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Remote Vehicle Control through Cell Phone Using DTMF

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Abstract: ***The aim of the proposed project is to use a mobile phone to drive a car. The project necessitates the use of two mobile phones, one to control the robot and the other to deliver DTMF signals to the robot vehicle. The commands are received by a DTMF decoder connected to an 8051 microcontroller, which then controls the vehicle movement with the help of a motor driver. Thus, with the motor driver IC, two DC motors enable vehicle movement based on commands supplied from the phone. The power source is a battery. New technologies can be implemented using a robotic vehicle. The Dual Tone Multi Frequency (DTMF) system is utilised to control the robot. In everyday life, DTMF technology can be valuable. To this generation, DTMF technology is unrivalled. The science of Digital Signal Processing underpins DTMF technology. Previously, a Radio Frequency circuit was employed for wireless control, but it had a significant disadvantage in terms of range. As a result, it restricts control and has a negative impact on the vehicle's performance. DTMF, on the other hand, transforms this deprivation of the Radio Frequency circuit into domination. It gives you a wider range of options for working and produces better results. The phone in the microcontroller is used to operate and maintain this system. The remote handling operation of a robot using Dual Tone Multi Frequency is referred to as wireless communication.***

Keywords: ***Dual Tone Multi Frequency, Voltage Regulator, Microcontroller, Cell phone, Motor Driver, DC Motor.***

I. INTRODUCTION

An Embedded System is a combination of computer hardware and software, as well as mechanical and other components, that is designed to execute a certain task. An embedded system is not processing-only computer, nor is it a PC or UNIX software system, nor is it a traditional commercial or scientific application. There are two types of embedded systems: high-end and low-end. High-end embedded system having 32-bit or 64-bit controllers and an operating system. Lower-end embedded systems - Typically, 8,16-bit controllers are utilised with limited operating systems and hardware layouts created specifically for the purpose.

II. OBJECTIVE

The purpose of this paper is that the robot is operated using DTMF technology, which allows it to be commanded through a GSM network. The phone's keypad serves as a remote control for the vehicle's movement. As it is not an Automated Guided Vehicle (AGV), the vehicle will be operated manually. The Robots which are controlled by wireless communication use radio frequency circuits, but they are having some disadvantages like limited operating range, a limited frequency range, and limited control. It offers reliable control and a working range as large as the service provider's coverage area.

III.RESEARCH METHODOLOGY

The approaches utilised for the design of the hardware and software pieces are described in this study. A block diagram is used to plan out project operations[1]. To alleviate this problem, a radio frequency circuit is employed for a short distance. The usage of Dual Tone Multi Frequency is for long-distance communication. The main goal of this project is to use Dual Tone Multi Frequency to drive a car.

A. Components Required

- VOLTAGE REGULATOR
- MICROCONTROLLER (AT89S52/AT89C51)
- PUSH BUTTONS
- DTMF DECODER
- L293D MOTOR DRIVER

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- DC MOTOR
- LED
- 1N4007
- RESISTORS
- CAPACITORS
- BATTERY

1) Voltage Regulator

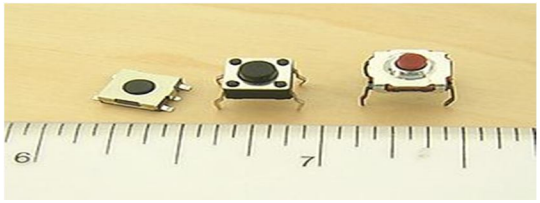
The three-terminal positive regulators of the LM78XX/LM78XXA series are available in the TO-220/D-PAK package and with a variety of fixed output voltages, making them suitable for a wide range of applications. They can deliver over 1A output current if appropriate heat sinking is given. Although these devices are generally designed as fixed voltage regulators, they can be used in conjunction with external components to achieve variable voltages and currents.

2) Microcontroller

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density non volatile memory technology and is compatible with the industry standard 80C51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional non volatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications.

