MOBILE CONTROLLED ROBOT

Using DTMF and Arduino

PROJECT REPORT

Digital Logic and Design (CSE1003)

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Slot:B1

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(SCHOOL OF COMPUTER SCIENCE AND ENGINEERING)

May, 2016

CERTIFICATE

This is to certify that the project work entitled " **Mobile Controlled Robot** " that is being submitted by Pratik Kejriwal (15BCE0226), Aryaman Panth (15BCE0303), Divya Debashrita (15BCE0525), Sanskar Katiyar (15BCE0619), Diksha Singh (15BCE0715) and Sagarika Shreevastava (15BCE0742) for Digital Logic and Design (CSE1003) (Slot B1) is a record of bonafide work done under my supervision. The contents of this Project work, in full or in parts, have neither been taken from any other source nor have been submitted for any other CAL course.

Date: May 5, 2016

Place : Vellore

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ABSTRACT

AIM: To process analog signals through a digital system

The project revolves around using digital systems using Integrated Circuits to build a remotely operated robot. The robot is operated wirelessly using a pair of phones, Arduino Uno and a DTMF Decoder Module.

The robot can perform basic locomotion tasks like moving forward, backward and turning to either direction. Though the robot is not fairly limited to these actions only, but **our main aim was to show how analog signals can be converted into digital form and then processed further for digital applications.**

The development of the project has divided into three phases:

1. **Driver Section** – Connection of the Motor Driver Modules with the components (wheels, DC motors, aux cable) for the formation of the robot
2. **Control Section** – Using DTMF (Dual Tone Multiple Frequency) which will be fixed on the phone, and used for sending signals to command the robot.
3. **Remote Section** – The Microcontroller (Arduino Uno) is fixed on the robot, which will receive signals from the remote (mobile) to follow the instructions. This is done by fixing another phone on the chassis of the robot.

The phone we have with us as the remote makes notes of coupled frequencies when we press any button on the keypad. This note is detected by the DTMF and converted into a Binary signal which is detected and further processed by the Arduino.

The Arduino has been programmed to move the components of the robot in a known manner on the basis of the signal received.

1. Introduction:

Our main objective was to develop a project which can use different analog signals to work on a

robot that can move forward, backward and turn both ways. We also wanted the robot to be controlled by mobile phone.

Anybody who receives a call from the mobile attached to the chassis of the robot will be able to control the robot's movements. If the person presses 2 then the robot will move forward, if they press 8 then it goes backward. Pressing 4 will turn the robot left and pressing 6 will turn it right.

2. THEORY:

DTMF (Dual Tone Multiple Frequency)

