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Cell Phone Controlled Robotic Vehicle

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ABSTRACT

As wireless control is widely used nowadays because of their wide range of control. The wireless controlled robots use RF circuits, which were run-over by wireless control using mobile network, but both have the drawbacks of limited range & operation. The operation of control using mobile network is limited with the availability of cellular network. This drawback can be removed by replacing cellular signal with satellite signal. This enables the user to control the robot in remote areas too.

Keywords: DTMF, Motor Driver, Microcontroller, GSM Network.

I. INTRODUCTION

As mentioned above, the operation of control using RF circuits have a limited range, limited frequency, whereas cellular network has a broad range but cannot be used in remote areas. So to overcome these drawbacks, satellite network can be used. As using a satellite phone would sharply increase the cost of the project, so by converting a GSM Phone to a satellite phone is an easy way to reduce the cost of the project. This can be done by using the **Thuyara Sat Sleeve** gadget, which will convert a simple GSM Phone to a satellite phone. It has robust control, a wide range (where satellite signals are present i.e. in 154 countries) and we can have up to 12 controls.

Figure 1. Thuyara Sat Sleeve

II. METHODOLOGY

As our project is based on control of a robotic vehicle using cell phone that makes a call to the mobile phone attached to the robot. The keypad of Mobile Phones is associated with Dual Tone Multi Frequency (DTMF) which provides two output frequencies (one high band frequency and one low band frequency). During the call, if any button is pressed, a tone corresponding to the button pressed is heard at the other end of the call. This tone is called as Dual Tone Multiple frequency Tone.

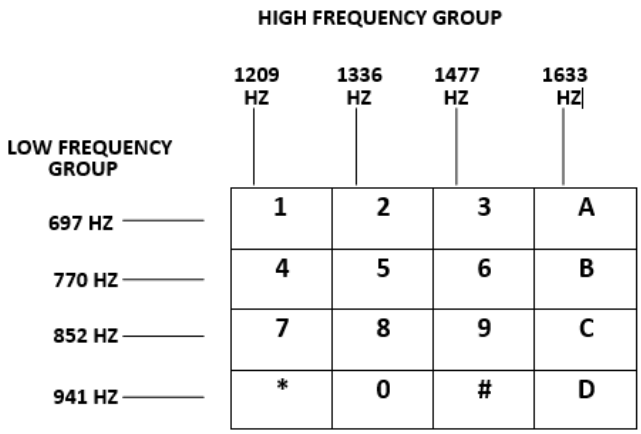

Figure 2. Frequency of Respected Keys

Above figure shows the frequencies of respected keys of keypad. The mobile phone works as a remote to control the robot. This project can be used in military works for surveillance across borders, for archaeological surveys, forest conservation etc.

Our aim is to prepare an unmanned robotic vehicle which can be used for military uses and archaeological surveys. The receiver phone is directly connected with the DTMF Decoder. The Dual-Tone is received by the DTMF Decoder through the phone stacked with the robot. The received tone is decoded by the DTMF Decoder into its equivalent binary digit and this binary number is sent to the microcontroller. The microcontroller is pre-programmed to take a decision for any given input which outputs this input to motor driver to drive the motor to move forward or backward or turn in either direction. The mobile that makes a call acts like a remote. So this project doesn't require any additional transmitter and receiver sections.

III. FRAMEWORK OF THE SYSTEM

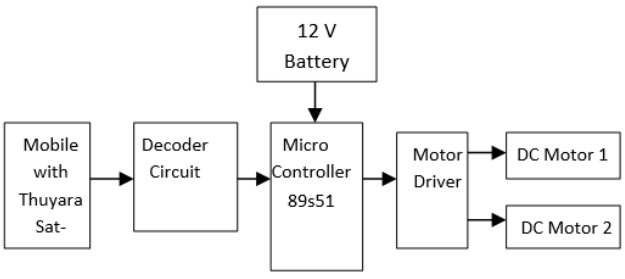

Figure 3. Block Diagram of the Project

The microcontroller 89s51 is the heart of the project programmed in embedded C with help of KIEL Compiler. When the user will call the phone connected to the robot(the other phone must be in auto answer mode), the phone through which call is made behaves as remote and when any key is pressed the DTMF tone is sent by the cell phone is received by the cell phone connected with the robot which is connected with decoder circuit which decodes the dual tone into binary code. The binary code generated by the decoder circuit is sent to the microcontroller which sends command to the motor driver to move the robot. The motor driver is connected with two motors, one holds the forward and reverse operations and other sideways (right & left) operations. The different commands for different buttons are already programmed, suppose if 2 is pressed, the robot will move forward and for 8, 4, 6 the robot will move in reverse, left and right direction respectively and 5 to stop the vehicle.