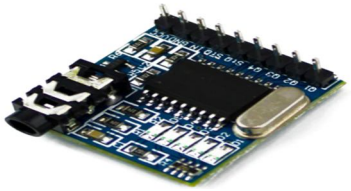
3) Push Buttons

A basic switch mechanism for controlling some part of a machine or process is a push-button (sometimes written pushbutton) or simply button. Buttons are commonly composed of hard materials such as plastic or metal. The surface is usually flat or contoured to allow the human finger or hand to easily depress or push it. The "pressing" of the button is referred to by a variety of names, including press, depress, mash, and punch.



4) DTMF Decoder

The MT8870D/MT8870D-1 is a full-featured DTMF receiver that includes both a band split filter and a digital decoder. The audible sounds you hear when you push keys on your phone are known as dual-tone multi-frequency (DTMF, sometimes known as touch-tone). The tone generator (top) is controlled by a DIP switch and a 5589 chip. Through the speaker, you can actually hear the tones.

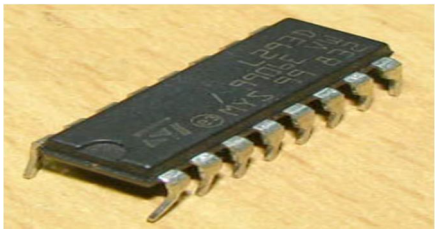


The 8870 is used in the bottom circuit to decode a tone and display the number associated with it on the 7-segment LED. Many people are familiar with touch-tone (telephone), and it is a mature technology that can be easily implemented with off-the-shelf, single-chip, low-cost components. For these reasons, DTMF is commonly used in telephone-based remote control applications (e.g., accessing messages from an answering machine, requesting account balance information from your bank's database).

5) L293D MOTOR DRIVER

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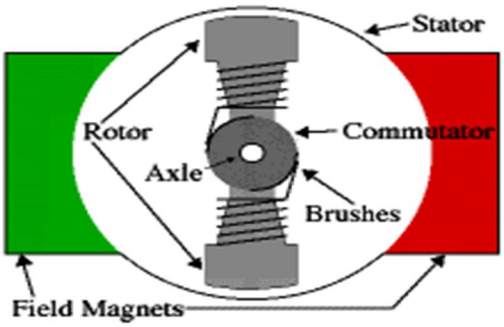
The integrated circuit L293D is a dual H-bridge motor driver (IC). Because they take a low-current control signal and convert it to a higher-current signal, motor drivers operate as current amplifiers. The motors are driven by this increased current signal.



Two DC motors can be driven in both forward and reverse directions simultaneously in the common mode of operation. Input logic at pins 2 and 7 and 10 and 15 can control the activities of two motors. The appropriate motor will be stopped if input logic 00 or 11 is used. The linked driver is enabled when the enable input is high. As a result, the outputs become active and work in sync with their respective inputs.

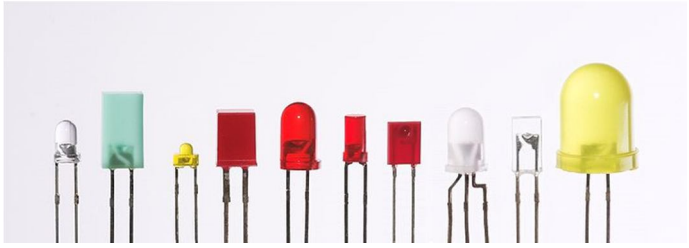
6) DC MOTOR

An electric motor that runs on direct current (DC) is known as a DC motor. When a current-carrying conductor is put in an external magnetic field, it will experience a force proportional to the current in the conductor as well as the strength of the external magnetic field. We know that with magnets, opposite polarities (North and South) attract, whereas like polarities (North and North, South and South) repel.



7) LED

A semiconductor light source is a light-emitting diode (LED). LEDs are rapidly being employed for lighting and as indication lamps in a variety of applications. When a light-emitting diode is forward biased (turned on), electrons within the device can recombine with holes, releasing energy in the form of photons. Because LEDs have a small surface area (less than 1 mm2), integrated optical components can be employed to alter the pattern of light they emit.



Light-emitting diodes are utilised in a variety of applications, including aviation lighting, car lighting, and traffic signals. LEDs' small size, narrow bandwidth capability, fast switching speed, and exceptional dependability have enabled the development of novel text and video displays and sensors, while their high switching rates are also valuable in sophisticated communications technologies.

