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MEMS BASED HANDS GESTURE CONTROLLED ROBOT USING GSM

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ABSTRACT:

Science has seen a rise in robots technology in recent years. Our project's goal is to create an easily manipulable, hand-motion controlled robot. The robot, operated by hand movements, is affixed to a robotic vehicle. Both the arm's and the car's movements are managed by the accelerometer. Wearable accelerometers are the foundation for the construction of a wireless robotic arm using accelerometers. There are three axes on the accelerometer. Human hand motion's angular displacement is measured using accelerometers. The signal sent by the acceleration force is conveyed to the controller when it is installed on a hand glove and connected to it. uses MEMS sensors to operate.

I. INTRODUCTION

In order to create an intelligent wheelchair that can function as an interface for human-robot interaction, this study suggests an integrated method for the real-time detection, tracking, and direction identification of hands. The purpose of this research is to show how well finger and hand movements may be converted into signals that a computer can understand using accelerometers. The accelerometer data is filtered and calibrated for gesture recognition. In addition to measuring movement-induced acceleration, the accelerometers are also capable of measuring the strength and direction of gravity. We rotate the sensitive axis of the device with respect to gravity and utilize the resulting signal as an absolute measurement to calibrate the accelerometers.Because MEMS accelerometers are compact and light, integrating a single chip wireless solution with one would result in an autonomous device that could be applied to the fingernails. The back of the hand and the fingers each have accelerometers connected. Accelerometer locations and sensitive directions are shown by arrows on the hand; the hand's plane represents the accelerometer's sensitive direction.The gesture-based wheelchair is appropriate for the elderly and physically disabled who have lost the capacity to use their limbs because of paralysis, old age, or congenital defects. It might be difficult for elderly people to move about the home for daily tasks without assistance or outside support. Our suggested approach makes use of a wheelchair that enables elderly or physically disabled people to move about the house easily and independently without the need for outside assistance. Due to an increase in forgetfulness with age, elderly people may often lose track of how to navigate to various places in the home. It is challenging for people with physical disabilities to operate a wheelchair on their own without assistance. The elderly and others with physical disabilities may utilize the system to access various areas in the home, such as the kitchen, living room, dining room, etc., by simply demonstrating a gesture that is specified for that specific space. Another benefit of the system is that users who find it more comfortable may even use their foot in lieu of their hand.The purpose of this project is to use MEMS ACCELEROMETER SENSOR (Micro Electro-Mechanical Systems) technology to control electrical equipment and a wheelchair. The Micro ElectrMechanical Sensor, or MEMS Accelerometer Sensor, is a very sensitive device that can measure tilt. This sensor detects tilt and uses the accelerometer to adjust the wheelchair's

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direction based on tilt. For instance, a wheelchair will travel in the right way if it is tilted to the right, and it will move in the left direction if it is tilted to the left. Wheelchair movement may be commanded in four directions: forward, reverse, left, and right. An ultrasonic sensor is used to identify obstacles.In the world of electronics, automation is the phrase that is spelled the most often. The need for automation led to several technological advancements in the field. A technology that has seen significant advancement is the MEMS accelerometer sensor. Because they were so user-friendly, these technologies were more important than any other. Because of its easier to use functionality, MEMS accelerometer sensor-based products are readily accessible to the average person.

NEED OF PROJECT:

to create a wheelchair control that reorganizes hand gestures or movements in a way that is helpful to those who are physically impaired. A physically challenged person might get to the desired area with the use of a wheelchair by using hand gestures to control the chair's movement. The purpose of this study is to provide a workable alternative to those disabled individuals who are unable to use a wheelchair on their own. Those with severe paralysis conditions are among them. Automated control systems for wheelchairs have shown to be useful solutions for a variety of HCI issues. In essence, their purpose is to improve computer or system usability for individuals, particularly those with disabilities.

