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VOICE COMMAND BASED CALAMITY RECUE ROBOT

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ABSTRACT

A rescue robot is a robot that has been designed for the purpose of aiding in most rescue workforces. In most of common circumstances that skill rescue robots are mining fortunes, urban ruins, and imprisoned situations and blasts. This robot will help us in these situations by helping humans. The major objective of this project is to control the robot by using voice commands and to use in disaster regions. It is aimed for the users to control a pick and place device through voice commands. Here the user can control all the movements of robot through voice commands to remove the objects in disaster regions. It uses a microphone to convert the given voice commands to electrical signals and this signal is recognized using voice recognizer by means of a voice sensor. This sensor is known as the VR Module. It will produce an output which is used by a controller to produce a control output. This output will drive the motor, thus robotic action takes place. It consists of L293D IC which will as a driving mechanism of the pick and place robot. Also, it has servomotor that helps for movement of arms. The two micro servos are used in gripping the objects at a distance. The VR module is used here to recognize the voice and give the output to microcontroller. If the signal is same with that of the trained signal in keypad, the servos will work according to it.

Keywords: ATmega 328, VR Module (easyVR3.0), L293D

I. INTRODUCTION

Nowadays robots are having wide applications in various fields. In many industries robots are used for performing different functions. Robots are more accurate and efficient as compare to human being. Use of robots in industries can increase the quality of products and their production rates. As compare to earlier days, today robots are used in various areas such as defence & medical fields, in industries etc.

Many areas of the world are getting affected due to natural calamity. Disasters are exceptional & unstoppable events that are either manmade or natural. Voice controlled robot is an interesting project, mainly used for industrial and surveillance applications. This is a system which will act automatically when the voice command is reached. These voice commands should ensure the various operations that is to be performed. Our project is aimed to see the working of a pick and place device using voice commands at calamity affecting regions.

The system uses one voice recognition (VR) Module namely EasyVR3.0 for the application and recognition of voice commands. This module will produce a signal and this signal is given to the microcontroller. Microcontroller will take the controlling action for the motors. Thus the driving system of the robot works.

Based upon the signal from the microcontroller the motor connected in the robotic system runs and thus robotic action will take place.

The advantages of voice controlled robots are hands-free and fast data input operations. In future voice recognition system will have greater usages in calamity, defence and industrial regions. Normally the handicapped people cannot operate manual controlled robots. These people can use only their voice. And there are a lot of regions where the human cannot involve. So we decided to design the voice controlled robot since researches are going on.

II. BLOCK DIAGRAM

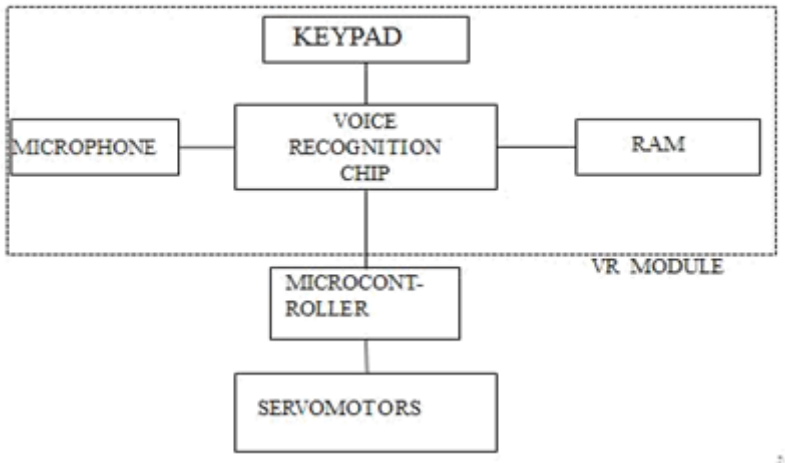

Fig 1: Block Diagram

2.1 Voice Recognition Module

This voice recognition module is used to recognize the voice or sounds. It receives configuration commands or responses through serial port interface. With this module, we can control many devices through our voice. This module can store up to 15 pieces of voice instructions. Those 15 pieces are divided into 3 groups, with 5 in each group. First we should train the module with voice instructions group by group. After that, we should import one group before it could recognize the 5 voice instructions within that group. If we need to implement instructions in other groups, we should import the group. This module is speaker dependant

Here the Easy VR module is used, with specification 3.0. It is a voice recognition shield for Arduino boards integrating an Easy VR module. It includes all of the features of the Easy VR module in a shield form factor that simplifies connection to the Arduino main board and PC.

