Volume-4, Issue-12, Dec-2015 • ISSN No 2277 - 8160

Research Paper Engineering

Implementation of Super Vision Robot using DTMF Technology

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ABSTRACT

In this paper Author tried to implement the SUPER VISION ROBOT using state diagram and remote ROBOT is controlled by cell-phone that makes a call by operator. This paper proposes a control system which enables controlling remotely through mobile phone and DTMF (Dual Tone Multi Frequency). Programming codes for design based with the help of Very High speed Hardware descriptive Language (VHDL) and state diagram represented by binary code and state levels, coordinated with frequency levels and controlling of. For simulation author used supporting tool preferred as ISE Xilinx. The output results are included in the paper.

KEYWORDS : DTMF, VHDL, Xilinx.

INTRODUCTION

Concept of controlling a robot by using cell-phone that makes a call to the cell-phone attached to the robot. In the course of a call, if any button is pressed a tone corresponding to the button pressed, is heard at the other end of the call is called dual-tone multiple/frequency (DTMF TONE) .The robot perceives this DTMF tone with the help of the phone stacked in the robot. It is a generic communication term for touch tone. The keypad on the phone could be used to represent the digits and a separate tone is used for each digit. Pressing any key generate unique tone which consists of two different frequencies one each of higher and lower frequency range. The resultant tone is convolution of two frequencies associated with a particular key. DTMF signalling is used for telephone signalling over a line in the voice-frequency band to a call switching centre. The version of DTMF used for telephone tones dialling is known as 'touch-tone'. DTMF assigns specific frequency to each key so that it can easily be identified by the electronic circuit. The signal generated by the DTMF encoder is a direct algebraic summation, in real time of the amplitudes of two sine(-cosine) waves of different frequency ,i.e. pressing '5' will send a tone made by adding 1336 Hz and 770 Hz to the other end of the line. The appearance and capabilities of the robots share features of a mechanical and movable structure under some control. The control of the robot involves three distinct phases: perception, processing and action. Generally, the preceptors are sensors mounted on the robot, processing is done by the processor, and the task is performed using motors or with some other actuators.

PRINCIPLES OF DTMF

"Dual-Tone Multi-Frequency" abbreviated as DTMF and it is a method of designating digits with tone-frequencies that will be transmitted via an analog communication channel or network like a telephone line. It was developed by Western Electric and introduced by AT&T in 1963. During its development, unique individual frequency filters were chosen carefully so that the tones could easily travel via the telephone lines (the maximum guaranteed bandwidth for a standard telephone line extends from around 300 Hz to 3.5 kHz). DTMF was not intended for data transfer, rather for control signals only. With a standard DTMF encoder/decoder, it is possible to signal at a rate of around 10 tones/signals per second. The DTMF keypad is laid out in a 4x4 matrix, with two frequencies (each row representing a low frequency and each column representing a high frequency) played simultaneously by a standard home phone/fax or mobile phone. Each key on the telephone's keypad has a unique frequency assigned to it. Pressing a single key (such as '1') will send a sinusoidal tone for each of the two frequencies (697 Hz and 1209 Hz). The multiple tones are the reason for calling the system as multiple-frequency. This prevents the misinterpretation of the harmonics and hence, it is immune to noise. These tones are then decoded by the switching centre to determine which key was pressed. When any key is pressed on the DTMF keypad, the circuit plays the corresponding DTMF tone. 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. When any of the key like "1", "2", "*", "#" etc is pressed particular code is transmitted. This code is consist of two frequency among which one is higher frequency and second one is lower frequency

KEYPAD BUTTON	Lower Frequency	Higher Frequency
1	697	1209
2	697	1336
3	697	1477
4	770	1209
5	770	1336
6	770	1477
7	852	1209
8	852	1336
9	852	1477
*	941	1209
#	941	1336
0	941	1477

Figure. 1 The combination of frequency for respected keys

It gives 4-bit digital output Q1, Q2, Q3, and Q4 according to the received keys. Following figure shows the equivalent digital output as per related working of keypad.