II. LITERATURE SURVEY

Robots may be controlled in a variety of ways using different techniques and design requirements. Most often, robots are operated independently, wirelessly, or with a tether (wired). Mobile phones, joysticks, keypads, computer terminals, and even internet interfaces are a few of the conventional wireless controlling techniques that allow for control from any location. The robotic arm and vehicle may be controlled using some of the commonly used techniques listed below. a system with a microcontroller basis that an Android application can control. Both the robotic arm and the vehicle may be controlled by the operator via the user-friendly interface on their mobile device. The cell phone and robotic car are interfaced using a Bluetooth module. In accordance with the signal received, this provides the robot's motors with the appropriate motional orders. This framework may be used in the chemical industry to handle dangerous substances like as sodium cyanide, nitric acid, and sulfuric acid, among others, and keeps people from ingesting them or breathing them in. In any business, they may also be utilized to move large things [1].

mostly used for patient operations, a robotic arm with an integrated microprocessor, LCD, DC motors, and RF video camera that is operated via a LAN or Internet connection. An appropriate averaging procedure is used to minimize the noise originating from the sensor output. The data from the specified computer may be received by the Ethernet adapter that is configured with that specific IP address. Through a serial connection, the adapter will transmit the data it has received to the microcontroller. The microprocessor controls the robotic arm by sending the proper signals to the DC geared motors once it has received the data. This framework is mostly employed to use high-speed blades—basically, a robotic arm—to cut the patient's skin [2].

The vehicle may be programmed to move in response to hand motion detection, and it will stop moving if it detects an obstruction in its path. By only dragging his hand in the appropriate directions, the user may control the

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vehicle's movement in all four directions. such that there are no buttons for the user to push. An accelerometer is a basic inertial navigation sensor that can record gesture signals. An ultrasonic sensor is another feature of this system that may assist keep the autonomous car from running into any obstacles. The microcontroller and encoder circuit receive the data from the sensors. Using an RF transmitter, the encoded signal is sent. After receiving the signal, an RF receiver decodes it. Ultimately, the microprocessor modifies the robots' motions by sending the motors the proper signals. This technique may be used to field surveys close to borders, construction, and the disposal of hazardous material [3].

Two independent accelerometers may be used to control the robotic arm and platform. The platform and robotic arm move in accordance with the user's motions and postures, which are recorded by two accelerometers fixed on the user's leg and on the hand, respectively. The robotic arm performs pick and place/drop tasks as well as lifting and lowering things, while the platform moves forward, backward, right, and left. The various hand and leg motions that the user makes are sent via the RF Module. Additionally, the system has an IP-based camera that can wirelessly feed live video to any Internet-enabled device, including tablets, laptops, and smartphones. The primary benefit of this kind of robotic arm is its ability to do very accurate medical procedures while operating in dangerous environments and regions that are inaccessible to humans. [4].

III. DESIGN OF HARDWARE

This chapter provides a quick explanation of the hardware. It goes into great depth about each module's circuit diagram.

ARDUINO UNO

A microcontroller board based on the ATmega328 is called the Arduino Uno (datasheet). It has a 16 MHz ceramic resonator, 6 analog inputs, 14 digital input/output pins (six of which may be used as PWM outputs), a USB port, a power connector, an ICSP header, and a reset button. It comes with everything required to support the microcontroller; all you need to do is power it with a battery or an AC-to-DC converter or connect it to a computer via a USB connection to get going.The FTDI USB-to-serial driver chip is not used by the Uno, setting it apart from all previous boards. As an alternative, it has the Atmega16U2 (or Atmega8U2 up to version R2) configured as a serial-to-USB converter. The 8U2 HWB line on the Uno board is pulled to ground by a resistor, which facilitates DFU mode entry. The Arduino board now includes the following updates:

• 1.0 pin out: two further new pins, the IOREF, are positioned next to the RESET pin, the SDA and SCL pins that were introduced, and they enable the shields to adjust to the voltage supplied by the board. Shields will eventually work with both the Arduino Due, which runs on 3.3V, and the boards that utilize the AVR, which runs on 5V. The second pin is unconnected and set aside for future uses.

• A more robust RESET circuit.

• The 8U2 is replaced with an ATMega 16U2.

"Uno" is an Italian word for one, and it was chosen to commemorate the impending introduction of Arduino 1.0. Going future, the Arduino reference versions will be the Uno and version 1.0. The Uno is the most recent in a line of USB Arduino boards and the platform's standard model; see the index of Arduino boards for a comparison with earlier iterations.

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Fig: ARDUINO UNO

POWER SUPPLY:

The purpose of the power supplies is to convert the high voltage AC mains energy into a low voltage supply that is appropriate for use in electronic circuits and other devices. One may disassemble a power supply into a number of blocks, each of which carries out a specific task. "Regulated D.C. Power Supply" refers to a d.c. power supply that keeps the output voltage constant regardless of differences in the a.c. main or the load.

