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Arm Robot Surveillance Using Dual Tone Multiple Frequency Technology

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Abstract
Surveillance place a pivotal role in addressing a wide range of security challenges .In the present paper we propose a Dual Tone Multiple Frequency (DTMF) based Robot with video surveillance. In the proposed model a DTMF based Robot with video surveillance with multiple key functions, Arm picker and security system was implemented. Master and slave concept using 3 Microcontroller and motor driver IC to drive motors was implemented and belt wheel platform was used to move the robot from one place to another. Multiple key functions were used to perform more functions and a camera for surveillance .The robot can navigate with the help of the user.
Keywords: Dual Tone Multiple Frequency ,DTMF Robot, Microcontroller

I. Introduction

DTMF (Dual Tone Multiple Frequency) is a concept used in mobile phones to dial numbers. DTMF Tone is generated by two frequencies (low frequency and high frequency) .The two frequencies are arranged by matrix format and when user presses the keys the two frequencies will get shorted and will generate a tone, that tone is detected by DTMF decoder. DTMF Encoder is used to generate DTMF tones in mobile and will decode the tone and gives a 4 bit binary output and this output is the source of input to the Robot. A DTMF Decoder which gives a 4 bit binary output can perform 16 operations, but as mobiles have only 12 keys only 12 operations can be performed. Another drawback of DTMF decoder is that anyone who knows the receiver mobile number can access the Robot, So Robot needs a security system to access it. So a security system (Password) and multiple function keys is to be implemented.

A mobile phone placed in the Robot will acts as a receiver, output signal taken through audio jack and given input to DTMF decoder, the Decoder decodes the analog frequency and give output as 4 bit binary value, this output value is given to the input of Microcontroller (Atmel 89s52). Three Microcontrollers are used and each Microcontroller have been assigned specific task and function by using coding, 3 Microcontroller has been separated 2 categories 1: master, 2: slaves. Master has one Microcontroller and remaining 2 Microcontrollers act as slaves.

Master controller deals with Password system and slave selection while slave 1 deals with the function and operation of platform and camera arm and slave 2 deals with the function and operation of Arm section and camera arm. Security system is protecting the Robot using 4 digit password. Only when the password is entered the user can access the Robot to perform operation. To select slaves *and # will be assigned. An arm is used to pick and place operation and task defined by the user. Camera is used to cover the complete surveillance area.

II. Literature review

Ladwa.T.M "Control of remote domestic system using DTMF" 2009 proposed a remote domestic system using DTMF. The proposed model was used to control home appliance using DTMF decode such as light ON and OFF, switching motor ON and OFF, etc.
Kumar, M. "Design of cell phone operated robot using DTMF for object research"
2013 proposed a robot controlled by DTMF and GSM. DTMF used to control the Robot and GSM is used to send and received sensors information and commends.
Muhury,L. "Device control by using GSM network," 2012 proposed an application controlled by GSM modem. In GSM modem can able to send and receive data and information. GSM modem was used and the network is used in external device controlling
Felix, C. "Home automation using GSM," 2011 proposed a home automation using GSM. The

proposed GSM model was better than Zig bee, RF, IR etc. it was able to control sensors, switching, temperature controlling.

III. The system setup

The Robot based on DTMF (Dual Tone Multi Frequency) technique is implemented. The DTMF Decoder circuit is made using M8870 Decoder IC. Just connect your cell phone headset (headphone) jack to the mobile phone and then mobile control electrical appliances and electrical equipment via DTMF key pad of your cell phone and this concept is implemented in this Robot so that it can able to control any were in the world were ever mobile network is available. Security system is implemented so authorized users only able to access this Robot, each key has multiple function so many operation can be performed in this robot. A 4 digit password is given and only when the user enters the password, the robot can be accessed by user. DTMF have limited key to operate the robot. As the robot requires more controls multiple key function concept is implemented so that each key have 2 functions and over all 24 operations can be performed.