KEYPAD BUTTON	FREQUENCY GENERATION	Q4	Q3	Q2	Q1
0	2277	0	0	0	0
1	1906	0	0	0	1
3	2174	0	0	1	1
5	2106	0	1	0	1
7	2061	0	1	1	1
9	2329	1	0	0	1
2	2033	0	0	1	0
8	2188	1	0	0	0
4	1979	0	1	0	0
6	2247	0	1	1	0
*	2150	1	0	1	0
#	2418	1	0	1	1
0	2277	0	0	0	0

Figure 2 The frequency output for each key.

Each of these tones is composed of two pure sine waves of the low and high frequencies superimposed on each other. These two frequencies explicitly represent one of the digits on the telephone keypad. Thus generated signal can be expressed mathematically as follows:

$f(t) = A1 \sin(2\pi f_1 t) + A2 \sin(2\pi f_2 t)$ ------- (A)

Where A1, A2 are the amplitudes & f1, f2 are the frequencies of high & low frequency range. Properties of DTMF tone frequencies are:

No frequency is an integer multiple of another

The difference between any two frequencies does not equal any of the frequencies

The sum of any two frequencies does not equal any of the frequencies.

KEYPAD CONTROLLER STATE

This paper describes the wakeup and start up processes of a ROBOT and the integration of newly configured nodes into a communication cluster that is already in operation. The communication uses dual tone multiple access to the media for providing communication between nodes. The paper has considered two processes called wake up and start. The wakeup process is for wakeup the cluster and prepares all the nodes for starting communication. Since DTMF access to the media, all the nodes must be synchronous for participate in data exchange process. The start up process provides the cluster with conditions to become synchronous and to start communication.

KEYPAD BUTTON	Lower Frequency	Higher Frequency	STATE	BINARY	PRESENT STATE	NEXT STATE		
0	941	1209	T0	00000	HALT	DEFAULT_CONFIG 0000		
1	697	1209	T1	00001	DEFAULT_CONFIG	READY 0011		
2	697	1336	T2	00010	MOVE_FORWARD	ROBOT_ACTIVE 0101	INTEGRATION_LISTEN 1010	INITIALIZE_SCHEDULE 1011
3	697	1477	T3	00011	READY	ROBOT_ACTIVE 0101	ROBOT_LISTEN 0111	ROBOT_SEND 1001
4	770	1209	T4	00100	MOVE_LEFT	ROBOT_ACTIVE 0101	INTEGRATION_LISTEN 1010	INITIALIZE_SCHEDULE 1011
5	770	1336	T5	00101	ROBOT_ACTIVE	ROBOT_LISTEN 0111		
6	770	1477	T6	00110	MOVE_RIGHT	ROBOT_ACTIVE 0101	INTEGRATION_LISTEN 1010	INITIALIZE_SCHEDULE 1011
7	852	1209	T7	00111	ROBOT_LISTEN	ROBOT_SEND 1001		
8	852	1336	T8	01000	MOVE_BACKWARD	ROBOT_ACTIVE 0101	INTEGRATION_LISTEN 1010	INITIALIZE_SCHEDULE 1011
9	852	1477	T9	01001	ROBOT_SEND	INTEGRATION_LISTEN 1010		
*	941	1209	T10	01010	INTEGRATION_LISTEN	INITIALIZE_SCHEDULE 1011		
#	941	1336	T11	01011	INITIALIZE_SCHEDULE	ROBOT_PAUSE 0000		
0	941	1477	T0	00000	ROBOT_PAUSE	HALT 0000		

Figure 3: shows STATE of KEYPAD CONTROLLER

There are all states which are used for ROBOT controlling.

