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Robotic Vehicle Control by Using Android Application

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Abstract : *Upcoming world would be more futuristic where robot will make an important role in our daily life of both fields industrial & social Our grant project Robotic Vehicle using Android Application is a smallest demo of these ultra-tech future. The project based on a simple concept where a car can be operating through Bluetooth signals of our daily uses smartphone. Microcontroller and ULN relay driver are use as control devices.*

Keywords: *Introduction of robotic vehicle, Design, Control Diagram, Manufacturing, Component used,*

I. Introduction

This project is design to control a robotic vehicle using android application. Blue tooth device is interface to the control unit on the robot for sensing the signals, which is transmitted by the android application. The data is conveyed to the control unit. This moves the robot as desired. An 89C51 microcontroller IC is use to interface Bluetooth module with relay.

Here makes a model of robotic vehicle. For the motion of robotic vehicle 150RPM, 12V gear motors are use. 12V rechargeable battery is use for the energy. The robot is possible to operate by using mobile phone. Here IC 8870 is use for convert DTMF signal in to binary signal. Here Atmel series 40 pin microcontroller IC having 4 port and each port has 8 pin input/output data pins is use for interface DTMF signal with gear motor. Here port 1 is use as an input port and port 2 is use as an output port. The current obtain from microcontroller IC is not sufficient to drive relay so for relay driving current buffer IC ULN2003 is use. To drive supply of gear motor relay are use.

II. Development Of Project

A. Project Design

The project design is specially divided into two major parts: -

1. Structural Design
2. Communicational Design

- Structural Design
  - Looking as like a car or any vehicle
  - Works with the help of gear motor
  - Hole the body structure should capable to carry all the equipment, including battery, circuits & motor.
- Communicational Design
  - Works through electric power as 12V battery
  - Android smart phone use as a remote.
  - Microcontroller & ULN relay driver are used as control panel.

B. Component Selection

There various component will be used for this project, which makes an important role for overall project output. So, component selection plays a critical value.

Component selection is describing briefly here

1. Body Material

The body structure is made by aluminium alloy for higher strength with less weight. Less weight increases more battery backup. And aluminium alloy makes a great performance by resisting corrosion and dashing look.

2. Wheel

Wheel of this robotic vehicle also made by aluminium alloy with rubber or plastic with rubber. And the diameter of this wheel is not more than 3 inch.

3. Extra arm

An extra arm is mounted with the main body for working purposes like trolley for carrying, hand arm for lifting etc.

4. Power Source

Power source is the main part of any kind of robot to operate motors and other controlling devices, and mostly it's given by battery. More battery provides more power. For robotic vehicle 12 V is suitable. Current rating depends upon as usual working purpose. For more power 24 V also use with higher current rating.

Here 12 V, 10 Amah battery are used for this project.

5. Motors

For the motion of robotic vehicle at left side, at right side, at front side and at back side, gear motors are used, stepper motor also use for any rotational motion or angular movement which convert electrical energy in to mechanical energy.

Selection of motors is very difficult for various types with different ratings are available in market. 100-400 watts, 12 V to 24 V, and 100 rpm to 3000 rpm ratings motors are normally used in robot. It is selected by requirement and here 12 V, 150 rpm 100-watt gear motor are used.

6. Blue Tooth Module

Here blue tooth module is used to receive android signal from cell phone and send to microcontroller IC.

7. DTMF to Binary Converter

This section is use for convert DTMF signal into binary signal. The DTMF signals obtain from cell phone is connecting to the input of DTMF to binary converter. From this section 4 outputs are obtaining that is connected to the input of microcontroller IC. Here for this IC 8870 is use.