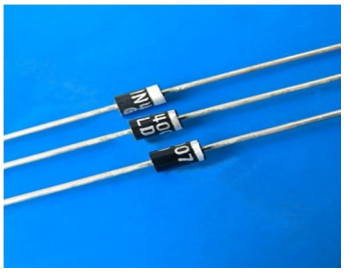
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8) 1N4007

To convert AC to DC, diodes are employed. When employing any type of diode, three things must be kept in mind.

a) Maximum forward current capacity
b) Maximum reverse voltage capacity
c) Maximum forward voltage capacity



Diodes with similar capacity can be substituted for one another. Aside from that, a higher-capacity diode can be used in place of a lower-capacity diode, but a lower-capacity diode cannot be used in place of a higher-capacity diode.

9) Resistors

An electronic component that opposes current by producing a voltage which is dropped between its terminals that is proportional to the current is called as Resistor. As defined by Ohm's law:

$$IR = V$$



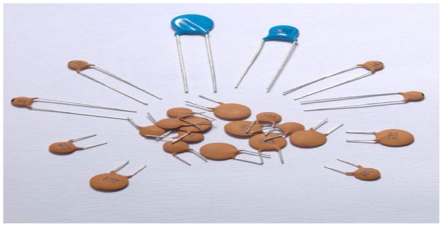
Electrical networks and electronic circuitry both employ resistors. They're found in almost every piece of electrical equipment. Resistors are distinguished by their resistance and the amount of power they can dissipate. Temperature coefficient, noise, and inductance are some of the other qualities. Critical resistance, the value below which power dissipation limits the maximum allowed current flow and over which applied voltage sets the limit, is less well-known. Critical resistance is determined by design and is dependent on the materials that make up the resistor as well as its physical size. Resistors, like hybrid and printed circuits, can be used in integrated circuits. Equipment designers must consider the size and location of leads (or terminals); resistors must be physically large enough to avoid overheating when dissipating their power. When a voltage V is put across a resistor's terminals, a current I flows through the resistor in direct proportion to the voltage.

10) Capacitors

A capacitor has two terminals. They are one of the most basic passive components simultaneously with resistors and inductors. Capacitors have similar to a fully charged electric battery. A capacitor, also known as a condenser, is an electrical component that consists of two conductors separated by a dielectric. An electric field exists in the dielectric when the conductors have a voltage potential difference. This field stores energy while also exerting a mechanical push on the plates. The effect is strongest between conductors that are wide, flat, parallel, and closely spaced. Capacitance, which is measured in farads, is the only constant parameter that defines an ideal capacitor. In practise, a little amount of leakage current travels through the dielectric between the plates. The analogous series resistance is introduced by the conductors and leads, and the dielectric has an electric field strength limit as a result in breakdown voltage.

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11) Battery

An electrical battery is made up of one or more electrochemical cells that work together to transform chemical energy into electrical energy. Many domestic and industrial applications now employ batteries as a power source. Batteries can be used once and then discarded, or they can be refilled and used in standby power applications for years.

B. Software Used

Keil software is used for implementation of our project.

1) Introduction to Keil Micro Vision

Keil µVision2 is a free programme that alleviates many of the problems that an embedded programme developer faces. This programme is an integrated development environment (IDE) that includes a text editor, a compiler, and the ability to convert source code to hex files.You can create software applications with the Vision Project Manager and Run-Time Environment by leveraging pre-built software components and device support from Software Packs. Libraries, source modules, configuration files, source code templates, and documentation are among the programme components. To support a wide range of devices and applications, software components might be generic.The integrated Vision Editor has all of the basic capabilities of a source code editor and used while debugging. For C/C++, colour syntax highlighting, text indentation, and source highlighting have been streamlined.

Keil software is a cross compiler.

2) Concept of Compiler

Compiler is a program which is used to convert the high level language to byte code , machine language or object based code. The compiler analyses the whole source code and then it collects and rearrange the instructions without modifying the definition of the code.

