RF AND ANDROID APPLICATION BASED WHEEL CHAIR CONTROL SYSTEM

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ABSTRACT--*Wheelchairs are a way of reincarnating the purpose of life in the lives of disabled people. Effective and efficient ways of delivering a cost-effective and affordable wheelchair to the common masses, which is not only at par with the present day technology, but is much easier to use are presented herewith. Replacement of the popular android application based controlled wheel chair with a hand-glove control system for easier manoeuvring by bending the fingers and control the wheel chair using voice recognition also are implemented in our project. Intended users control the system by wearing an instrumented glove by using RF (Radio Frequency) transceivers and sensors for controlling the movement and direction of the wheelchair. Health condition also monitored by using heart rate and temperature sensors and the data's are uploaded in IOT. Accelerometer sensor is used to detect the fall detection and message will send to concerned person.*

I. INTRODUCTION

While the needs of many individuals with disabilities can be satisfied with power wheelchairs, some members of the disabled community find it is difficult or impossible to operate a standard power wheelchair. This project could be part of an assistive technology. It is for more independent, productive and enjoyable living. Android-based wheelchair controller is a system where the DC motor is used to move the wheelchair. Nowadays, handicapped people face problem to control wheelchair by themselves. Sometimes they need other people to help them. This project will provide a new way to control the movement of wheelchair such as turn direction to left, right, forward and reverse direction. The overall wheelchair operation uses DC motor and motor driver module combines with microcontroller system for instance board. Android-based wheelchair controller that consists of android device and a control box that can be attached to standard wheelchairs to control the movement by using a DC motor. Bluetooth communication protocol is used to communicate sensory and command information between the android device and the control box. There are 4 options for basic motions of a wheelchair to be to be applied by the user.

The four conditions of the wheelchair can be described as the following:

a. Moving forward
b. Moving backward
c. Turning to the right
d. Turning to the left

This project also provided a controller to the electrical appliance by using radio frequency as a wireless connection between control box and electrical appliance.

Organization

The rest of this paper is organized as follows. Section II presents Related work. Section III is System analysis, Section III is Methodology. Section is IV Architecture and Finally the Section V is Result and Conclusion.

II. RELATED WORKS

Development of an Intelligent Wheelchair with Visual Oral Motion

This paper describes an intelligent wheelchair with a novel interface which uses visual oral motion. The wheelchair runs in various lighting environments, traditional mouth region detection method did not consider these conditions. To achieve detection of mouth region and analysis mouth motion in real-time and in various lighting environments, we proposed mouth cavity region detection method. In our system, the user moves his mouth open and close to run the wheelchair. They carried out six operational experiments and running experiments. Experiments with five subjects obtained our system is supposed to use a certain extent in a campus corridor.

Low cost self assistive voice controlled technology for disabled people

This paper describes the design of an innovative and low cost self-assistive technology that is used to facilitate the control of a wheelchair and home appliances by using advanced voice commands of the disabled people. This proposed system will provide an alternative to the physically challenged people with quadriplegics who is permanently unable to move their limbs (but who is able to speak and hear) and elderly people in controlling the motion of the wheelchair and home appliances using their voices to lead an independent, confident and enjoyable life. The performance of this microcontroller based and voice integrated design is evaluated in terms of accuracy and velocity in various environments. The results show that it could be part of an assistive technology for the disabled persons without any third person's assistance.

II. SYSTEM ANALYSIS

EXISTING SYSTEM

The microphone is used to receive the voice commands from the user and then convert them into the electrical signals. The electrical signals are transferred to the voice module to digitize and store the voice signals as template, which indicates the commands from the users.

In order to use the developed system, the voice of the user must be trained before that command is stored in the voice module. When the user provides the command to the system, if the user command matches to the stored command, the voice module gives the output to the microcontroller. In addition, the microcontroller also receives the output signals from the front and rear ultrasonic sensors, which works as an obstacle detection unit. The microcontroller output is attached to the motor speed control module and the electrical actuator.

PROPOSED SYSTEM

The goal of this method is to develop a wheelchair system which controls its movement by the mere bending of a person's fingers and voice recognition system. Gloves consists of RF transmitter and receiver, voice recognition system is accessed by Mobile app. Heart rate and temperature sensor is used to detect the health condition of the disabled people and the data's are updated in IOT.