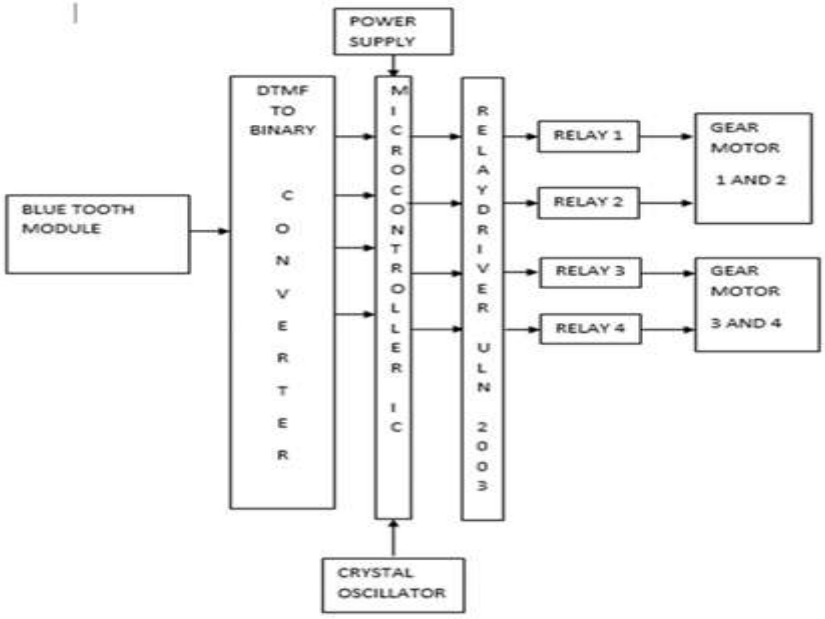

Fig. 2.1 Microcontroller IC

8. Microcontroller Ic- AT89C51: -

The AT89C51 controller are optimize for control applications. It is low power, high performance HMOS 8bit microcomputer with 8k bytes of flash programmable and erasable read only memory (EPROM). The program memory to be reprogrammed in system by allowing the on chip flash or by a conventional non-volatile memory programmer.

 Pin Descriptions

AT89C51.

It consists of four input output ports like Port 0, Port 1, Port 2, and Port 3.

Port 0

It is an 8-bit open drain bi-directional input port. When 1s are written to port 0 pins can be used as high impedance inputs. It can be configured to be the multiplexed low order address/data bus during accesses to data memory and external program . It uses strong internal pull-ups when releasing 1's in this application. It also receives the programming and outputs the code bytes during program verification

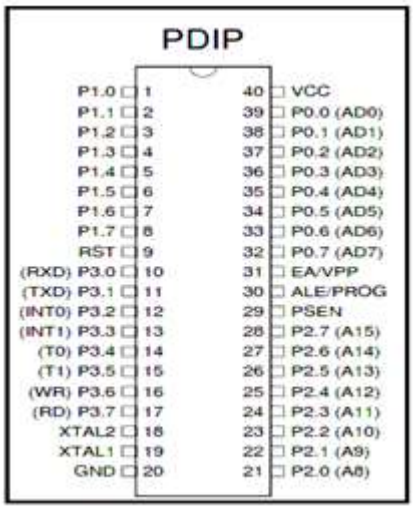

Fig. 2.2 MICROCONTROLLER IC-

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Port 1

It is an 8-bit bi-directional input port with internal pull-ups. The port1 output buffers can be sink/source four TTL inputs. When 1s are written to port1 pins, Then they are pulled high by the internal and can be used as inputs. As inputs, port 1 pins which are externally being pulled low, will source current because of the internal pull-ups. In addition it can be configured to be the timer/counter to external count port (P.0/T2) and the timer/counter 2-triggered input (P1.1/T2EX), respectively, refer the following table.

Port Pins	**Alternate Functions**
P1.0	T2 (External count inputs to timer/counter), Clock out
P1.1	T2EX (Timer/counter 2 capture/reload trigger and direction control)

Port 2: -

It is an 8-bit bi-directional input port with internal pull-ups. The port 2 output buffers can be sink/source four TTL inputs. When 1s are written to the port then they are pulled high by the internal pull-ups and can be used as inputs. It emits high order address byte during fetches from external program memory and during accesses to the external data memory that use 16-bit address (MOVX @ DPTR). In this application port 2 uses strong internal pull-ups when releasing 1s. Port2 also receives the high order address bits and some control signals during flash programming and verifications.

Port 3:-

Port 3 is an 8-bit bi-directional port with internal pull-ups. When 1s are written to the port then they are pulled high by the internal pull-ups and can be used as inputs. It also serves the function of special features of the AT8951. It also receives the high order address bits and some control signals during flash programming and verifications

Port Pins	**Alternate Functions**
P3.0	R x D (Series input port)
P3.1	T x D (Series output port)
P3.2	(External interrupt 0)
P3.3	(External interrupt 1)
P3.4	T0 (Timer 0 external)
P3.5	T1 (Timer 1 external input)
P3.6	(External data memory write-strobe is)
P3.7	(External data memory-read strobe is)

RST: -

Reset input is a high on this pin for two machine cycles, while the oscillator is running resets the device.

 ALE/PROG: -

Address latch enable is an output pulse for latching the low byte of the address during accesses to the external memory. This pin is program pulse input during flash programming. In normal operation ALE is emitted at a constant rate of 1/6 of the oscillator frequency and may be used for external timing and clocking purpose too.