We have interpreters also but they are different from compilers. Interpreter is a program that directly executes the instructions but compilers analyses and executes each line of the source code.

The programs which are created by compilers can run faster than the same programs executed by interpreters.

3) Concept of Cross- Compiler

Compilers are programmes that run on one machine and generate code for target microprocessor Ike 8051 on the host processors. A cross compiler is one that is capable of producing executable code for platforms other than the one on which it is now executing. To build executables for installed systems or multiple platforms, cross compiler tools are utilised. Cross development refers to the process of writing code for another environment while working in one environment. Cross compiler is the name of the compiler used for cross development. The compiler s used for cross development are called cross compilers.

4) Keil c cross Compiler

Keil is a German based software development company which provides several tools like IDE, Project manager, simulator, debuggers, c compilers mainly three tools

Assembler

Compiler

Linker

The C source code is compiled into an object file using a compiler. To make an absolute object module appropriate for our in-circuit emulator, we need a linker.

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5) *Building an Application in µVision2*

a) First select project (any appropriate name for the project to be created)

b) Select project (Build target or rebuild all target files. Vision2 assembles, connects, and compiles the files in your project.)

6) *Creating our Own Application in µVision2*

Now we create a new project in µVision2. For that we must follow below steps:

a) Select Project - Choose New Project from the drop-down menu.

b) Choose a directory and type the project file's name.

c) Select Project - Select Device from the Device Database and choose an 8051, 251, or C16x/ST10 device.

d) To add to the project, create source files.

e) Select Project - Targets, Groups, and Files from the drop-down menu. Select Source Group1 under Add/Files and add the source files to the project.

f) Set the tool choices under Project - Options. All special parameters are set automatically when you pick the target device from the Device Database. The memory map of your target hardware is usually all that needs to be configured. For most applications, the default memory model parameters are ideal.

g) Select Project - Select Rebuild all target files or Build target from the Project menu.

7) *Debugging an application in µVision2*

Now we are debugging the created application using Microvision2. To debug follow below steps:

a) Select debug - Start/Stop Debug Session is visible, select it. Now here breakpoints comes in debugging. Breakpoints are points in the program that makes the program execution to stop or halts. Check for breakpoints and perform required insert or remove operations to fix

b) By using Step toolbar buttons for analyses of program in single-step. Then enter G, main in the output window for execution of the main C function in the program.

c) Now search for Serial Window and open it using #1 button on the toolbar.

d) For debugging the program use standard points like Step, Run, Step-out, Go, Break, step over and so on.

8) *Starting Microvision2 and Creating a Project*

µVision2 is popular windows application.

a) First click on the program icon

b) For creating a new project select New Project from the Project menu of Microvision2.
It opens default Windows dialog which asks for project file name.

c) We should use separate folders for every project we create.

d) To maintain separate folders- directly click on Create New Folder to get an empty folder.

e) Then select the created empty folder and save the new project with the file name like Project1 or Project Dtmf.
After giving the file name µVision2 creates a new project file with the given file name.

f) This project file contains default targets and group name of the file. They are visible in the Project itself.

9) *Windows-files*

Select a CPU for your project from the Project – Select Device for Target menu. The Vision2 device data base is displayed in the Select Device dialogue box. Simply choose the microcontroller you want to use. The Philips 80C51RD+ CPU is used in our examples. This option configures the 80C51RD+ device with the relevant tool options, making tool configuration easier.

10) *Building Projects and Creating a HEX Files*

a) Open the created project in the keil IDE.

b) Click the drop-down box menu in the project. Then select the Targets option.

c) We must translate the source files and application line by clicking on the Build Target icon.

d) If the application has any syntax errors. They are visible by Microvision2 in the Output window. Check for the errors and warning if any by double click on the message to display in the source file in the Microvision2 editor window. Make suitable corrections according to the errors and warning then the application is ready to debug.

e) After testing the application, it's time to create an Intel HEX file for downloading the software into an EPROM programmer.
f) When Create HEX files under Options for Target – Output is enabled, Vision2 creates HEX files throughout each build session.
g) When you specify the programme under the option Run User Program #1 following the make process, your PROM programming utility will start.

