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Human Interfaced Manipulated Robot Using Accelerometer

Bijaya Khamaria[1], Sidhartha Sankar Padhi[2], Chandan Maharana[3]
[1,2]*Asso. Professor,* [3]*Student*
Department of Mechanical Engineering Einstein Academy of Technology and Management
Bhubaneswar, Khurdha Odisha, India

Abstract: *An accelerometer is a device that measures the vibration, or acceleration of motion of a structure. The force caused by vibration or a change in motion causes the mass to squeeze the piezoelectric material which produces an electrical charge that is proportional to the force exerted upon it.This paper presents a model for gesture controlled user interface (GCUI), and identifies trends in technology, application and usability. In this paper an integrated approach is developed for real time detections, gesture based data which control vehicle movement and manipulation on gesture of the user using hand movements. This new development is highly useful for the industries like biomedical, construction, packaging and waste management, etc.*

Keywords: *Accelerometer, RF, AT89C51 microcontroller, modular, motor driver.*

I. Introduction

In the existing system, human hand movements are sensed by the robot through sensors and it follow the same. As the person moves their hand, the accelerometer also moves accordingly sensor displaces and this sensor senses the parameter according to the position of hand.

In this system, a gesture driven robotic vehicle is developed, in which the vehicle movements and manipulations ie, handling and control is depends on the gesture of the user. In this system, gesture is captured by accelerometer and it is processed by software namely, microcontroller software and the parameters are sent to microcontroller and encoder circuit, It is further transmitted (transmitter section) by RF433 MHZ transmitter. In the receiver section, the RF 433 MHZ receiver holds down the received parameters and process with microcontroller and gives those parameters to the robotic vehicle so that it act accordingly to the gesture. By this system, it is possible to achieve processing of long distance. This system is knowingly developed to apply in medical field for nursing assistance to physicians and in surgeries.

II. Block Diagram

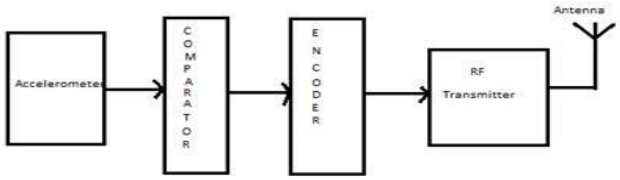

Figure 1: Block diagram of transmitter module

Accelerometer:- An Accelerometer is a kind of sensor which gives an analog data while moving in X,Y,Z direction or may be X,Y direction only depends on the type of the sensor. In accelerometer there is some arrow showing if we tilt these sensors in that direction then the data at that corresponding pin will change in the analog form.

Comparator: - For the purpose to change the analog voltage into digital we use comparator which compare that analog voltage to a reference voltage and give a particular high or low voltage.

RF Transmitter Module (TX):- The transmitter module is working on the frequency of 433MHz and is easily available in the market at nominal cost. In the circuit, vcc pin is connected to the + terminal. The data pin is connected to the HT12E (pin no-1) that is transmitted or we can say that encoded data. The next pin is GND that is connected to the ground terminal. Now the last pin ANT this is connected to a small wire as an antenna.

Figure 2: Block diagram of receiver module.

RF Receiver Module (RX):- The RF receiver module will receive the data which is transferred by the gesture device. It is also working as similar to the transmitter module- Connect the +vcc pin to the 5volt terminal. Connect the ground pin to the ground terminal .The data pin is then connected to the HT12D (pin-2) .So that we can get the decoded 4 bit data.

Decoder (HT12D):- We can say that an HT12D converts that serial data into parallel which is received by the RF receiver module. The input data is decoded when there is no error or unmatched codes are found. A valid transmission in indicated by a high signal at VT pin that is pin no1.

Microcontroller:- AT89C51 is microcontroller used in an integrated circuit with a processor and other support devices like program memory, data memory, I/O port, serial communication interface etc. integrated together.

Transmitters are usually subject to Regulatory Requirements which dictate the maximum allowable Transmitter power output, Harmonics, and band edge requirements.

III. System implementation

3.1 Methodology for hand motion recognition

The handheld controller is a 3D rigid body that can be rotated about the three orthogonal axes. Yaw, pitch and roll are referred to as rotation. These rotation takes place as Z-axis is called yaw , the next rotation X-axis is called pitch and last rotation about the Y-axis is called roll. Any orientation can be achieved by the composing those three elemental rotation. In our work, all of the planned hand motions for robot control are simple gestures, each of which contains only one of the three elemental rotations. Gestures composed of more than one elemental rotation are too complicated for such kind of application.

3.2 Methodology for communication signal

Transmitter Module

An RF transmitter module is a small PCB ie, printed circuit board sub-assembly capable of transmitting a radio wave and modulating that wave to carry data. Transmitter modules are usually implemented alongside a micro controller which will provide data to the module which is transmitted. RF transmitters are usually subject to regulatory requirements which dictate the maximum allowable transmitter power output, harmonics and band edge requirement.

