shows the block diagram of transmitter.

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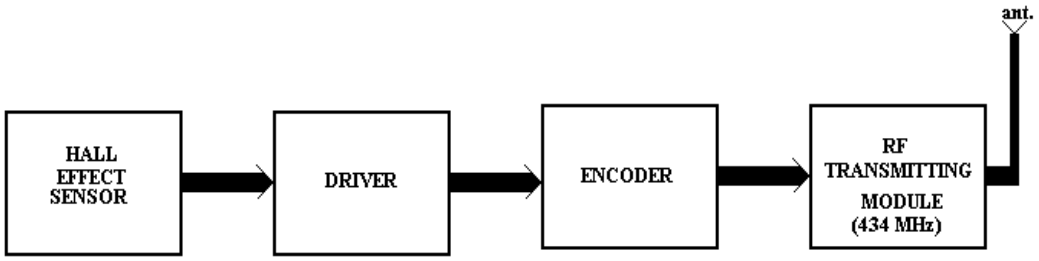

Figure-1 Block diagramof Transmitter

RECEIVER: The receiver section consists of RF 434 MHZ receiver modules, MAX232, microcontroller, H-bridge driver and DC motor. The RF receiver module receives the signal from the transmitter and it is applied to the input of MAX232 which is used to control the voltage level matching between receiving signal with controller and it provides serial data interface. The controller controls the motion of robot through H-bridge driver.

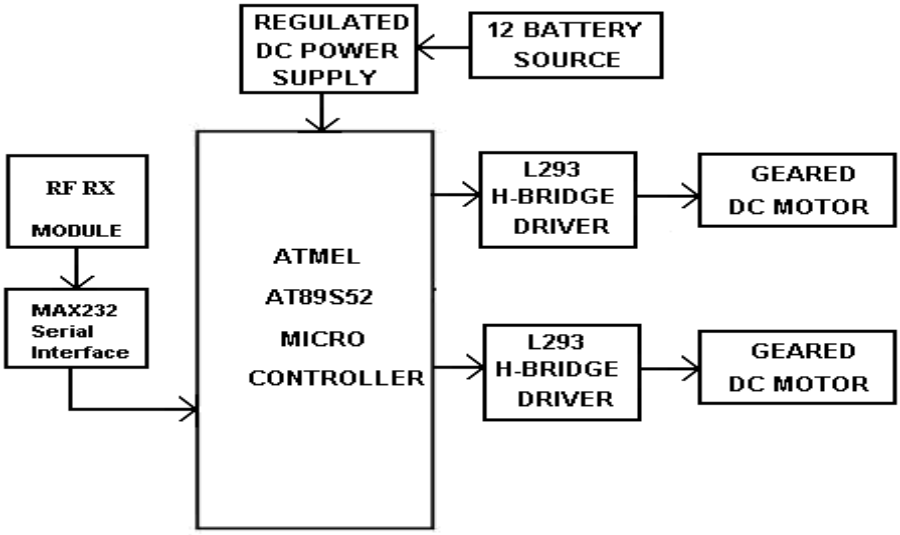

Figure-2Block diagram for rover and arm control

MICROCONTROLLER[AT89S52]: Generally Microcontrollers have a CPU, Memory, Addressing Circuits, Interrupt handling circuits an internal UART, Ports, timers. The microcontroller models vary in data sizes from 4 to 32 bits. Four bit units are produced in huge volumes for very simple applications. 8-bit access is more flexible then the other [16-32] bit words can be used in high speed application in signal processing. Figure-2 shows the block diagram for rover and arm control unit.Serial and parallel communication devices like RS232, data encoder and Data decoder are used.

ENCODER [HT12A]: The 2^{12} encoders are a series of CMOS LSIs for remote control system applications. They are efficient of encoding the information which consists of N address bits and 12-N data bits. Each and every data input can be set to one of the two logic states. The programmed data are transmitted together with the higher bits through an RF or an infrared transmission medium on the receipt of a trigger signal. The efficient to select a DATA trigger on the HT12A further enhances the application flexibility of the 212 series of encoders. The HT12A then provides the 38 kHz carrier for infrared systems.