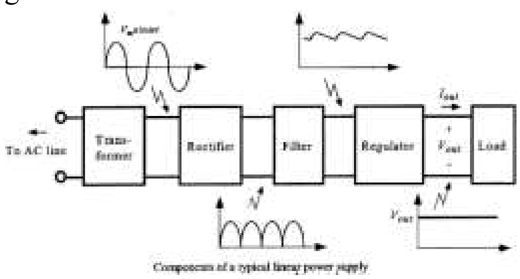


Fig: Block Diagram of Power Supply

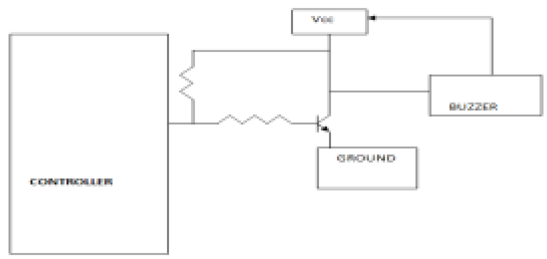
LCD DISPLAY

The model shown here is the one that is most often utilized in practice due to its cheap cost and enormous potential. Its HD44780 microcontroller (Hitachi) platform allows it to display messages in two lines of sixteen characters each. All of the alphabets, Greek letters, punctuation, mathematical symbols, etc., are shown. Furthermore, it is possible to show custom symbols created by the user. Some important features are the automatic changing of the message on the display (shift left and right), the presence of the pointer, the lighting, etc.

Fig: LCD

BUZZER

Relays, buzzer circuits, and other circuits cannot be driven by the current available on digital systems and microcontroller pins. The microcontroller pin can provide a maximum of 1-2 milliamps of current, even though these circuits need around 10 milliamps to work. Because of this, a driver—such as a power transistor—is positioned between the buzzer circuit and microcontroller.



LED:

A light source made of semiconductors with two leads is called an LED. When turned on, this p-n junction diode generates light.[5] Within the device, electrons may recombine with electron holes when a proper voltage is given to the leads, releasing energy in the form of photons.

This phenomenon is known as electroluminescence, and the energy band gap of the semiconductor controls the hue of the light, which corresponds to the photon's energy. Since LEDs are usually tiny—less than 1 mm2—the radiation pattern may be modified by integrated optical components.

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Early LEDs were often utilized to replace tiny incandescent bulbs as indication lighting for electrical equipment. They were quickly bundled into seven-segment displays for use as numeric readouts, and digital clocks became popular with them. Modern advancements have led to the creation of LEDs that are appropriate for task and ambient lighting. New displays and sensors have been made possible by LEDs, and enhanced communications technology has benefited from their rapid switching rates.Compared to incandescent light sources, LEDs are smaller, quicker switching, more physically resilient, need less energy, and have a longer lifespan. Applications for light-emitting diodes are many and include traffic signals, advertising, traffic lights, camera flashes, lit wallpaper, aircraft illumination, and car headlights. Additionally, they are much more energy-efficient, and their disposal may pose less environmental risks.

MEMS:

MEMS is a process technique that combines mechanical and electrical components to build small integrated devices or systems. They may be made in sizes ranging from a few micrometers to millimeters and are created utilizing integrated circuit (IC) batch manufacturing processes. These systems (or gadgets) can perceive, regulate, and act on a micro level while producing consequences on a large scale. Because MEMS is multidisciplinary, it draws on design, engineering, and manufacturing knowledge from a broad spectrum of technical domains, such as fluid engineering, optics, instrumentation, and packaging, as well as integrated circuit fabrication technology, mechanical engineering, materials science, electrical engineering, chemistry, and chemical engineering.

The wide diversity of markets and applications that use MEMS devices is another indication of the complexity of MEMS. Systems for the automotive, medical, electrical, communication, and military industries all use MEMS. Airbag sensor accelerometers, inkjet printer heads, computer disk driver read/write heads, projection display chips, blood pressure sensors, optical switches, micro valves, biosensors, and many more items that are produced and distributed in large commercial quantities are examples of current MEMS devices.

By fusing micromachining with silicon-based microelectronics, MEMS has been dubbed one of the most promising technologies of the twenty-first century. It has the ability to completely transform consumer and industrial goods. Its methods and microsystem-based gadgets have the power to significantly alter how we all live our lives.