3.1. DTMF Decoder

DTMF generation is a composite audio signals of two tones between the frequency of 697Hz and 1633Hz. The DTMF keypad is arranged such that each row will have its own unique tone frequency and also each column will have its own unique tone. Below is a representation of the typical DTMF keypad and the associated row/column frequencies.
By pressing a key, for example pressing key 5, will generate a dual tone consisting of 770 Hz for the low Group, and 1336 Hz of the high group.

Fig 3.1.1 DTMF keypad
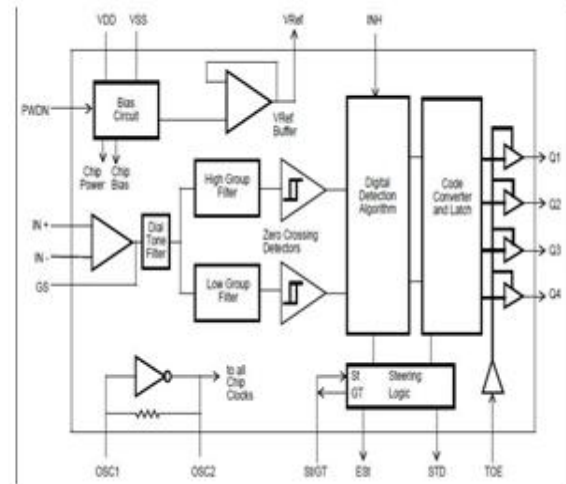
3.2. DTMF working

Fig 3.2.1 DTMF block diagram

DTMF (Dual Tone Multi Frequency) decoder is a decoder circuit which detects the telephone dial tone and decodes the key .A touch tone decoder IC, IC MT8870DE was used for DTMF Signal detection and decodes the signal to 4 digital outputs. The M-8870 DTMF (Dual Tone Multi Frequency) decoder IC was used to determine the frequencies of the limited tones. The DTMF communication is a one way communication which consists of a touch tone initiator and a decoder, which decodes the input bits and interfaces it to a computer for any further application.

DTMF technology is used in telephone switching centers to identify the dialed number. The decoder identifies the DTMF tone and will generate the binary equivalent of the key pressed. The M-8870 DTMF decoder IC decodes the tone generated by the cell phone. The microphone pin will directly tap the DTMF signals. The red wire of the microphone is DTMF input to the circuit. The microphone wire signals are processed by the DTMF decoder IC and generate binary equivalent sequence Q1, Q2, Q3, and Q4 as parallel sequence.

The M-8870 decoder IC contains an inbuilt operational amplifier. The signals from the microphone pin are fed in to inverting input of the Op amp through a series of resistance (100kΩ) and capacitance (0.1 μF). The non inverting input of Op-amp is connected to a Reference voltage (pin4 - VREF) is connected to the non inverting input of the Op-amp. The output voltage is taken from the pin 3 (GS) .The reference voltage VREF is Vcc /2. The feedback signal is fed in to the inverting input pin 2 through a resistor (270kΩ).

The output of Op Amp is passed through the filter network. The filter network contains switched capacitors, which divides the DTMF tones into low and high frequency signals. Filtered frequencies will pass through the frequency detector and code detector

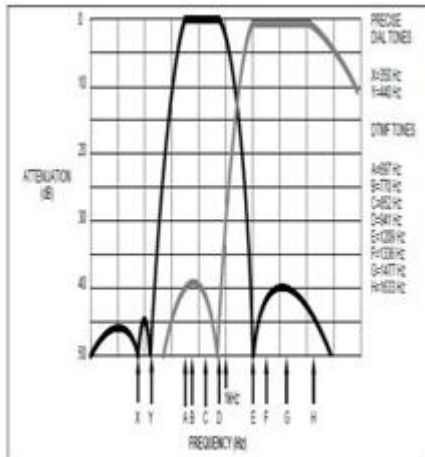circuits and a four digit binary code is latched at the output of M-8870 DTMF decoder IC.

Fig3.2.2 DTMF frequency filter resonance

Digit	Freq Low	Freq High	D3	D2	D1	D0
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	697	1633	1	1	0	1
B	770	1633	1	1	1	0
C	852	1633	1	1	1	1
D	941	1633	0	0	0	0

Table: 3.3.1. DTMF decoder output.