11) CPU Simulation

µVision2 simulates up to 16 Mbytes of memory, from which read, write, and code execution access can be mapped. Illegal memory accesses are caught and reported by the µVision2 simulator. The simulator supports the integrated peripherals of the many 8051 versions in addition to memory mapping. The Device is used to configure the on-chip peripherals of the CPU you've chosen.

12) Database Selection

When you create your project aim, you have made a choice. For additional information about choosing a device, see page 58. The Debug menu allows you to select and display the on-chip peripheral components. The controls in the dialogue boxes can also be used to adjust the aspects of each peripheral.

13) Start Debugging

The Debug - Start/Stop Debug Session Command activates Vision2's debug mode. Vision2 will load the application programme and perform the start up code based on the Target – Debug Configuration Options. Vision2 saves the editor screen layout and restores the last debug session's screen layout. If the programme execution halts, Vision2 displays CPU instructions in the disassembly window or opens an editor window with the source text. A yellow arrow indicates the next executable statement. Most editor features are still available during debugging.

14) Disassembly Window

The programme execution is shown in assembly code or mixed in with the source code in the Disassembly Window (device dependent). All debug-stepping commands function on the assembly level when the Disassembly Window is the active window.
Open the disassembly Window by view menu then disassembly window:

- View - Trace - Enable Trace Recording enables the trace history.
- To rapidly access commands or set parameters, use the Context Menu.
- By clicking into the left (colored) margin, you can set breakpoints.

All programme step instructions function on the CPU instruction level rather than programme source lines if the Disassembly Window is selected as the active window. Using toolbar buttons or context menu commands, you can pick a text line and set or modify code breakpoints.
To change the CPU instructions, we can use the dialogue Debug – Inline Assembly... This allows you to rectify errors or make temporary changes to the debugged target programme. There are numerous sample programmes available to assist you in getting started with the most common embedded 8051 devices.
Your 8051 device's on-chip peripherals (I2C, CAN, UART, SPI, Interrupts, I/O Ports, A/D Converter, D/A Converter, and PWM Modules) are correctly simulated by the Keil Vision Debugger. Simulation aids in the understanding of hardware setups.

15) Embedded C

The C Standards Committee created Embedded C as a set of language extensions for the C programming language to solve issues of similarity between C extensions for different embedded devices. Fixed-point arithmetic, named address spaces, and basic I/O hardware addressing are among the features not accessible in standard C. The main() function, variable definition, datatype declaration, conditional statements (if, switch case), loops (while, for), functions, arrays and strings, structures and union, bit operations, macros, and so on are all used in embedded C. Embedded processors are widely used in passenger cars, mobile phones, medical equipment, aerospace systems, and defence systems, and even common household appliances like dish washers, televisions, washing machines, and video recorders now contain at least one of these devices.

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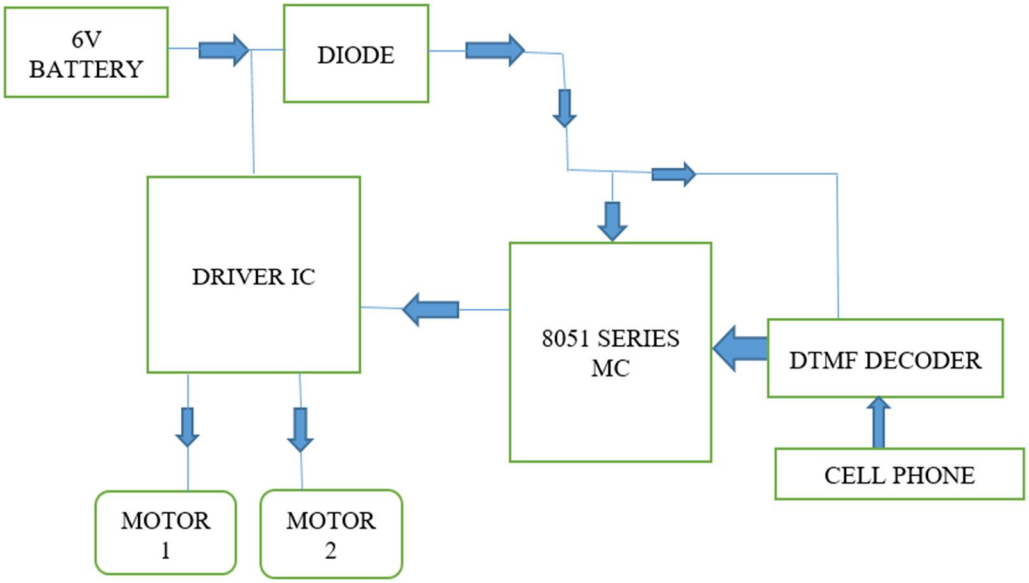