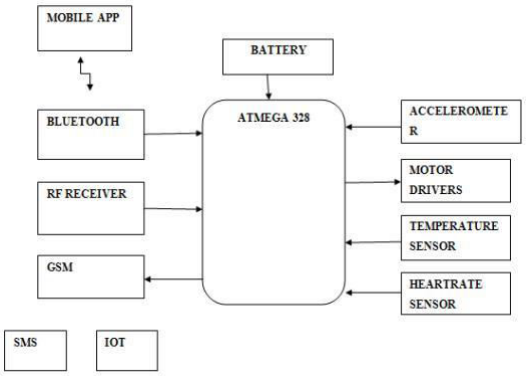
III. METHODOLOGY

ATMEGA328 CONTROLLER

The Arduino Uno is a microcontroller board based on the ATmega328 . It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial

converter. Revision 2 of the Uno board has a resistor pulling the 8U2 HWB line to ground, making it easier to put into DFU mode.

BLOCK DIAGRAM



BLOCK DIAGRAM -RECEIVER PART

Power

The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector.

The recommended range is 7 to 12 volts. The power pins are as follows:

- **VIN.** The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source).
- **5V.**This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 12V), the USB connector (5V), or the VIN pin of the board (7-12V).
- **3V3.** A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.
- **GND.** Ground pins.

Input and Output

Each of the 14 digital pins on the Uno can be used as an input or output, using pin Mode (), digital Write(), and digital Read() functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 ohms. In addition, some pins have specialized functions:

- **Serial: 0 (RX) and 1 (TX).** Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip.
- **External Interrupts: 2 and 3.** These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.
- **PWM: 3, 5, 6, 9, 10, and 11.** Provide 8-bit PWM output with the analog Write() function.
- **AREF.** Reference voltage for the analog inputs. Used with analog Reference().
- **Reset.** Bring this line LOW to reset the microcontroller.

Communication

The Arduino Uno has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer.

Programming

The Arduino Uno can be programmed with the Arduino software (download). Select "Arduino Uno from the Tools > Board menu (according to the microcontroller on board).. The ATmega328 on the Arduino Uno comes pre-burned with a boot loader that allows to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol (reference, C header files).

Also bypass the bootloader and program the microcontroller through the ICSP (In-Circuit Serial Programming) header; see these instructions for details. The ATmega16U2 (or 8U2 in the rev1 and rev2 boards) firmware source code is available. The ATmega16U2/8U2 is loaded with a DFU bootloader, which can be activated by:

- On Rev1 boards: connecting the solder jumper on the back of the board (near the map of Italy) and then resetting the 8U2.
- On Rev2 or later boards: there is a resistor that pulling the 8U2/16U2 HWB line to ground, making it easier to put into DFU mode.

USB Over current Protection

The Arduino Uno has a resettable poly fuse that protects computer's USB ports from shorts and over current. Although most computers provide their own internal protection, the fuse provides an extra layer of protection. If more than 500mA is applied to the USB port, the fuse will automatically break the connection until the short or overload is removed.

Physical Characteristics

The maximum length and width of the Uno PCB are 2.7 and 2.1 inches respectively, with the USB connector and power jack extending beyond the former dimension. Four screw holes allow the board to be attached to a surface or case. Note that the distance between digital pins 7 and 8 is 160 mil (0.16"), not an even multiple of the 100 mil spacing of the other pins.

ATMEGA 328 Features:

Features

- High Performance, Low Power AVR
- 8-Bit Microcontroller
- Advanced RISC Architecture
- 131 Powerful Instructions – Most Single Clock Cycle Execution
- 32 x 8 General Purpose Working Registers
- Fully Static Operation
- Up to 20 MIPS Throughput at 20 MHz
- On-chip 2-cycle Multiplier
- High Endurance Non-volatile Memory Segments
- Write/Erase Cycles: 10,000 Flash/100,000 EEPROM
- Data retention: 20 years at 85°C/100 years at 25°C