3.3. Motor driver (L293D)

The H-bridge motor driver is the most common method to drive DC motors in two directions with computer control. H-bridges can be built with bi-polar junction transistors (BJT) or with a field effect transistors (FET), or can be even purchased as integrated packages such as the L293. For low current motors the L293 is simplest and inexpensive one while for high current motors, it is easy and inexpensive to make our own H-bridge.
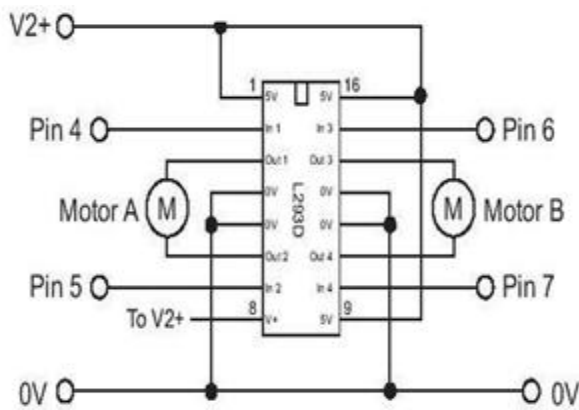
Fig: 3.3.1 Motor driver circuit diagram.

3.4. Working

The Device is a high voltage, high current integrated four channel driver designed for standard DTL or TTL logic levels and drive inductive loads and switching power transistors. . A separate supply input is provided for the logic which allows operations at lower voltages. The internal clamp diodes are enabled in the circuit and the device is suitable for switching applications at frequencies less than 5 KHz. The L293D assembled in a 16 lead plastic package has 4 center pins connected together while the L293DD assembled in 20 lead surface mount has 8 center pins connected together and both of them can be used for heat sinking.
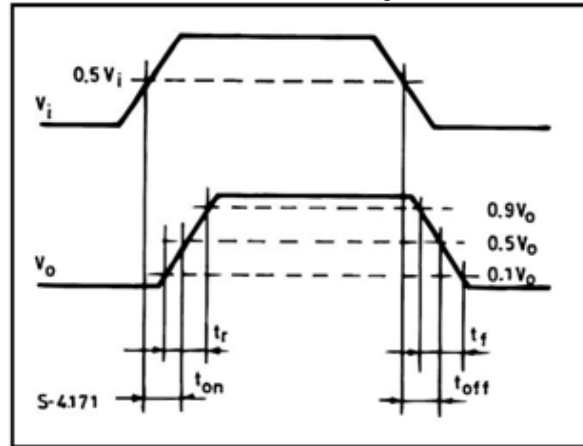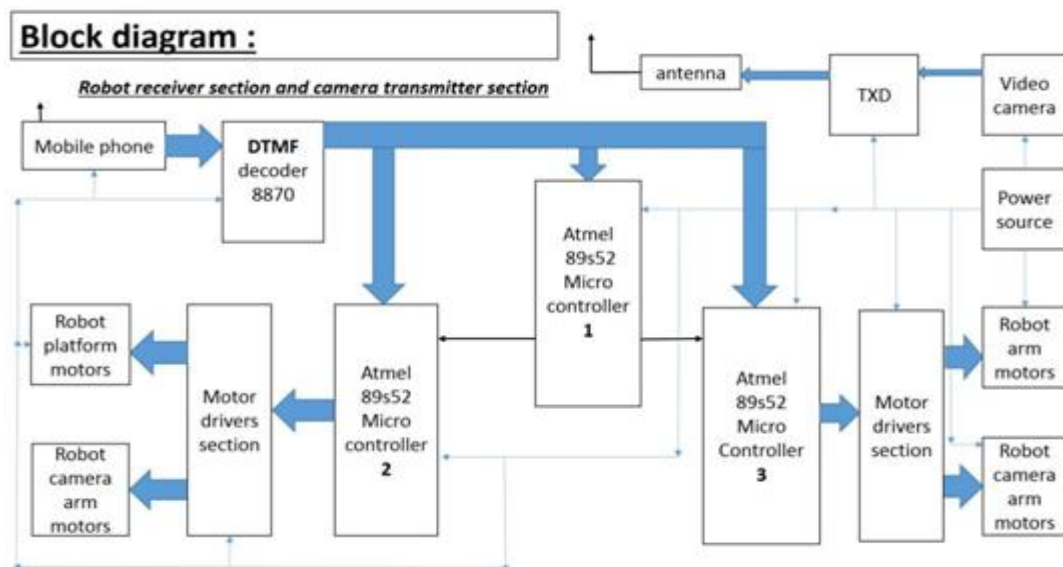