Easy VR 3.0 is a multi-purpose speech recognition module designed to add versatile, robust and cost effective speech and voice recognition capabilities to virtually any application. Easy VR is the third generation version of the successful VR bot module and built on the features and functionality of its predecessor. In addition to the Easy VR 3.0 features like up to 32 user-defined speaker dependant (SD) commands and 26 built in speaker independent (SI) commands for ready to run basic controls, the shield has an additional Arduino line-out/headphone jack, an access to the I/O pin of Easy VR module.

2.2 Atmega 328

At mega 328 is a single chip microcontroller designed by ATMEL and belongs to system where a simple, low powered, low cost microcontroller is needed. Operating voltage 5v.Input voltage 7-12v.Digital I/O pins is 14(of which 6 provide PWM output).ATMEL AVR 8-bit and 32 –bit microcontrollers deliver a unique combination of performance ,power efficiency and design flexibility for a wide range of applications.

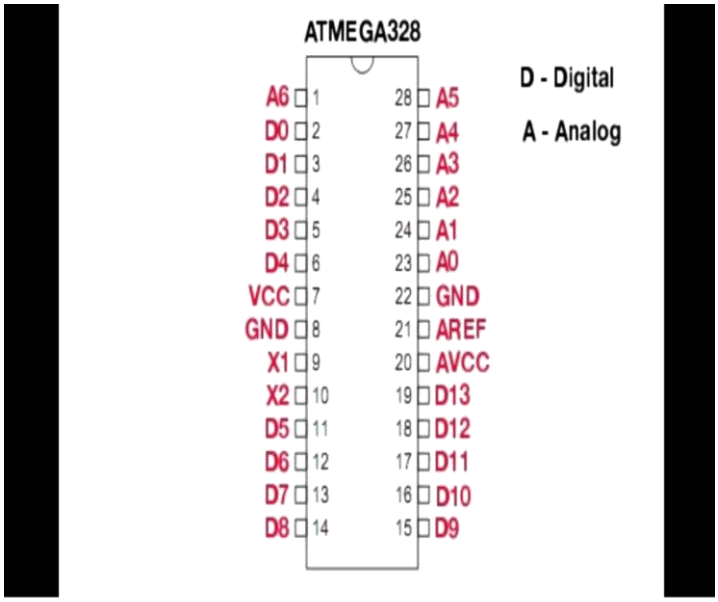

Fig 2.Pin diagram of ATMEGA328

2.3 Motor Driving System

Motor driving system of calamity rescue robot consists of mainly servomotors and micro servomotors Both the servo motor and micro servomotors are used for making the angular movements. Both the motors can provide an angle of rotation.

Servomotors are working on the basis of coming input pulses. Servo motor can control the machinery of the system. It is a kind of very small auxiliary motor indirect variable speed device, servo motor speed is controlled by the input signal, and can in the fastest time to respond. It provides an angle of rotation based upon the coming pulses.

Micro servomotors are similar to servomotor motor, but these are small as compared to the servomotor. It can also provide an angle of rotation. Therefore, it can be used to provide the gripping action of the pick and place robot. Micro servomotors are light weight high output power. Servo can rotate approximately 180 degrees (90 in each direction), and works just like the standard kinds but smaller. We can use any servo code, hardware or library to control these servos. Good for beginners who want to make different movements.

III. HARDWARE

3.1 Voice Reconition Module

Voice recognition module is a multi-purpose speech recognition module designed to easily add versatile, an UART interface powered at 3.3v – 5v, such as PIC and Arduino boards. Some applications examples include home automation, such as voice controlled light switches, locks, curtains or kitchen appliances, or adding "hearing" to the most popular robots on the market.

The outer headers J1 and J2 are the mikroBUS™ interface connectors, providing selectable 3.3V/5V power input to the module and voltage translated digital I/O lines, including: UART receive/transmit lines and control pins.