- DEFAULT_CONFIG:- In this state ROBOT boot itself and default configuration of robot if key pressed by cell phone is "1"
- READY: - initialized core mechanism if key pressed by cell phone is "3"
- ROBOT_ACTIVE:- robot ready for works in normal operation and time synchronisation if key pressed by cell phone is "5"
- ROBOT_LISTEN:- transmission of robot wakeup pattern and data information to cell phone if key pressed by cell phone is "7"
- ROBOT_SEND:- communicated with cell phone about data information if key pressed by cell phone is "9"
- MOVE_FORWARD:- ROBOT move in forward direction if key pressed by cell phone is "2"
- MOVE_BACKWARD:- ROBOT move in back direction if key pressed by cell phone is "8"
- MOVE_LEFT:- ROBOT move in left direction if key pressed by cell phone is "4"
- MOVE_RIGHT:- ROBOT move in right direction if key pressed by cell phone is "6"
- INITILIZE_LISTEN:- When key pressed by cell phone is "*" then robot captures the data information and stored it in memory device
- INITILIZE_SCHEDULE:- When key pressed by cell phone is "#" then robot sends all data information to controller cell phone for destination. It also send saved data information which stored by robot itself. It also send video and photo clip to the destination in frame structure format with the help of CODEC.

KEYPAD OPERATION

As per flow and state diagram the robot works in present state and next stage with key pad number and equivalent binary number with relative frequency generated by the key tone. The ROBOT_LISTEN state is controlled by the wakeup timer and the wakeup noise timer. The two timers are controlled by the parameters listen timeout and listen timeout noise. Listen timeout enables a fast cluster wakeup in case of a noise free environment, while listen timeout noise enables wakeup under more difficult conditions regarding noise interference. In ROBOT_SEND state transmits the wakeup pattern on the configured channel and checks for collisions. After return from wakeup the ROBOT_ACTIVE state attempts to identify the reason for the wakeup collision detected in ROBOT _SEND state. The monitoring is bounded by the expiration of listen timeout as configured. Either the detection of a wakeup pattern indicating a wakeup attempt by another node or the reception of a frame header indicating ongoing communication, causes the direct transition to READY state.

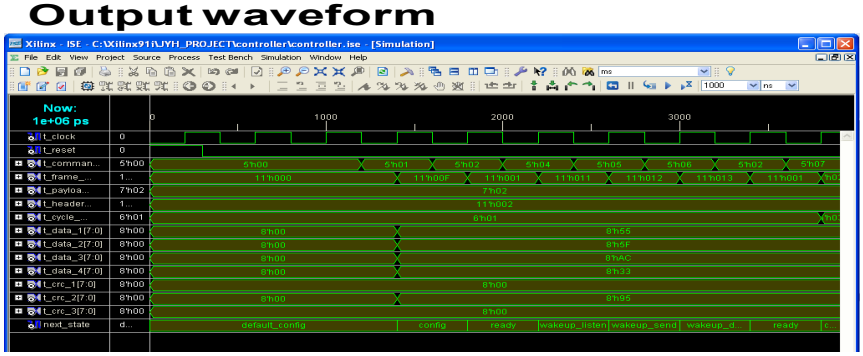
KEYPAD BUTTON	FREQUENCY GENERATION	Q4	Q3	Q2	Q1	STATE	OPERATION	MODULE BLOCK
0	2277	0	0	0	0	HALT	STOP ALL THE OPERATION / FATAL ERROR	ALL
1	1906	0	0	0	1	DEFAULT_CONFIG	DEFAULT CONFIGURATION OF ROBOT	ALL
3	2174	0	0	1	1	READY	INITIALIZE CORE MECHANISM	ALL
5	2106	0	1	0	1	ROBOT_ACTIVE	ROBOT WORKS IN NORMAL OPERATION & TIME SYN.	SENSOR,CODEC
7	2061	0	1	1	1	ROBOT_LISTEN	TRANSMITION OF THE WAKEUP PATTERN	SENSOR,CODEC
9	2329	1	0	0	1	ROBOT_SEND	TX THE WAKEUP PATTERN ON THE CONFIGURED	SENSOR,CODEC
2	2033	0	0	1	0	MOVE_FORWARD	ROBOT MOVE IN FORWARD DIRECTION	CAMERA, M1,M2
8	2188	1	0	0	0	MOVE_BACKWARD	ROBOT MOVE IN BACKWARD DIRECTION	CAMERA, M1,M2
4	1979	0	1	0	0	MOVE_LEFT	ROBOT MOVE IN LEFT DIRECTION	CAMERA, M1,M2
6	2247	0	1	1	0	MOVE_RIGHT	ROBOT MOVE IN RIGHT DIRECTION	CAMERA, M1,M2
*	2150	1	0	1	0	INTEGRATION_LISTEN	DETECTION AND STARTUP DATA TRANSMITTING	CODEC,FSS
#	2418	1	0	1	1	INITIALIZE_SCHEDULE	STARTUP FRAME & DERIVES A SCHEDULE FROM ROBOT	CODEC,FES
0	2277	0	0	0	0	ROBOT_PAUSE	IF COLLISION SEND TO NORMAL_ACTIVE	ALL