Cameras are to be used for surveillance and robust control and to control the robot from a distance. Proximity sensor is to be assembled to prevent the robot from any obstacle. When an obstacle occurs in the way of robot, the proximity sensor will detect it and automatically the robot will stop and it will wait for the command from the user. Same will happen if fire will be detected.

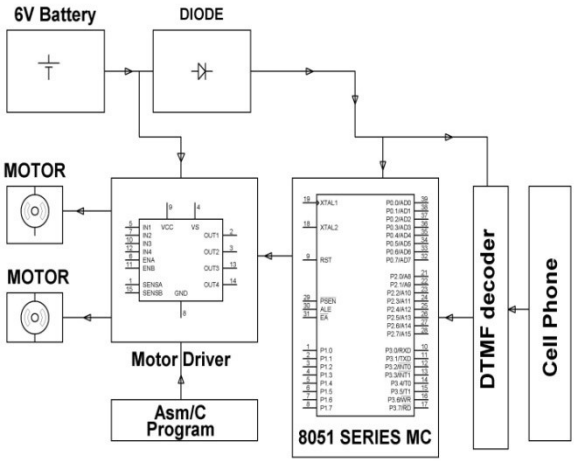

Figure 4. Circuit Diagram of the Project

IV. FEATURES

1. Microcontroller:

The microcontroller used here is ATMEL 89s52 which has 8K Bytes of In-System Programmable (ISP) Flash Memory.

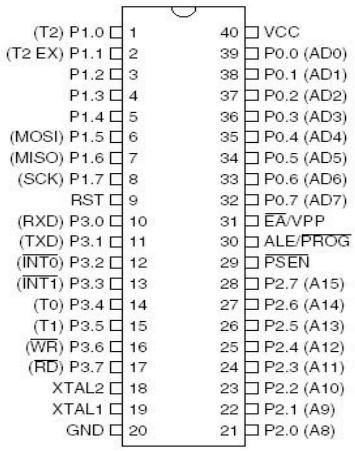

Figure 5. Circuit Diagram of Microcontroller

Features of this type of Microcontroller:

- The operating range of this type of microcontroller is 4.0V to 5.5V.
- It has fully static operation i.e. 0 Hz to 33 MHz.
- ATMEL 89s52 microcontroller has 256 x 8-bit internal RAM, 32 programmable I/O lines.
- It has three 16-bit timer/counters, eight interrupt sources and full duplex UART serial channel.

2. Motor Driver:

In this robot a dual H-bridge motor driver L293D integrated circuit (IC) is used. Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors. L293D contains two inbuilt H-bridge driver circuits. In its common mode of operation, two DC motors can be driven simultaneously, both in forward and reverse direction.

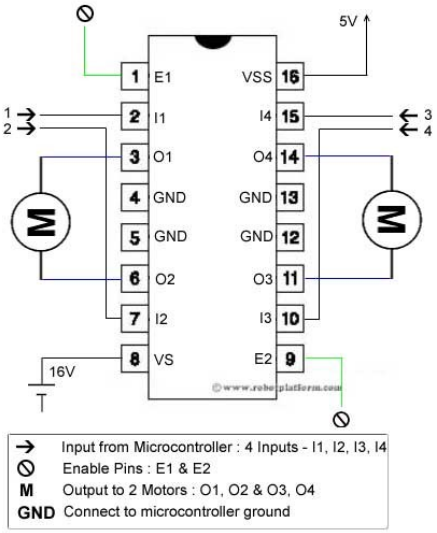

Figure 6. Pin Diagram of Motor Driver L293D

Some other features of Motor Driver L293D are:

- Wide Supply-Voltage Range: 4.5 V to 36 V.
- Separate Input-Logic Supply.
- Internal ESD Protection.
- Thermal Shutdown.
- High-Noise-Immunity Inputs.
- Output Current 1 A per Channel (600 mA for L293D).
- Peak Output Current 2 A per Channel (1.2 A for L293D).
- Output Clamp Diodes for Inductive Transient Suppression (L293D).