Receiver modules

An RF Receiver module RF433-RX is 433 MHz radio receiver receives the modulated RF signal, and then it demodulates. There are two types of RF receiver module. Super-regenerative modules are usually of low cost and low power designs using a series of amplifiers use to extract modulated data from a carrier wave. Super-regenerative modules are generally imprecise as their frequency of operation varies in a fair amount with temperature and power supply voltage. Super heterodyne receivers having a performance advantage over super-regenerative; they offer increased an accuracy and stability over a large voltage and temperature range. This stability comes from a fixed crystal design which in turn leads to a comparatively more expensive product.

- Moves in forward direction
- Moves in reverse direction,
- Speed controls in both the direction

- It can even turn left or right while moving forward or in reverse direction.
- In case of bump, moves reverse turn left or right and wail for the next instruction.
- On the spot left or right turn to pass through the narrow space
- We have also added head light, back light and turning lights to left a right .

3.3 Methodology for Motion Control

L293D is a dual H-bridge motor driver integrated circuit (IC). Motor drivers act as current amplifiers as they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors. L293D contains two inbuilt H-bridge driver circuits. In common mode of operation, two DC motors can be driven simultaneously, both in forward and reverse direction. The motor operations of two motors can be controlled by input logic. When an enable input is high, the associated driver gets enabled. As a result, the outputs become active and work in phase with their inputs. Similarly, when the enable input is low, that driver is disabled, and their outputs are off and in the high-impedance state.

This project controls a remote robot through RF. The ordinary 433 MHz RF modules are used in this project. AT89C51 microcontroller is used in this project.

This robot can perform their operations without direct human guidance. They are used basically for industrial applications and can be made laser guided.

Navigation is achieved by one of the several means, including following a path defined by buried inductive wires, surface mounted magnetic or optical strips; or alternatively by the way of laser guidance.

This is an improved version of my previous robot which we designed years ago.

Intelligent spy robot project has been designed for the spying purpose .it is radio controlled and can be operated at a radial distance of 100m radius. Most probably our army youth need to venture into the enemy area just to track their activities. Which is often a very risky job and may cost precious life? Such dangerous job could be done using small spy robot all the developed and advance nations are in the process of making it, a robot that can fight against enemy. Our robot us just a step towards similar activity.

Radio receiver which receives the transmitted coded from the remote place these codes are converted to digital format and output is available to the pin no 2 of the ic2 master microcontroller; this is the pin of inbuilt art of the microcontroller. We Based on the input codes master will give command to slave microcontroller and robot will behave as follows.

IV. Working of RF control

This robot is radio operated which is, self powered, and has all the controls like a normal car. A laser gun has been installed on it so that it can fire on enemy remotely whenever required; this is not possible until a wireless camera is installed. Wireless camera will send real time video and audio signals which could be seen on a remote monitor and action can be taken accordingly. Being in size small of it, will not be tracked by enemy on his radar. Robot silently enter into enemy canopy or tent and send us all the information through its' tiny camera eyes. It can also be used for suicide attack, if required.

Heart of our robot is microcontroller 8051 family, we are using at89C51 In two microcontrollers where first microcontroller which acts as master controller, decodes all the commands received from the transmitter and give commands to slave microcontroller. Slave microcontroller is responsible for executing all the commands received from the master and also generating pulse width modulation pulses for the speed control driver circuit which drives 4 nos. of motors.

Two no bumper switch is added bmp 1 and bmp2 so that in case of accident our battery dose not drains out. Both the motors will stop instantly and after few second robots will move in opposite direction take turn to left or right direction and stops and stop.