 PSEN: -

Program store enable is read strobe to the external program memory. When the AT89c52 is executing code from external program memory, this pin is activated twice each machine cycle; expect that two activations are skipped during each access to external data memory.

 EA/VPP: -

External access enables, which is must be strapped to GND in order to enable the device to fetch code from external program memory locations is starting at 0000H up to FFFFH. It should be strapped to Vcc fir internal program executions.

 XTAL1: -

Input to the inverting oscillator amplifier and also input to internal clock operating circuit.

 XTAL2: -

It gives output from inverting oscillator amplifier.

 VCC: -

Implies supply voltage

 GND: -

Implies ground supply

 Cristal Oscillator: -

XTAL1 and XTAL2 are the input and output of an inverting amplifier which can be configured for the uses of an on-chip oscillator. Either a quartz crystal or ceramic resonator may be used for this function. It is use to provide external clock pulse for microcontroller IC.

9. RELAY DRIVER ULN 2003: -

The current obtain from microcontroller IC is not sufficient to drive relay so for relay driving current buffer IC ULN 2003 is use.

10. RELAY: -

Here relay 1 and 2 is use to drive supply of gear motor 1 and 2. As well as relay 3 and 4 is use to drive supply of gear motor 3 and 4

11. RESISTORS

SRNO	PART NO	VALUE OF PART
1]	R1	470KΩ
2]	R2	100KΩ
3]	R3	22KΩ
4]	R4	1KΩ
5]	R5 TO R8, R13	10 KΩ
6]	R9 TO R12	2.2KΩ

12. CAPACITORS

SRNO	PART NO	VALUE OF PART
1]	C1, C2	0.1µF
2]	C3, C4	22PF
3]	C5	4.7 µF

13. DIODES

SRNO	PART NO	TYPE
1]	D1 to D5	LED

14. ICS

SRNO	PART NO	IC MODEL
1]	IC1	8870
2]	IC2	89 S51
3]	IC3	ULN 2003

C. Manufacturing Process

The manufacturing process is also divided into two major parts: -

1. Structural Base
2. Communicational Base

➢ Structural Base: -

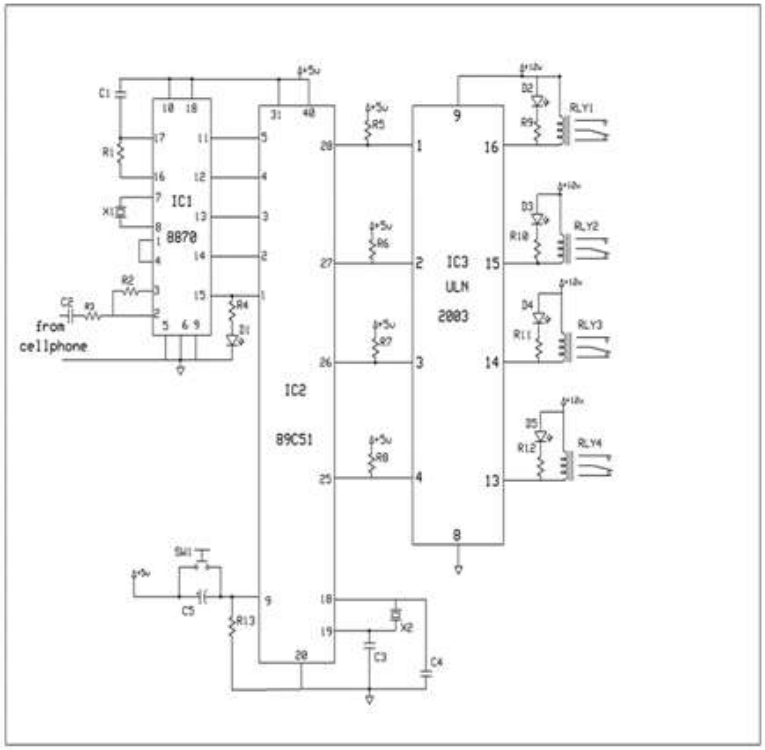
- Etching
- Soldering
- Fitting
- Welding
- Lamination

➢ Communicational Base: -

- Hardware installation
- Programing of Microcontroller
- Bluetooth connectivity

D. Required Tools

- Hacksaw Blade
- Welding Machine
- Nuts, Bolts & Screw
- Soldering Machine
- Steel Tape
- Drilling Machine
- Wrench
- Hammer
- Screw driver