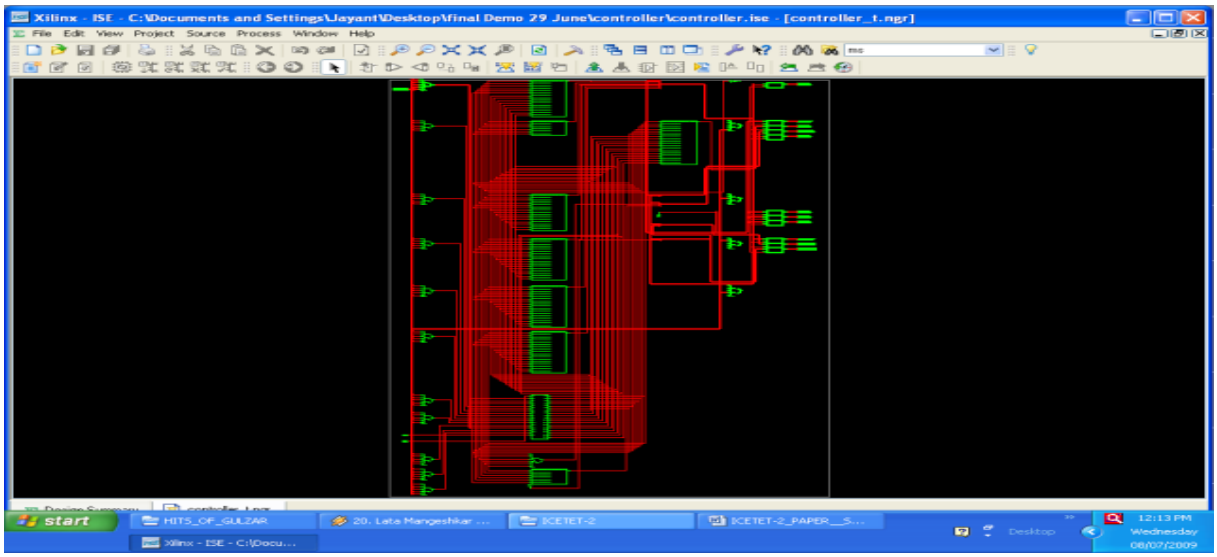
Figure 4: shows FRAME of KEYPAD CONTROLLER