Fig: 3.4.1 Switching times

Fig: 3.4.2 DTMF Robot block diagram and wireless camera transmitter

Transmitter consists of GSM or CDMA handset (mobile) and is used as a remote control to operate robot. AV or camera receiver is placed in transmitter section and DTMF encoder is fixed in mobile phone as default. Mobile phone, Microcontrollers, DTMF receiver or decoder, motor drivers, power source (battery), robot platform, arms and camera are placed in receiver section. One mobile phone is placed in the Robot and get output through the audio jack and its given to the DTMF decoder. DTMF decoder output is given to the input of master and the slave Microcontroller separately. Master Microcontroller is used to deal with password protection and the slave selection. The slave1 controller is used to control the Robot platform and camera arm and slave2 controller is used to control the robot and camera arm.

DTMF encoder is placed in mobile phone acts as a remote control and 3x4 matrix mobile key pads is the control keys of the Robot .The Robot acts according to the program coded by the programmer when a call is being made to the receiver mobile. The low and high frequency new tone generated by the DTMF encoder is transmitted to receiver through the call and the remote controlled operation can be

performed .Only 12 operation can be performed ,but Robot can perform 24 operation with receiver coding. One mobile phone is kept permanently in the receiver. Audio jack of mobile phone sent the received analog signal to the DTMF decoder for decoding and filtering it, and gives a 4 bit digital output. The 4 bit output is fed to the input of Microcontrollers. The Robot uses 3 Microcontrollers of which one Microcontroller act as Master and remaining 2 Microcontroller act as slaves. Master controller contains

3.3 Robotcircuit

password protection and slave selection as DTMF normally has security problems that anyone can access it if they know the receiver mobile number. A security system will be implemented to