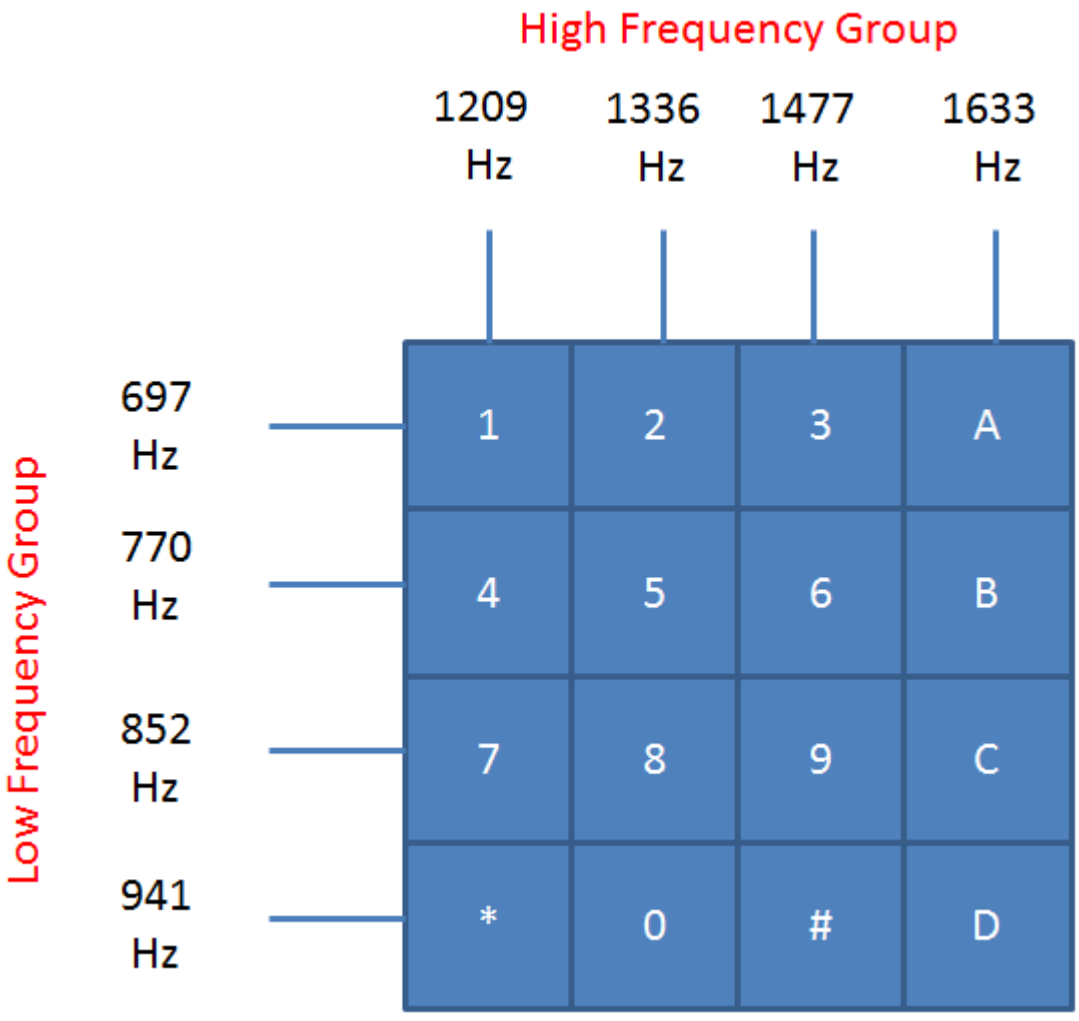
Dual Tone Multiple Frequency is the frequency heard when a key on the phone keypad is pressed. In the premature days, our telephone systems were operated by human operators in a telephone exchange room. The caller will pick up the phone, giving instruction to the operator to connect their line to the destination. It is a kind of manual switching. As more and more people entered in the telephone technology as useful communication gear, manual switching becomes a time consuming tedious task.

As technology established, pulse or dial tone technique were invented for telephone communication switching. It employs electronics and computers to support switching operations. DTMF is the ultimate technique used in any of the Mobile, Telephone communication systems.

The operation of DTMF method are as follows*:*

- Caller generates a dial tone consisting of two frequencies. It is transmitted via the telephone line (communication media).
- Telephone exchange consists of a DTMF decoder, which decodes the frequencies in to digital code.
- These codes are the address of destination subscriber; it is read and processed by a computer which connects caller to the destination subscriber.

Using a DTMF Decoder:



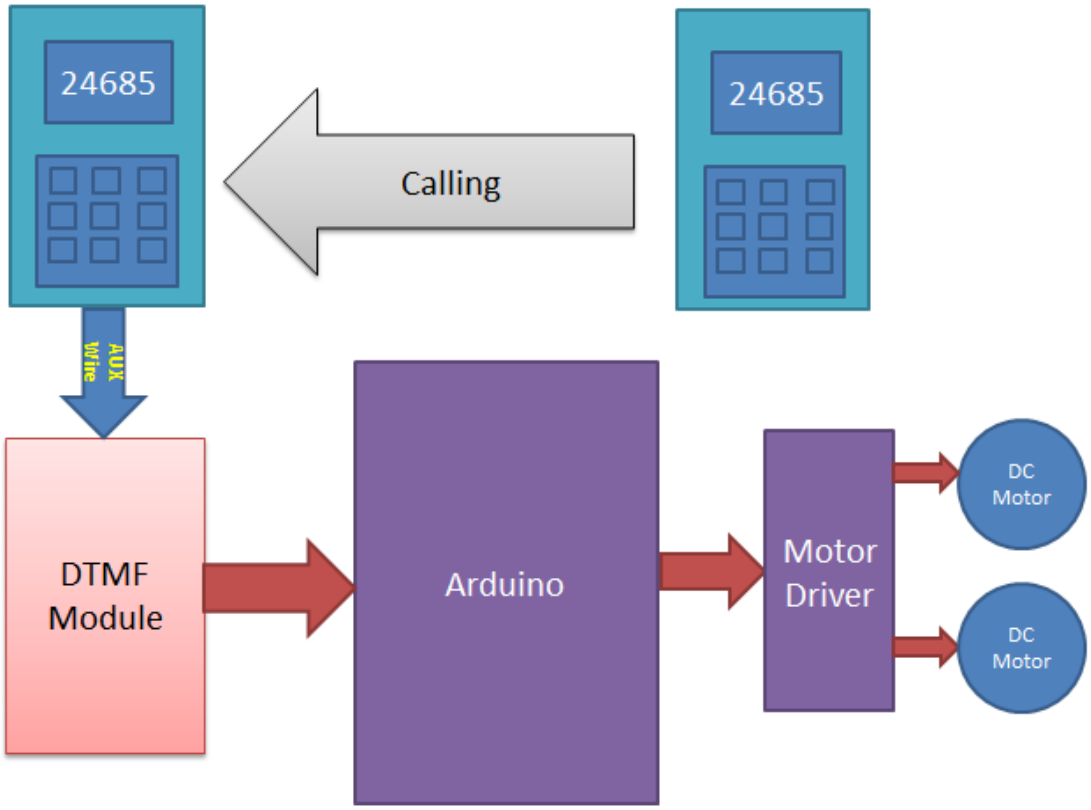
Button	Low DTMF frequency (Hz)	High DTMF frequency (Hz)	Binary coded output			
			Q1	Q2	Q3	Q4
1	697	1209	0	0	0	1
2	697	1336	0	0	1	0
3	697	1477	0	0	1	1
4	770	1209	0	1	0	0
5	770	1336	0	1	0	1
6	770	1477	0	1	1	0
7	852	1209	0	1	1	1
8	852	1336	1	0	0	0
9	852	1477	1	0	0	1
0	941	1336	1	0	1	0
*	941	1209	1	0	1	1
#	941	1477	1	1	0	0

A DTMF Decoder can be used to convert the values of the received frequencies into the 4-bit Binary equivalent of the key pressed. We can use this 4-bit binary number to proceed and operate the signals of the robot.

3. METHODOLOGY

Required Components

- Arduino Uno
- 2 DC Motors
- 2 Mobile Phones
- DTMF decoder Module – HT970 or MT8870
- Motor Driver L293D
- 9 Volt Battery & 12V Battery
- Battery Connector
- Aux wire
- Robot Chasis with wheel
- Connecting wires



Circuit diagram for Arduino based DTMF Controlled Robot is given on the next page. Here one motor driver is connected to Uno for driving robot. Motor driver's input pin I1, I2, I3, I4 is connected at Uno digital pin number 2, 3, 4 and 5 respectively.

We have used two DC motors to driver robot in which one motor is connected at output pin of motor driver and the other motor to the other pair of pin. A 6 or 12 volt Battery is also used to power the motor driver for driving motors.