III. Controlling & Working

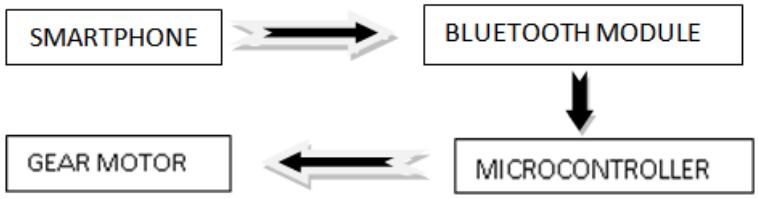
A. Circuit Diagram

There are different components are use for different function. Here we explain working of circuit step by step. Here speaker wire of cell phone is connected at pin no 2 of IC1. By this we send DTMF signal from cell phone at pin no2. Here IC1 is use for convert DTMF signal in to binary signal. The +VCC of this IC is at pin no 10 and 18 ground pin no are 5, 6 and 9. Crystal is connected at pin no 7 and 8. From this section 4 outputs are obtain which are at pin no 11, 12, 13 and 14. Which are connected at pin no 5, 4,3and2 of microcontroller IC respectively.

Here we use Atmel series microcontroller IC having 4 ports. + VCC of this IC is at pin no 31 and 40. Ground pin no is 20 crystals is connected at pin no 18 and 19. And for reset pin no 9 is use. Here port 1 is use as an input port and port 2 is use as an output port. Port 2 is connected to the input of IC3. Here IC3 is current buffer IC. The current obtain from micro-controller IC is not sufficient to drive relay so for relay driving current buffer IC ULN 2003 is use. Here +12-volt supply is connected at pin no 9 and ground pin no is 8. Here input pin no's are 1,2,3 and 4. And output pins are 16,15,14 and 13. Here output pin no is connected to relay 1 to 4. And switching terminal of relay 1 and 2 is connected to supply terminal of gear motor 1 and 2. Also switching terminal of relay 3 and 4 is connected to the supply terminal of gear motor 3 and 4.

A. Control Panel

Control panel should have minimum number of keys to operate entire vehicle. Here the main reference signals are generate by android smartphone and transmit via bluetooth and the other devices are work as follows:



IV. Application Area

1. It is applicable at industries.
2. It is applicable at house.
3. It is applicable at school and colleges for demonstration.
4. It is applicable at shops, and shopping malls for transport the material.
5. It is applicable mine to do work without human.
6. It is applicable in defense for national security

B. Advantage

- It is possible to operate robot by mobile phone.
- Due to the use of rechargeable battery life of battery is more.
- Due to the use of gear motor torque of gear motor is more.
- There is no complicated wiring.
- It has low maintenance.
- It has low energy consumption.
- It has Low cost.
- It is useful to prevent air pollution.
- Easy to construction.
- It has Small in size.

C. Limitation

- Cannot be controlled from long distance.
- Cannot use hole day, depends upon battery capacity.
- Installation cost may be increase, depends upon size and fetchers.
- Only smartphone can control/operate this car or vehicle.

D. Future Modification

- Here we operate robotic vehicle by using cell phone. It is possible to operate by using TV remote. For this TSOP sensor is necessary.

- Here the size of circuit is big. It is possible to decrease size by using microcontroller VLSI IC.
- Here we operate robotic vehicle. It is possible to connect robotic arm to the vehicle. For pick and place purpose
- Here we charge the battery of robotic vehicle by electrical energy. It is possible to charge by using solar panel
- Here we make robotic vehicle it is possible to connect agriculture machines to do work of field.
- It is possible to connect generator to the robotic vehicle due to this when the robotic vehicle work then robotic vehicle generate electrical energy and by this we charge battery of robotic vehicle.
- It is possible to connect this system for robotic tank and by this it is possible to fire on enemy.
- It is possible to connect this system to the ship.
- It is possible to connect sensors at front side of vehicle due to this if any object came in front of vehicle then direction of vehicle is automatically change.

V. Conclusion

By making this project we conclude that this project is very useful for industries. Also it is possible to operate robotic vehicle by using RF frequency. Where mobile tower range is not available.

By making this project we learn following things: -

1) Importance of project.
2) Selection of project.
3) Connection of gear motors.
4) Working of battery and there charging system.
5) Making figure on the paper by using books and internet.
6) Making layout on the paper and on the copper clad.
7) Etching process, fitting process, component selection, measurement and mounting, soldering for fault finding and circuit tracing system.
8) Explanation of project.

By this project we give real practical knowledge. By this we confidently say that this knowledge it useful to stand us on our leg for earning.

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