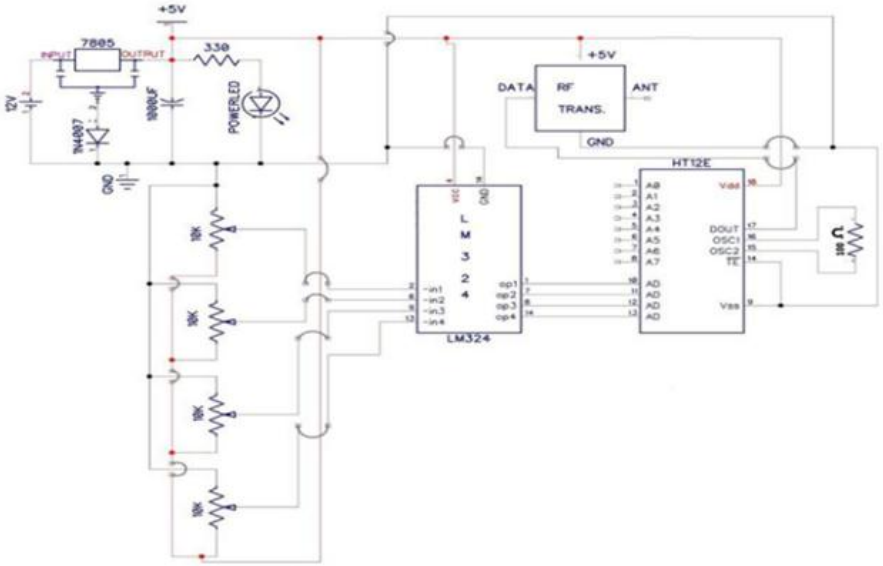

Figure 3: Transmitter circuit for the system

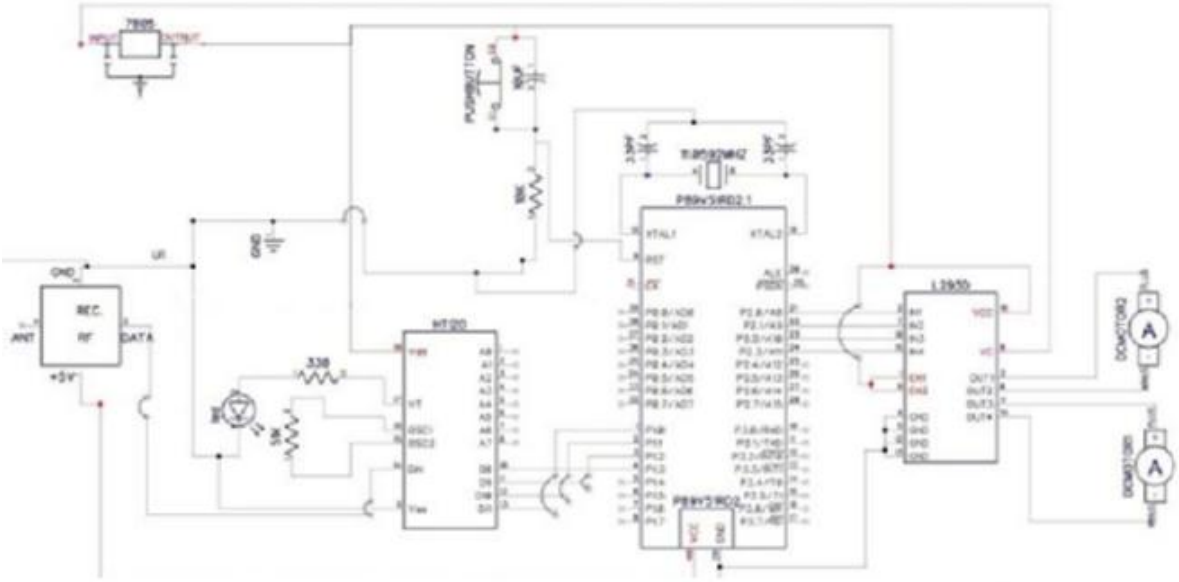

Figure 4: Receiver circuit for the system

V. Circuit element

Axis accelerometer

MMA7361L is a three axis Low-G accelerometer with user selectable having 1.5g or ±6g acceleration range. Board has all the necessary components required for the accelerometer. As board comes with onboard 3.3V Low Drop voltage regulator. Accelerometer module can be powered from 2.2V to 6V. MMA7361L accelerometer has self test, 0g-Detect which detects linear freefall, user selectable g range of 1.5g and 6g and sleep mode to reduce power consumption.

Possible applications of this board include Robotics, Tilt and Motion Sensing, Freefall Detection, Image Stabilization,
Navigation and Dead Reckoning, Tilt Compensation in inertial sensors, 3D-Gaming. Transmitter receives serial data and transmits it wirelessly through RF through its antenna connected at pin4. The transmission occurs at the rate of 1Kbps-10Kbps. The transmitted data is received by an RF receiver operating at the same frequency as that of the transmitted

VI. Result

Transmission through RF (Radio frequency) is better than IR (infrared) because of many reasons. Firstly, signals through RF can travel through larger distances making it suitable for long range applications. Also, while IR mostly operates in line Of sight mode, RF signals can travel even when there is an obstruction between transmitter & receiver. Next, RF transmission is more strong and reliable than IR transmission. RF communication uses a specific frequency unlike IR signals which are affected by other IR emitting sources. This RF module comprises of an RF Transmitter and an RF Receiver. The transmitter/receiver (TX/RX) pair operates at a frequency of 433MHz an RF transmitter receives serial data and transmits it wirelessly through RF through its antenna connected at **pin4**. The transmission occurs at the rate of 1Kbps-10Kbps. The transmitted data is received by an RF receiver operating at the same frequency as that of the transmitted.

VII. Future Scope

In the receiver section a wireless camera is placed to monitor the performance of robot arm along with patient side (Robot arm side) 5 vital parameters (ECG, Respiration rate, Pulse rate, Temperature, Heart beat) of patient is monitored. This is a preventive measure for any imbalance in victim's metabolism (temperature, pressure, heart rate), ALARM in transmitter's section (physician side) will be ringing, which in turn brings into notice of physician that patient is in some critical situation, so that the physician immediately going to stops the action of robotic arm and he will inform the nearby doctors to take care of patient. This robotic arm developed is to reduce man power in medical field, take care of patient in absence of specialist/surgeon and to impart the robotic in medical areas.

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