DECODER [HT12D]: The HT12D type of decoders are the serial connection of CMOS LSIs for the remote control system operations. They are connected with Holtek 2^{12} series of encoders. For proper operation, two decoders with the same number of addresses and data format can be used. The decoders are receives the serial addresses and the data from a programmed 2^{12} series of encoders that are transferred by a carrier signal using an RF medium. They compares

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the serial input addresses more than two times repeatedly with their local form of addresses. If non matching codes are to be found, the input data codes are decoded and then send to the output pins. If the VT pin has goes high the valid transmission can be performed. The 2^{12} series of decoders are able to decoding the information that consists of N bits of data and 12^N bits of addresses. Of this series, the HT12D is arranged to gives the 8 address bits and 4 data bits.

H-BRIDGE DRIVER [L293D]: The L293D is quadruple high current half H-drivers. The L293D is designed to gives the bi-directional drives currents of about1 A at voltages ranges from 4.5 V - 36 V. The L293D is also be designed for gives the bi-directional drives currents of about 600-mA at voltages ranges from 4.5 V - 36 V. Both devices are designed to drive inductive loads such as relays, switches, solenoid valves, bipolar stepper motors, along with the other high-current/high-voltage loads in positive supply operations.Drivers are enabled in pairs, the drivers 1 and 2 are enabled by 1,2EN then the drivers 3 and 4 are enabled by the 3,4EN. The proper data inputs, each pair of drivers gets forms the full-H reversible drive suitable for the solenoid. On the L293D, external high speed output of the clamp diodes can be used for the inductive transient suppression region. A VCC1 terminal has gets separate from the VCC2, is given for the logic inputs to the minimize device power dissipation region. The L293D are characterized for the operation about 0°C to 70°C.

OPERATION: Table 1: Function of Robot through hand control

MODE: OFF

S.NO	FUNCTION OF ROBOT	HAND CONTROL
1.	To move the robot on forward direction	Little finger
2.	To move the robot on backward direction	Ring finger
3.	To rotate the robot on left direction	Middle finger
4.	To rotate the robot on right direction	Index finger

MODE: ON

S.NO	FUNCTION OF ROBOT	HAND CONTROL
1.	To pick an object	Index finger

The above Table 1 Shows the Function of Robot through hand control for various movements.

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Figure-3Hardware kit for rover and arm control

III.PROCESS DESCRIPTION

The glove transfers the data to the robot arm, where the program is implemented in the microcontroller. Hall Effect sensors are fixed on the glove and magnet is fixed on thumb of the glove is used to give command to the rover. The Hall Effect sensor produces some amount of voltage and it is given to the driver circuit. The driver circuit produces the current and voltage in a range 1A and 4.5-36V.The voltage is converted as a parallel binary code and it transferred by the RF transmitter. The frequency of the transferred signal is 434MHz.

The frequency is received in the receiver end and it is converted into voltage. The driver circuit produces the voltage and sends it to the decoder circuit. Decoder circuit is used to convert the parallel data into serial data. The data are executed with the program which is programmed in microcontroller. After execution of microcontroller gives the instruction to the motor driver and arm driver. This selection is done by using the mode (On/Off) button on the glove. As per the instruction the robot arm or Motor will operate.Figure-3 shows the Hardware kit implementation for rover and arm control.

IV.CONCLUSION

In many application of supervisory robotic gadget it becomes quite hard and difficult when there comes the part of supervisory. Robots are mostly used in military application, industrial robotics, construction vehicles in civil side, medical application for surgery. In this field robotcontrolor particular machine is quite complicatedwith remote or switches, sometime the operator may get confused in the switches and button itself, so a new concept is introduced to control the machine with the hand movement and simultaneously control the movement of robot.A Gesture Controlled robot is a robot that can be controlled by human hand gestures not by old buttons. The only need is to wear a small transmitting device in hand which included an acceleration meter. This will transmit an appropriate command to the robot so that the robot can do the required operations. The microcontroller based robotic arm control using Hall Effect Sensors were implementation and it is widely used for deaf and dump peoples.

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