Fig 3. Easy VR 3.0

3.1.1 Microphone

The microphone provided with the Easy VR 3 module is an Omni directional electrets condenser microphone (Horn EM9745P-382): Sensitivity -38dB (0dB=1V/Pa @1KHz) .Load Impedance is 2.2K. Operating Voltage is 3V. Almost flat frequency response in the range 100Hz – 20 kHz. The microphone circuit is optimized for use at ARMS_LENGTH (default, about 60cm) or FAR_MIC distance settings.

If we use a microphone with different specifications the recognition accuracy may be adversely affected. Differences in rated load impedance and sensitivity can be compensated to a certain extent by changing the microphone gain. This can be done in several ways: Replacing the internal gain resistor R4 (1.2kΩ). Adding an external resistor Rx going in parallel with R4 (it can only reduce gain, useful for HEADSET distance settings). Removing the internal resistor R4 and using only the external resistor Rx.

3.1.2 Voice Recognition Chip

Voice recognition chip is the heart of the entire system. HM2007 is a voice recognition chip with on-chip analog front end, voice analysis, recognition process and system control functions. The input voice command is analysed, processed, recognized and then obtained at one of its output port which is then decoded, amplified and given to motors of robot. The peculiarity of HM 2007 is that it has much more accuracy and reliability.

The chip provides the options of recognizing either forty 0.96 second words or twenty 1.92 second words. This circuit allows the user to choose either the 0.96 second word length (40 word vocabulary) or the 1.92 second word length (20 word vocabulary). For memory the circuit uses an 8K*8 static RAM.

The chip has two operational modes; manual mode and CPU mode. The CPU mode is designed to allow the chip to work under a host computer. This is an attractive approach to speech recognition for computers. Because the speech recognition chip operates as a co-processors to the main CPU. The jobs of listening and recognition don't occupying any of the computers CPU time. When the HM 2007 recognizes a command it can signal an interrupt to the host CPU and then relay the command code. The HM 2007 chip can be cascaded to provide a larger word recognition library.

3.1.3 Keypad

The keypad is used for training the chip used in the system. By, training the chip to certain commands the robot can take successive motions. Also, there is definite memory location for voice commands**.**

3.1.4 RAM

The RAM in VR module provides the storage facility. It can store the command signals which are applied to the system**.** It stores decoded voice commands by the chip at the assigned locations. Thus, RAM can store all the commands given to the VR module .This helps to check the commands when there is problem associated with the system. The RAM of VR module has the same function as the RAM in central processing unit in the computer.

3.2 Servo Motor

Servo motor can control the machinery. It is a kind of very small auxiliary motor indirect variable speed device, servo motor speed is controlled by the input signal, and can in the fastest time to respond in the automatic control system plays a very important role, servo motor has a mobile time, high linearity, click start a low voltage dynamic characteristics of servo positioning location is accurate, able to convert voltage signal into torque and rotational speed for the drive control object.

The main function of the servo motor, with the speed change control voltage uniform and stable, the servo motor to position mainly by the pulse, a pulse current when received, will be a corresponding angle of rotation corresponds to one pulse in order to achieve unique, because the servo motor itself has a pulse current issue features an angle of rotation will be issued whenever the corresponding number of pulse, pulse and servo motor to accept the formation of echoes, or called closed-loop, thisway, the system will know how many pulses sent to the servo motor, while the number of pulses received back, so it can accurately control motor rotation, precise positioning can be achieved 0.001mm.

3.3 Micro Servomotor

Micro servomotor is a tiny and lightweight motor with high output power. Servo can rotate approximately 180 degrees (90 in each direction), and works just like the standard kinds but smaller. We can use any servo code, hardware or library to control these servos. Good for beginners who want to make stuff move without building a motor controller with feedback & gear box, especially since it will fit in small places. It comes with a 3 horns (arms) and hardware.

3.4 Toy Motor

Toy motor is another type of motor that can be used for the movement of picks and place robot. It is typically an electric motor that uses the principle of electromagnetism. Electromagnetism is the force that transforms electric power from the battery into mechanical power in the toy car's wheel. It consist of steel that forms the body of the motor, an axle(shaft), a nylon end cap and two battery leads. The nylon end cap is held in place by two tabs that are part of the steel can . By bending the tabs back, we can free the end cap and remove it. Inside the end cap are the motor's brushes. These brushes transfer power from the battery to the commutator as the motor spins.