Peripheral Features

- Two 8-bit Timer/Counters with Separate Pre scalar and Compare Mode
- One 16-bit Timer/Counter with Separate Pre scalar, Compare Mode, and Capture Mode
- Real Time Counter with Separate Oscillator
- Six PWM Channels
- 8-channel 10-bit ADC in TQFP and QFN/MLF package
- Temperature Measurement
- -channel 10-bit ADC in PDIP Package
- Programmable Serial USART
- Master/Slave SPI Serial Interface
- Byte-oriented 2-wire Serial Interface

AT MEGA328 ARCHITECTURE

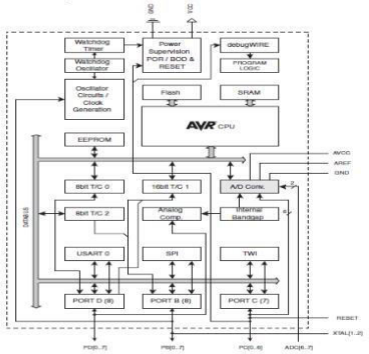


Fig ATMEGA328 Architecture

AVCC

AVCC is the supply voltage pin for the A/D Converter, PC3:0, and ADC7:6. It should be externally connected to VCC, even if the ADC is not used. If the ADC is used, it should be

connected to VCC through a low-pass filter. Note that PC6..4 use digital supply voltage, VCC.

AREF

AREF is the analog reference pin for the A/D Converter.1.1.9 ADC7:6 (TQFP and QFN/MLF Package Only)In the TQFP and QFN/MLF package, ADC7:6 serve as analog inputs to the A/D converter. These pins are powered from the analog supply and serve as 10-bit ADC channels.

DC MOTOR

A DC motor in simple words is a device that converts direct current (electrical energy) into mechanical energy. It's of vital importance for the industry today, and is equally important for engineers to look into the working principle of DC motor in details that has been discussed in this article. In order to understand the operating principle of dc motor we need to first look into its constructional feature.

BLUETOOTH

Bluetooth is a method for data communication that uses short-range radio links to replace cables between computers and their connected units. Industry-wide Bluetooth promises very substantial benefits for wireless network operators, end workers, and content developers of exciting new applications. Bluetooth is a standard for short range, low power, low cost wireless communication that uses radio technology. embedded Bluetooth capability is becoming widespread in numerous types of device.

ANDROID APP

Since Android is used in a number of development projects many of which have comfortable proximity with the concept of smart cities, it was the platform of choice for user end device. A companion application developed in Android Studio running at the user side will be installed on the user's smart phone. This app will take care of the sign-up, login, authentication, log generation and Bluetooth communication with the access control mechanism.

RF MODULE

An RF module (radio frequency module) is a (usually) small electronic device used to transmit and/or receive radio signals between two devices. In an embedded system it is often desirable to communicate with another device wirelessly. This wireless communication may be accomplished through optical communication or through radio frequency (RF) communication. For many applications the medium of choice is RF since it does not require line of sight. RF communications incorporate a transmitter and a receiver. They are of various types and ranges. Some can transmit up to 500 feet. RF modules are widely used in electronic design owing to the difficulty of designing radio circuitry. Good electronic radio design is notoriously complex because of the sensitivity of radio circuits and the accuracy of components and layouts required to achieve operation on a specific frequency. For these reasons, design engineers will often design a circuit for an application which requires radio communication and then "drop in" a pre-made radio module rather than attempt a discrete design, saving time and money on development. RF modules are most often used in medium and low volume products for consumer applications such as garage door openers, wireless alarm or monitoring systems, industrial remote controls, smart sensor applications, and wireless home automation systems.

Types of RF Module

The term RF module can be applied to many different types, shapes and sizes of small electronic sub assembly circuit board. It can also be applied to modules across a huge variation of functionality and capability. RF modules typically incorporate a printed circuit board, transmit or receive circuit, antenna, and serial

interface for communication to the host processor.

Most standard, well known types are covered here:

- Transmitter module
- Receiver module
- Transceiver module
- System on a chip module

Transmitter modules

An RF transmitter module is a small PCB 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 can be transmitted. RF transmitters are usually subject to regulatory requirements which dictate the maximum allowable transmitter power output, harmonics, and band edge requirements.