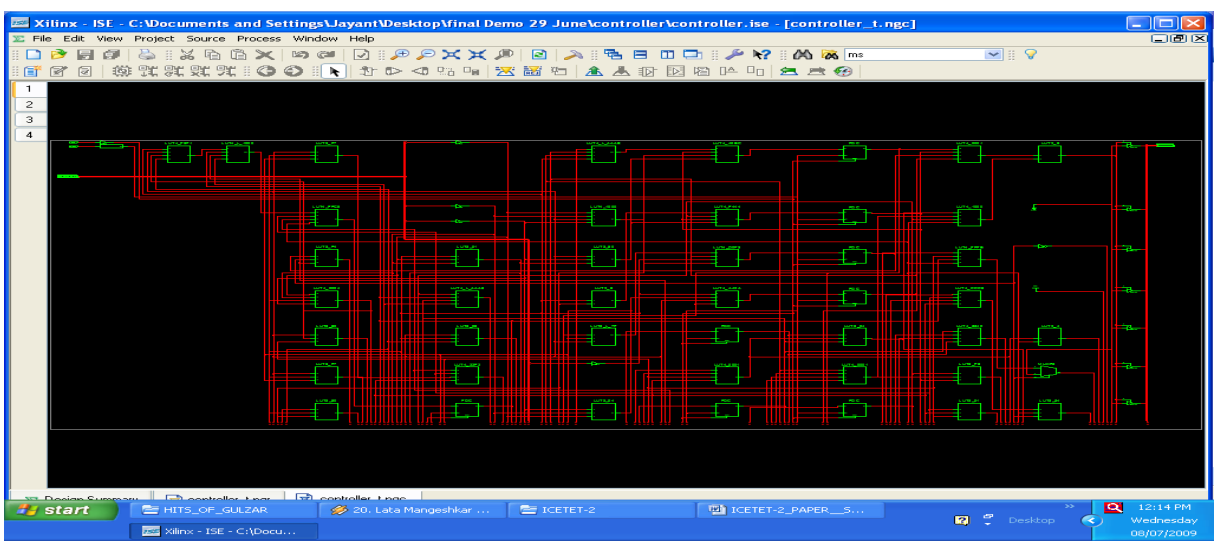
Otherwise ROBOT _DETECT is left after expiration of listen timeout; in this case the reason for wakeup collision is unknown. Any node entering state that has initial start capability should assure that both channels attached have been awakened before initiating. It cannot be assumed that all nodes and stars need the same amount of time to become completely awake and to be configured. Since at least two nodes are necessary to start up the cluster communication, it is advisable to delay any potential start up attempt of the node having instigated the wakeup by the minimal amount of time it takes another start node to become awake, to be configured and to enter start up.

OUTPUT of CONTROLLER BY STATE FORMATION

Output waveform







CONCLUSION

Authors studied here the implantable approach of supervision robot using DTMF technology. This paper will help in future to the researcher to design the robot with other technologies too.

REFERENCES

1. Bobade,V.B., Mane, S. "Approach to Super Vision Robot by Using State Diagram and VHDL Simulation". IJSR - INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH. Volume : 4 | Issue : 12 | December 2015 • ISSN No 2277 – 8179. 2. Srivastava, A., Tripathi H. N., GSM Calling based Multi-tasking Robot vehicle with Password protection. International Journal of Advanced Research in Computer Science and Software Engineering Volume 4, Issue 1, January 2014 ISSN: 2277 128X. 3. Soufi1A. A., Alzubaidi A. J., Remote Control System through Mobile and DTMF. International Journal of Computational Engineering Research||Vol, 03||Issue, 8|| ||Issn 2250-3005 || ||August||2013|| Page 45. 4. Gupta S. D., Ochi A. R., Hossain M. S., Siddique N. A., Designing & Implementation of Mobile Operated Toy . International Journal of Scientific and Research Publications, Volume 3, Issue 1, January 2013 1 ISSN 2250-3153 . 5. Chakraborty H.i *, Banerjee P. Design of a Circuit for Remote Control of Multiple Devices using DTMF Encoder and Decoder. International Journal of Scientific and Research Publications, Volume 3, Issue 12, December 2013 1 ISSN 2250-3153 . 6. Subramanian V. R. Application Of Dual Tone Multi Frequency TechnologyAnd Sensing In Autonomous Robotic Navigation. International Journal of Research in Engineering and Technology ISSN: 2319-1163 | ISSN: 2321-7308. 7. K. Gayathri, S. Shamsheer Daula, DTMF detection using Recursive DFT on FPGA International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 Vol. 3, Issue 2, March -April 2013, pp.1492-1497 1492 8. S. Nagakishore Bhavanam, Dr. P. Siddaiah, Dr. P. Ramana Reddy , Goertzel Algorithm based DTMF Detection. International Association of Scientific Innovation and Research (IASIR), USA .