3. DTMF Decoder:

MT8870 DTMF decoder is used in this robot. It helps in providing a decoded value for particular key pressed, by which a particular motor works associated with the command to move in the required direction.

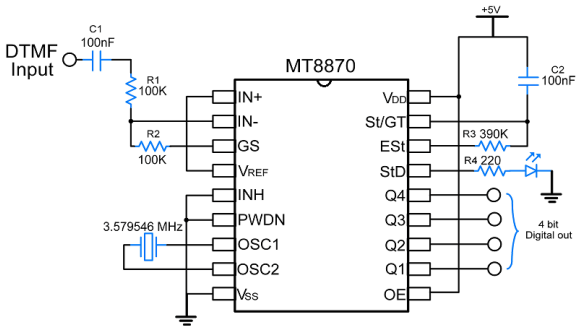

Figure 7. Basic connections of MT8870 DTMF Decoder

Various features of DTMF Decoder MT8870:

- Decodes DTMF as 4 bit binary
- TTL level output for direct connection to microcontrollers
- Low power 5V DC operation
- Based on excellent MT8870 IC

4. Thuyara Sat-Sleeve:
   This device/gadget from the leading satellite phone company Thuyara is used to convert a simple cell phone into a satellite phone. This is done to expand the working area of the robot and can be used in remote areas where mobile network is not available.
   Various Features of Thuyara Sat-Sleeve:

- Very light weighted only 171g.
- Can be easily connected with the phone via 3.5 mm jack.
- Operating temperature -10 C to 55 C.
- Power supply Output DC 5V / 2.0A.

5. Power Supply:
   Power supply of 12V is used to run the robot.

6. Proximity Sensor:
   Proximity sensor is used to protect the robot from any obstacle or any fire in the way of robot.

V. MODIFICATIONS FOR VARIOUS FIELDS

This project can be used in multiple fields with some modifications with context with the requirement. As it is small, lightweight, compatible and a robust robot, so these features give extra advantages to be used in various fields.

1. Defence

It can be a very useful thing in a defence system for border surveillance by fixing multiple cameras with night vision mode so that it can work in night too.

This robot can be used in wars by mounting a gun on it like RS1A3 Mini Rex Armed Robot made by Russia. This can help in saving loss of life in wars.

This robot can be used for spying purposes to have an eye on the enemy and be updated from all their actions. The robot can be made self-destructing as if in case the robot is going to be caught. Self-destruction of the robot hides the user's identity and by self-destructing by going near to the enemy, it can also work as war robot.

2. Rescue Operations

This robot can be used for rescue operations by installing PIR (Passive Infrared Sensor) sensor with it. It is a pyroelectric sensor, which generates energy when exposed to heat. The PIR sensor absorbs the heat of a human being who is under any debris or buries under snow due to any natural hazard and the sensor is energized and gives indication of the buried life.

3. Archaeological Surveys

For archaeological surveys mainly in remote areas, this robot controlled with satellite phone is suitable. The robot is to be fitted with GPR sensor so that anything beneath the earth can be detected by it and give signal to the user. As it is a small gadget, so it can make its own path and can work in congested places where no other gadgets can work.

4. Forest Conservation

This robot can help in forest conservation as it can help the forest officers to keep an eye on the various activities of the forest. It can help in controlling deforestation and keep an eye on habitat of the animals.

VI.CONCLUSION

This robot has multi-tasking features and the drawbacks that were seen in communication through RF Circuits and mobile network communication has been overcome by the combination of satellite and mobile network combination. It has various sensors and various modifications can be done as per its requirement. It can come up with many advantages in the defence system, archaeological surveys, rescue operation and forest conservation.

VII. REFERENCES

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