Figure BLOCK DIAGRAM

The above block diagram represents the way in which the components are connected together for achieving the common goal or output for the system. Here the 6v Battery is used for power supply to the system. Diode is used for converting AC power to DC power if input power supply is AC. The commands are received by a DTMF decoder connected to an 8051 microcontroller, which then controls the vehicle movement with the help of a motor driver whereas the DTMF (Dual Tone Multiple Frequency) decoder IC is used to decode keystrokes similar to those on a telephone [3] and Because motor driver IC take a low-current control signal and convert it to a higher-current signal, they operate as current amplifiers. The motors are driven by this increased current signal.

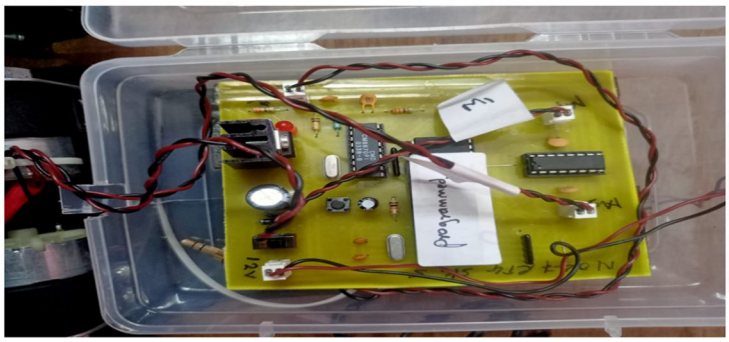
C. Working

- The DTMF robotic vehicle requires two mobile phones each at both the ends. Both the mobile phones are used for passing command to the robotic vehicle in which one works as a transmitter and the other as receiver.
- The transmitter mobile passes commands to the receiver mobile which transfers commands to the robotic vehicle. To control the robotic vehicle[7], we have to call receiver mobile from the transmitter mobile.
- These mobile phones acts as a dual tone frequency generator. The tone or frequency generated depends on the key strokes pressed. When a call is made from the transmitter mobile, The receiver mobile accepts the call to the specified contact and according to the keypad pressed in the transmitter mobile, the actions are performed from the list of commands as code saved in the microcontroller.
- The DTMF decoder is used to decode the received tone, thus giving the binary equivalent of received tone. With the help of DTMF decoder, the received frequency is processed by the 8051 microcontroller. The 8051 is programmed accordingly using the Keil software to execute the appropriate commands.
- Further the output result of the microcontroller is given to the Motor Driver IC, which is connected to the two DC Motors[10]. The Motor Driver IC helps in handling of the DC Motors, which are useful for the vehicle movement.
- When a Key gets pressed on the transmitter mobile, received by the receiver mobile and the DTMF decoder attached to it will decode the signal to binary equivalent and gives to the 8051 microcontroller, Which in with the help of programming converts binary number to appropriate commands. These commands are passed to the driver motor, which further passes these commands to the DC motors to rotate the motors and thus moving the vehicle. In this way according to the commands given by the Driver Motor, The vehicle moves in different directions.