Receiver modules

An RF receiver module receives the modulated RF signal, and demodulates it. There are two types of RF receiver modules super heterodyne receivers. Super-regenerative modules are usually low cost and low power designs using a series of amplifiers to extract modulated data from a carrier wave. Super-regenerative modules are generally imprecise as their frequency of operation varies considerably with temperature and power supply voltage. Super heterodyne receivers have a performance advantage over super-regenerative; they offer increased accuracy and stability over a large voltage and temperature range. This stability comes from a fixed crystal design which in the past tended to mean a comparatively more expensive product. However, advances in receiver chip design now mean that currently there is little price difference between super heterodyne and super-regenerative receiver modules.

Transceiver modules

An RF transceiver module incorporates both a transmitter and receiver. The circuit is typically designed for half-duplex operation, although full-duplex modules are available, typically at a higher cost due to the added complexity.

System on a chip (SOC) module

An SOC module is the same as a transceiver module, but it is often made with an onboard microcontroller. The microcontroller is typically used to handle radio data managing a protocol such as an IEEE 802.15.4 compliant module. This type of module is typically used for designs that require additional processing for compliance with a protocol when the designer does not wish to incorporate this processing into the host microcontroller.

TEMPERATURE SENSOR

The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly proportional to the Centigrade temperature. The LM35 device has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from the output to obtain convenient Centigrade scaling. Lower cost is assured by trimming and calibration at the wafer level. The low-output impedance, linear output, and precise inherent calibration of the LM35 device makes interfacing to readout or control circuitry especially easy. The device is used with single power supplies, or with plus and minus supplies. As the LM35 device draws only 60 μA from the supply, it has very low self-heating of less than 0.1°C in still air. The LM35D device is available in an 8-lead surface-mount small-outline package and a plastic TO-220 package.

HEART BEAT SENSOR

This sensor is designed to measure heart beat when finger is placed on it. The digital output of this sensor will be interfaced to Arduino board and it will directly measure heartbeats in beats per minute

(BPM) rate. It works on the principle of light modulation by blood flow through finger at each pulse. Hence, the measurement threshold is set form 60 to 100 bpm..

ACCELEROMETER (ADXL335)

The ADXL335 is a complete 3-axis acceleration measurement system. The ADXL335 has a measurement range of ±3 *g* mini-mum. It contains a poly silicon surface-micro machined sensor and signal conditioning circuitry to implement an open-loop acceleration measurement architecture. The output signals are analog voltages that are proportional to acceleration.

GSM

GSM (Global System for Mobile Communication) is a public service available at no cost to the user. Nowadays mobile hand set is not new to the user. Everywhere user can be seen using mobile phones and they are very much conversant with mobile hand set. There is no extra cost of communication equipments.

IOT (The Internet of Things)

The Internet of Things (IoT) is an important topic in technology industry, policy, and engineering circles and has become headline news in both the specialty press and the popular media. This technology is embodied in a wide spectrum of networked products, systems, and sensors, which take advantage of advancements in computing power, electronics miniaturization, and network interconnections to offer new capabilities not previously possible. An abundance of conferences, reports, and news articles discuss and debate the prospective impact of the "IoT revolution"—from new market opportunities and business models to concerns about security, privacy, and technical interoperability.

The large-scale implementation of IoT devices promises to transform many aspects of the way we live. For consumers, new IoT products like Internet-enabled appliances, home automation components, and energy management devices are moving us toward a vision of the "smart home'', offering more security and energy efficiency

RESULT

This project is based over Atmega328 as its core processor. First kind of interface is which displays that the user can move in any direction of their choice. Wheelchair can be controlled using Hand gestures, as well as android phone. The wheelchair circuit consists of a RF and Bluetooth receiver used to receive these commands and then operate the wheelchair motors in order to achieve desired movement. This allows the disabled person operate the wheelchair easily as well as another person can operate the wheelchair from particular distance. So in this way, the wheelchair system is taken to a new level by the usage of automation and safety to the user using the Atmega328 based Wheelchair system.

CONCLUSION

The project implementation will help all the people who are dependent on wheelchair for their mobility .All common man can reach out for this wheelchair to become independent if they hold smart phone and hand gesture recognition. The application build can be use full for android phone. The proposed system also helps to monitor health condition. Wheelchair is simple to operate and does not need any external help.

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