3.5 Motor Driving Mechanism – L293d

L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that we can control two DC motor with a single L293D IC. Dual H-bridge motor driver integrated circuit(IC).

3.6 Micro Controller-Arduino

Arduino is an open – source platform used for building electronics projects. Arduino consists of both physical programmable circuit boards (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on our computer, used to write and upload computer code to the physical board.

The Arduino platform has become quite popular with people just starting out with electronics, and for good reason. Unlike most previous programmable circuit board, the Arduino doesn't need a separate piece of hardware (called a programmer) in order to load new code on to the board- we can simply use a USB cable. Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program. Finally, Arduino provides a standard form factor that breaks out the function of the micro-controller into a more accessible.

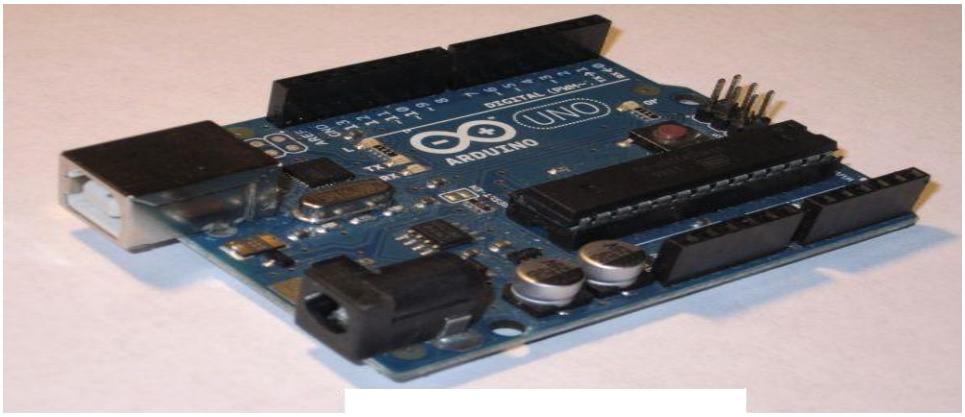

Fig 4: Arduino Board

The Arduino UNO is a microcontroller board based on the AT mega 328 (datasheet). It has 14 digital input/output pins (which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB

connection, a power jack, an ICSB 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 on proceeding boards in that it doesn't use the FTDI USB-to-serial driver chip. In still, it features the AT mega 8U to programmed as a USB-to-serial converter.

The high-performance AT mega 8 bit AVR RISC-based microcontroller combines 32KB ISP flash memory with read-while-write capabilities, 1 KB EEPROM, 2 KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D convertor (8 channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8 – 5. 5volts.

By executing powerful l instructions in a single clock cycle, the devices achieve throughputs approaching 1 MIPS per MHz, balancing power consumption and processing speed.

3.7 Acp Sheet

ACP sheet means Aluminum Composite Panel. These sheets are made from non combustible polyethylene core that is further laminated and sandwiched between the two finest aluminium sheets. For complete corrosion resistance and weather protection, external surface of the aluminium is coated with PVDF resin. Besides this, the inside of the aluminium surface is also coated with polyester for a smooth surface. These aluminium composite panel sheets are widely used for designing false ceilings, advertisement boards and partitions. Here ACP sheet provide the base of the robotic system.

3.7.1 Design Steps

The design steps involving are the interfacing of the VR module to the Arduino and the mechanical construction of pick and place robot. After this construction, the voice signal through the microphone is given to the VR chip.VR chip recognize the command and the signal output is given to the microcontroller. The corresponding signal from the controller will control robotic action.

3.7.2 Fixing of Toy Motor

Fig 5: Toy motor on ACP sheet

Toy motors are fixed at the ACP sheet and it provides the front and backward motions for the robot. Thus by using the toy motor driving system, the motion of the robot is permissible. Toy motors are the simple motors which are acting on the principle of electromagnetism.