rectify this, as the system has a 4 digit password and if only user knows this password, they can be able to access the Robot. Another drawback in DTMF is only 12 key can able to perform operation. Multiple key functions are implemented so that each key have two functions and 24 functions can be performed totally. Slave 1 controller deals with Robot platform and camera arm and when then user gives a command it will either forward, backward, left or right. Slave 2 controller deals with Robot and camera arm. Robot arm is used to pick and place operation and camera arm is used to keep the surveillance of the Robot. Motor drivers are used to switch the motors forward and backward. H bridge circuit is normally used to drive the DC gear motor. Camera is being fixed into camera arm. Wheels and motors are used to move the robot from one place to anothe
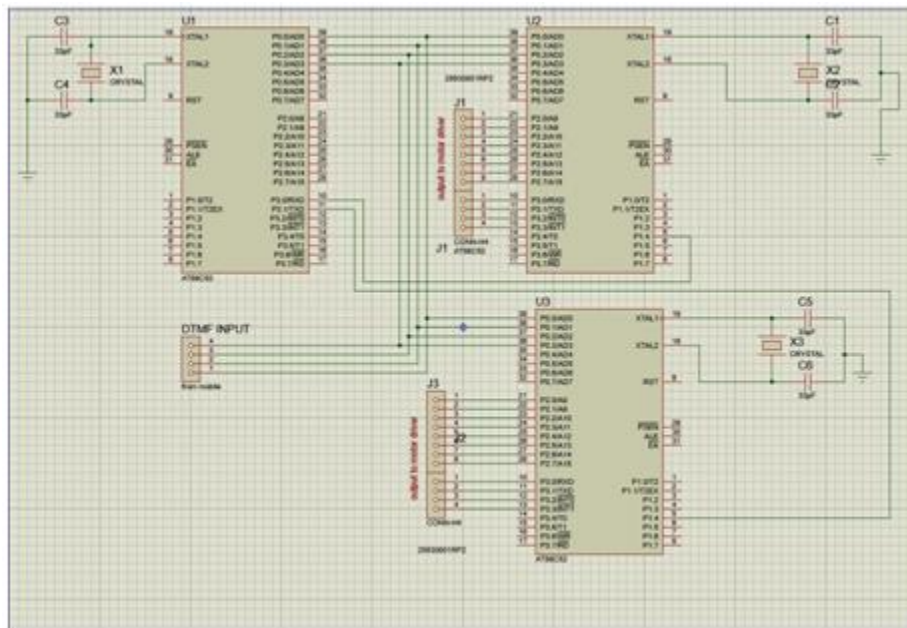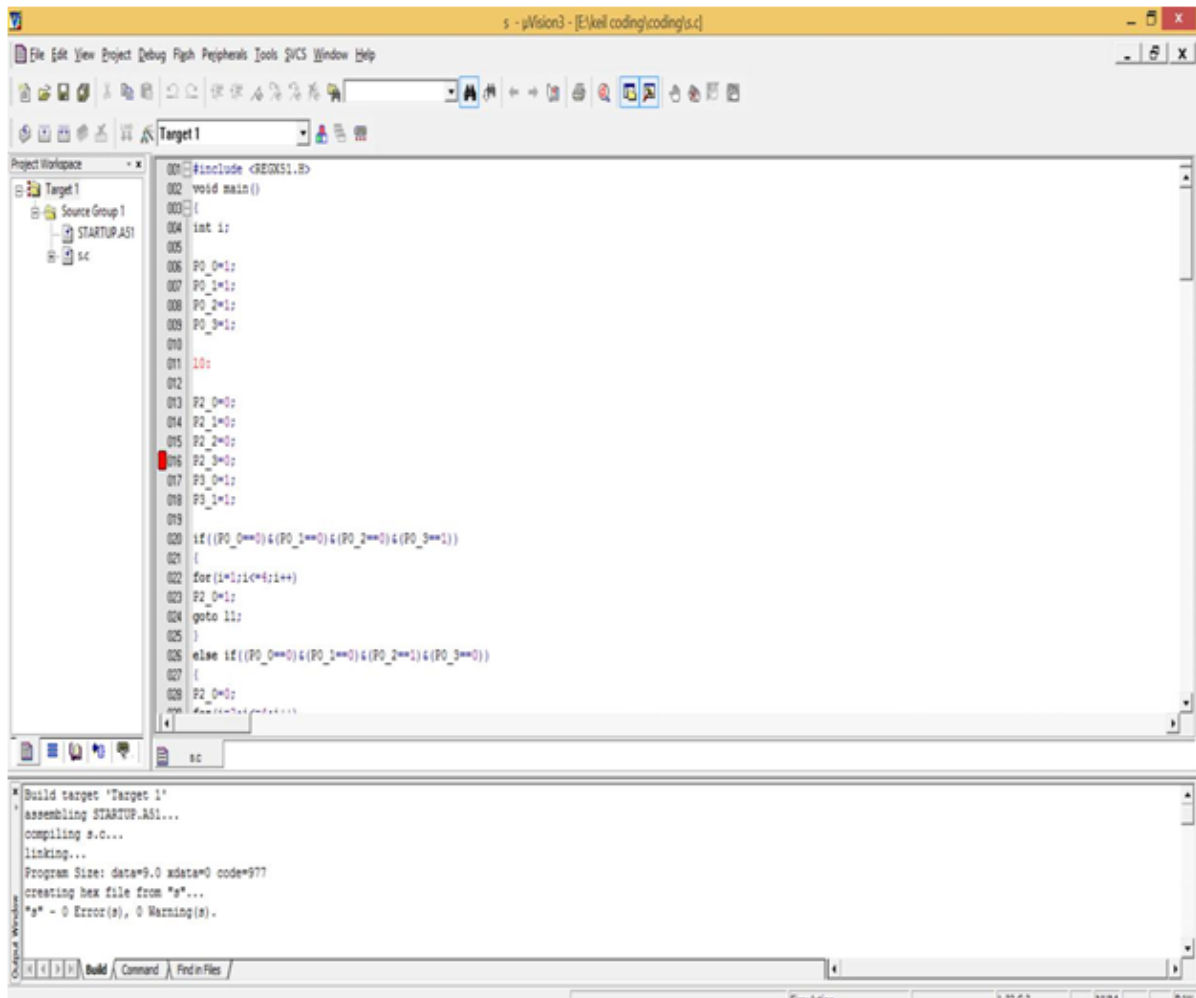