MEMS is the second revolution in micro manufacturing, if semiconductor micro fabrication was considered the first. This study, which is structured into four major parts, introduces the area of MEMS. The reader is introduced to MEMS in the first part, which covers terminology, history, present and future uses, market conditions, and miniaturization-related concerns. The second portion covers the basic techniques for fabricating MEMS, including as photolithography, bulk micromachining, surface micromachining, and high aspect ratio micromachining. It also covers the assembling, system integration, and packaging of MEMS devices.

RF PAIR:

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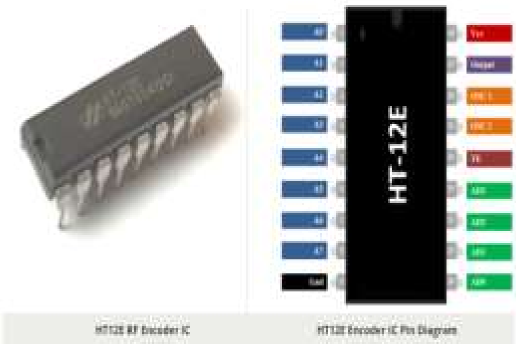
HT12E RF ENCODER IC



HT12E RF Encoder IC | HT12E Encoder IC Pin Diagram

HT12D RF DECODER IC

HT12D RF Decoder IC | HT12D RF Decoder IC Pinout

HT12D Pin Configuration

Pin Number	Pin Name	Description
1 to 8	A0,A1,A2,A3,A4,A5,A6 & A7	These are the 8-bit address bits, which is used to protect your data. We should set the bits in same pattern of Encoder and Decoder IC to pair them.
9	Ground Pin	Connected to the Ground of circuit
10 to 13	AD0, AD1, AD2 & AD3	These four pins are used to obtain the data bits by decoding the data from HT12E IC.
14	Input	The Encoded 12 bit output data obtained from HT12E has to be given here
15 and 16	Oscillator pins 1 & 2	The IC has a built in oscillator. This oscillator can be used by connecting these two pins through a 1M Resistor
17	Valid Transmission (VT)	This pin will go high when a data is received. It is not mandatory to use it.
18	Vcc/Vdd	This pin powers the IC should use only 5V

GSM

The European Telecommunications Standards Institute (ETSI) created the Global System for Mobile Communications (GSM) standard to define the protocols for second-generation (2G) digital cellular networks, which are used by mobile devices like tablets and phones. Finland hosted its first deployment of it in December 1991.[2]By the middle of the 2010s, it had established itself as the industry standard for mobile communications, holding over 90% of the market and functioning in more than 193 nations and territories.[3]

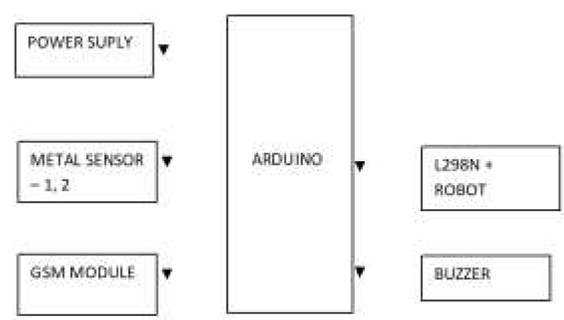
First generation (1G) analog cellular networks were replaced by 2G networks. A digital, circuit-switched network designed for full duplex voice communication was first specified in the GSM standard. With time, this grew to include packet data delivery via General Packet Radio Service (GPRS), circuit-switched transport, and Enhanced Data Rates for GSM Evolution (EDGE).

The third-generation (3G) UMTS standards and the fourth-generation (4G) LTE Advanced standards, which are not included in the ETSI GSM standard, were subsequently created by the 3GPP.

The GSM Association is the owner of the trade mark "GSM". It might also be a reference to Full Rate, the (originally) most widely used voice codec.

IV. BLOCK DIAGRAM AND HARDWARE DISCRIPTION

4.1. BLOCK DIAGRAM:



V. CONCLUSION

The remote control car's obstacle avoidance technology has significantly improved both its usefulness and safety. Our achievement involves the effective integration of sensors, microcontrollers, and motor control methods to allow the remote control vehicle to drive through a range of situations and avoid impediments in its route.

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