3.7.3 Arm Construction

Arm construction of pick and place robot is done by using servomotor. Here the servomotor can provide the arm movements. Generally, the servomotor provides the angular motion of the robotic arm. Servomotor rotation will be provided by the microcontroller used.

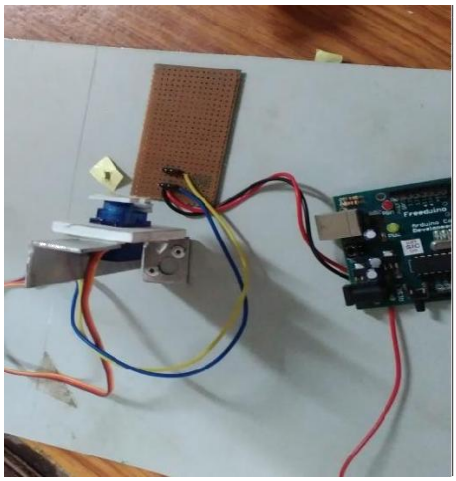

Fig.6: Arm 1

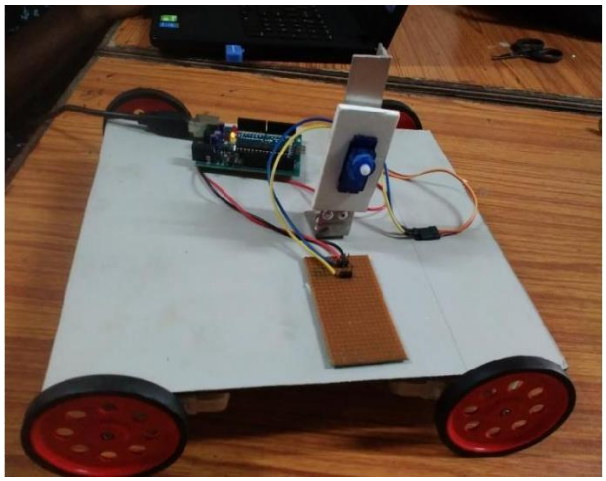

Fig 7: Arm with base

3.7.4 Final Pick And Place Robot

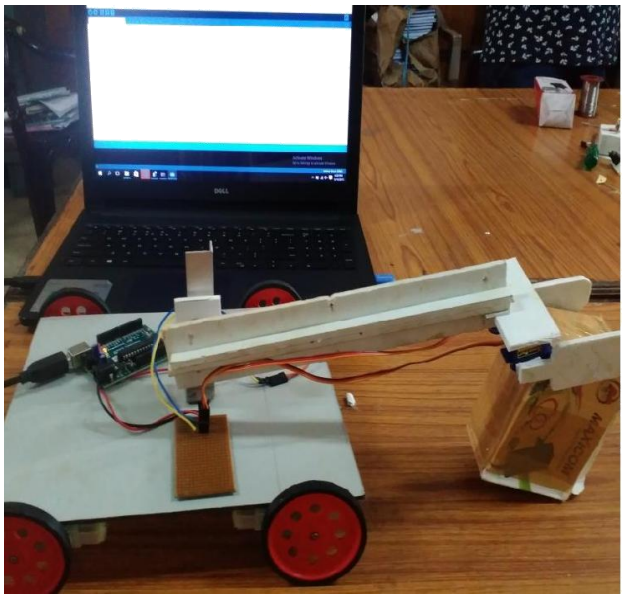

Fig 8: Final Robot

Fig 9: VR Module Used

The second arm of the robot is constructed by using form sheet. In this arm we are making the gripping portion of the robot. Here we are using two micro servomotor and these motors together with provide the pick and place operation. Here the voice command is given by using the VR module. Interfacing of VR module with the microcontroller will provide the voice recognition.

IV. CONCLUSION

With the completion of our project, we learned the basics of some new technologies including Arduino programming and easy VR sensor. This project also helped us in learning how to manage a project.We have designed the voice command based pick and place robot which can act as calamity rescue robot. This robot can work with the given voice commands. But, only standard commands can be used here to perform the robotic operation. Standard commands means the trained commands. For performing the robotic operation we will train the robot to perform different operations. Since, difficult portion of the construction was voice recognition of input commands, voice controlled robotic arm for picking and placing an object was successfully designed. The robot control was found to be user friendly.

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