A DTMF decoder attached with this circuit and this decoder is plugged into a mobile using an aux wire for receiving command or DTMF Tone. DTMF decoder pin D3-D0 is directly connected with Arduino's pin number 8, 9, 10, 11. Another 9V battery is used to power the remaining circuit.

Working:

On pressing the following key the corresponding actions take place:
2 – Move forward
8 – Move backward
4 – Turn left (sticky)
6 – Turn right (sticky)
5 – Stop Moving

Sketch to Upload on Uno

```
int motor_left[]={2,3};
int motor_right[]={4,5};
int D3=8;
int D2=9;
int D1=10;
int D0=11;
int r1;
int r2;
int r3;
int r4;
void setup()
{ Serial.begin(9600);

for(int i=0;i<2;i++)
{
pinMode(motor_left[i],OUTPUT);
pinMode(motor_right[i],OUTPUT);
}
pinMode(D3,INPUT);
pinMode(D2,INPUT);
pinMode(D1,INPUT);
pinMode(D0,INPUT);
r1=0;
r2=0;
r3=0;
r4=0;
} //end of void setup

void loop()
{
r1=digitalRead(D3); //r1 to r4 get the values of D3 to D0
respectively
r2=digitalRead(D2);
r3=digitalRead(D1);
r4=digitalRead(D0);

if(r1==LOW&&r2==LOW&&r3==HIGH&&r4==LOW) // Binary 0010 ; Decimal 2
{ Serial.println("Moving Forward");
moveforward();
}

if(r1==LOW&&r2==HIGH&&r3==LOW&&r4==LOW) // Binary 0100 ; Decimal 4
{ Serial.println("Moving Left");
moveleft();
}

if(r1==LOW&&r2==HIGH&&r3==LOW&&r4==HIGH) // Binary 0101 ; Decimal 5
{ Serial.println("Not moving");
nomove();
}
```

```
if(r1==LOW&&r2==HIGH&&r3==HIGH&&r4==LOW) // Binary 0110 ; Decimal 6
{ Serial.println("Moving Right");
moveright();
}

if(r1==HIGH&&r2==LOW&&r3==LOW&&r4==LOW) // Binary 1000 ; Decimal 8
{ Serial.println("Moving Backward");
movebackward();
}

} //end of void loop

void moveforward()
{
digitalWrite(motor_left[0],HIGH);
digitalWrite(motor_left[1],LOW);
digitalWrite(motor_right[0],HIGH);
digitalWrite(motor_right[1],LOW);
}

void movebackward()
{
digitalWrite(motor_left[0],LOW);
digitalWrite(motor_left[1],HIGH);
digitalWrite(motor_right[0],LOW);
digitalWrite(motor_right[1],HIGH);
}

void moveleft()
{
digitalWrite(motor_left[0],LOW);
digitalWrite(motor_left[1],HIGH);
digitalWrite(motor_right[0],HIGH);
digitalWrite(motor_right[1],LOW);
}

void moveright()
{
digitalWrite(motor_left[0],HIGH);
digitalWrite(motor_left[1],LOW);
digitalWrite(motor_right[0],LOW);
digitalWrite(motor_right[1],HIGH);
}

void nomove()
{
digitalWrite(motor_left[0],LOW);
digitalWrite(motor_left[1],LOW);
digitalWrite(motor_right[0],LOW);
digitalWrite(motor_right[1],LOW);
}
```

4. CONCLUSION

The main objective of the project was to demonstrate the conversion of analog to digital signals and the processing of those digital signals to form a digital system and control it.

The microcontroller helps us in determining the inputs in form of binary numbers. We further process those binary numbers to operate the motors by using binary numbers again through the L293D Motor driver.

We successfully demonstrated the working of our project using an age old technology (DTMF) in a completely different context.

5. REFERENCES

- Digital Circuits and Design, Morris Mano, Michel Ciletti
- Circuits Digest
- Arudino Resources