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IV. CONCLUSION

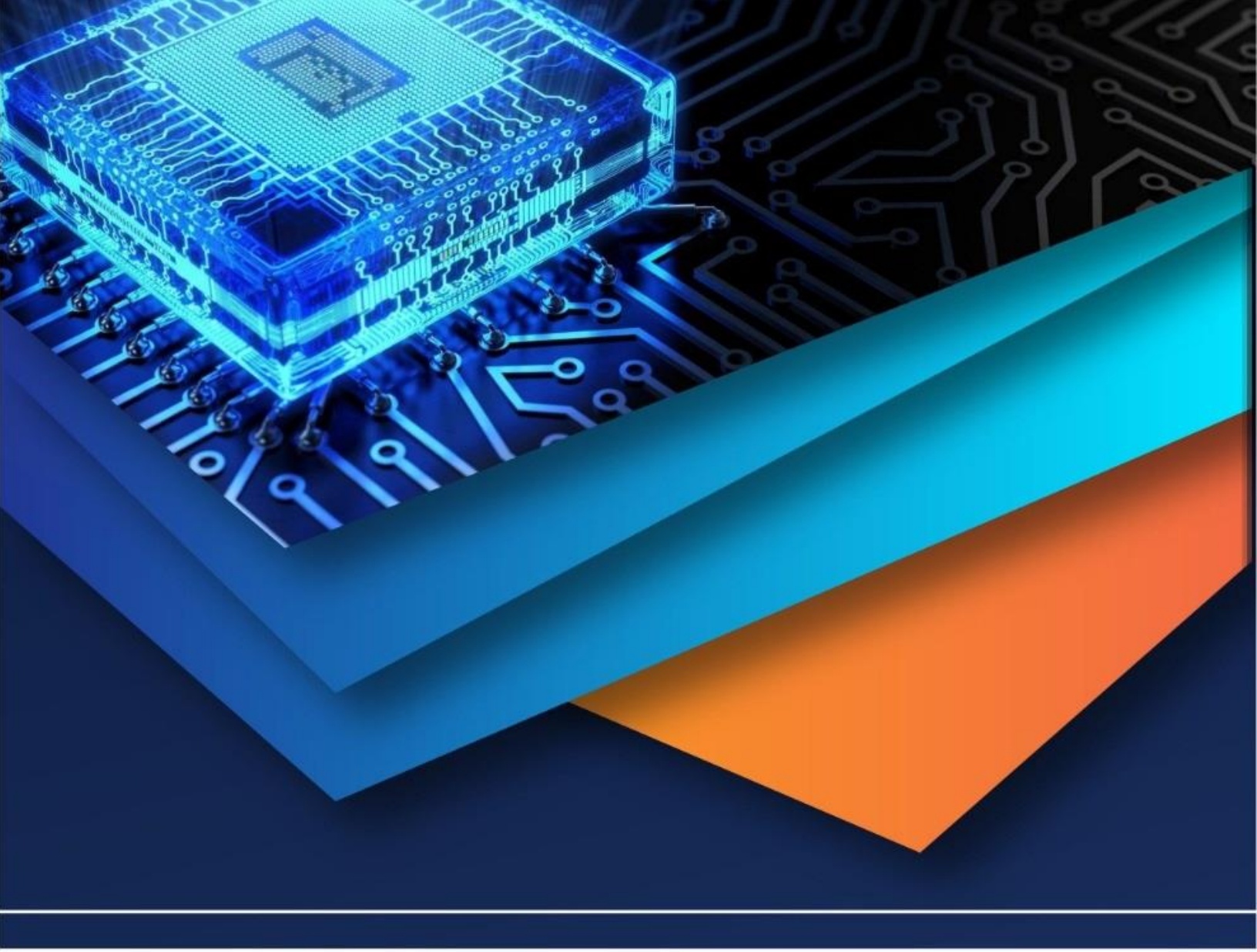
From the work we have done, it is concluded that mobile based operating vehicles can be designed using Microcontroller (AT89S52/AT89C51), DTMF decoder(MT8870D/MT8870D-1), IC 7404, two mobile phones and Motor Drivers(L293D). The commands are received by a DTMF decoder connected to an 8051 microcontroller, which then controls the vehicle movement with the help of a motor driver. Thus, with the motor driver IC, two DC motors enable vehicle movement based on commands supplied from the phone. The power source is a battery. The commands are received by a DTMF decoder connected to an 8051 microcontroller, which then controls the vehicle movement with the help of a motor driver. Thus, with the motor driver IC, two DC motors enable vehicle movement based on commands supplied from the phone. The power source is a battery.





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