Fig: 3.5.1Robot circuit diagram

IV. Results and discussion

Master controller program was of zero error and warning, so the program was executed

Master controller result

Slave 1 and slave 2 controller program was of zero error and warning so program was executed.
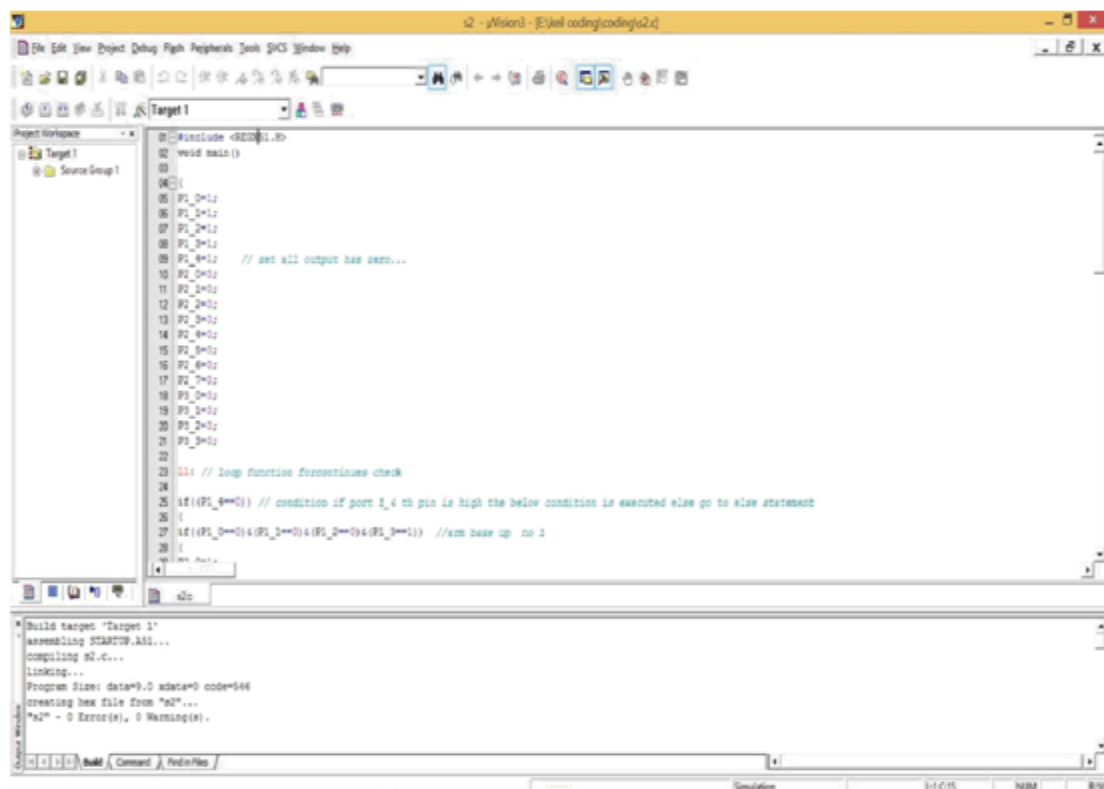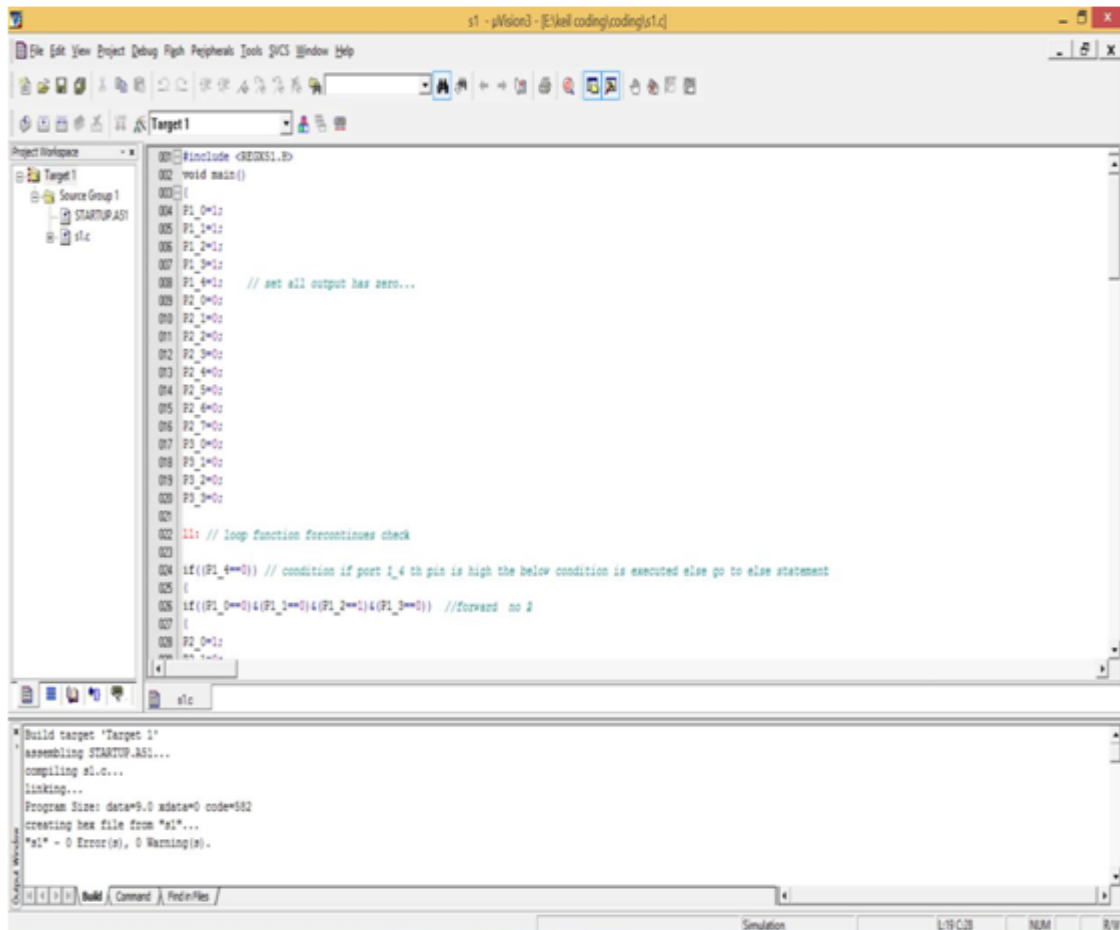
Slave 1 controller result

Fig: 4.1**Surveillance arm robot using DTMF**

Fig: 4.1 **DTMF ROBOT circuit board**

V. Conclusion

Surveillance arm robot using DTMF technology robot is implemented for the security system using multiple key function. The program is executed successfully and the robot output is obtained. The complete operation using DTMF technology is performed; the overall result has been executed successfully when both the receiver and transmitter operate in the same OS.When the transmitter and receiver operates in different OS that is when an android mobile phone is connected as the transmitter (Remote) and windows mobile as receiver, the DTMF tone is not detected in DTMF decoder and is the future scope of this work

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